Toward an Andean Common Market for Science and Technology

Public Policy for Science, Technology
and Industrialization in the Andean Group

by

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NOTE TO READERS

The study that follows attempts to take a measure of intellectual and institutional aspects of science and technology policymaking, particularly with regard to industrialization, in an incipient South American common market. Though it surveys an area in which change is occurring continually, this work can be seen as a candid portrait, with some appropriate background explanation, of the situation as it stood at the end of 1973. Still, it should offer some insights, especially to those who are not in direct contact with the Andean Group, that may be useful for understanding the subject and for further analyses.

The study has benefited from interviews and material collected in Washington and New York, in such institutions as the Organization of American States, the Pan American Health Organization, the U.S. Agency for International Development, the National Academy of Sciences, the Ford and Rockefeller Foundations, the United Nations Development Programme, and the Overseas Development Council. I also visited and gained valuable information from the World and Inter-American Development Banks. Two months of field work in Peru, Colombia and Venezuela afforded opportunities for scores of interviews with government officials explicitly and implicitly involved in science and technology policymaking, business people, university professors, and officials of international organizations. For sometimes obvious reasons I do not identify all interviewees by name, though in all cases I received the generous cooperation of the people I visited.

I am thankful to Professors Tom E. Davis, Milton J. Esman, Franklin A. Long and William F. Whyte for their kindness in advising me during this project and in helping me

with sometimes crucial ideas which I would have missed entirely if it had not been for them. However, I am solely responsible for the analysis, interpretations and conclusions offered herein. I am also responsible for the translations of excerpts from the Spanish.

Finally, I wish to express my gratitude to Betty, David, Stephen and Douglas for their patience and loving understanding, and to Dr. Karel Stregl for his encouragement and singular contribution to my education. It is to Dr. Stregl that I dedicate this work.

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Abstract

Developing nations have chosen to explore alternatives for science and technology policies for obvious reasons, most prominently that science and technology are fundamental accoutrements of modern societies and among the crucial tools necessary for increasing national independence and welfare. This study explores some historical reasons for the present concern in a specific set of nations and analyzes some of the problems facing the Andean Group. The title suggests the theme: the combined efforts of developing nations may enhance possibilities for effective policy. But these possibilities are beset by numerous hazards because of the diversity of both the challenge facing policymakers and their response. Moreover, the efforts to create an Andean common market for science and technology are really just beginning.

The first reason for the current science and technology policymaking focus is the failure of universities and research institutes in developing countries to fulfill expectations for their contribution to economic and social development. The general category is how to develop domestic infrastructure to produce technical manpower, research, and other goods, in large part to alleviate dependency on the outside.

Second is the problem of technology transfer, most particularly in the relations between developing nations and foreign or multinational corporations. Two categories are

involved here: the price or terms of transferring proprietary technology, and the extreme reluctance of the trans-national firms to perform research and development (R & D) in host nations. The technology transfer problem is a current manifestation of Latin America's balance of payments difficulties.

The role of governments is the third factor. Nation-states have practiced at least implicit policies for science and technology for years. In the last decade, however, governments have been motivated to act more explicitly because of the two reasons cited above. Also, because they at least purport to represent national or social welfare interests, governments have been moving in the direction of defining and administering more comprehensive policies for science and technology. It is precisely the search for adequate definition of policy that makes the role of government currently of such interest.

The Andean Group is an incipient common market composed of Bolivia, Chile, Colombia, Ecuador, Peru, and Venezuela. It is the recipient of a great deal of international attention because of its vigorous activity in moving toward common policies in regard to tariffs, industrial development, and other important questions. Perhaps its most notable accomplishment, especially from the standpoint of multinational corporations, has been the elaboration of the yet to be fully implemented common regime for foreign capital and technology, which is called the Andean Foreign Investment Code. Several of the regional institutions of the Andean Group are described in their relation to policies for science and technology. The role of international technical assistance agencies is also important. The UNDP, for example, visualizes the Andean Group as a center for a larger Latin American integration movement; UNCTAD used an able Andean Group working paper as a basis for formulating its 1972 resolution on technology transfer, and the OAS and UNESCO hover over the Group in the hope that its

success, in the area of science and technology as well as elsewhere, will have a formidable demonstration effect.

What, then, are the Andean Group's beginnings in science and technology policy? Basically, the items are taken separately: proprietary technology is an object of contention with foreign firms. One policy remedy is improved negotiation by or with the help of governments, hopefully on the basis of exchanged information throughout the region and with other developing nations regarding prices and terms of contracts for licenses. The other remedy is linked directly to liberalization of trade, which may create increased demand for innovation and technology by national firms; under the right conditions, it may also stimulate the domestic production and assimilation of technology. Science, on the other hand, is treated by the Andean Group as a question of primary relevance for national governments, their education ministries and research councils. Still, one Andean Group institution is beginning regional policy planning for science.

The fit between regional planning and national implementation depends on many factors. They cannot all be treated in this study. The problems of elaborating a regional common market policy for science and technology, however, will be suggested by discussing the national intellectual and institutional environment for science and technology policy in the cases of Colombia, Peru and, in a more cursory manner, Venezuela.

It will be suggested that regional integration can be an effective instrument for economic and social development, and that policies for science and technology can be vital components of this instrument. But national systematic differences, the responses of multinational corporations, and the strength of various linkages between Andean institutions and those outside of the region largely define the parameters of progress in the short run for these science and technology policies. As a result the initiatives for an Andean common

market for science and technology have been weak and the prospects for its further success are not bright. Furthermore, it will be urged that consideration should be given by policymakers to the two major intellectual and institutional systems that define how various actors--national, regional, and international--have come to be involved in science and technology policymaking. These systems, which describe approaches to science and technology policy,can be called the "liberal-scientific," and the "technico-economic." Fragmentation may be unavoidable in large measure, but more effective policymaking for developing nations and their regional organizations will have to cope with the various systems that contribute to it. Such, however, are the challenges that face policymakers who strive to create an Andean common market for science and technology.

I

Vivimos en un país de grandes recursos naturales y poderosas energías latentes, que no sabemos aprovechar debidamente por falta del medio único, la investigación científica, que nos permitiría conocerlo y utilizarlo para asegurar su progreso y prosperidad.

We live in a country of great natural resources and powerful latent energies, which we do not know how to use properly for the lack of a single means, scientific research, which would allow us to understand it and to utilize it in order to assure its progress and prosperity.

Julio C. Tello, "La investigación científica" [1922], in Paginas Escogidas (Lima, Perú: Universidad Nacional Mayor de San Marcos, 1967), p. 37.

II

. . . in Latin America the primary function of science and technology is to contribute to overall development and improve the quality of human life. [From the Consensus of Brasilia.]

Final Report, Specialized Conference on the Application of Science and Technology to Latin American Development, May 12-19, 1972, Brasilia, Brazil (Washington, D.C.: General Secretariat, Organization of American States, 1972), p. 12.

III

La tecnología entendida como la combinación de elementos de información y organización y no solamente como tecnica de producción, jugará un papel estratégico en el desarrollo de la subregión.

Technology, understood as the combination of elements of information and organization, and not only as the technique of production, will play a strategic role in the development of the subregion.

"Los requisitos de desarrollo andino. Las políticas nacionales y la acción conjunta," Boletín de la Integración (Diciembre de 1972), p. 711.

IV

. . . o la integración económica es seguida paralelamente y de cerca por la integración técnica, o los beneficios derivados de un mercado ampliado serán desperdiciados por falta de potencial técnico para aprovecharlos. En dicho caso, las ventajas del mercado común serán, tanto desde el punto de vista técnico como desde el económico, aprovechadas por fuentes foráneas.

. . . either economic integration is accompanied in parallel and closely by technological integration, or the benefits derived from an enlarged market will be lost due to a lack of technical ability to take advantage of them. In that case, foreign sources will take advantage of the common market, both from the technical and the economic points of view.

Máximo Halty-Carrère, "Sugerencias para una política de desarrollo técnico en la subregión andina," Revista de la Integración, VI, No. 13 (Mayo 1973), 67.

CHAPTER I

INTRODUCTION

1. A Prologue

Science is one of mankind's more exciting activities, involving the search for knowledge about all phenomena through the systematic organization of information and the rigorous testing of hypotheses. More than an intellectually stimulating and satisfying exercise, science is also a fundamental contributor to the economic, social and cultural development of nations. This has not always been recognized explicitly. But as scholars probe the factors and relationships that seem to have been responsible for the success of nations, they have identified science and technology, the application of knowledge, to economic production as crucial aspects of the dynamic process of modernization which has enriched the industrially advanced areas of the world and which is now a compelling force for often traumatizing change in practically every society on earth.

The study that follows is an attempt to describe and analyze the multifaceted environment of a particular underdeveloped region as it strives toward the creation of a common market for science and technology. In addition, it has become an essay on science and technology policy for the Third World in general. Any attempt to comprehend the efforts of one underdeveloped region cannot be undertaken without examining science and technology policy as it relates to its universal context.

The region to be analyzed is South America's Andean Group which is composed of Bolivia, Chile, Columbia, Ecuador,

Peru, and Venezuela.[1] Chapters II and III will describe in greater detail the historical development of the Andean Group as well as its role in an international setting. It is sufficient to say here that for the Andean Group, as well as for the individual member countries, policies for science and technology are perceived as integral elements of a strategy for development that includes domestic economic and social policies as well as international economic and political relations. Development, in this context, is a process of self-sustained economic and social growth which also results in an alleviation of the dependency of underdeveloped nations. Operationally, the alleviation of dependency implies a strengthening of the powers of both public and private national institutions vis-à-vis foreign institutions. The future of regional policies for science and technology, like economic integration itself, depends on the relative strength of positive over negative factors emanating from a complex array of intellectual and institutional relationships.

This study presents only a partial view of its subject. It brings together information from beyond the Andean Group that is necessary to elucidate the group's international context, and it involves an historical dimension to describe change over time. But neither the international nor the historical relationships can be explained fully in these pages. In addition to the temporal and geographical constraints of the perspective, there is another that must be explained here. The study emphasizes policies for science and technology in relation to industrialization. Finally, the analysis of possibilities for an Andean common market for science and

1. Distinguished by its bold attempts to fashion a regional common market, the Andean Group has been evolving its juridical and institutional structure since 1968, although the August 1966 Declaration of Bogotá was the cornerstone of the Group's edifice.

technology will use evidence and criteria that are subjective and will yield conclusions that are largely intuitive.

Despite its limitations, the paper indicates the complexity of the problems faced by the Andean Group, a complexity that incorporates a number of sometimes distinguishable but nearly always overlapping parts. It looks at science and technology policies for the Andean Group and individual nations as parts of comprehensive development strategies that have similar objectives for all parties. It also includes observations and analysis that touch on broader questions relating to developing nations as a whole and illuminates dilemmas common to most of the issues with which science and technology policy are concerned. In general, the study attempts to show how the problem for all developing nations is one of constructing public policies that will apply knowledge and intelligence to the production of goods and services in such a way as to improve human welfare. Simply put though not so simply solved, the problem is a tremendously complex one whose definition, description and solution are much more elusive than is at first apparent.

Perhaps one way to introduce the problem is to divide it into two groups of questions: (1) those that arise from various points of view or intellectual positions and manifest themselves in the ways policies for science and technology are institutionalized; and (2) those that flow from the attempts to institutionalize policies and involve a series of functional relationships which represent the levels at which these policies are utilized for the benefit of developing nations and the incipient common market.

The following two sections will help to illuminate the problems inherent in these questions and set the stage for a more detailed description of the Andean Group.

a. Tensions Arising from Intellectual Constructs

How nations may assert the public power in terms of science and technology is a question as basic as that concerning the nature and role of governments themselves in developing countries. There are two approaches to the question that seem for a long time to have been competing in Latin America and hardly ever appear in a pure manifestation of their ideal types. Moreover, when they result in some form of public policy, these two approaches usually merge into a kind of hybrid that has characteristics of its own. This study will describe what may be only one phase or part of a cycle in the relationship between these two approaches.

One approach, which can be called liberal-scientific, has been in existence for a long time. Generally backed by scientists and educators and receiving greatly fluctuating attitudes of support from developing societies, the liberal-scientific mode argues that increasing inputs of resources for education and research will result, sooner or later, in a combination of scientific and technological factors with other economic factors of production to improve efficiency, growth and human welfare. Liberal-scientists also favor the improvement of international flows of knowledge and sometimes of foreign aid in order to augment internal capacities to conduct research, build universities and institutes, and educate scientific and technical personnel. Though state participation, particularly in financing, is important, the liberal-scientists warn of the dangers of governmental domination over education and the environment in which research is done. In this sense, the liberal-scientific view of policies for science and technology, in its pure form, is laissez-faire.[2]

2. Private entrepreneurs in developing nations, at least indirectly, often reinforce the liberal-scientific fears of

What may be considered the opposite approach to the liberal-scientific, at least in its ideal-typic formulation, is the techno-economic mode.[3] The techno-economists argue that strong public policies must emphasize technology over pure science to obtain better and more direct results in production from limited resources. Perhaps more nationalistic than the liberal-scientists, the techno-economists contend that public authority must be at least as actively concerned with the terms and procedures for transferring proprietary technology from abroad as with regard to unrequited transfers of foreign technical assistance. The techno-economists urge governments to make specific investments in science and technology to achieve explicitly stated goals in terms of economic production, such as the establishment of an industrial or agricultural technology institute to serve immediate needs and interests. Techno-economists employ various other state instruments too, such as taxes or subsidies, to encourage technical innovation and research in productive units.

The techno-economists' mode of policymaking creates antagonisms between themselves and the liberal-scientific advocates of free or autonomous universities. They may argue not only about the division of domestic resources between pure and applied research but also about what to do with foreign aid. The liberal-scientists encourage transfers from foreign governments or foundations to augment their limited funds. The techno-economists wish to have greater governmental

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the state through their own mistrust of too powerful political or governmental forces.

3. There may be a third approach, a radical one that questions the very nature of the emphasis on economics and would move, instead, toward questions concerning the basic structure of society and the feasibility of a future order that would be different from a "western" style modernization. This seems not to be a viable alternative in the Andean nations at this time.

control over foreign resources in order to support technological activities more under state direction and, in a sense, as an alternative for the universities that are often alienated from politics.

Tensions also arise between the techno-economists and two other generalized groups. Domestic users of technology, particularly private entrepreneurs, may appreciate state actions to lower the cost of imported technology but at the same time may resent and sometimes strenuously oppose the growth of public authority in controlling such imports. Foreign purveyors of technology, very often multinational corporations, may understand how national interests dictate supervision of capital and technology transfers, but they point out that such controls may jeopardize the flow of those transfers that may be essential to national development. The nultinational corporations are really saying that there must be a balance between their profitability and the developing nations' requirements for foreign factors on the one hand and economic independence and favoring of national interests on the other.

Latin American policies for science and technology in the past several decades clearly incorporate aspects of both the liberal-scientific and the techno-economic approaches. This hybrid of policies creates a number of additional tensions. Proliferating government agencies, for example, often compete, contradict, and do not communicate with each other, a common enough phenomenon in the growth of public institutions. Moreover, the vague community that joins liberal-scientists and techno-economists in a drive to impel governmental policy and action only papers over the functional and ideological differences between the two groups.

Another trend, born of the Latin American development planning experience of the 1960's and attempting to learn from

its failures, is toward the integral incorporation of high-level scientific and technological planning for all areas within national economic and social development programming. This trend accentuates the need for rationality and consistency in policies that are becoming more and more explicit. At the same time, it engenders new suspicions concerning the further increase of state powers. Hybrid policies for science and technology have been constructed around a consensus, however narrow and tenuous it may be. That limited consensus is composed of two parts, a belief that science and technology can in fact contribute to genuine economic and social development and a desire to counter the debilitating dependency of underdeveloped nations on foreign capital, technology and ideas. But the consensus goes little further than describing its conditions; as a force for moving beyond platitudes and rhetoric it falls apart when confronted with the realities of one central question: how will Latin American governments define and administer policies for science and technology?

There is a final tension that is wrapped up in the issue of using government power for science and technology policy-making. That is the tension between science and technology themselves, as well as between the producers and users of each. Part of this tension derives from definitions. Science is both an attitude toward nature and the systematic accumulation of knowledge, while technology is the effective application of knowledge or the pragmatic everyday innovation process to the production of goods and services. Policymakers face the question of distinguishing between science and technology with a great deal of equivocation. Science is a value that may be necessary for modernization but it also may promote the types of critical scrutiny of political processes and social systems that many underdeveloped nations feel it necessary to control. At the same time, the direct use of

technology is apparently mandated by the welfare and growth needs of individuals, economic units, interest groups and whole societies which must try to obtain concrete and immediate results from limited resources.

The tension between science and technology leads to conflicts in political behavior. Scientists, often oriented toward international criteria of excellence, may agree that they should devote more energy to engineering technology than to higher mathematics, for example. Nevertheless they still want more funds than their countries can afford for building up their laboratories or such frills as attendence at international conferences. On the other hand Latin American governments do not always maximize the potential contribution that their universities can make to production because of shortsightedness and fear of the universities' political activism. Governments may rely instead on sometimes inefficient or artificial means to encourage technological development and are often obliged to continue the importation of technological goods that might otherwise be produced locally. Such governmental actions may fragment and weaken public authority, divide the restricted available resources and make somewhat of a mockery of the drive to alleviate dependency.

b. Functional Relationships and Institutions

The past several pages have focused on the complexity of intellectual constructs and of conflicts between systems of thought that work themselves out in the definition and institutionalization of policies for science and technology. Future chapters treating science and technology policy in the Andean Group and in several member countries of the Group will illustrate how these questions arise and are dealt with in these contexts. Functional relationships between a number of types of institutions, however, are also important to the study of science and technology policymaking in the Andean

Group. They go beyond the very real institutional problems created when liberal-scientific and techno-economic approaches combine in a hybrid implanting of policies for science and technology and result, for example, in internecine competition between government agencies.

Within individual countries, the direct or indirect functional relationships between national scientific and technological policymaking institutions and the users of science and technology are fundamental to effective implementation. Policymaking institutions are those that, in their connection with the state, have explicit authority to define policy at various levels and to distribute resources, create incentives and/or levy penalties to carry out the directives of policy. The national institutions that are the subject of this paper include national research councils, national planning organs and various ministries that concern themselves with sectoral economic activity.

In addition, the Andean Group has three institutions that are involved in policies for science and technology: the economic integration policymaking Board of the Cartagena Agreement, the Andean Development Corporation, a financial agency, and the Andrés Bello Pact on education, science and culture. Relationships between these three institutions constitute a second level of interaction that will be subject to analysis. Third are the relationships between each of the Andean Group institutions and the national organs of the member countries. Finally, to complete the complex functional interactions, the relationships of both regional and national institutional structures to international agencies, foreign governments and multinational corporations describe aspects of Andean Group science and technology policy that reach far beyond the Andean region itself.

Like the intellectual constructs, functional or institutional relationships create opportunities and alternatives for

effecting national and regional policies for science and technology according to explicit developmental interests and objectives. At the same time tensions and conflicts arising from both intellectual and institutional questions are very real constraints for Andean Group policymaking.

2. Toward a Common Market for Science and Technology

A useful way to look at the Andean Group's efforts in the area of policies for science and technology is to see these efforts as directed toward the creation of a regional common market for science and technology. The notion of a common market represents both the liberal aspects of the first steps taken by the Andean Group to construct workable policies for science and technology and the nationalistic implications of a group that wishes to counter dependency and impel self-sustained regional development. The context is larger than the Andean region itself, for it incorporates ideas that are prevalent throughout Latin America and much of the Third World; and it proceeds from a healthy and diverse historical background that must be traced back at least fifteen years.

As we shall see, science and technology have become public issues in Latin America, particularly symbolizing an important aspect of the dependency of underdeveloped societies. They represent also Latin America's concern that future social and economic development rely in part upon new relationships with multinational corporations, international technical assistance organizations and other foreign purveyors of potentially appropriate and useable technology. The problems of making and implementing effective policies for science and technology are not technological per se. They are, as has been indicated above, fundamentally institutional and political. They reflect the inability of the developing nations of the Andean Group to come fully to grips with consensual definitions of national needs, priorities and effective means

of instituting policies and programs.

The historical background is also important for understanding what is happening in the Andean Group. The Group is, in part, a reaction to the failures of past Latin American economic integration movements and of the import substitution process of industrialization that has been national policy for some time.

For optimistic Latin Americans, the initial steps toward regional economic integration through the Latin American Free Trade Association (LAFTA) and the Central American Common Market (CACM) seemed to mark progress away from the disfunctional nationalism and toward a joining of efforts that would result in genuine developmental strides for their nations. Science and technology were to be essential ingredients in economic and social development. Leaders of the movement for progress in science and technology spoke out against the trend toward deepening Latin American dependency. The Argentine Nobel Prize winning scientist Dr. Bernardo Houssay captured this spirit in mid-1959 when he asserted that the "ideal [for Latin America] is to do as Japan has done in accepting technology from the Europeans, but not their political domination."[4] The development of science and technology would occur in the liberal-scientific mode, both nationally and internationally. Dr. Jose A. Mora, Secretary General of the Organization of American states, captured this spirit when he described the Inter-American Atomic Energy Commission as a "first impulse to think about a common market for science and technology in the American continent."[5]

The story of science and technology in Latin America for

4. Ciencia Interamericana, I, No. 1, January-February 1960, 5.

5. Ibid., 26-27.

more than a decade was one of disappointment that matched disillusionment with regional integration schemes. Both nationally and internationally, increasing inputs were made into Latin American education, science and technology. But the story of disappointment was about how the liberal-scientific mode worked in practice. Economic integration had made relatively few positive steps.[6] Serious imperfections in Latin American development became insistent. The imperfections were such important problems as university unrest and the difficulty of government direction of higher education; the brain drain, particularly of medical doctors and engineers; and growing concern that the resources flowing into science and technology seemed to be producing more pure researchers than work related directly to development imperatives. Indeed, many Latin Americans began to realize that unrequited transfers of resources and, even more, foreign capital and proprietary technology were deepening the dependency of their nations.

Another factor is an important background element for understanding what the Latin American nations are trying to do in the area of science and technology policy. That factor is a set of views about markets, how they affect developing nations and what that means with regard to government action. Latin Americans have come to believe, for many reasons--some of which seem less valid than others--that so-called free markets operate to the advantage of the rich countries and foreign corporations. That is to say, relatively free markets operate to the advantage of those economic and political units with greater power. The conclusion, therefore, is that

6. See Miguel S. Wionczek, "The Present Status of Latin American Integration Attempts," in Yale H. Ferguson and Walter F. Weiker, Continuing Issues in International Politics (Pacific Palisades, California, 1973), 383-402.

Latin American governments must intervene to right this power balance in the national and international marketplaces.

As has already been shown in part, the form of this Latin American government intervention is itself in contention. While most believe that governments theoretically should represent the social interest of their citizens, it is not altogether clear that governments' actions in fact contribute to the general welfare in terms of mass benefits in contrast to gains for interest groups or individuals. Some government actions may, in the medium and long term, be self-defeating for the whole nation. Indeed, the world's experience with the process of economic growth in poor nations in the past generation has been that it results in more greatly unequal income distributions than those that existed before sustained growth took place.

Such have been the conclusions of the founders of the Andean Group when they resolved in the mid-1960's that the market sizes, consumption capacities, productive abilities, capital and natural resource endowments and other handicaps of their six small nations must be overcome by creating an effective economic common market that would have as one of its goals special devices to favor its poorest members. Protectionist and nationalistic economic policy, in short, was an impediment to economic and social development. The Andean Group's founders were convinced that their integration movement would have to be more effective and strenuous than LAFTA, which together with the Alliance for Progress was seen to have favored growth in larger nations like Brazil and Mexico. Furthermore, the Andean Group saw LAFTA and the Alliance, combined with protectionist national policies, to be instruments of increasing foreign control of their industries and markets. Thus it is that the neo-nationalism and the strong anti-dependency policies of the Andean Group constitute the context for its conceptions for science and technology.

3. Assumptions and Organization of the Study

To anticipate conclusions, it should be stated that policymaking for science and technology in the Andean Group is in its earliest stages. Its first steps are few. The Group's Decision 24 of December 1970 incorporates a technology policy which, as implemented by the member countries, outlines a common means of national supervision and control of foreign capital and certain categories of proprietary technology. A new proposal of the Board of the Andean Group favors extending technology policy into a long range program with broadened impact on the importation of technology and regional technological development. The Andrés Bello Pact has a few regional science programs and is working on plans for science policy. Individual Andean countries have more highly elaborated policies for science and technology, both implicit and explicit. Though there are some efforts, in part strongly recommended by international organizations, to systematize these policies into coherent and integrated national schemes, the policies are likely to continue to be diverse and not always readily amenable to regional cooperation. Indeed it may be true that diversity between national policies for science and technology is itself a constraint on regional integration.

Nevertheless, this study proceeds from the proposition that economic integration and regional science and technology policies are worthy of special consideration by the Andean nations and that they are perhaps necessary conditions for regional development on terms likely to be acceptable to the Andean peoples. The study is explicitly based on the following assumptions:

(1) Developing nations like those of the Andean region are poor in part because they are not wealthy in immediately available or useable resources, a definitional question that is

necessary to be recognized as something more than a tautology.

(2) Serious ideological and institutional fragmentation, fostered by both internal and international relations, has hampered the more efficient use of these resources in terms of domestic human needs. This assumption suggests more than the obvious failures of markets and productive capabilities and is relevant to the use of governmental power that is fundamental in making and implementing policies.

(3) The enrichment of human resources is as important as exploitation of mineral wealth and capital funds, and all these resources require effective coordination in order to achieve nationally determined development goals.

(4) While science and technology policy is only one aspect of what might be a socially fulfilling development scheme, it may be one of the more crucial aspects in terms of mobilizing available resources efficiently and appropriately.

(5) In order to be more effective, development policy involving public and private groups and interests in culturally pluralistic and diverse societies requires the at least tacit support of a minimal consensus whose quality depends also on the strength of government and the amount of coercion permissible in a given society.

(6) Economic and political integration, such as that programmed by the Andean Group, is a worthy and potentially beneficial process that can aid in overcoming some of the handicaps and problems identified above, especially if combined with appropriate national policies and actions of foreign governments and international organizations.

(7) Science and technology policy, just as any other public policy, can also be seen by various national groups as dangerous because it may strengthen or enrich modernizing sectors without helping impoverished masses. This is a corollary to the fear of growth of governments; for while those who fear government

power may not be happy with their present state of affairs, they may still believe, often with good basis in fact, that public policies will leave them either relatively or absolutely worse off than before the installation of policies that affect them.

(8) Finally, national and regional efforts at scientific and technological development and policies toward that goal must move from the reality of what exists now in terms of ideologies, politics, policies, and institutional infrastructure in each of the countries. This existing reality and the historical forces that have led to its development are more often constraints to be overcome than favorable circumstances for common market evolution.

The chapters that follow will add substance to the thoughts and assumptions set forth in this introduction. Because of the complexity of relationships discussed above and due to the fact that science and technology, integration, and development policies often are responses to or reflect external relations of the Andean nations, the next chapter will set forth the historical and international context. Then, one chapter will describe the institutions, ideas and policies for science and technology of the Andean Group. Succeeding chapters deal with science and technology policy-making in Peru, Colombia and, to a more limited degree, Venezuela; these sections will set forth the national situations and some implications for the Andean Group. The final chapter will move on to analysis and conclusions.

CHAPTER II

ANDEAN POLICIES FOR SCIENCE AND TECHNOLOGY: THE HISTORICAL AND INTERNATIONAL SETTING

This chapter is an outline of the historical and international elements that meet in the Andean Group's struggle to define and implement policies for science and technology, for that struggle has been nourished by these very elements. In this sense, the survey presented here is also an introduction to the general context of science and technology policymaking throughout Latin America. The chapter will deal with the issue of dependency, the liberal scientists, the techno-economists, the international impetus to merge the two strategies, and the role of multinational corporations and national diversity.

1. Dependency

For Latin Americans who strive to construct effective policies for science and technology, the relevant historical and international questions are those that relate to the dependency of their underdeveloped nations. Both liberal-scientific advocates of science policy and perhaps even more vigorously the techno-economists proceed from the belief that dependency must be alleviated if their countries are to develop their resources and improve human welfare with self-respect and justice. In ways that may be differentiated best by the several approaches to and ability to use governmental power, liberal-scientists and techno-economists seek to evoke more fruitful contributions to national development by Latin American scientists, technologists, businessmen and

bureaucrats than dependent nations seem to have been able to stimulate in the past.

These proponents of science and technology policies are and must clearly be understood to be reformers and gradualists. They are nationalists and modernizers with some degree of variation in their approaches, ranging from the right side of a narrow spectrum, illustrated by Brazil's more receptive attitude toward foreign capital and technology, through a moderate nationalist center that is represented by Mexican writings and policy, to a leftist position currently identified with Peru's governmental activism. They are not to be mistaken for radical revolutionists who believe that the only way to counter dependency is to make rapid structural changes sufficient to alter drastically the political and economic orientation of the class that dependency theorists like Cardoso would call the "dependent" national bourgeoisie.[1] It

1. Fernando Henrique Cardoso, Ideologías de la burquesía industrial en sociedades dependientes (Agentina y Brasil), (México, 1971).

The footnotes of this chapter, it should be understood, are written to suggest the literature pertaining to each point. The works cited do not begin to exhaust those available. The author intends, however, to share his material with others so that those wishing to pursue the historical or analytical dimensions may do so if they wish. This explains the volume of material cited herein. Many of the scholarly works cited include their own references or bibliographies; these would be of immeasurable aid to scholars wishing to probe the development of Latin American ideas regarding policies for science and technology.

For one example of a broad historical summary that proceeds from a "technological dependency" perspective, see Alberto Sánchez Crespo, Esbozo del Desarrollo Industrial de América y de sus Principales Implicaciones Sobre El Sistema Científico y Tecnológico, Programa Regional de Desarrollo Cientifico y Tecnológico, Departamento de Asuntos Científicos, Organización de los Estados Americanos, Washington, D.C., 1972. A second, a national case

should be clear, therefore, that the range of viable policy proposals bears a direct relation both to the political and ideological possibilities in different Latin American countries and to the constituency advocating particular science and technology policies.

Since the second World War liberal-scientists have been aided by flows of ideas and resources from donor nations and international agencies, who themselves have become increasingly aware and sensitive to the implications of the dependency issue. While the liberal-scientists struggled to build scientific and technological infrastructures, many of them and their critics began to see, by the middle 1960's, the weaknesses of their liberal approach. These weaknesses were naivete regarding politics, a relatively uncritical attitude about their nations' potential for utilizing science without more explicit policies, and an unwillingness to meddle in the practical businessman's world of foreign capitalism and proprietary technology.

At about the same time, techno-economists began to move beyond the boundaries of liberal-scientific criteria for the

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study also begins with the dependency theory, Milcíades Chaves, "Aproximación al Estudio Del Sistema Científico y Tecnológico de Colombia" (Consideraciones sobre la ciencia y la tecnología en el devenir histórico Colombiano), in COLCIENCIAS, Visión Latinoamericana Sobre Ciencia y Tecnología en el Desarrollo, 3 volumes (Bogotá and Medellín, 1973), II, 653-714.

See also, Simón Teitel, "Tecnología, Industrialización y Dependencia," El Trimestre Económico [México], XL, No. 159 (Jul.-Sept. 1973), 601-25, in which the author concludes that it is difficult to generalize about what Latin American countries should do, and that neither reliance on private foreign investment nor governmental intervention constitutes a policy that is in and of itself either good or bad. "While the first is not synonymous with competition or efficiency, the other does not always represent rational planning and adequate regulation and control" (625).

role of science and technology in Latin American development. Indeed techno-economists in Latin America, responding in part to the early concerns stated by Mexican economist Víctor L. Urquidi and Raul Prebisch in the work of the Economic Commission on Latin America and in the first United Nations Conference on Trade and Development in 1964, became articulate critics of the nature and consequences of both foreign technical assistance and foreign presence in the form of entrepreneurs, capital and technology. Increasingly, the debates over science and technology policy raised new issues, especially the questions of power, the employment of economic tools and governmental authority to counter foreign influences, to invigorate domestic factors and to take active steps toward alleviating dependency.

2. The Liberal-Scientific Mode and International Assistance

a. The Dilemma

International assistance agencies have given material resources and have helped create a consciousness of the need to impel Latin American science. Such resources and intellectual support bolster the Latin American liberal-scientific approach to policy for science and technology and are considered a necessary input into educational and research development.

The post-World War II history of foreign technical assistance for Latin American scientific and technological development built on the bilateral exchanges of past generations and was often carried out through international agencies. UNESCO, for example, has operated a Regional Center for the Advancement of Science in Latin America in Montevideo since the late 1940's, helping create a community consciousness through the publication of numerous national directories of scientific institutions and personnel beginning in 1949. Through

international meetings and the propagandistic writings of staff members, UNESCO has encouraged increases in expenditures on research and scientific equipment, the creation of regional research centers and other forms of cooperation, and the establishment of policymaking organs to coordinate research with social and economic planning.[2]

In addition to UNESCO, other agencies of the United Nations and the Organization of American States butressed the liberal-scientific approach. Among the more prominent efforts were a February 1963 United Nations Conference on the Application of Science and Technology for the Benefit of Less Developed Areas, a 1965 Latin American conference (CASTALA) on the same subject that resulted in an extensive "guide line" for policies for science and technology, UNESCO-sponsored meetings of Latin American research councils that took place in 1966, 1968 and 1971, and a small science and technology program of the Organization of American States.[3] Contributions

2. UNESCO, Centro de Cooperación Científica para América Latina en colaboración con la O.E.A., Montevideo, Instituciones Científicas y Científicos Latinoamericanos [many volumes, since 1949]; Y. de Hemptinne, "The Science Policy of States in Course of Independent Development," Impact of Science on Society, XIII (1963), 233-47; A. Matveyev, "Science and Technology in the Development of Latin America," ibid., XV (1965), 205-10; "The Role of Science and Technology in Economic Development," First Meeting of UNESCO Panel of Consultants, Paris, Oct., 1965 International Social Science Journal, XVIII (1966), 444-47.

3. United Nations, Secretary General, United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas, Geneva, Feb. 1963, Science and Technology for Development (8 Vols.; New York, 1963); UNESCO, Conference on the Application of Science and Technology to the Development of Latin America, Guide Line for the Application of Science and Technology to Latin American Development: Final Report . . . , Santiago, Chile, Sept. 13-22, 1965; UNESCO, La política científica en América Latina (París, 1969); ibid., La política . . . 2 (París, 1971); Ciencia Interamericana, 1, March-April 1960, 9-11; ibid., 8, May-June 1967, 9-20.

were made to scientific and technological development through loans from members of the World Bank group and the Inter-American Development bank, while technical assistance was forthcoming from U.N. bodies such as the UNDP, UNIDO, FAO, WHO, as well as from the bilateral aid programs of the United States and other developed countries. All these contributions were, however, strictly within the liberal-scientific mode, hardly ever even venturing into areas defined as central by the techno-economists.

However, the national research councils that came into existence in practically all Latin American countries, in part as a result of UNESCO efforts, never fully attained the power, the prestige and policymaking function that their originators had intended. Rather, the national research councils functioned primarily as lobbys for the interests of the scientific community and as distributors of some financial resources. While liberal-scientists appreciated foreign advice on how to bargain with their own governments, in part through these national research councils, they did not always realize that technical assistance may have replaced rather than augmented their own national resources and therefore did not necessarily have, in sum, positive effects on Latin American scientific and technological development.

Two confusions were proliferated by the liberal-scientific way of looking at the problems of science. First, the distinctions between science and technology were dangerously blurred, and second, there was no real way to connect science to basic economic production problems. Dr. Bernardo Houssay's report on a UNESCO meeting held in Venezuela in 1960 pointed out that the Latin American delegates preferred "to think of science as a whole" and recommended simply that industrial and agricultural enterprises "strengthen their links with research and teaching institutions in view of the profound

effect which science has on modern commercial life."[4] Reams of liberal-scientific rhetoric about these "linkages" and the functional utility of science and technology during succeeding years have proved an utterly inadequate response to the apparent need for a more activist policy. Further, the liberal-scientists have been reluctant to contemplate the initiatives that they might take from their side to communicate with productive units.

Hence, the situation of science and technology in Latin America remained generally depressing. During the mid-1960's, Latin America devoted approximately 0.2% of its gross domestic product to research and development as compared with 1.3% for West Germany, 2.2% in Great Britain and the United States' 3.1%. The entire region, with a population greater than that of the United States, had a university enrollment of less than 640,000 compared with 5,000,000 in the North American industrial power. Five thousand active Latin American university researchers contrasted dismally with 500,000 in the United States.[5] Even more fundamentally, illiteracy, while trimmed considerably during the decade, remained at unacceptable levels in many countries.

By 1971, basic education figures had shown some progress. Secondary school enrollment had more than tripled while over 1 1/2 million students were registered at universities. Still, small percentages of originally matriculated university students completed their degrees, faculty members were largely part-time teachers, and scientific and technological activities were inadequately funded. The brain drain brought over 45,000 professionals, technicians and related workers from

4. B. A. Houssay, "Organization of Scientific Research in Latin America," Nature (Dec. 31, 1960), 1157.

5. Amílcar O. Herrera, Ciencia y Política en América Latina (México, 1971), 24-31.

Latin America to the United States from 1961 to 1970, a high percentage of the emigrees concentrated in the areas of medicine and engineering.[6] Such data proved that attention to the supply side of the problem would have to be balanced by serious consideration of the weak internal demand for technical personnel.

And yet, Latin America had some outstanding scientific and technological institutional development that derived from the liberal-scientific impetus and the spirit that UNESCO and others encouraged. Many research institutes were the result of direct assistance by foreign foundations, although a few, like the Venezuelan Institute of Scientific Research (1954) were the work of national governments. Perhaps more typical of the pattern of institutions established after the second World War were the Colombian Institute of Technological Research (1955, aided by the Armour Research Foundation); the Monterrey Institute of Technology (founded on the initiative of a North American institute); the Peruvian Institute of the Sea (1960, established with a UN grant and technical assistance from FAO), and the Central American Industrial Technology and Research Institute (1956, assisted by the UN). Moreover, foreign assistance, funding and/or administration has been a continuing necessity for some of the better institutes, cases in point including, for example, the Rockefeller Foundation's involvement in setting up and maintaining the International Center for Tropical Agriculture (1967) in Colombia, and the Kellogg Foundation's role in the Nutrition

6. Inter-American Development Bank, Economic and Social Progress in Latin America. Annual Report 1972 (Washington, D.C.), 410; Ronald Hilton, The Scientific Institutions of Latin America (Stanford, California, 1970), 704-11; Lucila Arrigazzi Jallade y Julia Gabel, "Utilización de los Recursos Humanos Altamente Calificados," in COLCIENCIAS, Visión Latinoamericana Sobre Ciencia y Tecnología en el Desarrollo (Bogotá, Colombia, 1973), Vol. I, 382, 384.

Institute of Central America and Panama (1949) at Guatemala City.[7]

b. A New Offensive

By the middle 1960's serious questions began to be raised regarding the liberal-scientific approach to scientific and technological development. Contrasted with the optimism of some who predicted that Latin America could foster a veritable scientific and technological revolution and that scholars would become governmental advisers,[8] others painted a gloomy picture. C. Chagas, who had been Secretary General of the 1963 UN Conference on Science and Technology asserted that unless strenuous action were taken in terms of developing human resources for science and technology "the people will reach a state of despondency where all problems become practically insoluble."[9] Brazilian physicist J. Leite Lopes, a member of the UNESCO Scientific Advisory Committee, claimed that Latin American scientists

> have largely ignored questions of survival of the developing nations; of the relationship between the powerful economies of the advanced countries and the national aspirations of the underdeveloped nations; of, in short, the human ideal of a decent living for the peoples of the latter countries.[10]

7. Hilton, Scientific Institutions, 74, 107-10, 198-99, 239-40, 258; Ciencia Interamericana, 5, Jan.-Feb. 1964, 3-7; ibid., 12, Jan.-June 1971, 16-18.

8. Rolando Garcia, "The Latin American Universities," in Ruth Gruber, ed., Science and the New Nations (New York, 1961), 230-37.

9. C. Chagas, "Training of Scientists and Technicians in Latin America," Impact of Science on Society, XIII (1963), 201.

10. J. Leite Lopes, "Science for Development--A View from Latin America," Bulletin of the Atomic Scientists (Sept.

But Leite Lopes and others faced a dilemma, for they mistrusted politicians for a lack of scientific orientation and wanted scientists to carry the fundamental responsibility for analyzing the issues, informing the public and impelling policy changes. Wishful thinking was still a part of such a conclusion, for it failed to confront the question of whether scientists had better knowledge or truer instincts about how to use public powers for national welfare than had politicians.

The growing storm of criticism evoked multifaceted examinations of Latin America's scientific and technological backwardness. Writers in the liberal-scientific mode emphasized the scientific and technological gap between the Latin American countries and world leaders such as the United States,[11] the economic and social dualism created in developing nations by technology,[12] the domestic social and cultural

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1966), 10-11; also see N. W. Pirie, "Science and Development," Political Quarterly, XXXVIII (Jan.-March 1967), 62-71, and José Barzelatto, "The Scientific Community and Latin American Development," Ciencia Interamericana, 12 (Jan.-Feb. 1971), 2-4.

11. Karl E. Lachmann, "La transferencia de tecnología a los paises en desarrollo," Comercio Exterior [México], feb. 1967, 131-134; Antonio García, "América Latina: Una industriatización sin revolución industrial," ibid., abril 1968, 321-326; Amílcar O. Herrera, "La ciencia en el desarrollo de América Latina," ibid., sept. 1969, 704-712; Dr. Manfred Nitsch, "La trampa tecnológica y los paises en desarrollo," ibid., sept. 1971, 816-823; Richard N. Adams, "La Brecha Tecnológica. Algunas de sus Consecuencias en el Desarrollo de América Latina," Foro Internacional (México), X, No. 1 (julio-sept. 1969), 28-40; Jorge A. Sabato, "Quantity versus Quality in Scientific Research: The Special Case of Developing Countries," Impact of Science on Society, XX (July-Sept. 1970), 183-193.

12. Anibal Pinto S.C., "Concentración del progreso técnico y de sus frutos en el desarrollo latinoamericano," El Trimestre Economico [México], No. 125, enero-marzo 1965, 3-69.

constraints that contributed to backwardness,[13] and the socio-political ramifications of technological dependency.[14] Concerted efforts were made to study openly and rigorously the brain drain of scientists, engineers and medical personnel from Latin America.[15] Sometimes specific research deplored the paucity of national efforts to develop technical manpower and research capabilities in the face of an industrialization process that demanded the successful acceptance of foreign technology and the substitution of domestic factors for imported skills and techniques.[16] Finally, foreign aid came under attack. The lack of appropriate effectiveness of technical assistance began to be seen not just as a function of the poor capacity of underdeveloped nations to absorb it efficiently,[17] but also as related to the tendency of this aid

13. Marcel Roche, "Social Aspects of Science in a Developing Country," Impact of Science on Society, XVI, No.1 (1966), 41-50; Roche, "Science in Spanish and Spanish American Civilization," in Ciba Foundation, Civilization and Science in Conflict or Collaboration? (Amsterdam, 1972), 143-160; Amílcar Herrera, "Social Determinants of Science Policy in Latin America," Journal of Development Studies, 9 (Oct. 1972), 19-37; Oscar Varsavsky, Hacia Una Política Científica Nacional (Buenos Aires, 1972).

14. Helio Jaguaribe, "Ciencia y tecnología en el cuadro sociopolítico de la América Latina," El Trimestre Económico, abril-junio 1971, 389-432.

15. Perhaps the first important study (carried out, it is important to note, by a multilateral assistance agency) was, Pan American Health Organization, Migration of Health Personnel, Scientists, and Engineers from Latin America (Washington, D.C., Sept. 1966); see Hilton, Scientific Institutions, 707-710.

16. For example, Víctor L. Urquidi y Adrían Lajous Vargas, La educación superior, la ciencia y la tecnología en el desarrollo de México (México, 1967).

17. For example, Sam Schulman, "Intellectual and Technological Underdevelopment: A Case Study--Colombia," Social Forces, XLVI (March 1968), 309-17.

to fortify the status quo and mitigate against progressive structural reforms that were necessary to modernization and development. In this view, developing nations would have to insist that foreign technical assistance become part of a "national and general effort at structural change," that it give "absolute priority to the education and training of native teams" and that the receiving country have "freedom of choice" over it.[18] Binding together much of the sentiment of the late 1960's was the view that foreign influences of all kinds were perpetrating a cultural dependency upon, and therefore enervating in terms of national development, Latin American universities.[19]

It was seldom exactly clear what all this criticism meant in terms of public policies related to science and technology. This was the case not only because the liberal-scientific critics themselves did not know how to manipulate governments that might also be their oppressors, but also because international agencies continued to prescribe general policy approaches to science and technology in underdeveloped nations, even though, as in the case of the UN and its "world plan of action,"[20] national governments retained the option

18. Quotations from Helio Jaguaribe, "La asistencia técnica extranjera y el desarrollo nacional," in Jaguaribe et al, La Dominación de América Latina (Lima 1968), 32-33; also see Jaguaribe, "Asistencia técnica externa y desarrollo económico," El Trimestre Económico, No. 137, enero-marzo 1968, 3-23; María del Rosario Green, "Inversión Estranjera, Ayuda y Dependencia en América Latina," Foro Internacional, XII, No. 1 (julio-sept. 1971), 1-26.

19. Among many examples, particularly emanating from "radical" social scientists, see Orlando Fals Borda, Ciencia Propia y Colonialismo Intelectual (México, 1970 and later editions); Jorge Artel, "La Función Creadora de la Universidad," Desarrollo Indoamericana [Bogotá], No. 19, Año 6 (Oct. 1972), 3-8.

20. UN Department of Economic and Social Affairs, World Plan of Action for the Application of Science and Technology

to do as much or as little as they wished. The liberal-scientists, in short, could go no further than to catalog the categories and try to identify the problems.[21]

Chilean economist Osvaldo Sunkel exemplified this dilemma. In a 1971 article Sunkel blamed the Latin American universities' inability to contribute to real development on the lack of educational reform and on the role of foreign capital, which transferred technology without stimulating scientific and technological development in the host countries. He asserted that the international division of labor in science and technology would only be redressed in favor of poor countries through an alteration in the balance of decisionmaking power over foreign capital and the mobilization of domestic demand for the creation of local capabilities. Sunkel pointed out, for example, the comparison of the favorable

> impact that the development of State activities in the electrical, power and oil industries has had on the corresponding engineering courses of our universities, with the almost non-existent effect of the development of the pharmaceutical industry on the development of chemistry.[22]

Like other liberal-scientists, however, Sunkel had only a partial remedy to impel scientific and technological development through relevant government policy. While it seemed easy to

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to Development (New York, 1971); Robin Clarke, "The Great Experiment: Science and Technology in the Second U.N. Development Decade," U.N. No. E71.I.19 (New York, 1971).

21. Marcos Kaplan, "Política científica y ciencia política," Comercio Exterior (dic. 1970), 1016-30; Darío Abad Arango, "Tecnología y dependencia," El Trimestre Económico, No. 158 (abril-junio 1973), 371-92 are two excellent summaries of the issues.

22. Osvaldo Sunkel, "Underdevelopment, the Transfer of Science and Technology, and the Latin American University," Human Relations, 24, No. 1 (Feb. 1971), 12.

obtain a consensus on the need for national "techno-scientific" activity for the achievement of autonomous economic, social and cultural development, few Latin Americans could agree on how, in politically sensitive climates, the university could be made "an authentic agent of socio-political transformation." As Sunkel pointed out, radical students who reject mindless technological modernization perpetuate an activism that often helps destroy the basis for the dialogue necessary for "scientific and ideological enlightenment."[23] As events have shown over the past six years, governments have reacted to that political activism in almost all Latin American universities with an energy that weakens the entire university.

Liberal-scientists continued to seek outside assistance to promote the development of science and technology in Latin America. But the debates inspired awareness of the problems related to foreign aid, dependency and foreign capital. In addition, it seemed clear that if there were to be a more effective way of putting government policy to work, it would have to avoid the dilemmas and ideological confrontation that writers like Sunkel analyzed. The new approach, involving increased concern for planning in the areas of science and technology as well as for policies regarding the importation of proprietary technology, was that of the techno-economists.

3. The Techno-Economic Mode and International Economics

a. The Problems of the Techno-Economists

The Andean Group is currently encouraging the techno-economic approach to policies for science and technology more vigorously than the liberal-scientific mode. This techno-economic approach became prominent in Latin America through the efforts of individual scholars, the United Nations Confer-

23. Ibid., 12, 13, 16, 17.

ence on Trade and Development (UNCTAD), the Economic Commission on Latin America (ECLA) and the Organization of American States (OAS). Here it is possible to see the incorporation of free floating ideas, published in journals or recommended by the resolutions and counsel of international organizations, into national and regional policymaking. In the sense that the central issues of both liberal-scientists and techno-economists have become generally proliferated and discussed throughout the hemisphere, one could conclude that there is a common market for information that becomes operative in rhetoric and sometimes at the political level.

Mexican economist Víctor L. Urquidi raised the techno-economic issues for policymakers as early as 1962, at a time when Raul Prebisch and ECLA were beginning to cope with dilemmas of the import substitution industrialization that they had prescribed as the basic motor for Latin America's leap forward from underdevelopment. The most poignant dilemma of Latin American industrialization policies was that they seemed to result in deepening dependency for the reason that protectionism encouraged foreigners to invest directly in production within national barriers in order to build or hold markets. Urquidi found that a crucial displacement was occurring within the weak Latin American economies. Foreign capital was replacing domestic capital. Moreover, foreign capital carried technology with it, technology both in the forms of know-how and the results of applied research. The dynamism of North American and other foreign enterprise, and their control of technology, was gradually working its way into Latin America without creating the ripple effects that produced the dynamic and innovative growth of industrial nations. How, Urquidi asked, could Latin Americans gain access to the technological potential that had contributed so greatly to U.S. productivity without becoming at the same time minor participants in the most modern industrial sectors

of their own countries? Without making the more rigorous critique of protectionism that has since become an important part of the Andean techno-economic argument, Urquidi argued for a "true revolution in attitudes toward scientific and technical research." Lacking such new attitudes and a firm government policy in this respect, and if Latin Americans contented themselves with industrial technology carried primarily by foreign subsidiaries, the region would fall into a "sort of technological colonialism."[24]

Urquidi suggested some alternatives for Latin America. Some viable alternative choices were of the liberal scientific variety and included training researchers, strengthening institutes, linking domestic private production with a new concern for technological research, and taking advantage of non-proprietary foreign scientific and technical knowledge. But the key was Urquidi's techno-economic proposal for a policy that would control foreign capital so that private Latin American initiative would not be enervated, so that foreign investment would be obliged to bring its interests into line with the urgent necessities of host countries. Central elements of Urquidi's argument were well summed up in a short passage that recognized political as well as technological and economic considerations.

> It is undeniable that foreign industrial investments bring with them access to the results of research, and that this is translated into a constant improvement of products and in the appearance of new products . . . But if Latin America has to be limited to this means of technology transmission it would not take advantage of all the technical possibilities, and [this means of transmission] would give

24. Victor L. Urquidi, "El desarrollo latinoamericano, el capital extranjero y la transmisión de la tecnología," El Trimestre Económico, No. 113 (enero-marzo 1962), 25.

> foreign capital investment a predominant position in Latin American industry that would not be advantageous from either the economic or political point of view. Consequently, the industrial countries ought to undertake a policy of technological cooperation that consists in facilitating Latin American access to all that could benefit it for its industrial development, outside of the domination of foreign industrial enterprises, in order that Latin American private initiative could place itself at technological levels that would permit it to be developed with full financial independence from private foreign capital; if this is what is desired . . . from the point of view of national development policy [this full financial independence from private foreign capital] would of course be preferable.[25] [Emphasis mine.]

Urquidi's argument had shortcomings and was not as specific as proposals that would be made within a few years. It was not clear what kind of nationalist policy could properly control foreign capital and technology, nor was it clear how much or what kind of foreign cooperation would be appropriate in terms of transferring proprietary technology or its equivalent. However, in part as a result of Urquidi's writings, some Latin American journals began to pick up the theme of technology as an important issue for public discussion. One 1963 ECLA article pointed out the need for governmental involvement in technological research while another article published in Mexico dealt with a program of creative technology that featured public awareness more than governmental policy-making.[26]

25. Ibid., 27; also in Urquidi, Viabilidad Económica de América Latina (México, 1962), and in English as The Challenge of Development in Latin America (New York, 1964), Chapter 8.

26. Bruno Leuschner, "Technological Research in Latin America," Economic Bulletin for Latin America, VIII, No. 1 (March, 1963), 63-86; Jack Baranson, "Un programa de tecnología

Another important impetus to the techno-economic approach was that of ECLA Secretary General Raul Prebisch, who, as chief presiding officer of the first UNCTAD meeting in 1964 reported on the importance of technological development in industrial growth and exportation. The UNCTAD group passed a resolution on technology transfer that called on governments to take some, though unspecified, steps in this regard and asked competent international bodies to study such laws as those regarding patents and other proprietary technology. The second UNCTAD in 1968 also dealt in part with the transfer of technology on the techno-economic level, as a result of which the UNCTAD Secretariat and also other UN agencies began the study of this process, particularly in regard to restrictive trade practices, licensing and know-how agreements.[27]

While actions of UNCTAD and other international bodies are not binding on sovereign states, the 1968 draft resolution helped bring techno-economic issues squarely before underdeveloped nations. Written by Brazil, Chile, India and Pakistan, the 1968 document made the usual plea that developed

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creativa para ayudar al desarrollo económico de los paises menos industrializados," El Trimestre Económico, No. 117 (enero-marzo 1963), 33-68.

27. UNCTAD, Proceedings (8 Vols.; New York, 1964), V, 331-32; II, 32-3; I, 57, 206-07; UNCTAD II, Proceedings (5 Vols.; New York, 1968), I, 353-55, 357-58, 66; Walter A. Chudson, "The International Transfer of Commercial Technology to Developing Countries" [one of a series by the United Nations Institute for Training and Research, UNITAR] (New York, 1971); Charles Cooper and Francisco Sercovitch, "The channels and mechanism for the transfer of technology from developed to developing countries," UNCTAD, TD/B/AC.11/5, 27 April 1971. The importance of UNCTAD's work is indicated, for example, in Miguel S. Wionczek, "La tranferencia de tecnología en un marco de industrialización Mexicana," OAS, Programa Regional de Desarrollo Científico y Tecnológico (Washington, D.C., 1972), 40-42, 44-49.

countries "encourage and assist the holders of patented and non-patented technology" to make effective transfers to developing nations, and it went on to indicate what the developing nations, could do themselves. Developing nations, the draft resolution stated, should

(a) Set up appropriate national and regional centres for providing guidance on the technology most suited to the needs of their enterprises;

(b) Whenever possible, purchase technology outright, so as to ensure its availability to their enterprises;

(c) Jointly investigate and explore possibilities of outright purchase or licensing of imported technology and patented know-how for the common needs of their industrial development on a suitable participation basis;

(d) Associate their scientists and technologists from the earliest stages in the process of transfer of technology, so that technology is absorbed within indigenous research and development and utilized in the most efficient and economic manner;

(e) Exchange scientific and technical information and assist in the transfer iter se of tried-out indigenous technology.[28]

All this was within a context wherein UNCTAD and the underdeveloped nations realized the interrelation between technology, industrialization, and the search for export markets for Third World manufactured goods in industrial countries. But a world common market for science and technology on such terms as was suggested in the UNCTAD proposal was a pipe dream, not least because of the powerlessness of the well-intentioned international agencies and the separate proprietary interests of the industrial owners of technology who were largely domiciled in the advanced industrial countries.

28. UNCTAD II, Proceedings, I, 358.

The important 1972 UNCTAD resolution of technology transfer went much further than its predecessors; because of its later date and the fact that the Andean Group made significant inputs into its conception, that resolution must await discussion for several pages.

The Latin American technical literature began increasingly to reflect techno-economic concerns. Technology selection was theoretically important,[29] but increasingly and with greater vigor articles focused on the evolution of governmental policies for technological development and the transfer of technology.[30] Technology, in fact, became a question of crucial importance for Latin American international economic relations, as was set forth in two ECLA articles. One of these, in 1969, was a fine survey of the transfer of technology and its relation to trade policy and export promotion.

29. For example, Zofia Dobrska, "La selección de técnicas en los paises en vías de desarrollo," El Trimestre Económico, No. 126 (abril-junio 1965), 311-22; Max Brice, "Problemas metodológicos en el estudio cuantitativo del cambio tecnológico en la empresa latinoamericana," ibid., No. 147 (julio-sept. 1970), 575-600; Julio G. López, "La selección de la tecnología y el crecimiento económico," Desarrollo Económico [Buenos Aires], 6, No. 24 (enero-marzo 1967), 533-64; Alfredo Monza, "La teoria del cambio tecnológico y las economías dependentes," Desarrollo Económico, 12, No. 46 (julio-sept. 1972), 253-78.

30. For example, Karl E. Lachmann, "La transferencia de tecnología a los paises en desarrollo," Comercio Exterior (feb. 1967), 131-34; Pedro José González, "Selección de tecnologías e inversión extranjera," ibid., 135-37; Antonio García, "America Latina: Una industrialización sin revolución industrial," ibid (abril 1968), 321-26; Miguel S. Wionczek, "Los problemas de la transferencia de tecnología en un marco de industrialización acelerada: el caso de México," ibid. (sept. 1971), 782-805; Francisco R. Sagasti, "Subdesarrollo, ciencia y tecnología: el punto de vista de los paises subdesarrollados," ibid. (abril 1972), 339-345. This last and important article also appears in English in Science Studies, 3 (1973), 47-59.

Another rigorously set forth the question of selection of techniques as a major problem area for Latin American policy consideration.[31] While much of this literature was exploratory and cognizant of the vast amount of empirical research that would have to be done on technology transfer, development and utilization, the practical importance of the themes was underlined in a July 1967 speech by the Mexican Undersecretary of Industry and Commerce that dealt with national industry, technology and regional economic integration. The Mexican official, Lic. Plácido García Reynoso, declared that the development of a Latin American economic common market and the opening of new markets in the hemisphere for the export of manufactured goods

> could greatly aid in the acceleration of Mexican industrialization. Nevertheless, the degree to which we can take advantage of these new expectations will depend principally on the means by which the Mexican State and the private entrepreneurial sector jointly make our manufacturing production competitive and improve Mexican entrepreneurial dynamism . . .[32]

This increasing awareness of techno-economic arguments, as Miguel S. Wionczek has recently pointed out, was indeed becoming characteristic of significant numbers of Latin American scholars, businessmen and government officials by the end of the 1960's.[33]

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31. "The Transfer of Technology and Its Relation to Trade Policy and Export Promotion in Latin America," Economic Bulletin for Latin America, XIV, No. 1 (1969), 47-71; Ignacy Sachs, "Selection of Techniques: Problems and Policies for Latin America," ibid., XV, No. 1 (1970), 1-34.

32. Plácido García Reynoso, "Industria nacional, tecnología e integración regional," Comercio Exterior (agosto 1967), 622-27; quotation from 627.

33. Miguel S. Wionczek, "La transferencia de tecnología . . . ," (Washington, D.C., 1972), 6, 8, 10, 24, 40.

Techno-economic analyses, though diverse and tentative, were interesting for their reinforcement of the need for Latin American scientific and technological development. For example, one Mexican scholar pointed out various measures of the technological backwardness of developing nations and determined that while national scientific and technological development was necessary, technical knowledge would still have to be imported. It was not the cost of foreign technology that was the main problem; rather, developing nations must pay principal attention to establishing conditions in their countries to make that technology better serve its purpose through the creation of technical capabilities that would allow for appropriate assimilation.[34] Many such issues were aired in a full-scale seminar that took place in Chile in 1971. Seminar participants dealt intensively with foreign investments and the transfer of technology in Latin America. Topics ranged from mechanisms of the diffusion of knowledge and selection of technology to international enterprise in Latin American industrialization.[35]

34. Herman Von Bertrab, "La tecnología y la industrialización," Comercio Exterior (enero 1969), 34-41; also see Víctor L. Urquidi, "Elaboración de una estrategia tecnológica para América Latina," Ciencia Interamericana, 10 (julio-dic. 1969), 1-3.

    For one scholarly warning of the possibly disastrous impact of bringing Argentine technology and labor productivity up to U.S. levels, given existing market demand, see the projections predicting 40% potential unemployment in Osvaldo Baccion, Reynaldo F. Bajuray y Guido Di Tella, "Eficiencia y ocupación en la Argentina," Económico [La Plata], XVI, No. 2 (Mayo-Ag. 1970), 169-93.

35. Karl-Heinz Stanzik y Horacio Godoy, eds., Inversiones extranjeras y Transferencia de tecnología en América Latina. Sesiones del seminario realizado en Santiago de Chile del 24 al 30 de octubre de 1971 (Santiago de Chile, 1972). Two of the papers were published in Comercio Exterior [México]: Máximo Vega-Centeno, "Mecanismos de difusión del conocimiento y elección de tecnología,"

b. Vaitsos and the Commercialization of Technology

With the work of the OAS planning and study group for the entire Latin American region and the brilliant studies of Harvard educated economist Constantine V. Vaitsos, techno-economic formulations for science and technology policymaking soon took on a dramatic new cast. The OAS efforts began to bring together both liberal-scientific and techno-economic questions in a novel synthesis aimed at the creation of a new Latin American consciousness of the issues and the necessity of regional consensus and national action to combat scientific and technological dependency.[36] Vaitsos' outstanding work is distinguished by its single-minded determination to validate the study of the commercialization of technology, a new conception of techno-economics precisely formulated within the categories of international economics and of Latin American economic and social development.

Vaitsos' advent as perhaps the leading theorist of the techno-economic view in terms of technology policy as a function of international economic relations came at precisely the time when the infant Andean Group was considering the formulation of the basis for Decision 24, the Group's common regime for the regulation of foreign capital and technology. During 1970, experts of the Andean Group contemplated how to deal with an interrelated set of questions: the control of foreign investment in order to provide opportunities for domestic entrepreneurs and to cope with the increasingly disturbing influx of foreign power over Latin American industrial

(enero 1972), 61-66; Fernando Fajnzylber, "La empresa internacional en la industrialización de América Latina," (abril 1972), 324-38.

36. Máximo Halty-Carrière, "The Process of International Transfer of Technology: Some Comments Regarding Latin America," Ciencia Interamericana, 11 (enero-feb. 1970), 8-12. Because it is an integrative attempt, the OAS work will be discussed in the following section of this chapter.

production and balance of payments difficulties that were exacerbated by the manner in which import substitution industrialization was proceeding. As Chile and Colombia had been demonstrating since 1967, national policies could effectively make savings for the national balance of payments by supervising the contracts whereby proprietary technology was imported. Government "committees on royalties" would determine when some payments were unreasonable or inappropriate and alter the purchase terms. Such supervision, it was found in Colombia by 1970, could also root out various instruments within so-called technology contracts that restricted the activities of foreign subsidiaries or national firms, compelled the purchase of certain goods or technical services, seemed to allow for overpricing or price-fixing in international shipments that mitigated against the national economic interest, and apparently helped foreigners avoid certain local taxes.[37] As Miguel S. Wionczek pointed out, such means of supervising the transfer of at least some categories of technology were among those that showed how the Andean nations might find the "most suitable solution to the general problem of financial transactions between foreign enterprises in the area and the exterior."[38]

At the same time, while the control of foreign technology was inevitably linked to the control of foreign capital and while both seemed both economically and politically appropriate, Wionczek made it clear that there had to be a middle road to follow. There was a dilemma, he argued, inherent in

37. "La transferencia de tecnología hacia los paises del Grupo Andino," OAS, Programa Regional de Desarrollo Científico y Tecnológico (Washington, D.C., 1972), AC/PE-46, 100-105; Constantine V. Vaitsos, "Strategic Choices in the Commercialization of Technology: the point of view of developing countries," International Social Science Journal, XXV, No. 3 (1973), 383.

38. Miguel S. Wionczek, Inversión y tecnología extranjera en América Latina (México, 1971), 89. Also see Celso Furtado, Economic Development of Latin America (Cambridge, England, 1970), Chapter 18.

any policy directed at countering the foreign take-over of domestic industry. (Urquidi had pointed out a number of years earlier that it was both politically expedient and economically appropriate to protect domestic capital from foreign investors.) But too strict control or outright prohibition of foreign capital from specific industrial areas "in the absence of a national and regional technology policy and of a profound change in the attitudes of national enterprise" would be likely to "sharpen the absolute and relative technological backwardness of national industries," Wionczek warned.[39]

Thus, Decision 24 was already in the making during 1970, having been called forth by the Declaration of Bogotá, which was the first action to form the Andean Group in 1966, and by the Cartagena Agreement of 1969 that formally established the Group's economic integration mechanisms.[40] Constantine Vaitsos made significant contributions to Decision 24's formulation in papers presented to the Board of the Cartagena Agreement, in published articles, and in his continuing role as expert on technology policy for the Andean Group.[41] Vaitsos explicitly limited his arguments to the international commerce in proprietary technology, although these arguments have crucial implications for the efficacy of economic integration in the Andean Group and for all areas of policies for science and technology. Though one summarizes another's original work only at great risk, it can be suggested that Vaitsos contended in general for three propositions. First, a self-sustained economic and social development would occur in underdeveloped nations like those of the Andean Group only

39. Wionczek, Inversión y tecnología extranjera, 87.

40. Ibid., 68-69; for background see 67-94 in full.

41. Also see Chapter V for Vaitsos' work in Colombia, which was a prelude to his involvement with the Andean group.

if new, rational and farsighted state policies brought forth dynamic industrial entrepreneurship. It was the general absence of such entrepreneurial capability that made Wionczek's dilemma so poignant. Second, technological progress, though poorly understood as a factor of economic production, had to be as much as possible under local or regional control. Regional integration and revision of the overly protectionist economic policies of the previous generation were necessary conditions for achieving the purposes of these two propositions. Finally and perhaps most important, the technology transfer question had to be raised beyond mere concern for immediate balance of payments effects that was displayed, for example, by partial supervision of contracts for licenses on patented, trademarked and similarly categorized technology. Technology transfer, in fact, had to be analyzed as a commercial transaction from which underdeveloped nations were not benefitting sufficiently.

Vaitsos' principal contributions to technology policymaking, therefore, have centered on the development and implications of the commercialization of technology. It is important to explicate what all this means; the following discussion is derived from a careful reading of Vaitsos' work. Though very often difficult to identify because of its embodiment in capital, goods or people, technology is a special kind of knowledge that is inexhaustible, since the seller retains the knowledge even after it has been sold. The sale of technological knowledge takes place in an imperfect market in which the sellers have a number of advantages. Sellers have control in part through "ownership" and the ability to manipulate the form, price and quantity of the technology. Buyers, especially if they are underdeveloped countries, lack understanding of exactly what they purchase, generally have no domestic substitutes or could develop them only at great expense, and therefore have little bargaining

power over the terms of the transaction. Furthermore, since many important units of Andean Group industry are affiliates of foreign or multinational corporations, these affiliates have no incentive to bargain strenuously for better technology transfer terms because of the foreign control over them. Foreign purveyors of technology extract monopoly rents through the sale of their goods to underdeveloped countries because of their power, the special characteristics of limited markets of developing countries, the use of technology contracts to secure higher than normal prices for intermediate goods and other benefits, legal structures such as patent legislation that violate anti-monopoly or anti-trust principles, and the weakness, passiveness or ignorance of the poor nations. The international technology market, in short, is characterized by a distribution of benefits and returns that are absolutely contrary to the interests of developing nations.

From the analysis of Vaitsos has emanated what might be considered a pure form of the techno-economic prescription for technology policy in the Andean Group as well as for other developing nations or groups. The prescription includes three important parts: the elaboration of increasingly precise hypotheses based on empirical evidence concerning the international technology market; the binding of the commercialization of technology to comprehensive economic integration and development policies which will eventually bring forth a vigorous regional industrial entrepreneurial capability; and the establishment of government technology commercialization policies and institutions, based on these principles, manned by thoroughly competent and sophisticated personnel, and linked effectively to other economic and social development policymaking and implementation in both national and inter-

national areas.[42] The combination of these elements of the prescription would dramatically enhance the bargaining position of developing nations in the international commerce in technology.

42. Constantine V. Vaitsos, "Bargaining and the Distribution of Returns in the Purchase of Technology by Developing Countries," Bulletin, Institute of Development Studies, University of Sussex, 3 (Oct. 1970), 16-23; Vaitsos, "The Process of Commercialization of Technology in the Andean Pact," OAS, ScA/PS-13 (Washington, D.C., 1972); Vaitsos, "Opciones Estrategicas . . . ," Comercio Exterior (sept. 1971), 806-15; Vaitsos, "Patents Revisited: Their Function in Developing Countries," Journal of Development Studies, 9 (Oct. 1972), 71-97; Vaitsos, "La función de las patentes en los paises en vías de desarrollo," El Trimestre Económico, No. 157 (enero-marzo 1973), 195-232; Vaitsos, "El cambio de políticas de los gobiernos latinoamericanos con relación al desarrollo económico y la inversión extranjera directa," El Trimestre Económico, XLI, No. 161 (enero-marzo 1974), 133-71; Vaitsos, Comercialización de Tecnología en el Pacto Andino (Lima, 1973).

It will be noted again later that Vaitsos' work has made an impact on other writings on this subject, for example in Miguel S. Wionczek, "La tranferencia de tecnologia . . ." (Washington, D.C., 1972), 40-44, and in UNCTAD III, Proceedings (New York, 1972), III, 117, 119, 122-36. Also, Julio Fidel, "Antecedentes y perspectivas de la inversión extranjera y la comercialización de tecnología. El caso argentina," Desarrollo Económico [Buenos Aires], 13, No. 50 (julio-set. 1973), 285-314.

There is a growing literature on the Third World attack on the patent system. Some examples, in addition to the Vaitsos article cited above, are: UNCTAD III, Vol. III, 131-33; Mayer Gabay, "The Patent System and Technological Development in Latin America," ScA/PS-7, March 1972, Regional Scientific and Technological Development Program, Department of Scientific Affairs, Organization of American States, Washington, D.C.; Ulf Anderfelt, International Patent-Legislation and Developing Countries [The Hague, 1971]; Jorge Katz, "Patentes, corporaciones multinacionales y tecnología: Un examen crítico de la legislación internacional," Desarrollo Económico [Buenos Aires], 12, No. 45 (abril-junio 1972), 105-149; Daniel Chudnovsky y Jorge Katz, "Patentes e importación de tecnología," Económica [La Plata], XVI, No. 1 (enero-abril 1970), 61-86.

The techno-economic approach to technology policy suggested even more than the prescriptions which applied most elementally to national governments. It meant that a common market for science and technology would be a market quite different from the liberal-scientific concept of that market. It would be a market for exchanging, as Vaitsos put it, information about information; that is, about the terms of the commerce in technology between national governments that were usually secretive about their contracts with foreigners and other such arrangements. It would be a market of knowledge about alternative sources of technology and about the facts and procedures of bargaining, a market that should include not only developing nations but also some sympathetic high income countries.[43] The implications domestically were important also. Most importantly, these implications were that economic common markets, common markets for science and technology, and new national development and industrialization policies would foster entrepreneurial skills as well as internal demand for domestic scientific and technological factors. Reciprocally, such a healthy climate would invigorate the scientific and technological infrastructure. In all of this, the state would have an important role, though this role would vary from country to country. In brief, the techno-economic paradigm for Latin American development is a long term view of state stewardship of entrepreneurial development, through direct and indirect economic policy instruments, as a key to industrialization and the necessarily related scientific and technological development.

43. For example, Miguel S. Wionczek, "El mercado de capital, tecnología e información en la región del Pacifico y su posible apertura a América Latina," Comercio Exterior (feb. 1971), 130-37.

4. International Impetus and Merging Strategies

As we have seen, by 1970 some Latin American nations were beginning to integrate the liberal-scientific and techno-economic approaches to science and technology policymaking at least schematically on an intellectual level.[44] It would prove to be, however, the international organizations who were the major forces working to construct and propagandize a new synthesis for national and regional consumption. Although it was reasonable to expect such attempts at synthesis from Latin America where there was a tendency to intellectualize about development in global and rather lofty philosophic terms, the institutional framework and authority was fragmented at the national level and inevitably could not, certainly at least in a short period of time, put the two systems of thought coherently or effectively together into a feasible whole. The division of responsibility, for example, between liberal-scientific education ministries and national research councils on the one hand and increasingly techno-economic minded industrial and financial organs of state on the other was not bridged by sufficiently knowledgeable and powerful central development planning and implementing agencies. This remains one of the crucial difficulties of Latin American public policymaking. In contract, international agencies like the UN and the OAS, who were under less constraint, were able to do what national organs could not: allow the Third World in general and Latin America in particular to begin to see the shape of the hybrid of liberal-scientific and techno-economic strategies for science and technology policies to propel economic and social development.

It is interesting to trace the transition to the new

44. A good illustration is Instituto Nacional de la Investigación Científica, Política Nacional y Programas en Ciencia y Tecnología (México, 1970).

hybrid in this regional organization. As has been suggested earlier, the beginning years of the OAS program for science and technology were dominated by the liberal-scientific ideology. Liberal-scientific ideas held complete sway at the first inter-American meeting on science and technology held under OAS auspices in 1964.[45] Latin American governmental planning for science and technology became a prime topic at a mid-1966 meeting of the OAS Consultative Committee on Science, but aside from the planning exercise the categories discussed did not deviate from previously established liberal-scientific patterns. The OAS working papers merely followed UNESCO recommendations to promote rational and explicit planning at the highest possible level, drawing attention to the experience of the OECD countries in science policy.[46]

With the April 1967 Punta del Este declaration of the Latin American heads of state, the OAS moved more forcefully into programs of technical assistance for science and technology and further than previously into the area of policy.[47]

45. Ciencia Interamericana, 5, No. 1 (enero-feb. 1964), 18; Ibid., No. 2 (marzo-abril 1964), 27-31; Jorge Grieve, "Ciencia, tecnología, desarrollo económico y política gubernamental," ibid., 3-12.

46. Ciencia Interamericana, 7, No. 3 (mayo-unio 1966), 1-11, 13-15.

47. Ciencia Interamericana, 8, No. 2 (marzo-abril 1967), 10-13; ibid., No. 3 (mayo-junio 1967), 6-20, 25-26; ibid., 9, No. 1-6 (enero-dic. 1968), 18-20.

The establishment of a special multilateral fund to finance the activities of the expanded regional program, one-third donated by Latin American governments and matched by a two-thirds contribution by the U.S., enabled the OAS program's expenditures to increase from over three-quarters of a million dollars in the first year of operation to around eight million dollars annually. The majority of these resources have been devoted to international cooperation and investment in education and science. But a small portion of the budget has financed a unit within the program's staff that elaborates and analyzes science and technology policies for Latin America.

The OAS policy planning and study unit came to life within a Latin American milieu of science and technology policymaking that was nourished by increasing activity in both the liberal-scientific and the techno-economic areas. Various Latin American countries upgraded or established new national research councils or other science and technology policymaking bodies in the liberal-scientific mode. These bodies, with different degrees of state-granted authority, were to perform duties in diagnosing national scientific and technological needs and capacities, draw up plans of action, and attempt to obtain governmental and other resources for investment in human resource development, research and further studies for policy elaboration.[48]

If the trend was toward increasing governmental intervention from the liberal-scientific perspective, this was also true for the techno-economic mode. Between December 1970 and 1973, the Andean Group, followed closely by Brazil, Argentina

48. See note 44 and UNESCO, La política . . .--2 (Paris, (1972), passim; Arnaldo Niskier, Ciência e Tecnologia para o Desenvolvimento (Rio de Janeiro, 1970) argues for Brazilian national ministry for science and technology; Brazil, Presidency of the Republic, Basic Plan for Scientific and Technological Development 1973/74 (June 1973); Ciencia Interamericana, 8, No. 3 (mayo-junio 1967), 27, on creation of Chile's national commission; ibid., 12, No. 1-2 (enero-junio 1971), 28, on Peru's CNI; ibid., 13, No. 5-6 (sept.-dic. 1972), 39-41, on Mexico's CONACYT; ibid., 12, no. 1-2 (enero-junio 1971), 22, and No. 3-4 (julio-dic. 1971), 17, on Argentina. This is only a very partial list which is supplemented for Peru and Colombia, at least, in later chapters of this study.

The public debate in Brazil was covered in a series of articles in that nation's leading newspaper under the title "The Brazilian Technological Challenge." See O Estado de São Paulo, May 6, 1973, 1, 192, 193; May 8, 1973, 24; May 9, 1973, 16; May 11, 1973, 16; May 12, 1973, 16; May 13, 1973, 260. Also ibid., May 23, 1973, 3; July 10, 1973, 14; July 26, 1973, 26, 27, 73; and Sept. 4, 1973, 25.

and Mexico instituted legislation to effect control of certain categories of imported proprietary technology, sometimes in conjunction with the supervision of foreign capital.[49] At the same time some major Latin American journals featured articles or documents on science and technology policy in countries that in some respects they emulated, while Latin American governments were encouraged to consider similar policies for public multinational corporations that were designed to assist the regional integration effort.[50]

The movement toward the hybride mode, therefore, was natural. Máximo Halty-Carrière, directing the OAS planning and study units, made the techno-economic argument an important part of his group's approach. This approach emphasized

49. Acuerdo de Cartagena, Decision 24, December 1970, "Regimen Común de Tratamiento a los capitales extranjeros y sobre marcas, patentes, licencias y regalías" (Lima); Brazil, Law No. 5,722 of 21 Dec. 1971; for previous Brazilian legislation dating from 1963 see Francisco Aleida Biato, "Algunos Aspectos de la Producción y Transferencia de Tecnología en el Brasil," OAS, AC/PE-16 (Washington, D.C., 1972), 21; Argentine Law No. 19,231 of Sept. 10, 1971 and Decree No. 6,187 of Dec. 22, 1971, in Ciencia Interamericana, 13, No. 3-4 (mayo-agosto 1972), 26-30.

For an example of a study made in Argentina as a result of the registration of contracts in the automotive sector, see Bruno C. Reddavero, "Analisis de la transferencia de la tecnología externa a la industria Argentina: El caso de la Industria Automotriz," Económica [La Plata], XVIII, No. 3 (set.-dic. 1972), 367-88.

50. For example, Gobierno de Japón, Oficina de Ciencia y Tecnología, "Libro blanco sobre ciencia y tecnología para una sociedad avanzada-resumen," Comercio Exterior (feb. 1971), suplemento; Nicholas Jaquier, "Hacia una política tecnólogica: el modelo japones," ibid. (agosto 1972), 745-48; K. D. Sigh, "La reglamentación para la adquisición de tecnología en los paises en desarrollo," ibid. (oct. 1972), 959-62; Marcos Kaplan, "Cooperación Científica-Técnica y Corporaciones Públicas Multinacionales en América Latina," Desarrollo Indoamericano [Bogotá], Año 6, No. 19 (oct. 1972), 25-28, 55-57.

rational and coherent science and technology planning in Latin America, with particular emphasis on the Andean Group. And it brought together scholars in the preparation of analyses and in discussion of the problems of policymaking.[51] National planning for science and technology, adapted to each country's conditions and needs, was proposed as the way to reconcile ideological and functional fragmentation problems with consensual agreement that science and technology could be harnessed for explicit and realizable economic and social development goals. Unfortunately, while it was relatively easy to talk of this intellectual and planning merger, the principal theorist of such planning, Peruvian social scientist Francisco R. Sagasti, had great difficulty moving from the theoretical systems analysis approach to a de facto reconciliation of liberal-scientific and techno-economic requirements.[52] This reconciliation in a functional sense would have to be the job of national advocates of science and technology policy planning and, even more importantly, its outcome would depend primarily on political factors, as will be described in later chapters of this paper.

The OAS efforts to evolve a hybrid approach to Latin American science and technology policymaking and to reach some kind of consensus in favor of a regional conjunction of policies reached a high point in May 1972, precisely the time of the Third UNCTAD meeting. The OAS-sponsored Specialized

51. See note 36; Máximo Halty-Carrière, "Producción, Transferencia y Adaptación de Tecnología Industrial," in COLCIENCIAS, Visión Latinoamericana Sobre Ciencia y Tecnología en el Desarrollo (Bogotá, 1973), I, 449-533, in which the author refers to a "common market" for science and technology. OAS-sponsored seminars focusing on planning for science and technology were held, in cooperation with local research councils, in Buenos Aires, Aug. 8-10, 1970; Washington, D.C., April 3-4, 1972; and Bogotá, April 6-8 and 10-15, 1972.

52. See Chapter IV, note 17 and pages 112-114.

Conference on the Application of Science and Technology to Latin American Development (CACTAL) drew strength from the UN emphasis on a world scientific and technological plan of action for the Second United Nations Development Decade.[53] But it also was a decidedly hemispheric affair that resulted in the Consensus of Brasilia on science, technology and Latin American development. The Consensus of Brasilia put together liberal-scientific and techno-economic concerns with those of regional integration under the umbrella of three categories: scientific and technological development, technological innovation and the transfer of technology, and regional cooperation.[54] Interestingly, CACTAL brought together representatives of multinational corporations and non-Latin American countries and organizations in addition to country delegates and those

53. See note 20. The World Plan of Action includes, for example, guidelines for expenditures on science and technology for developing nations by both underdeveloped and advanced countries (39), as well as suggestions for institutional development and relationships (51-52, 65-71).

My understanding of the role of the OAS in science and technology policymaking in Latin America was enhanced greatly in interviews in Washington, D.C., with Alejandro Moya and Francisco Sagasti, July 3, 1973; Dr. Marcelo Alonso, July 12, 1973; and Dr. Jesse D. Perkinson and Joaquin Cordua, Aug. 23, 1973. Also see Dr. Marcelo Alonso, "Trends in Science and Technology in Latin America," in Symposium on the Scientific and Technological Gap in Latin America, April 17-18, 1972, Proceedings (Lincoln, Nebraska, 1973), 32-49.

54. OAS "Working Document" for CACTAL, #OEA/Ser.K/XVIII.1; CACTAL/doc. 5 rev. 1, 20 April 1972; CACTAL, #OEA/Ser.C/VI.22.1, Final-Report, May 12-19, 1972, Brasilia, Brazil (1972), including the Consensus of Brasilia, 10-26. A follow-up meeting was held later; OAS, Meeting of the Group of Government Experts for the Application of Science and Technology to Latin American Development, #OEA/Ser.C/VI.22.1-a(1), Washington, D.C., Oct. 25 to Nov. 5, 1972 (1972). The first two documents cited here catalog the mass of materials brought together at CACTAL and summarized, to a large extent, in the OAS "Working Document."

from groups such as the Andean Common Market in order to sponsor a genuine interaction of ideas that might benefit and strengthen the resulting consensus.

Consensus, however, was more apparent than real. The conference's recommendations were only indicative for national governments of various degrees of interest and motivation. Nevertheless, something important was accomplished and OAS experts saw the techno-economic approach taking hold in Latin American thought. They realized that the OAS regional science and technology program would have to try to make links to the national governments that went beyond the ties to ministries of education. Another indication of advances in considerations of techno-economic ideas was the fact that multinational corporations took a fairly strong adversary position with regard to technology transfer questions and practically estranged themselves from the conference proceedings that touched on that question.

The May 16, 1972 UNCTAD III resolution on technology transfer began from the techno-economic position and articulated the fragmentation problem in the functional relationships involved in all aspects of Latin American science and technology policymaking. Similar to the case of the Consensus of Brasilia, the UNCTAD resolution reflected but could resolve only peripherally the problems encountered by Latin America or the Andean nations. It urged nations to establish institutions "for the specific purpose of dealing with the whole range of complex questions connected with the transfer of technology from developed to developing countries." A background paper declared that "there is undoubtedly need for some national machinery to ensure centralized responsibility and co-ordination" in this regard. The resolution asked developed nations to "facilitate an accelerated transfer of technology on favorable terms to developing countries" in both

public and private areas. It sought action by all institutions "to improve the scientific and technological infrastructure of the developing countries." Finally, it encouraged UNCTAD cooperation with other international organizations by furnishing information and advice for developing nations and their regional and subregional groups.[55]

The UNCTAD resolution, passed without dissent but not favorably viewed in some respects by developed nations attending the conference,[56] helped to mobilize a number of international agencies to assist science and technology policy-making in the Andean Group and developing nations throughout the world. This is reflected, for example, in UNDP attention to the Cartagena Agreement and its corollaries as a center for Latin American integration, the recent establishment of a technology transfer advisory service in the UN-sponsored Latin American Institute of Economic and Social Planning (ILPES) in Santiago, Chile, and UNDP/UNESCO planning for an Andean Group science and technology information network.[57]

The international impetus to merge science and technology strategies went beyond the institutional inputs of the OAS and UNCTAD, illustrating intellectual continuity, institutional

55. United Nations Conference on Trade and Development, Third Session, Santiago de Chile, Document No. TD.180, Vol. I, pp. 109-111 [for resolution 39 (III). Transfer of Technology]; Vol. III, p. 118 ("Transfer of Technology," Report by the UNCTAD secretariat); also see Anthony Connors, "The UNCTAD III Resolution on the Transfer of Technology," Institute for Development Studies, Bulletin (University of Sussex, England), 5 (Jan. 1973), 14-20.

56. See J. Ann Zammit, "UNCTAD III: End of an Illusion," ibid., 3-13.

57. Interviews with Carlos A. Dabezies and Patricio Silva, UNDP, New York, Aug. 8, 1973; UNISIST Newsletter, No. 4 (1973), 4-5; Surendra J. Patel, "La transferencia de tecnología a los paises en desarrollo," Foro Internacional, XIII, No. 1 (julio-sept. 1972), 11-26.

linkage and a Third World orientation. Over a three year period and with the cooperation of ECLA, other UN specialized agencies, the OAS and the Inter-American Development Bank, the UN Advisory Committee on the Application of Science and Technology to Development (ACAST) elaborated a Latin American regional plan of action that was published in May 1973 and complemented the 1971 UN World Plan of Action.[58] Intellectual continuity and some functional cooperation existed at the level of the international organizations that brought together in comprehensive single documents the hybrid of liberal-scientific and techno-economic prescriptions for policy. But individual nations and regional integration bodies lagged behind the international institutions in terms of reconciling the two modes of policy definition and implementation.[59] The OAS and the UN might elevate certain sectors of hemispheric consciousness and try, on paper at least, to integrate ideas. But they could not demonstrate how to overcome functional problems at the national and regional levels. International assistance agencies, for all their shortcomings, simply were fundamentally different from national societies, with their individual politics, pressures and fragmented policymaking systems.

Still the merging of strategies, even as tenuously as it had been done, made clear three significant issues: that international assistance agencies could lead only to a limited degree in impelling dynamic new science and technology policy-

58. United Nations, Economic and Social Council, Economic Commission for Latin America, A Latin American Plan of Action for the Application of Science and Technology to Development, E/CN.12/966, Santiago, Chile, May 1973. A Spanish edition was published as Plan de acción regional para la applicación de la ciencia y la tecnología al desarrollo de América Latina (México, 1973).

59. For recognition of the need to integrate goth formulations see Miguel S. Wionczek, "La transferencia de tecnología . . . (Washington, D.C., 1972).

making in Latin America; that national governments would themselves have to deal with the question of how to use and rationalize their powers; and that foreign capital and multinational corporations were going to remain a central factor in the outcome. The following sections of this chapter will discuss these last two points.

5. Multinational Corporations

Multinational corporations (MNC's) are the exemplars, in the Latin American view, of foreign capital participating in underdeveloped economies. Unlike many Latin Americans, however, they do not see themselves as a barrier to scientific and technological development. Fully conscious of the importance of technology for industrial development and politically aware of the sensitive issue of the sovereignty of developing nations, the MNC's generally agree that developing nations should make more effective use of science and technology. In short, there is a vague consensus between MNC's and developing nations about economic development, and that consensus if weak, especially over the terms of international business relations that will lead to effective development. The most significant conflicts arise from MNC concern about the activity of the governments of developing nations regarding foreign capital and technology which, in the view of foreign capitalists, is likely to harm the interests of all parties and superimpose narrow political judgments over economic decisionmaking processes that may better be left to business and the interplay of market forces.

Private foreign business argues that its role in development and innovation is compatible with the improvement of welfare in poor nations.[60] Yet, developing nations are

60. For example, The Council of the Americas, Inc., The Effects of Foreign Investment on (1) Latin America as a

suspicious. When, they ask, have MNC's helped us develop technologies under our control or the capability for technological development? In addition, poor nations, as indicated by the critiques of UNCTAD for example, are becoming increasingly bitter about their deteriorating "technological balance of payments,"[61] which in large part they blame on foreign proprietary control of technology and the characteristics of the

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Whole, (2) Argentina, (3) Brazil, (4) Mexico (July 1972).

On the other hand, Vaitsos argues that "In many respects nationalism can be an important producer's good which implies the development of local human capital, local entrepreneurs and companies, and national capacities to assimilate, adapt or advance productive knowledge so as to take greater advantage of the opportunities offered by the world economy. In this sense, nationalism implies not only the preservation of political independence and cultural heritage, but becomes a significant policy instrument of economic development." Constantine V. Vaitsos, "The Changing Policies of Latin American Governments Toward Economic Development and Direct Foreign Investments" (mimeographed, April 1973), 24; also see remarks by Víctor L. Urquidi concerning foreign investment and Latin American development in Adalbert Krieger Vasena and Javier Pazos, Latin America. A Broader World Role (London, 1973), 171-75, and Víctor L. Urquidi, "Latin American Development and the Technical Gap," Symposium on the Scientific and Technological Gap in Latin America, Proceedings, 246-57.

61. UNCTAD estimates that the cost to all developing countries for technology in terms only of rights to use patents, licenses, know-how, trademarks and other technical knowledge for investment studies through operative production cost around $1,500 million in 1968. UNCTAD considers this to have been an underestimate of the total cost and believes that the foreign exchange costs of technology transfer will grow at a rate of 20 per cent annually. UNCTAD III, III, 113-117.

Also see the following article, which was previously published as an UNCTAD II paper [U.N. Doc. No. TD/28]: G. H. G. Oldham, C. Freemen and E. Turckcan, "The Technological Balance of Payments," Development Digest, 7 (Jan. 1969), 71-74.

international market for technology. More specifically, the Andean Group has experienced the decided antipathy of many foreigners toward its program for controlling foreign capital and technology. One U.S. business publication pictured the Group as a "model of decisive energetic action, but action which is not favorable to private foreign investment," scarcely veiling the implied threat that the Andean foreign investment code would make capital difficult to obtain for regional development. Latin American analysts and polemicists alike suggest that technology is an instrument by which MNC's gain and hold foreign markets while gathering control over resources and dynamic industrial units practically for the sole purpose of satisfying the interests of the firms. Foreign attacks on the Andean investment code and control over technology, therefore, are perceived in Latin America as threads from a single fabric that represent the actual divergence between MNC's and the neo-nationalistic development schemes of the Andean Group.[62]

U.S. business in Latin America, while a group that contains many and sometimes widely contrasting viewpoints, seems to be moving away from its initially hostile attitude toward the Andean Group and actions such as Decision 24. At the very least, U.S. firms are finding it necessary to accept the fact that this group of developing nations is attempting to write new rules of the game in certain crucial areas that

62. Many sources are the basis of these statements. The quotation is from Business Latin America, April 8, 1971, 107; for a highly critical analysis of the foreign hostility to Decision 24, see Wionczek, Inversión y Tecnología extranjera, 127-135.

Also see John T. Lindquist, "Forced Divestment and the Andean Group," Development Digest, 12 (Jan. 1974), 81-87, which is a summary of Discussion Paper No. 31, Princeton, New Jersey: Research Program in Economic Development, Woodrow Wilson School, Princeton University, Oct. 1972.

MNC's and others had assumed were practically unalterable. In fact, such changes as the Andean Group and UNCTAD, for example, have proposed with regard to financial and commercial relations between developing and advanced nations may lead to the establishment of a new basis for international economic relations affecting MNC's and poor countries.

The change in foreign attitudes toward the capital and technology rulings of the Andean Group have come in part because Decision 24 has not been fully implemented and definitive rulings have not been made on some apparently ambiguous clauses.[63] Indeed, a costly and intellectually stimulating September 1973 series of seminars was arranged by the Council of the Americas to attempt to depoliticize the issues and help business to come to grips with the new emerging reality in the Andean Group. The Council of the Americas, an information arm sometimes considered a lobby for the majority of U.S. business operating in Latin America, was formerly a strong opponent of Decision 24.

Foreign business is still vitally concerned that Andean efforts to control or gain more power over technology is really

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63. Foreign firms in both Colombia and Peru are much more concerned at this point about those aspects of Decision 24 relating to divestment or transformation into nationally controlled units than with any question of technological development. And those that are less concerned with total or majority control than with profits and productivity, talk about financial management and management "technology" rather than about research and hard technology.

    Interviews with Rene Moosman Barbieri, Empresas Eléctricas, Lima, Oct. 2; Juan Enrique Riveros, ADELA Administración y Servicios del Perú, S.A., Lima, Oct. 1; Romero Cubas, American Chamber of Commerce of Perú, Lima, Oct. 4; Walter Johnson, First National City Bank, Lima, Oct. 12, 1973; also with Antonio Copello Faccini, Comité de Acción Interamericana, Bogotá, Nov. 7, 1973, and Daniel Cammaert, ADELA Administración y Servicios de Colombia, S.A., Bogotá, Nov. 5, 1973.

an attack on private capital, its prerogatives and proprietary rights in technology. Foreign capital is clearly not ready to accept the Vaitsos argument that the "marginal cost of using or selling an already developed technology is zero for the owner of that technology" and that practically any price for that technology over zero represents an unjustified return to the owner that is appropriated only because of the owner's strong bargaining position in relation to underdeveloped nations.[64] One presentation of the Council of the Americas at the 1972 CACTAL meeting in Brazil argued that increasing quantities of foreign capital and technology were required for Latin American development, that Vaitsos' study of how the proprietary technology transfer mechanism affected Colombia in the case of the pharmaceutical sectors was interesting but could not be the basis for technology policy conclusions until more research was done, and that Latin American actions that might stem the importation of foreign capital and technology would be contrary to the region's interests. The strong implication of this argument was that CACTAL should not follow the example of the Andean Group's Decision 24. The Council of the Americas position was not well received at CACTAL.[65]

Charles S. Dennison, a former U.S. corporate executive now very active in international technology policy questions, tried to moderate the terms of conflict between international business and Latin American governments in a separate paper prepared for CACTAL. His proposal for opening dialogue and beginning cooperation between the "international productive sector" and Latin America was an attempt to join progressive

64. Vaitsos, "Bargaining and the Distribution of Returns," 16.

65. Council of the Americas, "Some Observations About the Costs and Benefits of Technology Transfers," submitted to CACTAL, May 17, 1972.

businessmen and Latin American policymakers, entrepreneurs and technologists in a mutually beneficial relationship that would not have the hard edges of either ideological antagonisms or government control of technology transfer. But as Dennison commented later, his efforts were meant only to indicate what measures "international corporations could adopt in response to [Latin American] countries' national aspirations." However, his carefully constructed and conciliatory "message fell far outside conventional corporate technological thinking and had little effect" in bringing the two sides together in what he termed a "joint technological liaison."[66]

Although Dennison's comments about the MNC attitudes toward technology transfer and technology developing in developing nations seems to confirm, by implication at least, part of the Latin American techno-economic argument, the issue between multinational corporations and underdeveloped nations is unresolved and likely to be in a state of flux for some time. The issue clearly seems to be how to stabilize and defuse areas of conflict while maximizing cooperation between developing nations and MNC's. The dialogue is necessarily continuing. A recent example was the February 1973 Caracas Round Table on Foreign Private Investment in Latin America. Participants included the OAS, Inter-American Development Bank (IDB), the International Chamber of Commerce (ICC), and the Inter-American Council for Trade and Production (CICYP). One of the conference's conclusions recommended an approach nearly identical to the one proposed by Dennison at CACTAL.[67]

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66. Charles S. Dennison, "The Role of the International Productive Sector in Latin American Scientific and Technological Development: Observations and Proposals," May 1972; Charles S. Dennison to author, Oct. 15, 1973, emphasis in original.

67. Charles S. Dennison, "Latin American Technological Development and the Private Investor--the Issues and the Potential for Joint Activities," prepared for the Third

The Andean Group's aim, in large part, is to favor the development of regional industry through the generally libealizing influences of larger market opportunities as well as special tariff and location preferences for local enterprise. In their movement away from the restrictive national protectionist policies for more traditional import substitution industrialization, the Andean nations hope to stimulate a dynamic state and private capitalism (depending more specifically on which country is being referred to). Domestic entrepreneurship would be fostered by combatting extreme protectionism in economic policies, business ignorance of technology, the relative lack of appropriate skills and techniques, weak demand for technology and lethargic governmental bureaucracies. Science and technology policy in the Andean Group and for individual member nations, therefore is, at least at the rhetorical level, oriented toward providing national business with the instruments for industrial growth and moving their countries away from such deep dependency on foreigners and the MNC's.

6. National Diversity

If multinational corporations are an important consideration for Latin American nations, national investors and business also remain a crucial factor in the determination of development policy. Despite general agreement in the Andean Group concerning the approach toward developmental nationalism, however, there is great variation between the member nations in

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Round Table, Caracas, Feb. 13-16, 1973; Charles S. Dennison, Memorandum, "Rapporteur's Report, III Roundtable on Foreign Private Investment in Latin America, CIAP-IDB, Caracas, Venezuela, Feb. 13-16, 1973." The Round Table, third in a series sponsored primarily by the OAS and IDB, anticipated future participation by the UN and the International Financial Corporation.

approach toward foreign capital, national enterprise and the politico-economic forces that determine what kinds of power governments will have and how they will use these powers. Although a real constraint on the evolution of regional economic integration and of an Andean common market for science and technology, this diversity will be described in greater detail in succeeding chapters.

The extent of present or programmed Chilean and Peruvian state enterprise necessitates special governmental action to ensure technological development appropriate to national goals. But Chile's recent readmission of some foreign business previously deprived of the right to participate in the economy by the Allende regime suggests a new attitude toward reconciling the national and foreign private industrial elements. Peru, on the other hand, is adamant about transforming foreign firms into nationally controlled enterprises, though the domestic mix of state and private industry will be determined by the pragmatism of Peru's military government and the degree of cooperation that can be secured between the private sector and the state. Private industry dominates practically entirely in Colombia and Venezuela, and national business clearly expects to be favored over foreign capital. Science and technology policymakers in these two countries must, however, carefully consider the reactions of both nationals and foreigners in their efforts to maximize results. As a consequence, the shape of an effective, workable science and technology policy consensus differs from country to country.

Political considerations are perhaps the most crucial in national efforts to create science and technology policies that will have the consensus support of the actors involved in their operation. Indeed, it may be true that the outcome of the interplay of political forces with regard to such policies may lead to policies that have only narrow consensus,

thereby requiring strong government determination to secure implementation. Peru, for example, seems willing to risk the emnity of a large segment of its private industry in planning science and technology, capital investment and industrial development. On the other hand, Colombia can hardly consider such a course in a situation where private trade associations are powerful functional elements of public policymaking. The agreement of Colombian national industry is practically an indispensible element for policy determination and implementation. Moreover, the relative impact on government policy will vary widely between countries in terms of the size and type of industry affected. Small and medium sized industry has the poorest understanding of technology and the least inclination to use it. Governmental aggressiveness will therefore have to be a more important factor in effective policy for smaller firms than for larger and more adaptable ones. Andean governments do not have uniform interest, power or motivation in this regard.

Universities have an uncertain place in the construction of science and technology policy consensus. Though important to the liberal-scientific conception of scientific and technological development, universities are politically suspect all over Latin America because they are perceived as the seat of destabilizing opposition to government power. Therefore, governments barely consider university participation a necessary condition for a consensual science and technology policy framework. The situation in Chile illustrates the point most dramatically. A U.S. scholar recently wrote that the Chilean military government was moving against the universities, proscribing social sciences as "morally poisonous" and subject to replacement "by such 'safe' disciplines as science and technology."[68] It is not entirely clear, however, that

68. Laurence Birns, "The Death of Chile," New York Review of Books, Nov. 1, 1973, p. 32; Paul Sigmund, "Chilean

scientists and technologists will be more amendable to government intervention in the university than the social scientists have been. In any case, the universities in Chile as elsewhere in the region have been weakened, such actions are likely to limit their usefulness, and the liberal-scientists will generally be obliged to participate in national development on terms laid down by the state. This is not an especially healthy environment for research and education or for science and technology policy consensus that must be based on visions of future national development. As later chapters will indicate, there are national variations in approach to this problem. Some Andean nations are able to create narrow consensus between governments and universities on specific science and technology policy issues and for short-run goals. That, however, will not be sufficient if these countries are to make the fullest possible use of their meager scientific and technological resources for economic and social development.

Finally, it is necessary to point out the diversity of current national attitudes toward Andean Group integration. This aspect of diversity stems in part from domestic variations as well as from the relationship of each nation to the international economy. Chile, Colombia and Venezuela were the strong early advocates of the regional system, but changes in regimes and economic situations have resulted in a situation where Peru and, for different reasons, Colombia are the strongholds of integration sentiment. Bolivia seems always to have been a marginal participant in the scheme, while Ecuador and Venezuela are now benefitting from windfall gains from petroleum opportunities and have weak pressures obliging them to work strenuously for integration. Chile has proclaimed

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Universities and the Coup," Change, 5 (Winter 1973-74), pp. 18-22. Similar ideas are expressed regarding Colombia in "Debate sobre la Universidad," El Tiempo (Bogotá), Lecturas Dominicales, Nov. 1, 1973, pp. 3-5.

its continued adherence to the integration scheme and specifically to the regional investment code, but its internal political and economic difficulties predominantly occupy policymakers of that nation. Further, Bolivia and Chile, for example, may see greater gains to be won from new associations with other Latin American powers that may weaken the six nation Andean Group. Science and technology policy on a regional basis may be capable of receiving a great deal of rhetorical and even institutional support, but without progress in economic integration for which such policy can be put to use a consensus on science and technology will be relatively meaningless and only marginally productive for the Andean nations.

In sum, an historical view of the international context adds both positive and negative factors to a complex picture of economic integration and of science and technology policymaking for the Andean Group and for its members. Nationalism and a common acceptance of superficial aspects of dependency theory make for limited agreement that at least symbolic efforts must be made to ameliorate debilitating reliance on foreign technology. Internal fragmentation and politics, pluralism and diversity emphasize the negative over the positive factors; this is illustrated in part by the problems of combining the approaches and activities of liberal-scientists and of techno-economists into feasible programs for scientific and technological development. It is possible that international assistance will help in the formulation of policies for science and technology but international economic factors and foreign capital may contribute more to Andean fragmentation than to the resolution of it.

CHAPTER III

FIRST STEPS TOWARD AN ANDEAN COMMON MARKET IN SCIENCE AND TECHNOLOGY

The Andean Group is completing the first major phase of its existence. The bold initiatives of the Group have aroused considerable interest from those around the world who seek developmental breakthroughs, and they have understandably evoked interest and concern from foreigners who conduct business in the region.

1. Andean Group Institutions

With a reasonably effective regional consensus that joined top level political leaders with economists and other technicos, the Andean Group moved to define and implement a number of carefully devised policies. These policies were written somewhat uniquely to favor the development of the region's poorest members, Bolivia and Ecuador.[1] Andean Group economic integration policies are comprehensive, concerned with trade liberalization and the construction of a common external tariff, industrialization, agricultural development, export promotion, finance, the harmonization of numerous economic and social policies within the region, and many other questions. Several proposals and policy decisions of the Group's institutions attempt to make policies for science and technology an integral part of non-dependent development.

1. This somewhat unique approach to one of the thorniest problems of distributing benefits and costs of regional integration in underdeveloped areas was only one indication of the intelligence with which the founders of the Andean Group pursued their task.

Though many important decisions have been made and intra-regional commerce has increased significantly, implementation of many Group policy decisions has slowed. In addition, though Venezuela has finally joined the important Cartagena Agreement only recently, that Caribbean nation has shown no intense desire to push itself into Andean regional integration strenuously at the time of this writing. These and other factors suggest that with the first phase of Andean Group development nearly at an end, a period of consolidation, re-evaluation and serious negotiation between the nations is necessarily underway. While observers still believe the Group has some chance of moving beyond its current accomplishments, predictions for its future are somewhat mixed.[2]

With the goal of consolidation and reevaluation in mind, the Andean Group rather quickly set up an institutional structure that was compatible with the Latin American Free Trade Association. The Group's successes have depended on the degree to which supranational policymaking could be reconciled with

2. Interview with Dr. Germánico Salgado, Lima, Oct. 16, 1973; Harold José Rizo, "Colombia and the Andean Group in the Process of Latin American Integration," Ph.D. thesis, University of Notre Dame, 1972; Dr. Germánico Salgado Peñaherrera (member of the Board of the Cartagena Agreement), "The Andean Group Building an Economic Union," paper delivered at V International Conference of the Institute for International Cooperation, University of Ottawa, April 11, 1973, and "La influencia del Grupo Andino en el futuro de la integración latinoamericana," mimeographed paper, 1973. Among the many other sources for these paragraphs, see David Morawetz, "Economic Integration Among Less Developed Countries with Special Reference to the Andean Group," Ph.D. thesis, Massachusetts Institute of Technology, 1972; William P. Avery and James D. Cochrane, "Innovation in Latin American Regionalism: The Andean Common Market," International Organization, 27, No. 2 (Spring 1973), 181-223; Edward S. Milensky, "Developmental Nationalism in Practice: The Problems and Progress of the Andean Group," Inter-American Economic Affairs, 26 (Spring 1973), 49-68; Kenneth A. Switzer, "The Andean Group: A Reappraisal," ibid., 69-81.

diverse and changing national priorities, governments and political climates. Thus far, its strength in this regard has been in the area of general aspects of integration, while its problems have stemmed from the definitional weakness regarding specific programs. As indeed is the case with development policymaking within its member nations, the Andean Group is built on a consensus whose periphery is strong and broadly based politically, but whose central areas are often frail and unsubstantial. This is a general problem which affects regional policies for science and technology just as it has policies in other areas of development. In addition, though in theory policies for science and technology should have an actively functional relationship between themselves (and with other categories of policymaking), these policies emanate from separate Andean Group institutions.

The Andean Group's structure presently includes several institutions. Also known as the Andean Pact, the 1969 Cartagena Agreement (Acuerdo de Cartagena) established the planning and policymaking structure that works in the broadest areas of economic integration. The principal Cartagena Agreement organs are the Commission, the highest policymaking body that is composed of representatives of the member states, the Board (Junta) of three elected officials and a well-staffed technical secretariat. The Board and the secretariat are also known as the Junta (JUNAC) and occupy a handsome brick and glass building in Lima which was donated by the Peruvian government. A separate regional compact (1968) laid the basis for the Andean Development Corporation (Corporación Andina de Fomento, CAF). The Andean Group's financial and promotional body, CAF has its main offices in Caracas, Venezuela. The 1970 Andrés Bello Pact (Convenio Andrés Bello) for educational, scientific and cultural integration set up a permanent executive secretariat (SECAB) in Bogotá, Colombia in 1972. Other Andean integration institutions include the

nascent Convenio Hipólito Unanue for public health, presently housed with the Peruvian Ministry of Public Health in Lima, and the recently-effected Convenio Simon Rodríguez, which joins the six countries in the area of labor policy and will have a secretariat in Quito, Ecuador. Of the Andean Group organs only JUNAC, CAF and SECAB are involved with policies for science and technology.

The relationships of these various organs with each other are not precisely defined. In part these relationships depend upon the good will and initiative of the personnel of the regional organizations as well as upon indirect linkages, sometimes through Andean Group institutional connections with member governments. They also depend, for example, on the strength and content of inter-ministerial Andean counterparts in education, foreign trade and economic policymaking, and development planning. In short, the spirit and initiatives of regional integration have fostered a number of integration institutions that paradoxically are not integrated among themselves.

While all the Andean Group regional institutions are dedicated to some form of integration or cooperation, they often have only informal links between them. Some officials are anxious to regularize and formalize these relationships. The two bodies most closely in harmony are the Cartagena Agreement and CAF, the latter perceiving its role to be that of implementing regional integration schemes such as industrial development projects in which two or more countries have a part.[3] Each Andean Group institution has formal links with and representation from a specific national governmental body.

The assiduous endeavor to reach consensus concerning regional integration is signified by the complexity of the

3. For example, Boletín de la Integración (Buenos Aires), Feb. 1973, 105.

bargaining and participatory relationships between the countries and Andean Group organs and among the regional institutions themselves. This complexity contributes to lengthy negotiations and periods of indecision, a slow and timid process which may be the only way in which the nations of the Andean regions can move toward effective integration.

It is appropriate to illustrate this complexity. The Cartagena Agreement groups have formal links with member governments through offices of the foreign ministry in the cases of Bolivia and Chile and through national bodies with authority over foreign trade and/or integration in the cases of Colombia, Ecuador and Venezuela. Representatives of labor and business, supposedly elected without governmental interference, serve on an Economic and Social Advisory Committee. Other Advisory Councils bring together representatives of relevant government ministries when specific questions are under consideration. Vigorous attempts are now being made under the Cartagena Agreement to set up an Andean regional court to interpret decisions and official acts and to decide international disputes; public and private members of the legal profession are involved in this process. An August 1973 conference at JUNAC's Lima headquarters brought together the foreign ministers of the six nations to evaluate legislation. Attending as observers were the three Junta members and its Secretary Director, CAF's Executive President, the Executive Secretary of the Andrés Bello Pact, and the General Secretary of LAFTA. CAF's directorate is composed of national representatives who, in a few cases, also represent their governments on the Commission of the Cartagena Agreement, but this does not necessarily suggest the existence of an interlocking directorate between the Commission and CAF. CAF's linkage offices in each country are major governmental institutions of finance and development, although the Venezuelan office is the Institute of Foreign Commerce (Instituto de Comercio Exterior, ICE). The annual meeting of Andean Group Ministers of Education is the highest organ of the

Andrés Bello Pact, while the Pact's "Technical Aid Organ" is an annual conference of the chiefs of educational planning. The Pact and SECAB have permanent formal connections to each government through Offices of Coordination established in education ministries. Thus it is obvious how complexity is a result of many types of participation, and also how this complexity makes for a slow-moving process of integration.

2. Andean Group Policies for Science and Technology

Andean Group policies for science and technology are in their first stages. It is too early to analyze their impact but it is possible to describe relevant existing Commission decisions and proposals, the ideas that they contain, and the work of SECAB and CAF.

There is not an integrated approach to science and technology, the two being separately considered by different Andean Group institutions. JUNAC's current proposal for a "subregional policy of technological development," which has its foundation in Decision 24 and other rulings of the Commission, is currently being discussed in the member countries and will soon be brought before the Commission of the Cartagena Agreement. The process of regional negotiation of this technology policy, to be discussed later in this study, illustrates some of the problems of institutional fragmentation within the Andean Group. CAF has the role of helping implement technology policy, while the Andrés Bello Pact may play a significant part in helping create a regional common market in the area of science. There are many blurry areas, however, for SECAB is in fact interested in applied research that has important economic potential and is not limiting itself to pure research or scientific education.

For the following discussion of policies for science and technology of the Andean Group it will be important to bear

in mind two facts: that regional policies and implementation will have to mesh to some degree with various conceptions of science and technology policies in the member countries, and that international organizations, multinational corporations and other foreign creators and purveyors of science and technology are intimately involved in regional policymaking processes. These situations contain factors that both favor and fragment Andean Group attempts to create a common market for science and technology.

3. Technology Policy and the Cartagena Agreement

a. The Plan

Technology policy in the Andean Pact, part and parcel of the Group's controversial rulings on the treatment of foreign capital and technology, can in no way be separated from the entire regional integration and development scheme. In terms of policies for industry and technology, there must be an increase of governmental power in economic affairs in behalf of state industry to augment the position of private national enterprise. Economic conditions that would strengthen national enterprise in contrast to foreign business, theoretically, would have the desireable effect of enhancing the power of national business to negotiate with foreigners even without explicit governmental actions. Technology policy is grounded in techno-economic analysis and incorporates two basic notions: that the power and ability of the Andean nations to negotiate and search for foreign technologies must be enhanced and that Andean scientific and technological development is an essential ingredient of non-dependent development.

To Andean Group planners, the creation of an economic common market will make possible the fuller and more efficient utilization of resources and plant capacities within the region. As Andean entrepreneurs are encouraged to participate increasingly in regional industrialization and commerce, governmental

policies and the necessities of business will create a demand for technology as an instrument of management. Likewise, with the growth of Andean industrial dynamism, public officials and businessmen will improve their ability to bargain with foreigners for capital, technology and markets outside of the region. Of course, the impact of regional economic integration will vary from country to country due to the economic and political diversity of the Andean nations.

Decisions 24 (December 1970), 37 (July 1971) and 49 (December 1971) of the Commission of the Cartagena Agreement incorporate existing Andean technology policy. Since this technology policy is an integral part of the so-called Andean Foreign Investment Code and of policies for regional industrial development, it is necessary to explain its context, primarily on the basis of Decision 24. Applicable to industry but also to natural resource and service sectors, the Code has the purpose of transforming firms in which foreign capital has a controlling interest into enterprises controlled by nationals. With a number of exceptions and ambiguous cases, the Code sets general guidelines for this "fade-out" or "divestment."[4] The Code also places restrictions on the remittance of profits earned by direct foreign investment and on foreign borrowing by foreign firms and establishes a system for supervising the importation and use of technology covered by trademarks, patents, licensing agreements and royalties.

Not uniformly effectuated in the Andean countries, the Foreign Investment Code is considered more a general statement of principles than an unalterable statute. The reasons for this are clear. In the first place, individual countries have

4. For example, divestment does not apply to firms that intend to export 80% of their production beyond the Andean region. In addition, Bolivia and Ecuador are given more than twenty years for reducing foreign ownership of firms while the other member countries are charged with carrying out divestment within fifteen years.

a great amount of leeway in how they follow Andean Pact rulings; the Commission, it is obvious, is not a supranational government. Second, the Investment Code attempts to reconcile three propositions that in practice are not easily brought together. As techno-economists like Víctor L. Urquidi and Miguel S. Wionczek have pointed out, the control of foreign capital and technology is an important part of an industrialization program that seeks to invigorate the domestic industrial sector. At the same time, Andean policymakers hope not to impede the flow of foreign capital and technology that is such a crucial element in their economic development scheme. Finally, the Code would hopefully ameliorate Andean competition for foreign capital and technology.[5]

The Foreign Investment Code aside, the technology policy of Decisions 24, 37 and 49 is intended to operate on several levels. First, it is directed toward regional cooperation, institutionalization and enforcement that is consistent with the notion of a common market for technology. Second, although the policy's impact on regional cooperation has been slight, it still functions broadly to harmonize national policies and implementation under a consensual intellectual framework. Third, Andean Group technology policy applies directly to regional programs of sectoral industrialization. Perhaps the most important such industrialization program to date was established by Decision 57, which allocates 72 "assignable units" of about 200 metal-working products for

5. Wionczek, Inversión y tecnología extranjera, 67-135; analyses by Robert Fullmer, John R. Pate, Jr., and The American Chamber of Commerce of Peru in materials prepared for Council of the Americas Workshop Seminar on the Andean Pact, Sept. 1973. For an important survey, see Constantine V. Vaitsos, "The Changing Policies of Latin American Governments Toward Economic Development and Direct Foreign Investments," mimeographed, April 1973, and also in Spanish in El Trimestre Económico (México), XLI, No. 161 (enero-marzo 1974), 133-171.

production in specific countries under conditions that favor these products in intraregional commerce.[6] Finally, the technology policy, together with the Foreign Investment Code, is a signal to foreigners and multinational corporations that the Andean Group is attempting to alter certain central international economic rules-of-the-game in favor of underdeveloped nations.[7]

Constantine V. Vaitsos is JUNAC's principal planner in the area of technology policy. His concept of the commercialization of technology is a key notion behind attempts to make that policy effective.[8] Basically, the commercialization of technology requires that the Andean nations negotiate intelligently and from a position of strength with foreigners and that they promote their own scientific and technological development. Both actions are consistent with a desire to alleviate dependency, around which the Andean Group has been able to gather the broad consensus that has been described earlier. Negotiation is one of the methods by which the Andean Group hopes to increase its power vis-à-vis foreigners over the use of resources, including technology and capital, and to move toward greater independence in political, economic and cultural terms. Scientific and technological development

6. Boletín de la Integración, dic. 1972, 705-08; Robert Fullmer, op. cit., 11-17. The Latin American term for metal-working is "metalmechanics." As with regard to the Foreign Investment Code, the metal-working decision is subject to negotiations between the Andean nations to work out all its details; this has the prospect of being a lengthy process.

7. See Vaitsos, cited in note 5 above.

8. See Vaitsos, Comercialización de tecnología; Junta of the Cartagena Agreement, "White Paper on Policies on Science and Technology Directed Towards the Social and Economic Development of the Andean Pact," J/AJ/24, Oct. 20, 1972 (Lima). See also Chapter II for more on Vaitsos and the commercialization of technology as an aspect of the ideology of developmental nationalism.

is the important other side of the coin; it demands the building or strengthening of domestic capabilities to search for, evaluate and adapt foreign techniques, to conduct research and to apply technology to the requirements of production and distribution.

Governmental institutions and information are necessary for the improvement of the negotiation part of technology policy. In part following patterns already established in Chile and Colombia, Decision 24 mandated the opening of governmental offices in each country which would review contracts for the importation of technology in certain explicit categories. Located in ministries such as those for industry or for economic development, these offices are concerned not only with the balance of payments effects of technology importation but also with information regarding technology transfer that may strengthen negotiations by the government or national firms with foreigners. Some offices attempt to make explicit choices between alternative technologies. Such technological choices are supposed to be made in terms of perceived national needs, such as the employment effects of the use of a particular technique or the utility of technology for firms or sectors other than those specifically involved in a contract. Sometimes the decision may be to suggest the use of local technical personnel or facilities instead of foreign ones in order to help create demand for domestic technological capabilities.

Decision 24 forbids contract clauses that restrain firms from taking some actions that otherwise might be advantageous to them, such as those that restrict the volume and content of production, limit exportation, prohibit the use of competitive technologies, stipulate options that can be exercised by technology suppliers and oblige payment of royalties for

trademarks that are not in fact used commercially.[9] The drive to remove restrictive clauses that restrain production or trade proceeds from the need for effective anti-monopoly legislation in developing nations that generally lack it and that at the same time wish to limit monopolistic and oligopolistic practices by multinational corporations. This is another element in the techno-economic effort to inspire competitively viable entrepreneurial development in underdeveloped nations.

Negotiating power is enhanced by the opportunity to make alternative choices. In large part, the Andean Group approach is to improve its position before the United States by seeking markets, capital, technology and advice in Western Europe, the Socialist bloc and Japan. Similarly, Andean technology policy seeks to counter dependency by applying Decision 24's instruction that national authorities undertake "continuous and systematic identification of technologies available in the world market for the different industrial fields, for purposes of having at their disposal the most favorable and convenient alternative solutions for the economic conditions of the subregion."[10] Worldwide technology searches would be just one of many ways by which the Andean nations could overcome their historically passive and undiscriminating approach to the importation of foreign technology.

Information is crucial in negotiation and is also an aspect of the power the appropriate government offices might exert. The common market for technology depends on the exchange of information. For this purpose, Decision 24 lays the basis for an Andean Industrial Property Bureau. Perhaps

9. From an English version of Decision 24, Journal of Common Market Studies, X (June 1972), 339-59; especially Articles 19b, 20, 25.

10. Decision 24, Article 22.

more important at this stage, the Decision commits the member nations to exchange information concerning authorizations and terms for foreign investment and technology importation. Exchanges of information about technology contracts would be, as Vaitsos sees it, the "first step toward the application of the principle of the 'most favored-nation in the purchase of technology.'"[11]

Regional power to enforce and adjudicate disputes is also important. For example, drawing on the principle made famous in Mexico's Calvo Clause, Article 51 states that controversies involving foreign capital or technology must be resolved only within the jurisdiction and under the laws of the country receiving them. Theoretically these pieces of Andean technology policy fit consistently together. Their implementation, however, requires that the nations develop sophisticated governmental procedures and retain well-trained personnel to analyze and apply the policy.[12]

b. Beyond Decision 24

Andean regional policy to promote technological development is only in the planning and study stages. Decision 24, however, calls on the Commission and the Junta of the Cartagena Agreement to approve a program to promote and protect the production of technology as well as the adaptation of existing technologies. According to the program, preferential treatment would be offered to products that incorporated "subregional technologies" and patent privileges would not be granted to certain commodities. A regional institutional

11. Vaitsos, Comercialización de tecnología, 140.

12. Ibid.; Decision 24, Articles 48, 51, 54; Junta del Acuerdo de Cartagena, "Propuesta de la Junta relativa al reglamento para la aplicación de las normas sobre propiedad industrial," JUN/Propuesta 19/Mod. 1, 17 de dic. 1971 (mimeographed).

system would centralize information concerning technologies available throughout the world that might be of potential use to Andean producers. When approved by the member countries, Decision 49 will go even further by authorizing definite Andean actions regarding industrial information and research as well as in offering engineering and economic evaluation services. Under Decision 49's mandate, the Junta will emphasize the utilization of regional technicians for making feasibility studies and studies of natural resources related to industrialization.[13]

In October 1973 the Commission of the Andean Pact published its comprehensive proposal for a regional policy of technological development which is being considered by the Commission for possible action at its late April 1974 meeting. Composed by Vaitsos' team of experts, the policy proposal chillingly describes the technological dependence of the Andean region to be nearly complete. It condemns narrow economic protectionism and argues for the necessity of both economic integration and the integration of the region's technological capability. The marked tone of anti-dependency is moderated by the recognition that even a regional common market for a well developed technological infrastructure cannot be autarkic. The political and perhaps ideological content of the proposal stands out strikingly in the declaration that

> information is not neutral and . . . its efficient management generates the capability of influencing political decisions in a determinative form. In other words, knowledge is power and, therefore, the

13. Decision 24, Articles 23, 24, 26; Decision 49, Articles 33, 34, 35. Articles 36 and 37 of Decision 49 reiterate Andean Group intentions to promote technological development and the appropriate transfer of technology, and to establish a system of information and control for prices on imported products.

> information system should be located under the control and responsibility of the Member Countries and their integration organs.[14]

The document proposes coordinated planning and a two-stage process of implementing policies for technology importation, assimilation, creation and adaptation. The crucially important information systems would be designed specifically for seven separate technology policy functions. The proposal links the technology transfer provisions of Decision 24 to instruments that include exchanges of information on technology importation between the Andean states and both other nations and multinational corporations. It advocates the establishment of special training programs for technology assimilation. Other instruments used to advance the policy would be incentives to promote science and technology, special contracts for technology production and an Andean Technological Development Projects system for research and development schemes involving more than one country. The plan parallels the efforts of member countries and the Andrés Bello Pact in education and science.

The regional common market for technology is the ideal of the Andean Group for the future, toward which steps would be taken slowly. During a first stage that would last approximately three years the general goals would be the creation of a consciousness about the problems caused by technological dependence and backwardness, the strengthening of national technological infrastructures, and the improvement of Andean Group institutions through policy implementation and specific projects. At the completion of the first phase, the Andean nations would evaluate what they and their regional institutions

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14. Comisión, Acuerdo de Cartagena, "Política subregional de desarrollo tecnológico, COM/XIII/dt 2, 26 Oct. 1973 (Lima).

had accomplished. Then they would select those policy instruments and procedures that had proven most effective and establish systematic and stable financial mechanisms to promote joint regional projects. Such a schedule takes a realistic view of the time factor in technological development; at the same time, however, the proposed schedule can only be met if initial decisions are made well, continuing commitments are met and the Andean nations remain determined to create a common technological infrastructure that will bind them in long-term development.[15]

c. International Linkages

The Andean Pact's progress toward definition of technology policy has been more than a unit or regional effort. The Junta's planning has benefitted from and is entangled in a complex pastiche of formal and informal interrelationships. Section VII of JUNAC, the technology policy unit, makes studies that are a foundation for rational technology policy principles and which suggest means of resolving specific regional problems. These studies have included extensive team investigation of technology development and transfer policy and procedure in foreign industry, a survey of engineering and consultancy services in the region, and a report on tropical wood and copper technology. Various papers, such as one concerning technological information systems in developing nations, are highly theoretical and seem not to address explicitly the region's practical questions. Others, including a critical overview of the capability and potential of regional research institutions, suggest the immensity of integration and development problems and the difficulty of bridging the chasm between research and productive units in

15. Ibid.

Latin America.[16]

Experts of Section VII as well as non-Latin Americans and some from Latin American nations beyond the Andean Group have worked on these studies. Essential financial assistance has come from the OAS, the Canadian government and other foreign institutions. Additional research has been a theoretical and material contribution to the Junta's work. Included in this research have been studies published by the OAS Department of Scientific Affairs, some done on contract by outsiders like the Science Policy Research Unit (SPRU) of the University of Sussex, England. The OAS, as has been pointed out earlier, is concerned both with scientific and technological development and with the transfer of all kinds of technology. The SPRU report emphasized commercial technology transfer questions in an international context, going on to recommend the establishment of an Andean Regional Technology Agency that would get a good start in terms of accumulated information and assistance from various United Nations agencies.[17]

One of the OAS science and technology policy schemes is the Pilot Project on Transfer of Technology. The Pilot Project

16. Comisión, Acuerdo de Cartagena, "Informe Anual de Las Actividades de la Junta," COM/XI/di 5, 23 mayo 1973; Junta, Acuerdo de Cartagena, "Resumen de los estudios realizados por la Junta del Acuerdo de Cartagena sobre politíca tecnológica," J/AJ/31 REV. 3, 5 abril 1973; Junta . . . , Ricardo Soifer, "Sobre los sistemas de información tecnológica en los paises en desarrollo," J/GT/3, 18 junio 1973; interview with Constantine V. Vaitsos, Lima, Oct. 10, 1973.

17. Programa Regional de Desarrollo Cientifíco y Tecnológico, Departamento de Asuntos Cientifícos, Organización de los Estados Americanos, "La Transferencia de Tecnología Hacia los Paises del Grupo Andino," AC/PE-46, abril 1972; ibid., Science Policy Research Center, University of Sussex, "The Transfer of Technology to Latin America," ScA/PS-1, March 1972, especially 171-83.

was derived from studies such as that of SPRU and in part focused its work on efforts to enhance Andean Group negotiating power for foreign technology. At the present time, however, the Pilot Project operates through national focal points and the Central American regional science and technology center, coordinated through Washington. Its connection with Andean Group institutions is only informal, though its interests are compatible with the techno-economic thinking of JUNAC. The Pilot Project aims to improve the conditions by which Latin American countries import technology by encouraging serious study and policymaking; it offers active though limited technical assistance for the creation of technology transfer regulation institutions. Because the Pilot Project is linked primarily to the individual nations, its efforts parallel and complement those of the Andean Pact. But the lack of effective coordination between the OAS and JUNAC may suggest that OAS Pilot Project work is not in fact supporting regional technology policy development as well as it might.[18]

Diverse international efforts to propel technology policy development in Latin America (some of which have been discussed in Chapter II) and the OAS Pilot Project in particular illustrate the dispersed nature of the forces playing on the Andean Group. These diverse forces weaken efforts of the Cartagena Agreement to draw the Andean nations firmly together under its leadership, for alternative intellectual leadership and even funding for technology policy development is available to individual countries. Similarly, the policy decisions of the Commission are far from uniformly put into

18. "Proyecto Analisis del Proceso de Transferencia de Tecnología," no date; also see Programa Regional de Desarrollo Científico y Tecnológico, OAS, Pierre Gonod, "El Problema de la Transferencia de Tecnología en América Latina," AC/PE-47, mayo 1972.

practice. Implementation varies according to different national constraints and task definitions. For example, national offices responsible for supervising royalty payments often lack sufficient information and expertise to evaluate costs or implications of the use of particular technologies. These offices are further handicapped by the small size of their staffs, the compartmentalization of governmental bureaucracy and weakness in dealing with enterprises, especially multinational corporations.

The enormous skill of the multinational corporations, therefore, is another factor that fragments Andean technology transfer policy. The large international firms can easily use their power in a manner that developing nations consider to be monopolistic or restrictive. Since these gigantic enterprises can invent devices that cannot necessarily be detected simply through examination of the clauses of technology contracts, they can, in a sense, circumvent antimonopolistic devices established under Decision 24. For some developing nations there may be short term or narrow advantages in not thoroughly enforcing Decision 24. The payoffs and barriers lie in corruption, red tape and bureaucratic prerogatives. Officials may lack interest in or not be forced by political pressures to consider broad social benefits that might be gained by faithful adherence to nominally explicit directives.[19]

Further analysis of the problems of defining and implementing the techno-economic type of technology policy in the Andean Group must await discussion of science and technology policymaking in individual nations. It is necessary at this point to proceed to the Andrés Bello Pact of the Andean nations.

19. Interview with Vaitsos; Shane Hunt, "Evaluating Direct Foreign Investment in Latin America," in Luigi R. Einaudi, ed., Latin America in the 1970's, Rand Corporation, R-1067-DOS, Dec. 1972, 127-46.

4. Science Policy and the Andrés Bello Pact

In the movement toward an Andean common market for science and technology, the Andrés Bello Pact plays a liberal-scientific role. It functions primarily to link educational planners and policymakers in the Andean region, and to encourage multinational research, mutual offering of assistance and coordination of planning for educational and scientific development consistent with regional needs. Through the Pact, education ministries and the Executive Secretariat of the Pact strive to create a regional community in the fields of education, science and culture. The work of the Pact is only in its preliminary stages of seeking cooperation and of defining policy and elaborating programs. With a broad range of concerns that include harmonization of the Andean educational systems and programs designed to impel a regional consciousness of common cultural factors, the Andrés Bello Pact intersects only narrowly with the technology policy work of the Cartagena Agreement.

Having made a limited impact to date on regional integration, the Pact's effectiveness can be judged only after the passage of a number of years. One of the Pact's accomplishments in this regard has been the establishment of a Coordinating Commission for Science and Technology, which brings together the national research councils or their equivalents from the six Andean Countries. This Coordinating Committee has met twice, in Lima in October 1972 and in Bogotá exactly a year later. Its deliberations have dealt with scientific and technological issues that arise from the liberal-scientific approach to policymaking. For example, a liberal-scientific priority area for the Pact is to make inventories of resources, projects and information in the area of science and technology. Resolutions passed at the October 1973 meeting of the Coordinating Committee in Bogotá also indicated specific interests that coincide in part with

techno-economic analyses. The topics of these resolutions included the technology of food and nutrition, the circulation and influences of marine currents, geophysics and antisysmic engineering, housing and urbanization, an integral study of Lake Titicaca, petrochemistry, coal and metallurgy. It is not evident what efforts are being made to finance and implement regional investigation of these proposed projects, though clearly several of them would reinforce the economic integration and technology policy work of the Cartagena Agreement.

The Andrés Bello Pact has had limited effectiveness in propelling regional cooperation in science and technology because of a number of problems. Financing is a major one. The Andean nations apportion among themselves the costs of operating the Pact's institutions and meetings but are not yet engaged in multinational research projects. Indeed, the financial commitment of the member nations may not be sufficiently strong to be able to move rapidly into integrated scientific programs. Moreover, the Pact must seek funds from outside the region for research, for example from the OAS, UNESCO and the U.S. Agency for International Development. SECAB, the Pact's permanent secretariat, has hopes of coordinating its efforts with the Cartagena Agreement and other Andean Group integration pacts, partly to avoid costly duplication of efforts. Yet, until actual scientific and technological work is begun, preliminary planning by SECAB will remain only a gesture toward regional cooperation.

Despite their contrasting approaches to regional policies for science and technology, JUNAC and SECAB are attempting to form a consensus on areas of joint interest. The Cartagena Agreement's new technology policy proposal was discussed at the October 1973 meeting of the Coordinating Committee for Science and Technology of the Andrés Bello Pact. The heavy emphasis of the proposal on applied research and its criticism

of the Andean scientific and technological infrastructure apparently displeased and may even have antagonized some of the delegates at the Bogotá sessions. Though cognizant of the need for technological development and the serious problems of the commercialization of technology, national research council representatives were also interested in satisfying their scientific constituencies along the broad liberal-scientific lines of the Andrés Bello Pact. In short, there is certain to be competition for limited resources for science and technology policy development. This competition is not likely, in the short run, to permit rapid implementation of regional cooperation between JUNAC and SECAB.

Intellectual orientations and institutional fragmentations are also divisive forces. According to protocol, the Cartagena Agreement technology policy proposal had to be presented to the formal link organs in each country for discussion. In at least some Andean countries the economic integration offices and research councils represented on the Coordinating Committee had not first reached a sufficient level of understanding between themselves to formulate a national position with regard to the regional policy proposal. In Colombia, even though COLCIENCIAS (the national research council), the Institute of Foreign Commerce (INCOMEX) and the National Planning Department (DNP) held discussions on Andean Group technology policy in the first real attempt to harmonize the views of these three Colombian institutions, this was only one step among the many necessary in the process of obtaining a consensus. Institutional politicking is essential to the evolution of common regional policies for science and technology. However such politicking is another of the forces that impede an Andean Common market for science and technology.[20]

20. This section is based on a number of sources, including interviews with various officials of COLCIENCIAS, Bogotá, Oct. and Nov. 1973; interview with Octavio Arizmendi

5. Technology Policy and the Andean Development Corporation

The Andean Development Corporation (CAF) is the financial and promotional institution of the Andean Group. CAF's responsibility is to aid the regional integration process through feasibility studies, loans from its own funds or from outside sources, and technical assistance for Andean Group programs. CAF, like the other Andean Group institutions, is only in its infancy but has the potential to play a large role in technology policy implementation.

Since Decision 24 is a norm followed in all its actions, the Andean Development Corporation will participate in no development project that does not follow the Decision strictures regarding foreign capital and technology. In other words, no loan may be consummated unless projects involving the use of foreign technology have concluded a contract for that technology in compliance with the rules of the Andean Foreign Investment Code.[21]

CAF's interest in technology, however, goes further than merely upholding the principles of Decision 24. It sees itself in a potential position for offering technical assistance to multinational industrial programs and coordinating relevant regional technological research and adaptation.

Posada, Executive Secretary, SECAB, Bogotá, Oct. 29, 1973; Octavio Arizmendi Posada, "El Convenio Andrés Bello y el Desarrollo de la Sub-región Andina," paper presented at a seminar on Andean integration, Hotel Bogota Hilton, Oct. 25, 1973. Dr. Arizmendi kindly made available to the author copies of most of the basic documents and reports of the Andrés Bello Pact.

21. Interviews with CAF officials, especially with Mario Balcázar A., Director of Promotion, Caracas, Nov. 21, 1973.

CAF is small; its professional staff numbers approximately 20 and it had approved, by April 1973, loans amounting to only slightly more than $20 million.

Presently, one staff engineer has the task of making professional assessments of industrial projects from the programmed regional metal-working sector. He visits operating plants that have been assigned the production of specific products under Decision 57 of the Cartagena Agreement and offers advice concerning such problems as quality control, product characteristics related to optimal market utility and acceptance, and negotiations with foreign firms for the use of technology or other factors. However, CAF recognizes that one adviser is clearly inadequate to handle fully the technical questions involved in Andean multinational industrial projects that come before it. CAF realizes, moreover, that the region's technological infrastructure is so deficient in quality and lacking in coordination that it cannot provide a significant service for modern industry. Because of this realization, the Andean Development Corporation decided to take steps toward assuming a more active role in technological development.

The first step toward a CAF technology program began with a study of Andean technological capability. The study was completed last year by an expert from the United Nations Development Program. It concluded that the region contained a set of technological research laboratories that could undertake investigation in particularly urgent areas but that important gaps existed in fields such as metal-working, petrochemistry and textiles. Existing research institutions were inhibited from greater productivity by inadequate laboratories, salaries insufficient to attract high quality researchers, the lack of financial resources, and the indifference of government officials and private entrepreneurs toward technology as an essential consideration for industrial development.[22] With these limitations in mind Andean

22. Interviews with Mario Balcázar A., Nov. 20 and 21; Lionel Segura, Nov. 21; Alfonso Londoño and Juan Enrique Allard,

Development Corporation officials have proposed that their institution continue to plan for technological development and to establish the means for financing and coordinating regional research projects.

A recent proposal of the Andean Development Corporation suggests that a special fund, largely under the direction of CAF, be set up for the purpose of financing these projects. The Fund would be similar in some respects to the plan for an Andean Technological Development Projects system that is part of the new technology policy proposal of the Commission of the Cartagena Agreement. The CAF technology development fund would bring together the efforts of JUNAC, the Andrés Bello Pact, national institutions and assistance from international organizations. It has been suggested that an early research project could be undertaken to enable the metal-working sector to produce parts and materials that otherwise have to be imported. Such a project would involve selection of products and firms for which research would be carried out, the elaboration of a research program and contracts with selected laboratories. CAF would assist with the financing, negotiation of contracts, and planning and coordination of research and production. In a more general way, CAF would promote regional technological development by making preliminary studies with a view to creating new institutions where needs exist.

Andean Development Corporation officials have a pragmatic view of how they can participate in regional technological development. They seek a practical mode of obtaining

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Nov. 23, and Enrique Vial, Vice President for Operations and Programming, Nov. 23, 1973, Caracas; CAF, Memoria y Balance, 1972, 31; The UNDP expert was Maurice Paquet, whose report I was permitted to read. Paquet's study was coordinated in part with a parallel project carried out by the Junta of the Cartagena Agreement.

foreign capital and technology on favorable terms, a mode somewhat removed from the apparent ideological fervor of JUNAC and from the theoretical arguments about the relationship between science and technology in the context of the Andrés Bello Pact. They believe that their perspective of regional development programs would enable them to work technology effectively into industrialization and promote research on a well-defined project basis. They are fully cognizant of the need for doing precisely this and wish to move beyond the beginning stages to construct linkages between technologists, planners, and financiers, on the one hand, and both the integration institutions of the Andean Group and international agencies such as the OAS and United Nations programs on the other. For example, CAF is discussing the possibility of becoming a regional center for the OAS Pilot Project on the Transfer of Technology.

As indicated above, CAF is not in a position presently to offer more than limited technical advice. To assist in the development of a cotton industry, for example, Bolivia was referred to a highly-rated Colombian research institute for help in the utilization of the cottonseed. This is precisely the type of advisory service that could be enormously expanded through a CAF technology policy coordinating unit. The unit could promote integration and development in areas such as housing, food, metal-working and natural resources where regional consensus or "political agreement," as one official put it, exists. Beyond making linkages, CAF would work with existing research institutions, using Andean technology policy as a guide, to organize budgets and priorities through what one CAF executive called a "program for a center to promote research" in key realizable areas. A small regional coordinating office, then, would supervise this "program for projects," distributing funds, registering research teams and consultants, and helping match technical

needs with the potential to satisfy them. Development of the capability of conducting technological research in the Andean region would be aided by contracted assistance from foreign research institutions and universities and the contributions of international and bilateral assistance agencies.[23]

The foregoing ideas regarding Andean Development Corporation participation in the implementation of technology policy are not beyond the memorandum stage however. CAF lacks the staff[24] and other resources necessary for planning and executing such a design. The financial institution must also await the outcome of regional negotiations concerning the Cartagena Agreement's policy proposal for technological development. There is some evidence of rivalry between JUNAC and CAF which may result in a slow-down of these negotiations. There is a feeling in CAF that some of the Cartagena Agreement's policies, especially regarding foreign capital and technology, may make it difficult to bring large quantities of new capital into the region. The apparent rivalry is shown also by the differing conceptions of CAF and JUNAC concerning the management of a regional technology development fund. Clearly, some workable arrangement will have to be agreed upon between the two Andean Group institutions, for otherwise a firm decision on a new technology policy may be delayed or its implementation weakened.

6. From Here, Where?

It is manifestly clear that the fitting together of policies for both science and technology in the Andean Group will only be accomplished after many years of hard labor, investment

23. Interviews with Balcázar, Londoño and Vial. CAF officials generously showed me internal memoranda and other documents which added substantially to my understanding of their ideas.

24. See note 21 above.

of resources and institution building. The outcome will depend crucially on how much power regional institutions gather, for example, in terms of obtaining foreign technical assistance without restrictions and under the management of the Andean Group itself. It will depend on how Andean Group institutions learn to work with each other. But, as we have seen, there are evident contrasts between the developmental nationalism ideology of the Commission and Board of the Cartagena Agreement, the more specific goal orientation of the Andean Development Corporation's pragmatism, and the liberal-scientific approach of the Andrés Bello Pact. Finally, the outcome will depend on how well the Group can work with its member nations and with outside forces, including international financiers and multinational corporations.

It is crucial to bear in mind the oft repeated statement in this study that technology policy for the Andean Group is in its early stages. While formulated in general terms to cover the whole gamut of technology transfer and development questions, the new technology policy proposal is in a lengthy and wearisome negotiation process that may result in a weak document. But even if the result is strong, it will still be subject to ratification and implementation by the member nations; in addition it will be subject, sooner or later, to administration by the several Andean Group institutions, all of which have yet to prove their effectiveness in this area.

There is, of course, general agreement that research institutes must be linked directly to industrial production in order to create a viable technology policy. Some basic and interrelated questions need to be answered before this is possible. For example, are contracts between enterprises and research institutes a good solution to this need? If so, precise policy instruments will have to be defined to accomplish this, especially for the private industrial sector. What then would be the role of governments in their direct

sponsorship of research institutes? Too much dependency on governmental financing and bureaucracy, it seems agreed, may hamper technological research and the establishment of links to business. But the degree of direct state involvement in technology policies in a system that activates entrepreneurial and technological development is not yet resolved. In part, the technology policy elements in the Andean Foreign Investment Code that are related, at least indirectly, with the entire regional integration and industrialization program, may help create an environment for increasing industrial demand for technology. However, it will be some time before there will be sufficient evidence to evaluate these relationships. Finally, whatever the shape of the technology policy, it will have to be reconciled with the need for adequate resources and freedom for innovative work by scientists and institutions, an issue with which the liberal-scientists are particularly concerned.

After agreement is reached on technology policy, the next test for the Andean Group lies in the establishment of an institutional basis to implement that policy. Perhaps a technology policy coordinating office in the Andean Development Corporation is one appropriate solution. If so, the Andean nations, in part with aid solicited from agencies such as the United Nations and the OAS, must provide adequate financing for it. Indeed, the commitment of the Andean countries can probably be measured as a function of their willingness to devote their own national financial resources to it. CAF officials estimate that a staff of six professionals, several bilingual secretaries and funds for travel, communications and meetings would be adequate to begin a technology advisory and coordinating unit for regional integration industrial projects. Such a unit would cost approximately $450,000 annually. For some degree of permanence, the office should be established for a minimum of three years on the

basis of a precisely designed plan of action. Additional funds, in part mobilized from existing sources or reallocated from those used for other research purposes, would be needed for other tasks and functions, such as hiring specialists as consultants or promoters, the creation of an appropriate information system, and investment in research. Monies for research, it has been suggested, should be distributed on a loan basis to participating institutions in conjunction with Andean Group projects. Such an Andean technology coordinating office would require effective collaboration with individual countries. JUNAC's recognition of the difficulties in coordinating regional technology development is indicated by the focus of its technology policy's first phase on the efforts of individual countries.

At this point, Andean Group science policy is a dream. Funds are scarce, education policy for all Latin American nations is a highly charged political issue, and the efforts of the Executive Secretariat are spread out over a broad area. An Andean common market for science, even in conception, will have to compete with national allegiances and limitations of scientific communities. Indeed, it will be constrained because there are already a large number of international connections, such as with private foundations and international assistance agencies, that divide the supranational orientation of Andean scientists and scientific institutions. The most consensual area in which the Andrés Bello Pact may make progress, precisely because it is the least politically troublesome, is that of "cultural integration," with its regional dissemination of books, bibliographies and a few scholars. But this is hardly enough to lead to a more prominent role of science and technology in development or to an enhancement of the Andean region's limited scientific resources.

CHAPTER IV

PERUVIAN POLICIES FOR SCIENCE AND TECHNOLOGY

As the home of the secretariat of the Cartagena Agreement, Peru is engaged in an economic and social development effort that, of all the Andean countries, most fully reflects the Andean Group's ideology of developmental nationalism. Peruvian policies for science and technology are heavily weighted toward the techno-economic orientation of the Andean Pact. Though policies of a liberal-scientific nature exist they are relatively weak; nevertheless they have been incorporated to some degree in an attempt to construct integrated if hybrid policies for science and technology. With this emphasis on the techno-economic orientation therefore, Peru illustrates the impact, at least to a limited degree, of Andean Group technology policy.

Peru will not be able to make a major contribution to an Andean common market for science and technology until it resolves the problems of its currently fragmented and only partially defined and implemented policies. Despite this, the Peruvian context and national policy formulations require individual treatment in this study. The fragmentation of Peruvian policies for science and technology stems in part from the diversity of their origin. Indeed, this fragmentation reflects similar institutional and intellectual fragmentation at the regional and at the wider international levels which preceeding chapters have pointed out. More than just an issue between the discipline of science and the practice of technology, science and technology policy fragmentation continues to have a debilitating effect despite the energetic

actions of Peru's military government to promote effective public policymaking in all areas. More specifically, existing policies have failed to join the government with users and producer-purveyors of science and technology in consensual and smoothly working relationships for two reasons. First, these policymaking efforts are relatively young, and second, in the current Peruvian politico-economic milieu consensus is not an entirely necessary ingredient for government actions.

Still, Peru has begun to implement promising sectoral technology programs. In addition, many leaders in science and technology policymaking are starting to deal with the issue of fragmentation, in part by emphasizing the necessity of high-level planning and coordination, and in part by recognizing the functional separation between science and technology in terms of public policy implementation at least in the short run.

1. Peruvian Research in Science and Technology

The relative weakness of the liberal-scientists in Peru becomes apparent if one considers the shape of the country's scientific and technological research program. Practical and techno-economic considerations predominate in determining how funds for research are to be allocated, while the greatest amount of actual research is carried out within government ministries and not by liberal-scientists. Overall, the Peruvian research effort is inadequate, as everyone realizes. As is common elsewhere in Latin America, the Peruvian scientific and technological infrastructure is characterized by a scarcity of well-trained researchers, paucity of incentives and rewards, insufficient relevance to national development needs (in part due to a lack of priorities and organizing mechanisms), and adamant university desire for independence from political direction.

There have, of course, been some good results from Peruvian research, or at least there have been exceptions to the general rule. These exceptions include notably the Navy's research and development program (with questionable ties to development goals), Dr. Alberto Hurtado's achievements in high altitude biology, and the Instituto del Mar del Perú. The Institute of the Sea was set up in 1960 with UN collaboration and is now an outstanding support to the nation's large and highly efficient fishing and fishmeal industry.

But, in terms of the total amount of resources allocated for research, the universities have definitely been neglected. A 1972 study by the Board of the Andean Pact examined Peruvian science and technology policymaking institutions. It estimated that the total budgeted spending for R&D for the country's universities in 1969 was about 70,000,000 soles (approximately $1,750,000). This was a smaller amount than the R&D expenditures of each of five major ministries, those of Industry and Commerce, Energy and Mines, Fishing, Health and Agriculture. Such data further substantiates the division between liberal-scientists and the government and suggests how techno-economic considerations prevail in national science and technology policymaking.[1]

2. The National Research Council

While by no means the predominating influence on policies for science and technology, the liberal-scientific approach is promoted by the Peruvian scientific community and, therefore, worthy of discussion. From at least the early 1960's, scientists and educators sought political leverage

1. (Junta del Acuerdo de Cartagena), "Estructura y funcionamiento de los organismos de política científica y tecnológica en el Perú," Informe Preliminar, J/AJ/26, 30 de nov. de 1972; Reunión de Ancon, 232a; Ciencia Interamericana, 13 (sept.-dic. 1972), 12-16; ibid., 14 (enero-abril 1973), 2-11.

to gain research support from the state and to promote science as a factor in the nation's development. With the help of the U.S. National Academy of Sciences and the Agency for International Development, the scientists formed the Peruvian Association for the Advancement of Science in 1967. The Association had little political power and no financial resources. The lack of interest of President Belaúnde prevented substantial further progress until the advent of the military regime in October 1968 and the friendly intervention of UNESCO.

Within a month of its succession to power, the new government decreed the creation of the National Research Council (Consejo Nacional de Investigación, CNI). It may have been that the Peruvian generals were anxious to mobilize political support from scientists (or to neutralize potential opposition) by creating the CNI, but apparently they also had a sincere interest in the developmental role of science and technology. Appended to the Office of the Presidency, the National Research Council was charged with a number of functions, the first and most comprehensive of which was "to formulate the country's policy of scientific and technological development compatible with the economic and social development policy of the Government."[2] This and other functions

2. Quote is from Decreto Ley No. 17096, Nov. 11, 1968, Article 2; interviews with Dr. Carlos J. del Río Cabrera, Director of Education and Research, National Engineering University, Lima, Oct. 13, 1973, and Dr. Oscar Miró-Quesada Cantuarias, Director General, National Institutes of Health, and President, CNI, Lima, Oct. 5, 1973. Also see, National Academy of Science, "Report of a Workshop on the Role of Science and Technology in Peruvian Economic Development, held in Paracas, Peru, April 17-22, 1966," and "Report of the Second Peru-U.S. Workshop on Science and Technology in Economic Development, El Bosque Peru, Nov. 20-24, 1967"; (Peru), Ministerio de Marina, Oficina de Investigación y Desarrollo, Reunión de Ancon: La ciencia y la tecnología en el desarrollo, 28 nov.-2 dic., 1968 (Lima, no date [1969?]); UNESCO, La política (1969), 125-127; UNESCO, La politica . . . 2 (1971), 160-171.

described in the decree law were similar to those carried out by the National Research Council, the National Academy of Sciences and the National Science Foundation of the United States. In the Peruvian case, the mandate of the National Research Council never clearly defined the proportionate relationships between science, technology, universities and government's role in economic development. Hence, such issues are still debated in Peru, the arguments including also the relevance of a U.S.-type institution of this sort in an underdeveloped economy like that of Peru which has very limited resources to devote to science and technology and a much different system of bargaining for their distribution.

Four years after the CNI's inception it was becoming evident that the institution had not been given a really significant role in elaborating a national science and technology policy. The government maintained that the institution was not performing satisfactorily due to administrative failures, and some officials began to have serious doubts even about the quality of CNI's studies. However, the government was partly to blame for this situation. The CNI never had a budget sufficient to do more than support a probably excessively large staff. In addition, although the basic law for the CNI authorized the establishment of a National Research Fund to finance scientific work, this provision of the statute was never implemented. Consequently, after four years and what they felt was a serious attempt to define a national science and technology policy, some members of the scientific community were justifiably frustrated and came to the conclusion that they really had not received a hearing in the seats of government power. Their perception was that government and scientists had dissimilar views of the world in terms of political procedure, perspective of the future shape of society and science's role in the midst of

revolutionary changes. Some scientists now charge that the government had never been dedicated to making the National Research Council an effective instrument of science policy.

There was, of course, other evidence of the weakness of the CNI. The Council used funds from the Organization of American States to finance the research and writing of reports, for example, but both parties were dissatisfied about the use and efficacy of these resources. Perhaps indicative of this dissatisfaction and contrary to a general rule of making research councils national focal centers, the OAS Pilot Project on Transfer of Technology was placed under the supervision of the executive officer of ITINTEC, the technology body of the Ministry of Industry and Commerce, which will be discussed later in this chapter.

The scientific community realized the need for reorganization but did not have an effective alternative to the CNI as a means of asserting its role in science and technology policymaking. Those who continued to have some faith in its future convinced the government to rehabilitate the National Research Council. In May 1973 a Commission, appointed by the government and composed almost entirely of university professors, began to formulate a new "National Design for Planning Scientific and Technological Research." Completed by September, the report concentrated on giving the CNI significant responsibilities in five areas. The first category, development of human resources, was particularly important to the universities. It reflected their feeling that the government gave the issue only slight consideration both in terms of education and of policies for science and technology. The other problem areas featured by the Commission's "National Design" were the establishment of an information and documentation center, technology transfer studies, investigation of material resources and investment in high priority research. The plan proposed increasing the budget of the National

Research Council perhaps six-fold; it insisted upon effective direction and reorganization of Council staff and activities. For this last purpose, the government appointed a new CNI Director General. He is Captain Enrique Anderson Rosas, a naval officer until recently in charge of the research and development program of the Peruvian Navy.

Captain Anderson and CNI President Dr. Oscar Miró-Quesada, also Director of the Peruvian National Institutes of Health, are aware of the need to accomplish the tasks outlined in the Commission's plan. They are hopeful that their personal links into the hierarchy of governmental power will help make this possible. They also seem to understand the importance of reconciling the desire of liberal-scientists for pure scientific research with the greater demands of their country for technology that will have immediate economic impact. But the task will not be simple, for the CNI serves primarily a constituency of scientists who yearn for the freedom to conduct their research. Further, many of these scientists demand the participation of intellectuals like themselves in both formulating and suggesting future implications of long-range science and technology programs.

The scientists are tormented by contradictions that are typical of the liberal-scientific group. Even though they are dedicated to using their resources for development, they are commonly disparaged by government and those outside their community for the irrelevance of their work in terms of national developmental requirements. The case against them has not been completely proven but a mark of its efficacy is that it is argued hotly even within the scientific community itself. Furthermore, inclined toward liberal pluralist politics and willing to accept the multiplicity of ideas that must be reconciled in the formation and development of a modern nation, they still must live under the exigencies of what is, in their terms, an authoritarian regime with different perceptions

than their own of how to cope with Peruvian problems.

The grievances of Peruvian scientists are many, but one measure of this discontent and of the condition of university-state relations is the fact that government employees often earn more than several times the salary of their university counterparts. Full time professors, often with advanced degrees obtained abroad and capable of significant research, frequently must supplement their university stipends with outside jobs. More directly to the point, some professors seek full involvement of the universities in discussing the new National Research Council program, which they hope would lead to greater political participation and the reaching of an effective consensus. Yet, reality suggests that minimal university participation will be permitted while the government largely determines the direction of a rejuvenated CNI and the extent to which the Commission's "National Design" will be put into effect. The government, meanwhile, shies away from mobilizing greater university involvement in policy-making in a context where politicians often view the schools as fomenters of political opposition. Additionally, as will be discussed later, the National Planning Institute (Instituto Nacional de Planificación, INP) desires a preponderant role in designing Peruvian policies for science and technology, disdaining participation by the National Research Council.[3]

3. Peruvian universities had greater entrée to government before the military regime came into office through personal and family ties and traditional prerogatives. Although it is indeed the case that the universities have grown in size since 1968, their position vis-à-vis the government has fallen drastically in terms of influence and impact on policy.

   The foregoing paragraphs are based on sources cited in the preceding note as well as the following: Interviews with Ing. Alberto Geiseke M., Peruvian Geophysical Institute (first CNI President), Lima, Sept. 25, 1973; Dr. Antonio Bacigalupo, Director of Research, Institute of Applied Nutrition and Food Technology, National Agrarian

3. Technology Policy for Peruvian Industrialization

Techno-economic science and technology policymaking attitudes and style are more evident, therefore, in Peruvian ministries that are occupied with economic development. Paralleled by the work of other ministries, industrial technology policy is an important aspect of the Peruvian industrialization program and the responsibility of various offices of the Ministry of Industry and Commerce (MIC), some of which are those for technological research, technical standards and industrial property, and the coordination of foreign technical assistance.[4]

In mid-1970 the government rationalized its vast schemes for industrial modernization and development in part through a new general law of industries which gave the state a powerful role in the industrialization process. Later augmented by further legislation and an ambitious national development plan for 1971-1975, this statute made it the purpose of the

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University "La Molina" (CNI President ad interim following Ing. Geiseke), Lima, Oct. 1, 1973; Drs. Ramiro Castro de la Mata and V. Enrique Fernández E., Cayetano Heredia medical university, Lima, Oct. 16, 1973; Enrique Anderson Rosas, Capitan de Navio A. P. (CNI Director General), Lima, Sept. 26 and Oct. 19, 1973; Dr. Ottoniel Velasco, Director Técnico, National Planning Institute, Lima, Oct. 11, 1973; Professor Máximo Vega Centeno, chief, Economics Department, Catholic University, Lima, Sept. 27, 1973; Ing. Isaias Flit S., ITINTEC, and Francisco R. Sagasti, Lima, Oct. 11, 1973. Máximo Vega Centeno, "Mecanismos de difusión del conocimiento y elección de tecnología," (Centro de Investigaciones Sociales, Económicas, Polfticas y Antropológicas, Lima, nov. de 1971); Carlos del Río, "De la investigación y su promoción" (mimeo, 1969). The only CNI documents listed in literature I have consulted are four cited in Francisco Sagasti, "Towards a Methodology for Planning Science and Technology in Underdeveloped Countries, Ph.D. thesis, University of Pennsylvania, 1972, xxviii.

4. (Junta del Acuerdo de Cartagena), "Estructura . . . en el Perú," 26-53.

government to pursue "permanent and self-sustaining development that contributes to effective economic independence." According to the act, this development "should strengthen the proposals of the Cartagena Agreement," illustrating the close connection of Peruvian policy to Andean Groups integration. Technology was highly visible in this new law of industries. It placed producers of technology in the first of five priority categories of industrial enterprises, and a technological criterion became one of four by which the Ministry of Industry and Commerce would classify industries. The new general law of industries also contained long portions devoted to industrial property.[5]

4. ITINTEC

One of the sections of the industrial development law most relevant to technology policy established the Institute of Industrial Technological Research and Technical Standards (Instituto de Investigación Tecnológica Industrial y de Normas Técnicas, ITINTEC). Soon governed by a Decree Law specifically written for it, ITINTEC has operated as a manager of technological research, hoping to foster centers of excellence in universities as well as practical industrial interest and activity in technology. As a decentralized public organ under the jurisdiction of MIC, ITINTEC assumed the duties of two separate offices then existing.[6] It became responsible for scientific and technological research funded by a two percent

5. Decreto Ley No. 18350, July 27, 1970, Articles 4, 11, 42, 26-114; Decreto Ley No. 19262, Jan. 6, 1972; Decreto Supremo No. 007-71 IC/DS, Jan. 21, 1971. See República Peruana, Presidencia de la República, Plan Nacional de Desarrollo para 1971-1975 (1971), Volumes 1 and 4; Robert E. Klitgaard, "Observations on the Peruvian National Plan for Development 1971-1975," Inter-American Economic Affairs, 25 (Winter 1971), pp. 3-22.

6. These were the Center of Industrial Technology and the Institute of Technical Standards and Certification.

tax on the net profits of all industry registered by MIC.

The two percent tax compels Peruvian industry to give at least passing notice to technology. But that is not sufficient to energize industrial technological development. Therefore, ITINTEC gives industry an option. Industry may use funds equivalent to the two percent tax for research approved by ITINTEC and forego paying the levy. Without such approval the tax must be paid to the government. In this case, which is apparently the more common one, ITINTEC may contract with universities or research institutes for specific projects or it may facilitate arrangements directly between industry and laboratories. Such ITINTEC-sponsored research includes the use of short-fiber cotton for the textile industry, attempts to improve breads and to substitute domestic crops for imported wheat, development of a carbonated beverage with high nutritional content, and a television set that could be produced at low-cost, using national materials and without paying royalties to foreigners. In another case, ITINTEC was involved in developing an intermediate technology for manufacturing automobile windshields through the adaptation of matrices that could be changed quickly, enabling a single high-speed machine to turn out the many styles required by the small but diverse Peruvian market.[7] Finally, ITINTEC may conduct research on its own premises. An example of this last possibility is a current industrial design project for low-cost modular furniture using domestic forest resources.[8]

7. ITINTEC officials proudly pointed out that this innovation was not a copy of a technique used years earlier in a developed country, but rather that this technique represented a new form of practical technology, admittedly small-scale yet also taking advantage of the most recently available industrial advances.

8. Decreto Ley No. 18350, Articles 14, 15 and Fifth Transitory Disposition; Decreto Supremo No. 007-71 IC/DS, Articles 131-138 and Seventh Transitory Disposition; Decreto Ley 19565, Sept. 26, 1972; interviews with Ing. Flit, Lima, Sept. 26 and Oct. 11, 1973.

A further illustration of ITINTEC's work combines innovation with the establishment of technical standards. Moraveco, one of Peru's largest metal-working industries, cooperates fully with ITINTEC in the incorporation of sophisticated standards into the production of buses, refrigerators, gas ranges and office furniture. Aware of the importance of meeting high international technical standards in order to gain contracts from foreign firms or to move its goods into foreign commerce, Moraveco manufactures gasoline tanks and seat belts, for example, that meet the standards of companies like Toyota and Dodge. The firm hopes that its buses will be fully competitive with European models now being sold in Peru and other Latin American countries.[9]

As a centerpiece of the techno-economic side of Peruvian policies for science and technology, ITINTEC serves additional intellectual and institutional functions. It lends advisory support and material justification for claims by the Ministry of Industry and Commerce that the government is actively countering technological dependency,or, the "domination [that is] now produced by [foreign] science and technology,"[10] as one Lima newspaper headlined an article on a speech by the Minister of Industry and Commerce. The ITINTEC Governing Council contains one representative of the National Research Council, and the Institute maintains close relationships with the Board of the Cartagena Agreement and other international and foreign agencies working in the areas of

9. Sources for the last two paragraphs include interviews with Ing. Flit (Note 8); Gustavo Flores, ITINTEC research director, Lima, Oct. 17, 1973; officials of the Society of Industries, Lima, Oct. 18, 1973; Patricio Ricketts, Moraveco, S.A., Lima, Oct. 12, 1973. Other interviewees expressed dissatisfaction with some ITINTEC research priorities, for example the allocation of resources to the television project.

10. Expreso, Lima, Oct. 18, 1973, 4; also see El Comercio, Lima, Oct. 18, 1973, 4.

policies for science and technology. In order to aid in Peruvian metal-working industrial development, partly in accordance with Decision 57 of the Cartagena Agreement, ITINTEC cooperates with INDUPERU, the government's new supervisory agency for state-related industrialization, and with the Development Finance Corporation (Corporación Financiera de Desarrollo, COFIDE), the state industrial finance institution and Peru's formal link with the Andean Development Corporation. Finally, reporting and responsible to MIC, ITINTEC works out projects in accordance with the national development plans established by the National Planning Institute. As the national focal center for the OAS Pilot Project on Transfer of Technology, ITINTEC will have to make similar close contacts with other government ministries and the industrial sector of the economy.

Despite these admirable beginnings, ITINTEC has not yet generated a uniformly high level of interest in technology on the part of Peruvian industry. Sometimes it even seems to antagonize potential partners in technological development. For example, in line with government policy to increase the national resource content in production, Peruvian glassmakers proposed the use of their two percent tax funds to import an X-ray spectograph from the United States as part of an industry-related laboratory development and research scheme. ITINTEC denied permission for this project, supporting the view of many national industries that the two percent tax monies are not being used to satisfy national technological needs. Because ITINTEC has not been able to glean complete national industrial support and also because it recognizes its basic organizational weaknesses, it is in a period of nearly complete reorganization. Many of its activities have been suspended until a new program and set of priorities for future work can be precisely drawn up and

approved.[11] The ITINTEC leadership, exemplified by the Director, Ing. Isaias Flit, is dedicated to the survival of their institution as a pragmatic, project-oriented builder of successful schemes.[12]

5. Peru and Andean Pact Technology Policy

In the same way that Andean economic integration is important for Peru's developmental nationalism, the Andean Group Foreign Investment Code has had a significant impact on the development of technology policy in the Ministry of Industry and Commerce and other Peruvian government offices. In 1969 Peru established a National Integration Office to coordinate its economic integration policies, and two years later Decisions 24 and 37 of the Andean Group regarding the treatment of foreign capital and technology were incorporated into national law.[13] The Peruvian Ministry of Economy and Finance has striven to regularize these acts of government, particularly those concerning capital, while MIC's Office of Industrial Property and Registration was given the job of supervising contracts for the transfer of technology. Though of Office does not have a precise analysis of the effects of

11. One of ITINTEC's new ideas is the upgrading and "marketing" of industrial standardization.

12. There is a notorious tendency for institutions, in Peru as in other countries, to languish after an initial flurry of activity, providing jobs for their personnel and little more; the current ITINTEC leadership hopes to avoid this passage into such an institutional no man's land. There is fairly good understanding among those involved that while ITINTEC is not in the business of training technicians, it suffers from lack of well prepared personnel who will devote intelligence, initiative and imagination to the Institute's purposes. One person to whom I talked, a member of ITINTEC's board, was enthusiastic about its possibilities in applying science and engineering capability to industrial production.

13. Decreto Ley No. 17796, Sept. 2, 1969; Decreto Ley No. 18900, June 30, 1971; Decreto Ley No. 18999, Oct. 19, 1971.

its technology transfer duties and though it has only been occupied with these new duties since the end of 1971, the Chief of the Office does feel that there has been a significant saving for Peru in terms of foreign exchange expenditures and in terms of lower prices for proprietary technology. Having passed the hurdle of initial large-scale registration of existing contracts, the Office presently finds its most difficult task in bargaining with foreign concessionary firms.[14] Andean Pact technology policy has had a less direct effect on ITINTEC, but the development of ITINTEC and other sectoral technology institutions has very likely benefitted just as much from the prominence given technology policy by the OAS, UNCTAD and conferences such as the 1972 CACTAL.

Improved bargaining for foreign capital and proprietary technology, according to Andean Group economist Constantine V. Vaitsos, is a vital part of the techno-economic policy. But intelligent negotiation requires both theoretical knowledge and appropriate information. Here is where Peru falls short, for although they are making efforts to build information centers to assist in this process, some Peruvian officials admit the inadequacy of their informational resources. They somewhat lamely concede that in negotiations they do the best they can with what little information and expertise is available to them. Inadequate informational resources often create serious negotiation problems vis-à-vis foreign business, however. Representatives of foreign businesses have accused the Peruvian government of acting arbitrarily, even vindictively, with regard to foreign capital. They contend that politics rather than good economic sense dictates decisions (often at a cost to the nation), and that in negotiations over capital and technology there is definitely some "bluff" in Peruvian arguments. Though some spokesmen for the

14. Interview with Cesar Suito, Office of Industrial Property and Registration, Lima, Oct. 4, 1973.

Andean Pact indicate that some regional exchange of relevant information for this bargaining has begun, it is not clear to what extent this is actually carried on or with what kind of results. A regional (or wider) common market for information concerning pricing, alternative technologies available, and contract disaggregation would definitely strengthen the bargaining position of nations like Peru.

Ideas promulgated by the Andean Group as well as United Nations agencies with regard to the receipt of technical assistance from foreign governments, foundations and international organizations have also had an impact on Peruvian policy. The impact has been felt in two ways: in the adjustment of foreign assistance to domestic planning and development specifications and in the application of technology policy.

A Peruvian program for international technical cooperation was instituted by law in 1971. It was based on the premise that foreign aid should "respond to the necessities of the country and be coordinated with development plans." The law placed responsibility for the program in the hands of the Ministry of Foreign Relations, Sectoral Planning Offices in various ministries and the National Planning Institute, which would design and oversee general policy.[15] In the Ministry of Industry and Commerce, for example, the Coordinator of International Technical Cooperation of the Planning Office evaluates projects falling within that ministry's purview. This agency requests and selects assistance on the basis of specific proposals; where possible, it chooses Peruvian technicians rather than foreigners. The task involves highly specific knowledge of the content of industrial projects, the disaggregation and professional analysis of

15. Decreto Ley 18742, Jan. 21, 1971; Decreto Supremo No. 0014-71-RE, Nov. 16, 1971; Interview with Antonio González Norris, INP, Lima, Sept. 28, 1973.

contracts, and bargaining for the terms of aid transfer. INDUPERU, the two-year-old offshoot of MIC which is responsible for organizing and managing the sizeable public sector industry, has a similar international technical cooperation office. The work of these two agencies is fully consistent with the techno-economic intent of Andean Pact technology policy.[16]

6. Merging Strategies Through National Planning

A small group of Peruvian techno-economists is attempting to harness the potential power of the government and the national planning apparatus in an effort, as one of the group put it, to "institutionalize rationality" through high-level planning and coordination of policies for science and technology. The group hopes to realize the potential for national science and technology policies implicit in Peru's development plan for 1971-1975, where science and technology are seen as important elements of national strategy, while the sectoral scheme for industrialization more fully and explicitly outlines the role of technology. The informally constituted group of science and technology policy planning advocates is conscious that technological development is a long-term proposition for a poor nation like Peru. It aims to reconcile contradictions, both implicit and explicit, in existing policies and to have the National Planning Institute devise the broad outlines for a set of science and technology policies.

Though somewhat naive concerning the possibilities for the national planning exercise, the group has been rewarded

16. Interviews with Inga. Magdalena Fajardo de Savarin, Coordinador de Cooperación Técnica Internacional, Oficina Sectorial de Planificación, MIC, Lima, Oct. 4, 1973; and Ing. Miguel Quintana Cama, Cooperación Técnica Internacional INDUPERU, Lima, Oct. 5, 1973; Decreto Ley No. 19272, Jan. 25, 1972; INDUPERU, Memoria 1972 (Lima, 1973); INDUPERU, Boletín Semanal, Año II, No. 30, various articles; ibid., No. 53, July 6, 1973, pp. 10-13.

with the formation of a science and technology policymaking team within the National Planning Institute. Composed of well-trained professionals in the fields of economics, engineering and political science and government, the team will design national aspects of policy in coordination with the international technical cooperation program. The informal group of policy advocates has been assisted in part by foreigners, such as the OAS and Canada, whose sponsorship of research projects provides information and ideological stimulation, opportunity for international communication, and a high degree of authenticity and respectability that may add to the acceptance of its proposals.[17]

Prospects for an explicit, nationally integrated set of

17. Peru's Plan Nacional de Desarrollo, 1971-1975, Volume I, 31-2, 43-4, 126-27, 134-36; Volume II, 17-20, 27-28; Gustavo Flores et al., "The Technology Policy Implicit in the Industrial Development Plan, the General Law of Industries and the General Law of Mining of Peru," mimeographed, no date; interviews with F. Sagasti, Oct. 11; A. Gonzalez N., Sept. 28; Dr. O. Velasco, Oct. 11, and Dr. Jorge Ichisawa, Research Office, INP, Lima, Oct. 2, 1973.

The most forceful exponent of national planning for science and technology is Francisco R. Sagasti, a Peruvian who derived important elements of his approach from his education in systems analysis and planning and who has been associated, in the past, with the Peruvian National Research Council, the OAS Department of Scientific Affairs and the Board of the Cartagena Agreement. Sagasti is currently Field Coordinator for the "Science and Technology Policy Instruments (STPI) Project," sponsored by the Canadian International Development Research Centre and involving participants from countries in Africa, Asia and Latin America. For Sagasti's work on planning, see: Francisco Sagasti, "Towards a Methodology for Planning Science and Technology in Underdeveloped Countries," Ph.D. thesis, University of Pennsylvania, 1972; Sagasti, "A Systems Approach to Science and Technology Policy-Making and Planning," OAS, Regional Scientific and Technological Development Program (Washington, D.C., 1972), and Sagasti, "Hacia Un Nuevo Enfoque para la Planifición Científica y Tecnológica," ibid. (1972).

Peruvian policies for science and technology are clouded, reflecting in part a degree of healthy pluralism within the nation's polity. Though the advocates of a strong national science and technology planning effort are pragmatic, politically conscious and ambitious, and technocratic, their techno-economic traits are not appreciated by many, especially the liberal-scientists. Yet, these advocates believe that they are laying the appropriate framework for policy on the basis of what Francisco Sagasti, perhaps their leading spokesman, calls "contextual" planning and analysis,[18] though this strategem may be hardly more than intelligent expediency. They hope to overcome the recognized "empire-building," rivalry and bureaucratization of government ministries, but they have yet to demonstrate the political strength to do this. The utility of this group and of the science and technology policy efforts of the National Planning Institute seems to be primarily in the arena of serving useful functions within Peru's public sector (through MIC and INDUPERU, for example), where the power of the military regime can overcome many impediments. Within a revolution whose ideology is not precisely defined, however, such a group will persevere only so long as its work and interests coincide with and do not threaten superior government interests and powers, regardless of the rationality of its intent.

The scheme of the National Planning Institute's direction for Peruvian science and technology policies excludes a significant role for the National Research Council and its liberal-scientific community, biasing the hybrid policy formulation very strongly toward the techno-economic approach. This exclusion could severely undercut the present attempt to reconcile government and the scientific community through a reformed National Research Council, as described in Section 2

18. See Sagasti, "Towards a Methodology," especially Chapter VI.

of this chapter; it would probably be costly in a country where the few existing scientists are already alienated to some degree from governmental policies. To reiterate an important point made earlier, the actions of government often elicit more negative than positive responses from the scientific community. Universities are happy to receive government funds, for example, through ITINTEC contracts, because this contributes materially to research and teaching programs. Yet, scientists desire the freedom to conduct their work, a condition they believe not to be enhanced by the procedures of a military government or by the authority of ITINTEC, which is seen to be, in effect, both contractor and judge of research and its results.

Academic researchers fail to understand how government officials, with technical trianing at times inferior to their own, can make competent decisions of such a nature. They perceive that bureaucrats tend to protect their power and domains, making safe rather than innovative decisions which lean toward implementation of economic policy but neglect the principle of developing the nation's technological infrastructure. For example, the Peruvian government recently awarded to a U.S. firm the contract to engineer an oil pipeline from the interior to the northern Pacific coast of the country. Some believe, however, that the National Engineering University in Lima was capable of doing the job and feel that neglect of their institution represented a purely political decision. Even if the Engineering University could not have done the entire job, it would make sense for the government to designate a national team, from that University or perhaps from the Ministry of Energy and Mines, to work along with the U.S. company so that in the future Peru would have an increased ability to handle similar projects. As the situation now stands, however, the slight to the National Engineering University dismays liberal-scientists who would

willingly participate in a national technology policy that actually helps develop domestic scientific and technological capabilities.

7. Peru, The Region and Beyond

Work has just begun to formulate an integrated national policy for science and technology in Peru, and the techno-economists are firmly in control. The Peruvian techno-economists of MIC, INDUPERU, ITINTEC, the National Planning Institute and other offices are knowledgeable and eager. They appear to think and, in part, to act as a "team" whose interests and activities transcend the narrow bureaucratic bonds of single administrative units. However, it will be some time before their efficacy in building a more unified and effective technology policy can be evaluated. Further, the techno-economists will have to raise science and technology from a relatively low position in the scale of Peruvian governmental priorities to a higher and more visible status. And, until there is some synthesis of the efforts of both liberal-scientists and techno-economists in policymaking and national scientific and technological development, Peru will only benefit minimally from and be able to contribute little to an Andean common market for science and technology.

For Peru, the Andean common market is only one among many of its national interests in international affairs. The country must continue to deal bilaterally with foreign purveyors of technology and capital and with multinational corporations for the goods it needs for development. Peru's relationships with foreigners and multinational corporations present problems of equal seriousness to their internal ones in large part because the techno-economists share a general mistrust of outsiders and they are therefore cautious in dealing with them. In spite of this mistrust, they recognize that Peru, like any other underdeveloped nations, will never

be totally independent in terms of technology and that the best their nation can accomplish is to achieve a healthy and "selective [technological] interdependency" that would permit Peru to have an increased control over the resources needed to meet development objectives and the means of utilizing them efficiently.[19] In its application of the Andean Investment Code, Peru has shown some ability to deal with foreign companies because of the regime's pragmatism and its ability to negotiate with the foreigners individually. But some compromises in applying the Code may be necessary if Peru wishes to increase the flow of foreign capital and technology, which until now have moved very slowly into the country. And the Peruvians will have to improve their ability to negotiate with foreigners, who may be able in the short run to take advantage of Peru's lack of expertise and knowledge in these areas.

Occupied, then, with internal questions of science and technology policy and engaged on many international levels in the transfer and commerce of technology, Peru has little to offer to and only somewhat more to gain from an Andean common market for technology. The most it can hope to gain in the short run is some help in the commercialization of technology. Regional scientific exchanges and technological development are too nebulous and their realization too far in the future to mean much for Peru at this time, although good results from a demonstration project in a multinational technology area such as metal-working may indeed prove to the Andean nations how much cooperation could gain for them.

Despite its position as the most consistent follower of Andean Group policies regarding industrialization, trade,

19. Interview with Ing. Flit, Sept. 26, 1973; also in Sagasti, "Towards a Methodology," 208; see Meir Merhav, Technological Dependence, Monopoly and Growth (Oxford, N.Y., 1969).

capital and technology, Peru will probably continue to have difficulties reconciling differences between itself and both other Andean nations and the regional integration institutions. Some influential Peruvian science and technology policymakers, for example, feel that the technology policy unit of the Board of the Cartagena Agreement has not made sufficient use of national intellectual and institutional resources in formulating the draft "Subregional Technological Development Policy." This suggests that JUNAC optimism about effecting that policy in a period of a few months could be an inaccurate assessment; six months or more might be required to reconcile numerous seemingly small differences between the proposal and the Peruvian position. Such delays would only detract from what momentum exists in the development of Andean Group science and technology policies. And, it should be pointed out, Peruvian developmental nationalism, revolutionary fervor and the ideology of technological dependency are not in themselves sufficient to propel dynamic national policies or to make Peru an enthusiastic participating member of an Andean common market for science and technology.

CHAPTER V

SCIENCE AND TECHNOLOGY POLICYMAKING IN COLOMBIA

Colombian science and technology policymaking is similar in some respects to that of Peru and other Latin American countries, but it has its unique aspects. Colombia, it is true, has a basic commitment to an Andean common market for science. But that commitment is weak; the country's internal intellectual and institutional fragmentation with regard to science and technology and its democratic-capitalistic politico-economic environment make it necessary for that nation to deal first with national questions and to integrate to a greater degree its policymaking structure. As it stands, the current national development plan[1] does not deal with science and technology as issues for comprehensive policy efforts.

Though the Colombian government has less power with regard to policies for science and technology than the military regime of Peru, it has several advantages. The Colombian milieu evokes a greater range of alternatives for policy consideration and these alternatives have enjoyed fuller public discussion. Also, because COLCIENCIAS, the Colombian national research and policymaking council, is making headway in bringing together the liberal-scientific and techno-economic approaches, there seems to be somewhat less antagonism between them than is apparent in Peru.

1. See, República de Colombia, Departamento Nacional de Planeación, Las Cuatro Estrategias (Bogotá, D.E., 1972).

Scientific and technological underdevelopment or dependency is an important motive for Colombian policies. The initial steps toward instituting high-level policies came during the activist Liberal administration of President Carlos Lleras Restrepo (1966-1970). The administration was impelled to act because of balance of payments difficulties, problems of industrial development, education and the serious "brain drain." This discussion of Colombia requires a different organization from the preceding one of Peru, for evaluation of Colombian policies do not fit as neatly into techno-economic and liberal-scientific categories. It begins with the Committee on Royalties. Then it uses COLCIENCIAS as a device for examining a number of technology policy issues that involve other public and private policymaking institutions and the productive sector.[2]

1. The Committee on Royalties

One of Colombia's responses to balance of payments deficits was the formation of the Committee on Royalties (Comité de Regalias) in the Ministry of Economic Development in 1967. The law setting up this Committee established national control of foreign exchange in a system that involved the Colombian Central Bank, development institutions and foreign commerce offices. A techno-economic approach to the importation of foreign technology, therefore, was only one aspect of a larger system whose primary purpose was foreign exchange control and of which the Committee on Royalties is a part.[3]

2. President Lleras was one of the strongest early supporters and instigators of the Andean Group as an instrument of national and regional economic development and integration.

3. Decreto Ley No. 444, 22 March 1967, Article 102; Decreto Ley No. 688, 20 April 1967, Articles 7, 8; Decreto No. 1234, 18 July 1972.

The Committee is an inter-agency institution located in the Industrial Division of the Development Ministry's Superintendency of Industry and Commerce. Its Secretary coordinates a group composed of officials from his Ministry, the National Planning Department (DNP) and other offices that have authority over foreign exchange. The Committee's small technical staff is charged with approving or disapproving contracts involving transfer of technology covered by royalties, commissions, trademarks and patents for which payment is made in foreign currency. It cannot survey technology contracts involving payments in pesos, and it does not negotiate directly with the foreign parties; rather, it provides a service of registering, investigating, and making recommendations to aid in bargaining between private national interests and foreigners.

Some results of the Committee have been striking. Savings produced through the revision of contract pricing has been estimated at about U.S. $13.6 million in the first three years of the Committee's existence. Payments have been eliminated for obsolete technology and for that which can be acquired from non-proprietary sources, and restrictive clauses have almost entirely been excluded. In addition the guidelines of the Committee have aided private companies in their negotiations with foreigners. For example, norms adopted for the multinational pharmaceutical industry, which Constantine V. Vaitsos showed to have used so-called technology contracts with local affiliates as a vehicle for the overpricing of intermediate goods, have led to wholesale revision of contracts with consequent savings of foreign exchange.[4]

4. Programa Regional de Desarrollo Científico y Tecnológico, Departamento de Asuntos Cientificos, Organización de los Estados Americanos, "La Transferencia de Tecnología Hacia los Paises del Grupo Andino," AC/PE-46, abril 1972, 100-102. Interview with Dr. Ismael Quintero, Secretario, Comité de Regalias, Bogotá, Nov. 5, 1973.

The Committee on Royalties must be seen not only in the context of Colombia's balance of payments but also in relation to the concern for the role of multinational corporations in the Colombian economy, the desire to control foreign capital in general, and the Andean Group's Foreign Investment Code.[5]

A major factor in the formation of the Andean Group was the fact that Colombia's concern with these issues coincided precisely with the interests of neighboring countries. Indeed, the national policy embodied in the Committee on Royalties was one of the models for the elaboration of Decision 24 of the Cartagena Agreement. In turn, Decision 24 has helped make the work of the Committee even more explicit. It is necessary to point out, however, that Bogota is only now beginning to implement the rules of the Foreign Investment Code that relate to foreign capital. The National Planning Department had a prominent role in drawing up proposals for the original Andean Group technology policy. Constantine V. Vaitsos, who is now in charge of the technology policy unit of the Board of the Cartagena Agreement, made empirical studies directly related to Colombian policy and helped design that country's proposals for consideration by early Andean Group planners. Thus, National Planning Department documents, which Vaitsos helped write, aided in defining the direction that was to be taken in the development of Andean Pact technology policy.[6]

5. Miguel S. Wionczek, Inversión y tecnología extranjera en América Latina (Mexico, 1971), especially 98-112.

6. República de Colombia, Departamento Nacional de Planeación, Resultados Principales Sobre el Estudio de Tecnología, Documento DNP-451-UEIA, feb. 1970; ibid., Algunos Aspectos Tácticos en la Compra de Tecnología, Documento DNP-548-UEIA, feb. 1970; ibid., Esquema de una Posible Política del Grupo Andino Sobre Transferencia de Tecnología Extranjera, Documento DNP-380-J, oct. 1969.

These documents also proposed an extension of the authority of the Committee on Royalties into related areas in order to rationalize national control and supervision over foreign technology transfers. They advocated giving the Committee an important role in a comprehensive foreign loan and capital investment policy, which would have extended its domain beyond its present primary concern for balance of payments questions. Much to the disappointment of techno-economic theorists like Vaitsos, this extension of the role of the Committee on Royalties has not yet been accomplished.

Some Colombian government officials want to integrate the Royalties Committee into a more comprehensive technology transfer and technological development policy. The Committee's directive not to register contracts requiring payment in local currency is one target for revision.[7] This impulse may proceed from the bureaucracy's desire to perpetuate or increase its activity and power and not from high-level policy decisions. The possible impact of the UNCTAD III resolution on technology transfer and Andean Group proposals notwithstanding, however, there seem to be few domestic pressures in favor of such technology policy development.

Colombian business is generally prosperous; hence the Conservative government has little inclination to be more activist in an area that may discourage foreign investment or that may seem to increase governmental power vis-à-vis the private sector in dealing with foreign technology suppliers. There is another side of the story, too. From the perspective of those who see the work of the Royalties Committee as part of the system of foreign exchange control, which is itself in turn a function of the larger foreign commerce and investment

7. Interviews with officials in the National Planning Department, the Ministry of Economic Development and the Colombian Institute of Foreign Commerce (INCOMEX), Bogotá, Nov. 1973.

policy, consolidation in another direction seems appropriate. This perspective suggests that technology is less important a consideration to Colombian policymakers than traditional considerations of commodity and capital flows in their relation to economic growth. Therefore, the trend toward the rationalization of a more far-reaching technology transfer policy under the jurisdiction of such an institution as an enlarged Committee on Royalties is in contention, both administratively and in terms of economic development policy orientation. In that case the impulse to rationalize foreign capital and trade policy would be under different agencies.

The Colombian government's explicit and implicit involvements in policies for science and technology, both those broadly construed and those more narrowly concerned with industrialization, encompass the work of other agencies besides the Committee on Royalties. These institutions include the Office of Standardization and Quality Control of the Ministry of Economic Development, the National Planning Department (DNP), the Colombian Institute of Foreign Commerce (Instituto Colombiano de Comercio Exterior, INCOMEX) and financial institutions such as the National Foundation for Planning Projects (Fondo Nacional de Proyectos de Planeación, FONADE) and the Institute of Industrial Development (Instituto de Fomento Industrial, IFI).[8] All of these institutions have a techno-economic interest in policymaking. Before turning to them, however, it will be useful to introduce COLCIENCIAS. As the Colombian national research and policymaking council, COLCIENCIAS joins both liberal-scientific and techno-economic approaches and provides us with a vehicle for discussing the

8. INCOMEX, attached to the Ministry of Economic Development, is Colombia's formal link to the Cartagena Agreement. FONADE is a branch of the National Planning Department.

other institutions listed above.[9]

2. COLCIENCIAS

Just as the Committee on Royalties was formed as a result of the policymaking activism of the Lleras Restrepo administration, so, too, in late 1968 were COLCIENCIAS (Fondo Colombiano de Investigaciones Científicas y Proyectos Especiales "Francisco José de Caldas") and the National Science and Technology Council (Consejo Nacional de Ciencia y Tecnología, CONCYT) formed. Both institutions resulted from a meeting which brought together members of the Colombian scientific community and government officials. The meeting was sponsored by the Ministry of Education with the collaboration by the U.S. National Academy of Sciences and A.I.D. Following in the wake of a UNESCO report regarding structural and functional aspects of science and technology policy organization,[10] President Lleras officially decreed the establishment of the two institutions, CONCYT, to act as an advisory body to the government "in everything related to the policy of scientific and technological development of the country" and COLCIENCIAS,

9. An interesting point worthy of mention but not to be elaborated in this paper, is the relationship between credit availability and technology. An engineering consultant with extensive experience in Colombian research and policy suggests that some industrial firms find credit much more readily available in U.S. dollars than Colombian currency, which facilitates purchases abroad. Though some are aware of their technological needs (Colombia's well developed textile industry, for example), most buy equipment and advice from abroad, relying too heavily on suppliers' information. They fail to analyze technology as such, sharing no interest in local research and little more in native provisioners of technology-embodied goods. This is one part of a complex problem that has implications for nearly every aspect of government policy.

10. The UNESCO report was written by the Foreign Secretary of the National Academy of Sciences.

to finance, stimulate, and coordinate scientific and technological research. The process was the nexus of a complex of motives that included the improvement of the status of research, the tying of research more directly to industrial and other national needs, the creation of conditions to counteract the "brain drain," the need for precise knowledge about the country and its resources, and, finally, the desire to impel the nation's technological and scientific development with high-level policymaking.[11]

These aims have not been well satisfied. CONCYT, which was to have been attached to the National Economic and Social Policy Council, has never become an active advisory or policymaking institution. To all intents and purposes it is now defunct, its members doing little more than advising in the development of COLCIENCIAS programs. In contrast to CONCYT, COLCIENCIAS has important functions, including the responsibility to fund research and to bring together teams of experts on its staff to work on such programs as technology transfer, human resources, food and nutrition, the development of an information system for science and technology, and natural resources. COLCIENCIAS also obtains the aid and cooperation of international agencies like UNESCO and it works with other Education Ministry institutions.[12] On the negative

11. Fondo Colombiano de Investigaciones Cientifícas y Proyectos Especiales "Francisco José de Caldas" (hereafter COLCIENCIAS), Normas Orgánicas de COLCIENCIAS, Bogotá, marzo de 1971; National Academy of Science, Report of the Colombia-U.S. Workshop on Science and Technology in Development, Fusagasuga, Colombia, Feb. 26-March 1, 1968, 2 Volumes (Washington, D.C., 1968). For some high-level motivations see the report of statements by President Carlos Lleras Restrepo, ibid., Vol. I, 38-40, 54-55. The quote about the function of CONCYT is in Article 1, Decreto No. 2869, nov. 20, 1969. See also, UNESCO, La Politíca (1969), 92-100.

12. Interviews with Dr. Oliverio Philips Michelsen, Asesor Industrial, Bogotá, Nov. 6, 1973, and Dr. Fernando Chaparro, COLCIENCIAS, Bogotá, Oct. 25, 1973; UNESCO, La política cientifica en América Latina-2 (1971), 105-115.

side, however, COLCIENCIAS' productions and publications are often perceived as no more than a series of reports that are merely filed away in a library. Moreover, some fear that since it is not sufficiently well known within the government, COLCIENCIAS could hardly wield much power even if it had more authority. Therefore, though some in the COLCIENCIAS and the National Planning Department wish to push COLCIENCIAS into more positive and more effective policymaking roles, its current influence is slight.

In lieu of an adequate replacement for CONCYT, COLCIENCIAS would favor constructing new legal and institutional links to the National Planning Department and to various other ministries. As the science and technology office of the Education Ministry, COLCIENCIAS began meeting informally with officials of INCOMEX and the Planning Department in October of 1973 to discuss Andean Pact technology policy proposals. The participants were not able to agree immediately on a precisely articulated national position, but COLCIENCIAS was awarded the task of drawing up an initial position paper. Institutional changes of a more long-lasting nature are uncertain at this time, for in addition to some rivalry and basic disagreement between governmental offices, there is an institutional instability due to the imminence of national elections in early 1974, whose result may bring about significant administrative changes.[13]

13. For more on COLCIENCIAS and discussions of the new Andean Pact technology proposal, see Chapter III, page 87.

Changes in the Colombian governmental structure might include promotion of the National Planning Department and INCOMEX to the status of ministries. There is, however, the question of how powerful a role the Planning Department can play in the government, for it has languished in the past several years under the Conservative regime. There would still be the questions regarding the precise role of COLCIENCIAS in formulating policies for science and technology: Would some functions be taken from it and centralized in the Planning Department? Would

And yet, COLCIENCIAS has had a few successes. Some of these successes may serve both liberal-scientific and techno-economic interests in industrial development. With over 90% of its funds provided by the Ministry of Education and the rest donated by international agencies, the budget of COLCIENCIAS is now more than 20,000,000 pesos annually; officials hope that the available finances will double within a few years. The government's financial commitment thus seems to be growing. Meanwhile, COLCIENCIAS had devoted a total of 22,400,000 pesos (nearly U.S. $1,000,000) for research in universities and institutes by the end of 1972. These research programs, now accounting for the largest portion of the budget, have been useful in both promoting interesting work and building good relations with universities in fields, for example, like engineering.[14]

Most of the studies conducted within COLCIENCIAS have the purpose of providing information for direct application or, more generally, for further use in policymaking. In this category are the studies of human, financial, and physical resources relating to science and technology. Examples are the

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consideration be given to the fact that the location of COLCIENCIAS in the Education Ministry leaves it in a weak policymaking position in regard to techno-economic policy issues? Only future decisions will clarify the answers to these questions and to many others like them.

14. Interviews with various COLCIENCIAS officials, including Dr. Efraim Otero, Director, Oct. 22, and Dr. Milcíades Chaves, Oct. 26, 1973; Also interviews with Dr. Philips (note 12) and Dean Carlos J. Amaya, Engineering Faculty, Universidad de los Andes, Bogota, Oct. 29, 1973. In addition, the interest of the Colombian Association for the Advancement of Science was noted at its second convention in Bogotá, El Tiempo (Bogotá), Nov. 1, 1973, 1-A. Also, COLCIENCIAS, Acuerdo Numero 007, 4 mayo 1973, and COLCIENCIAS, Documento Informativo de Colombia, Reunión del Grupo de Expertos Gubernementales Recomendada por CACTAL, Washington, D.C., 25 oct.-3 nov. de 1972, Cap. I.

soon to be published institutional description of human resources in the Colombian science and technology system, directory of the country's scientific and technological personnel and inventory of university and research institute laboratories. COLCIENCIAS also makes policy studies to define science and technology criteria and priorities that are related to Colombian economic development plans and needs. Policy recommendations tend to be vague in character and pose many problems in implementation. For even if the recommendations are carried forward to the appropriate ministry, public policy in Colombia is only indicative for the private sector. In the absence of sterner policy implementation instruments, the principal tools of enforcement for policies for science and technology in Colombia's private sector are discussion, persuasion and education.

The COLCIENCIAS research program must be differentiated frmm the ITINTEC technological development work in Peru, in large part because the Colombian institution is interested in more than just industrial technology. COLCIENCIAS, as the national research council, attempts to serve the entire liberal-scientific community. Though its programs and funding allocations are designed in general accordance with the "four strategies" of the Colombian national development plan, research funds are awarded primarily on the quality of the proposals submitted. There are no quantitative categorical limitations for apportioning monies between various fields of research. In order to increase the coverage of its resources, COLCIENCIAS makes its small awards in conjunction with larger expenditures of research institutions and contributions from other sources, multiplying the impact of the assistance. Meanwhile, COLCIENCIAS encourages the development of and collaboration between university research committees, partly to promote inter-institutional cooperation and in part to aid materially the growth of poorer, smaller schools. In addition,

COLCIENCIAS has made constructive suggestions. It is currently urging the creation of specialized research units, one of which, for example, would serve the metal-working sector.[15]

In addition to its allocation of research funds, COLCIENCIAS has a number of so-called "special programs" that illustrate how the institution may be able to integrate science and technology in policymaking. These programs are multidisciplinary and utilize inter-institutional research teams and advisory committees. The National Program of Research on

15. The preceeding paragraphs are based on interviews with COLCIENCIAS officials Dr. Jaime Ayala, Director of Scientific Affairs, Nov. 16; Dr. Fernando Chaparro, Oct. 25; Pedro Amaya, Coordinator of General Research Plans, Oct. 30, 1973. Also see Efraim Otero, Director, COLCIENCIAS, "Orientation to Development for Science and Engineering Education in Colombia," in Policies for the Application of Science and Technology to Development (Program on Policies for Science and Technology in Developing Nations, Cornell University, Ithaca, N.Y., 1973), 60-71.

It is also interesting to note that COLCIENCIAS is the coordinator of the "Group of the Year 2,000," a program composed of ten committees and about 150 Colombian experts whose purpose is to make prospective studies about alternative policies for the future and their implications. Initiated by the President of Colombia, the program is to work in such areas as energy, regional and urban development and transportation. Though not yet credited with having accomplished a great deal, the program is moving forward to develop a methodology and a model for its work. Interview with Hernando Gándara, Secretary of the "Group of the Year 2,000," Oct. 6, 1973; Hernando Gándara, "Anotacciones sobre prospectiva," Cuarernos de la Sociedad Colombiana de Planificación, No. 9, mayo-junio 1972, 9-16. COLCIENCIAS publishes the studies of the Group of the Year 2,000.

Some interested parties have not been pleased with COLCIENCIAS investments and priorities in research, however. While A.I.D. provided a considerable amount of COLCIENCIAS research funds in the early years, these donations were terminated because A.I.D. did not consider the program sufficiently interested in applied research in comparison with pure science.

Foods and Nutrition, one of the most successful to date, has drawn together public and private interests in both science and in production to build an elaborate scheme that conceivably could be a model for other industrial projects. But it is too early to evaluate the implementation of this National Program.[16]

The National Information System is another well-elaborated "special program" of COLCIENCIAS. Probably the most advanced plan of its kind in the Andean Group and rivaling that of countries like Brazil and Argentina in sophistication, the system will require institutional cooperation in the use and expansion of existing resources. Six major regional centers would be joined by other, more specialized units to provide specific scientific and technological information. The units in the newly initiated system will be linked by Telex and would interchange relevant photocopied and microfilmed material. Most important, the units are to be built up around the needs of their users. The design, therefore, takes into account the fact that while a researcher in physics may read several foreign languages a small businessman would probably require translation and advisory services in order to be able to utilize material effectively. Sectoral information subsystems are planned for education, health, agriculture, economics, and industry. Future possibilities for the information system include linkages with other Latin American countries and possible computerization.[17]

3. COLCIENCIAS and Technical Standards

In 1970 a governmental decree authorized the creation and

16. See, COLCIENCIAS, Bases Para un Programa Nacional de Investigaciones en Tecnología de Alimentos y Nutrición, Tercera Versión (Bogotá, Julio 1973).

17. Interview with Dr. Jaime Ayala, Nov. 16, 1973.

coordination of laboratories within the National Service of Standardization, Measurement and Quality Control. The COLCIENCIAS "special program" for technical standards and its involvement in the elaboration of the National Service illustrate conflicts between the national institution and other interest groups as well as the political problems of effecting technology policy in Colombia. As we shall see, politics have thus far stymied the development of the National Service.

The story begins with the nature of Colombian quality control and technical standards policy. The major institution in this field is the private, non-profit Colombian Institute of Technical Standards (ICONTEC). Through over 800 specialized subcommittees and the participation of thousands of experts and industry representatives, ICONTEC establishes standards which are applied by the government, hopefully in the interest of both producers and consumers. Since its inception in 1963, ICONTEC has had the function of representing Colombia in multinational bodies such as the International Organization for Standardization (ISO), the Pan American Standards Commission (COPANT), and the corresponding unit of the Andean Group. It has vastly increased its coverage through physical growth and continual additions to its lists of specific technical standards. As formal adviser to the government since 1964 and as recipient of public subsidies, ICONTEC's position has since been enhanced by a 1971 decree that gave the Institute a seat on a new National Council for Standards and Quality. Among the Council's ten government representatives is one from COLCIENCIAS.[18]

Once approved by this Council, quality and technical

18. Interview with Ing. Javier Henao Londoño, Director Ejecutivo, ICONTEC, Bogotá, Oct. 16, 1973; various issues of the ICONTEC, Memoria Anual and the monthly Boletín Informativo; for the connection with Andean regional planning, see Memoria Anual, dic. 1971, 15.

standards are implemented by the Division of Standards and Quality, a unit of the Ministry of Economic Development's Superintendency of Industry and Commerce. The Division's staff is small and its functions limited to inspections for promotion of technical standards. This office hopes to augment its position by working directly with pilot firms in various regions and sectors. In an area where Colombian industry is largely ignorant if not also wary of technology and its implications, such a program might have impact, especially since influential industry leaders stand squarely behind standardization appropriate to Colombian conditions as a means of achieving efficiency, quality and safety, and of aiding in Colombia's drive to export manufactured goods. While large firms could finance such improvements they still would benefit from government cooperation. Medium and smaller firms would require more assistance: their trade association (Asociación Colombiana Popular de Industrias, ACOPI) would help provide extension services, for example, in collaboration with the government's Superintendency of Industry and Commerce and the National Apprenticeship Service (Servicio Nacional de Aprendizaje, SENA).[19]

Standardization and quality control policy depends very heavily on both the participation and receptivity of private enterprise, especially in the writing of standards, though there is undoubtedly difficulty in obtaining a uniformly high level of adherence to published norms in all sectors. Because they are relatively successful, Colombian businessmen resist what they consider excessive and uneconomic growth of

19. Decreto No. 2416, 9 dic. de 1971; interviews with Ing. Henao (Note 18); Julio Cesar Belalcazar, Jefe, División de Normas y Calidades, Bogotá, Nov. 8; Dr. Ignacio Chiappe-Lemos, President, COPANT, and of the Asociación Colombiana de Industrias Plásticas (ACOPLASTICOS), Bogotá, Nov. 12; and Dr. Ovidio Oundjian B., General Secretary, COLCIENCIAS, Bogotá, Oct. 17, 1973.

government power in this as in other areas of technology policy. Even if industry is uncooperative, however, the government has the power to enforce standards rigidly when it wishes to do so. In a recent case of new guidelines for the manufacture of electric light bulbs, one foreign corporation cooperated fully with the new ruling, while the local subsidiary of a second foreign firm had to be shut down before it would comply. But such extreme enforcement measures may be the exception rather than the rule.

COLCIENCIAS desires that the government promulgate a more rigid and uniformly well implemented standardization program. It points to specific failures of the current system: below-standard brake fluid that was a danger to drivers, for example, and dinnerware containing materials harmful to health. But while these shortcomings could have occurred in any country, more important in the COLCINENCIAS view was the fact that industry representatives on ICONTEC committees may neglect weaknesses in standards affecting them either willfully or because they do not take the national interest to heart; examples relating to the automotive industry and the need for vehicles appropriate to Colombian conditions are given to illustrate this. Under a system where government is friendly to business and scrutiny of guidelines before approval by the National Council for Standards and Quality is probably cursory, the question is whether industry can, in effect, write the regulations by which its goods are to be made and by which consumers will judge them.

COLCIENCIAS, therefore, has been instrumental in taking the initiative which led to the 1970 decree for the National Service of Standardization, Measurement and Quality Control. Because the National Service required the collaboration of several government organs, a separate juridical unit had to be formed. This unit, the Managing Committee (Comité Directivo) of the National Service, included members of the

Ministries of Economic Development and Communications, the Superintendency of Industry and Commerce, and COLCIENCIAS. A Director of the National Service was named from PROEXPO (the Fund for Export Promotion, located in INCOMEX) to head what would be a small technical and administrative staff.

The operation of the new National Service depended on cooperation between the Managing Committee and the Superintendency of Industry and Commerce. However, the needed inter-institutional cooperation did not materialize due to disagreements about the disbursement of funds and because of fundamental differences over the relationship between the state and private industry. The Superintendency was evidently arguing for a less strenuous government policy than COLCIENCIAS. The result was that by the end of 1973 the National Service had not yet come into existence. Agreement on a plan of organization was to have been a prerequisite for Colombian acceptance of a West German offer of some 12,000,000 marks (nearly U.S. $4.5 million) in aid to begin the Service. For about three years the stalemate continued, finally brought to a head by German pressure on the National Planning Department to come up with a plan because the Bonn regime could not make its gift available indefinitely. Though Colombia had made a gesture in mid-1973 by sending the Administrative Director to Germany to discuss final arrangements, inter-administrative fragmentation had not yet been healed by the end of the year. It appeared that if agreement could not be reached soon, COLCIENCIAS and the Communications Ministry would denounce the existing governmental "contract" to build the National Service.

Bureaucracy and "political intentions" have been blamed for the present stand-still, though doubtless other factors must be weighed in the final judgment as well. The consensus among the participants on the need to tighten standardization policy was simply not sufficient to overcome obstacles to

what appears to be a progressive innovation. The argument seems to revolve around how to employ government power as much as anything else. ICONTEC continues to expand, is conducting studies to facilitate transfer of foreign technology, and plans to be more aggressive in selling its services. At the same time, the influential National Industrial Association is generally happy with the current public-private sector technical standards policy relationship, contending that the government should limit itself to "strictly necessary policy and control" functions.[20]

4. Technology Transfer and Research

How public and private sectors interact is also a focal question when it comes to developing a policy for technological research and transfer of industrial technology. Outside of the work of the Committee on Royalties, COLCIENCIAS is the principal center for defining governmental activity in this area, but it is just beginning to draw together sufficient diverse threads to knit a durable fabric of possibly effective technology policy for national development. At the same time, ideological differences and private sector initiatives make far from optimistic any proposition about success for the COLCIENCIAS-coordinated network of technology experts and institutions.

First, it must be pointed out that there is general agreement in Colombia on the relationship between standardization and quality control on the one hand and technology transfer on the other. But this general agreement does not extend to concurrence about the limits of governmental

20. Various interviews cited above (note 19); Asociación Nacional de Industrias, XXIX Asamblea General, Bogotá, oct. 17-19 de 1973, "Aspectos Básicos del Desarrollo Industrial, Cuarte Parte: De la Comercialización, los Mercados y la Tecnología," 20-23.

authority. Dr. Ignacio Chiappe Lemos represents the view of many in Colombia's modern industrial sector who perceive that technical standards facilitate international commerce in proprietary technology. These progressive industrialists are at least mildly nationalistic in their insistence that Colombia should be able to obtain appropriate technology from abroad on favorable terms to her, a view at least rhetorically similar to those of the more fervent techno-economists. However, industrial leaders like Dr. Chiappe Lemos argue that antagonism of the radical techno-economists toward foreigners and multinational corporations must not lead to an irrational insistence on autarkic national economic independence. In short, Dr. Chiappe Lemos represents the private entrepreneurial view that relationships with foreign business are not in and of themselves detrimental to national industrialization and that government policymakers do not have sufficient working knowledge of economic affairs with regard to domestic development and foreign economic relations and should, therefore, give way on many questions to experienced businessmen.[21]

In a milieu strongly influenced by the private sector views just described, the Technology Development Unit of COLCIENCIAS conducts its work in the areas of technology transfer and research. The Technology Unit is the national focal

21. Interviews with Dr. Ignacio Chiappe Lemos, Nov. 12; and Ing. Javier Henao, Oct. 16; Dr. Joaquin Ballejo, Banco Comercial Antiqueño, Bogotá, Oct. 30, 1973. Ignacio Chiappe Lemos, "El Papel de la Normalización en la Transferencia de Tecnología," (1973), a typescript given to the author; see also ICONTEC, Boletín Informativo, aug. 1973, 3-7; ibid., sept. 1973, 10-13.

Dr. Chiappe Lemos, a lawyer and economist, is simultaneously President of the Colombia Association of Plastics Industries (ACOPLASTICOS), of the governing board of the Colombian Institute of Technical Standards (ICONTEC) and of the Pan American Standards Commission (COPANT). He is also associated with the cosmetics industry, among others. He was among the founders of ICONTEC.

center for the OAS Pilot Project in Technology Transfer, receiving other assistance from the OAS, A.I.D. and similar international agencies. Until nearly the end of 1973, the Technology Unit's work mainly treated technology policy on a general and theoretical level.[22] The Unit's activities to date have included seminars with university technologists, businessmen and foreign experts; studies have been made of Colombian technological potential and of actual cases of technology transfer. Supposedly involved in the elaboration of the Pilot Project were industrial trade associations and government institution such as the Committee on Royalties, the National Planning Department, the National Apprenticeship Service and the Institute of Industrial Development. However, strong ties between representatives of these institutions have not been developed, exemplified, for example, by the extremely shallow communications between the Committee on Royalties and the chief of the COLCIENCIAS Technology Unit. COLCIENCIAS now intends to improve these communication linkages and also to promote programs that move technology studies closer to the productive sector, hoping thereby to improve policy, suggest solutions for specific problems, and educate the community in the need for technology.[23]

Some on-going programs indicate this trend. In one case,

22. This approach is opposite to that of the Venezuelan center for the OAS Pilot Project which has begun its work with direct contacts with individual industrial firms. See Chapter VI, page 155.

23. Interview with Luis Javier Jaramillo S., COLCIENCIAS, Bogotá, Nov. 6, 1973; one COLCIENCIAS-sponsored study is the following, which I was told is still being analyzed: Universidad Nacional de Colombia, Centro de Investigaciones para el Desarrollo, "Transferencia de Tecnología en la Industria en Colombia" (Bogotá, feb. 1972), part of which is published as document AC/PE-12, March 1972, by the OAS Regional Scientific and Technological Development Program.

COLCIENCIAS works with private, non-profit advisory institutions whose purpose is to extend technological services to industrial sectors that cannot afford those of the skilled, highly-priced private consultants with which Colombia is fairly well endowed. One of these consultancy agencies, the Foundation for the Development of Scientific and Technological Research (FICITEC), is engaging in a cooperative study with COLCIENCIAS to improve the effectiveness of foreign aid, to stimulate research, and to create awareness of the problem. FICITEC is particularly concerned with technology transfer to small- and medium-sized industry.[24]

Another set of projects, largely funded by the OAS, involves COLCIENCIAS in cooperation with the prominent Institute for Technological Research (IIT) in Bogota. In addition to foods research, IIT is concerned with technological development related to the Colombian metal-working sector, particularly in connection with programming for the implementation of Andean Group Decision 57. The National Planning Department also has a keen interest in the project. For an Institute like IIT, which is often criticized for its lack of relevance to development needs, this project has a number of benefits. For one thing, the study is fully in line with government policy. It can also lead to improvements in specific industries that would benefit the nation. Taking these ideas into consideration, the engineer in charge of the research has shown how some previously unutilized knowledge generated by the Colombian Agricultural Institute (ICA) could be used in

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24. See, e.g., FICITEC, "Evaluación de la Asistencia Técnica Prestada por Consultores Estranjeros a Seis Industrias del Sector" and "La Transferencia de Tecnología a La Pequeña y Mediana Industria Colombiana" (Bogotá, undated).

    FICITEC is an example of an institution set up and financed in part by Colombian banks.

the manufacture of cultivators well suited to Colombia's erosion-prone acreage. He has suggested how a cooperative workshop could maximize the productive potential of small firms engaged in welding and painting, and how metal-working development could be tied to progress in food processing and petrochemical sectors. In part as a result of such work, the IIT metal-working project has begun to bring the Institute research contracts from Colombian metal-working firms.[25]

The Technology Unit of COLCIENCIAS has additional ambitious projects that involve itself, universities and industry. One, sponsored by the OAS, is a Universidad de Valle (Cali) study of the handling of technology by approximately 25 large industries in the Cauca Valley. Another project by the Universidad Pontificia Bolivariana in the industrial city of Medellin involves the Popular Finance Corporation (Corporación Financiera Popular) in working out an R & D program for smaller firms. A third example is an intriguing Rockefeller Foundation-financed study being carried out by an engineering school faculty-student team at the University of the Andes in Bogota. Concerned with technological choice and employment, the project seeks to influence policy and

> to establish a preliminary operational and data basis for long-run studies of socio-economic effects of appropriate technological choices, in particular, the impact of such choices on employment and income distribution through systematic factor substitution studies.[26]

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25. Interviews with Dr. Norton Young L., Director, IIT, and Ing. Peter Montes, IIT, Bogotá, Nov. 8, 1973; Instituto de Investigaciones Tecnológicas, Informe de Actividades, 1972, p. 24; Norton Young L., "Desarrollo de Tecnología Autoctonas" (Bogotá, IIT, Nov. 17, 1971). A number of other interviews were also the basis for judgments on IIT.

26. Interview with Dr. Enrique Ogliastri, Universidad de los Andes, Bogotá, Nov. 5, 1973. This quote and others in this paragraph are from the proposal for the team's study, "Technological Choice and Employment in Developing

Based on the assumptions that technological underdevelopment is a crucial bottleneck in industrial development and that divergent, often contradictory "governmental policies and entrepreneurial and labor union practices" have "pernicious effects" on the choice and implication of technology, the team will examine public policy, union activity and concerns, and industrial choice of techniques. In each of these cases, the universities hope to improve their research capacity and will disseminate the results of the studies in open seminars for all participants.

5. Technology Policy and the Private Sector

COLCIENCIAS and its associates in technology transfer and utilization operate in a dynamic milieu where private institutions also are beginning to take an initiative in technological development. Colombian industry has made striking innovations in individual cases. One firm, utilizing the experience of an individual who had examined U.S. techniques, designed an infant incubator suited to the requirements and recommendations of area pediatricians and manufactures it at a cost approximately 25% lower than a Japanese import. Another made design and production adaptations for air compressors and pumps which have found acceptance in the local market, implying probable quality and price competitiveness.[27] Still, many businessmen and experts recognize that in too many areas Colombia is too dependent upon foreign technology. Examples of this reliance have been cited, for example, in cheese production, glass tempering and wood products.

Countries," April 1973, 1, 2. A previous work, done by one of the group is Jaime Silva Bautista, "Estudio Preliminar Sobre Transferencia de Tecnología en Algunos Sectores Productivos de Colombia," Universidad de los Andes, Facultad de Ingenieria, Bogotá, D.E., nov. de 1972.

27. Industria y Desarrollo, Vol. I, No. 8 (sept. 1972), 14-17.

Like governmental technology policy advocates, progressive industrial leaders seek a system to counter technological underdevelopment that joins public policy and social needs with private interests. As one method for accomplishing this, a spokesman for FEDEMETAL, the metals industry trade association, talked of the need for high level determination of general, indicative technology policy priorities in an institution such as COLCIENCIAS, in part to terminate science and technology policy fragmentation. Special institutes would then be charged with carrying out precise policy aspects. FEDEMETAL and similar groups would probably prefer sectoral technical research assistance to be done by private institutions, but they feel governmental financial aid is necessary. FEDEMETAL has considered, but has not yet been able to implement, a plan for a metallurgical and metal-working development center which would strengthen the local technical base with accelerated technology transfer from abroad. The center would rationalize metal-working development with a program of design, information dissemination, and technical assistance.[28]

ANDI, the powerful National Industrial Association whose influence often determines government policy decisions, recognizes technology as essential to national industrial development. It characterizes the Colombian industrial and technological research system as dominated by foreign technology, unable to use or select technology advantageously, failing to integrate it into domestic technical or consuming levels, lacking a conscious effort to define priorities for investment in technological development, and poorly equipped to

28. Interview with Dr. Alvaro Buenahora, Director, Federación Metalúrgica Colombiana, Bogotá, Nov. 14, 1973; XVI Asamblea General de Fedemetal, junio 30-julio 1, 1971, "Ante-proyecto para la fundación del centro de desarrollo del sector metalúrgico y metalmecánico."

negotiate for technology transfer.[29] Colombia, ANDI declares,

> should search for a technology policy that gives her the means to create her own technologies in industrial sectors that make efficient use of natural resources, [and] seek to increase exports and the substitution of imports, for which she should take into account some basic principles of policy directed toward the outside world and others directed to the application of internal policies.[30]

ANDI recognizes that technology transfer policy is intimately tied to foreign investment policy. Domestic scientific and technological development, ANDI admits, is a complex issue that depends heavily on projects oriented to the creation of demand for it. Though favorably disposed toward a government draft of a tax credit incentive plan to raise monies in the range of 20-100 million pesos,[31] ANDI also seems to favor consideration of an obligatory system like Peru's 2% tax on net industrial profits, which, levied on both the public and private sectors, could bring in perhaps 300 million pesos (over U.S. $12 million) for a national technology budget. The Association recommends an industrial technology policy very much in the techno-economic mode. The policy would include specific sectoral or subsectoral programs, definition of technology importation policies and organization of an information system to improve the country's bargaining position, stimulation of local capital goods production, technical training for policy formulation and application, and better linkages between industrial producers and technology policy organs. In

29. These were taken directly from ideas developed by Dr. Norton Young L. of IIT; see document cited in note 25 above. The argument is, of course, strikingly similar to the more radical techno-economic critiques.

30. From ANDI document (note 20), 100-101.

31. From under U.S. $1 to around 5 million, estimate based on 1970 data.

this scheme, COLCIENCIAS would evaluate the work being carriend out. These ANDI suggestions are embodied in a broad conceptualization that incorporates trade liberalization and Latin American economic integration (with special favors for national firms), industrial property, standardization and quality control.[32]

Public technology policy may benefit industrial interests through technology development, but it may not serve broader social interests particularly because of the configuration of Colombian politics. As a case in point, about two years ago, A.I.D. brought in a U.S. expert who demonstrated possibilities of a technique to manufacture cement from waste slag of steel production. But it could not impel the government to act. The new technique has the value of utilizing an inexpensive raw material; it could both increase the availability and lower prices of cement for construction. Possible reasons for the failure to implement a policy to put the technique into operation include bureaucratic lethargy, unwillingness of cement producers to permit a low-cost competitor, inability to induce a new capital investment, and an attitude in the government agencies parallelling that of reluctant private interest groups. Lacking more knowledge, this case and the foregoing discussion suggest how industry may select technology policy elements that serve individual or sectoral interests, meanwhile rejecting apparently feasible alternatives that might have some positive social impact.

Critics of Colombian policies and structures emphasize this last point. Many perceive that there is scant top-level government or interest group concern for overriding issues such as nutrition, poverty, employment, education, and income distribution; they contend, perhaps somewhat unreasonably, that for decades the politico-economic environment seems

32. Ibid., 101-107.

unlikely to permit adequate considerations of these questions in the context of policies for science and technology.[33] Indicative of how government has the power to favor some national interests is the overwhelming selection of Colombian engineering firms over foreign consultants for carrying out feasibility studies by the National Fund for Development Projects (FONADE). Similarly, INCOMEX is concerned with technology policy; but it is hard to see how this interest extends further than fairly large-scale export-oriented industry, integration-affected sectors such as metal-working, and the direct relation of the technology policy proposal of the Andean Group to these issues. Given a situation where large industry is politically powerful and small and medium-scale producers are both relatively weak and lacking a technology consciousness, the former group can gain more from government policy.[34]

Large-scale industry can benefit directly by the use of quality controls and standardization, particularly in export and in competition with imports; it profits from lowered technology costs when bargaining is improved by better knowledge and the assistance of the Committee on Royalties; it can better afford trained technicians and perhaps finance related research outside its establishment. There is little within current technology policy formulations that assure equal consideration for making technology available to small as well as large producers or the election of labor-intensive techniques. Modernizing industry, in short, is capable of

33. This is based on a number of interviews; similar attitudes are expressed in the journal Desarrollo Indoamericano (Bogotá) whose Oct. 1973 issue contains a number of relevant articles.

34. Interviews with Miguel A. Rivera Anzola, Sub-director ejecutivo, FONADE, Oct. 31 and Jorge Rodríguez Mancera, Jefe de División de Programación, INCOMEX, Bogotá, Oct. 30, 1973.

promoting policies and choosing those that benefit it; more traditional industrial sectors may then face difficult adjustment and reallocation problems while Colombian labor has largely to shift for itself.

6. Toward the Integration of National Policies

While there are some hopeful signs that Colombian policies for science and technology may eventually make a significant contribution to development, many problems persist. As noted above, COLCIENCIAS and other groups are beginning to emphasize pragmatic, project-oriented work, but results have yet to be demonstrated. The National Planning Department's Division of International Technical Assistance is determined to align foreign aid more closely to national policy criteria. It manifests a rational and properly nationalistic concern, but given the lack of policies to deal with the implications of technology, the Division's impact on policy outcome may nevertheless be rather limited.

Other Planning Department officials are beginning to think about defining more effective technology policy, especially with regard to negotiations with multinational corporations and the search for technologies for Andean Group metal-working sector development. Holland, chosen because it has a low concentration of U.S. capital in metals industries and because it has produced some of its own technology, is advising Colombia on alternatives. Planning Department activity is coordinated with the COLCIENCIAS-IIT study of the metal-working sector.[35]

35. República de Colombia, Departamento Nacional de Planeación, "Coordinación de Programas de Asistencia Técnica Externa a Nivel de los Paises del Grupo Andino," Documento DNP-379-UPEC, oct. 16, 1969; ibid., "Plan de Desarrollo Político Sobre Cooperación Técnica Internacional," Documento DNP-623-UPEC-Re. 2, enero de 1972; interviews with the following DNP officials: Timeleon López, Carlos Suarez, and Alberto Villate, Nov. 6; Rafael Vargas and Ivan Botero Paramo, Nov, 6, 7, 8, 1973.

Although COLCIENCIAS has begun to merge liberal-scientific and techno-economic strategies, relations between the Colombian government and the universities are poor, particularly with regard to the social sciences which are seen by the government as fomenting dangerous dissent and radical political activity.[36] However, COLCIENCIAS and other government programs have had a degree of favorable impact on training technicians, reducing the brain drain, and reconciling some university elements with public policy. Technology policy remains for some in the universities a promising field; for others it represents the disruptive side of modernization that lacks sufficient humanistic concern and that represents U.S. intrusion in Colombian affairs.[37]

General consensus in Colombia on a number of central issues has not led yet to their resolution in a well integrated set of policies for science and technology. A belief that government has a science and technology policy role does not settle the question of how great a role government should play. Agreement that political and organizational problems and lack of knowledge are more crucial than expertise in the most advanced techniques does not build effective policy-making institutional relations. Compatible views that foreign aid and technology should be accepted as free as possible from conditions and in a manner best suited to national needs does not insure either that this will occur or that the benefits will be spread throughout the economy.

36. Interview with Dr. Rodolfo Low-Maus, Ford Foundation, Bogota, Oct. 23, 1973; Rodolfo Low-Maus, Compendio del Sistema Educativo Colombiano (Bogotá, 1971), 109, 111; K. N. Rao and Rodolfo Low-Maus, A Review of the Development of Basic Sciences in Colombia (Bogotá, Oct. 1967), especially Chapt. 7.

37. For example, Operación Cacique, Tácticas de intrusión de los estados unidos en la universidad Colombiana (Bogotá, 1972), which castigates, COLCIENCIAS, among others, as an agent of foreign domination.

Dissatisfaction and frustration with some institutional arrangements lead to efforts to start new ones that also present difficulties. For example, moves to bypass a policy-making body such as COLCIENCIAS and to create new linkages of government and foreign technology sources with Colombian industry will contribute to the fragmentation of policymaking. Agreement that regional and subregional integration offers Colombia a reasonable incentive to economic growth does not avoid the probable conclusions that, as in all the cases cited above, those who have begun to be conscious of the technology question will gain substantially while, in the absence of other appropriately coordinated microeconomic and social policies, others will lose.

Colombia has made some valuable contribution to the Andean Group, both intellectual and institutionally. But, beyond being perhaps the strongest promoter of the Andrés Bello Pact, Colombia will probably continue to try to maximize its national advantage in industrial development and trade without making strenuous efforts toward an Andean common market for science and technology.[38] The integration of national policies for science and technology must, it seems, preceed regional integration on major industrial technology policy issues.

38. It is perhaps symbolic of the different national attitudes toward Andean Group integration and toward the Foreign Investment Code that Colombia's link to the Cartagena Agreement institutions is its foreign commerce promotional agency while Peru's link is a national office of integration.

CHAPTER VI

A GLIMPSE AT VENEZUELA

This chapter, which is only a partial introduction, touches on some general characteristics of science and technology policymaking for industrialization in Venezuela and its relation to the Andean Group.

One of the early promoters of the Andean Group, Venezuela has been associated from the start with the Andean Development Corporation and the Andrés Bello Pact. She is now moving into fullfledged membership of the Cartagena Agreement.

Although Venezuela has made a good beginning in national science and technology policymaking and institution building and despite her early involvement with the Andean Group, her ties to Andean regional policy, particularly in technology, are not secure. For instance, Venezuela joined in discussions that included aspects of the Andean Pact technology development policy proposal, but the Venezuelan government has not determined completely how it will implement the Foreign Investment Code. Further, regional industrial integration and development await negotiation in such areas as the allocation of metal-working sector units under Decision 57 and others.[1] Although Venezuela is the wealthiest Andean nation and has potentially a great deal to offer,[2] the delay in entering the Cartegena Agreement was partially determined, with other

1. El Tiempo (Bogotá), Nov. 9, 1973, 5-B.

2. Per capita gross domestic product is the highest in the subregion, about three times that of the four poorest members; and Venezuela stands to make windfall gains from petroleum price increases.

integration topics no doubt affected, by a condescending attitude. As one Venezuelan characterized it, "we are putting in our resources and the others [only] their sandals."[3]

Like other Latin American nations, Venezuela is concerned about its scientific and technological underdevelopment. The issue was prominent in the recent election campaign which ended in early December 1973. Newly elected President Carlos Andrés Pérez has stressed the need for foreign capital and technology on terms more favorable for his country, though it is neither clear how specific he has been nor how far he has raised the issue beyond polemics.[4]

In gross terms, rapidly moving out of the category of poor nations, Venezuela is still beset by immense problems of personal and regional inequality of income, unemployment, population growth, and neglect of agriculture and non-petroleum natural resources. Technology will be needed in many of the nation's prime industrial areas, including the petroleum industry's exploitation of high sulphur oil deposits. Other areas requiring technological advances include agricultural production, which fails to keep pace with accelerating food and raw material needs, and those industries which are high-cost producers and now will face increased Andean regional competition.

The prominent science and technology policymaking body in Venezuela is the National Council for Scientific and Technological Research (CONICIT). An autonomous institution linked to the Presidency, CONICIT was created in mid-1967

3. El Nacional (Caracas), Nov. 22, 1973.

4. El Universal (Caracas), Nov. 22, 1973, 2-13; The New York Times, Dec. 9, 1973, 13; Dec. 13, 1973, 2; and Jan. 3, 1974, 2; Luis Manuel Penalver, "La Ciencia y la Tecnología en Venezuela," Ciencia Interamericana (Washington, D.C.), Vol. 13 (sep.-dec. 1972), 2-11.

"to promote the development of science and technology" and "to advise superior organs of the National Public Power on this matter." But, CONICIT does not have the actual power to make policy; rather, through its staff of over one hundred persons and about nine Technical Commissions, it conducts useful studies and allocates or coordinates the distribution of funds for research and student training. CONICIT's President, Dr. Miguel Layrisse, described the council as a "buffer" between government and the scientific-technological infrastructure, largely a liberal-scientific function.[5]

To satisfy the need for a policymaking body, the Venezuelan government formed a new council in May 1973. It would function in both techno-economic and liberal-scientific areas, particularly with regard to science and technology investment consistent with the national development plan, coordination of diverse science and technology activities, and defining priorities for budget allocations and a national science and technology policy. This Commission for the Integration of the Scientific and Technological System, attached like CONICIT to the Presidency, is composed of officials from various ministries and the heads of prominent research groups who are concerned with science policy. The presiding officer is the Minister for Youth, Science and Culture, while CONICIT's President is the next ranking official. Though empowered to act where CONICIT lacks authority, the Commission has yet to prove that the large group of individuals involved will meet expectations. Already there are indications that poorly defined areas exist within the Commission's mandate, which through ambiguity leave gaps in coverage and bring into possible conflict overlapping Commission and CONICIT

5. Ley del Consejo Nacional de Investigaciones Científicas y Tecnológicas, 26 de junio y 13 de julio de 1967; interview with Dr. Miguel Layrisse, Nov. 20, 1973.

functions.[6]

Formation of the Commission had been among the suggestions of an elaboration of bases for a science and technology plan written by CONICIT at the request of former President Rafael Caldera. The CONICIT plan is the most comprehensive effort to date to articulate a hybrid set of policies for science and technology. This document attempts "to reflect Venezuelan reality and to map out specific actions to permit a decisive impulse to be given to the country's scientific and technological development" so that "it can serve as an instrument of economic, social and cultural development." The report is organized around the nation's social and economic development priorities as spelled out in the Fourth National Plan for 1970-1974. Priority areas are the petroleum industry, the industrialization process, agricultural development, urbanization, education, and health. It analyzes the organization of the national scientific and technological system, defines general features of a national policy for science and technology, and details actions for 1973-1974 in relation to policy planning mechanisms, research and education.[7]

In relation to industry, the CONICIT document points out that the industrial sector possesses "no organism that is occupied specifically with the promotion of industrial research." National policy promotes import substituting

6. Interviews with Dr. Miguel Layrisse, President, Nov. 20, and Señorita Socorro Álvarez, Nov. 22, 1973, CONICIT, Caracas; Presidencia de la República, Decreto No. 1296, 23 de mayo de 1973.

7. Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICIT), Ciencia y Tecnología Para El Desarrollo Nacional, Bases Para Un Plan de Acción 1973-1974 (Caracas, 1973), 43, ii, 39. The "plan" is really only a broad guideline that says nothing about the distribution of financial resources. I heard criticisms that it was too general and theoretical and needed to be revised drastically.

industrialization, but "until now there have not been considered mechanisms specifically related to technological innovation." Reared in a protectionist atmosphere which encourages wholesale importation of foreign technology without selection and adaptation, national industry is not exposed to competition that would impel innovation. Research, the report goes on, should play a critical role related to industrialization in areas of social science as well as in "the exact and natural sciences and their technologies." Taking a holistic view of the relation of science to production, CONICIT identified the following research problem areas: demographic processes, ideological and cultural structures and social organization, industrial organization and development, and technology transfer.[8]

Research more directly relevant to industry, the report recommended, should be undertaken in the adaptation and selection of foreign technology, development of original innovations and solution of technical problems of plant operation, environmental contamination, and inventory of nonrenewable natural resources. CONICIT would work with the Venezuelan Industrial Research Institute (INVESTI), hoping to transform it into an organ that could perform research under contract. CONICIT also proposed creation of a research fund to be financed by such means as a tax or tax rebate system. Finally, CONICIT, the Venezuelan Central Office for Coordination and Planning (CORDIPLAN) and other state organs would design a study of technology transfer, which "would incorporate actions in relation to some related activities most important for the country, among which the creation of engineering services is conspicuous."[9]

8. Ibid., 29, 9, 10-11.
9. Ibid., 11-12, 46-47, 61.

CONICIT is similar in many respects to COLCIENCIAS in Colombia. However, its resources are substantially larger for a country less than half the population of its western neighbor. CONICIT assigned funds for allocation in the calendar year 1972 that amounted to 22,821,845 Bolívares (slightly more than U.S. $5,180,000). The distribution was 6.1% for management, 9.7% for general administration, and the remainder for projects, conferences, research and education. 17.8% of the budget was used for planning and diagnostic studies in science and technology. Particularly important was the "Diagnosis of Experimental Research and Development Activity Performed in the Country," a study that focused on sociological aspects of the situation. Finally, 66.4% of assigned funds were devoted to scientific and technological development of all kinds; this accounted for 15,132,240 Bolívares (over U.S. $3,435,000).[10]

The National Scientific and Technical Information Center and the program on the Pilot Project on Transfer of Technology are also similar to those of COLCIENCIAS. Initiated in September 1971, as a separate department of CONICIT, the Information Center is concerned with collection, documentation, and dissemination of bibliographic data and specific publications of use to all types of researchers, institutions, and productive sectors. The project aims at coordinating existing information resources, developing new ones, and stimulating the training of personnel for the system. Among specific tasks, the Information Center unit and the Venezuelan Development Corporation (C.V.F.) are studying ways of creating an industrial documentation center in the Caracas Industrial Chamber of Commerce and a technological information

10. CONICIT, Memoria y Cuenta 1972 (Caracas, 1973), 18, 105; Dulce Arnao de Uzcátequi et al., Diagnóstico de la Actividad de Investigación y Desarrollo Experimental que se Realiza en el País (Caracas, mayo 1973).

unit for C.V.F. The CONICIT department will help coordinate the industrial information services required by the technology transfer Pilot Project, whose information center has not yet been started.[11]

CONICIT is the Venezuelan focal point for the OAS Pilot Project on the Transfer of Technology. Perhaps the most advanced of the Andean Group units in project orientation and design, the Venezuelan team works with other government offices and private industry groups to develop a "general consensus around the Project" in the areas of metal-working, industrial chemistry, electronics, and food. Having learned that technology is valued minimally in industrial feasibility studies and that some industrial technological choices may exacerbate social problems such as unemployment, the Project Coordinator is trying not only to improve research but also to aid individual private industries to obtain information concerning "existing alternatives, evaluation and negotiation for technical knowledge." Thus, the team hopes fully to benefit from the technical assistance of international organizations and other countries; it actively seeks associations with firms to solve technological problems identified by the Venezuelan national development plan.[12]

With this industry level orientation, the Pilot Project Coordinator points out that beyond creating an awareness of technology, the major problem is not technology per se, but finding a formula to effect its recommendations in the industrial sector. Since CONICIT lacks enforcement powers, the

11. CONICIT, Memoria y Cuenta 1972, 72-81.

12. Ibid., 81-84 (quotes from 83, 84; interview with Dr. Luis R. Matos A., CONICIT, Caracas, Nov. 22, 1973; "Transferencia de Tecnología" (mimeographed, undated), presentation by Fernando Baez Duarte and Luis R. Matos, CONICIT, before the IV Asamblea Nacional de Camaras y Asociaciones Industriales.

central question is the politics of convincing industry to consider national needs equally with individual interests in the selection of techniques. Interestingly, the Coordinator is also the Venezuelan contact for an international project sponsored by Canada's International Development Research Centre on Science and Technology Policy instruments.[13] Utilizing his experience with the Pilot Project and government contacts, he may be able to propose government policies, such as incentives and financing (in addition to technology search services) to align technology use with social priorities.

Venezuela has sufficient resources to make a large contribution to an Andean common market for science and technology. But first things come first, and especially in industrial questions Venezuela is likely to be protective of its own industrial sector as long as she can capitalize on petroleum prices and as long as industry is a potentially poor competitor with that of other nations of the region.

13. See Chapter IV, note 17.

CHAPTER VII

AN ASSESSMENT

An Andean common market for science and technology is a dream whose fulfillment is impossible in the short run but likely in the long run only to the extent that regional economic integration succeeds. This sobering judgment is based largely on the evidence that individual nations currently adhere to the Andean Group accords only when there are immediate real benefits to be gained and at minimal cost to themselves.

As we have seen, other factors are involved here too. One of these is the intellectual and functional incompatibility of the liberal-scientific and techno-economic approaches to policies for science and technology. In wealthy industrially developed countries, such intellectual differences can be borne more easily, for these countries possess sufficient resources as well as vigorous market demands for the development of science and technology in all their aspects. Moreover, private institutions and especially the governments of the advanced countries are better able to cope with the problems related to scientific and technological development because of their wealth in resources and also because these institutions have the power to act decisively. Importantly, they manage to do this without the destabilizing contention that often makes policy formulation and implementation a mockery in poor nations. The scientific and technological policymaking capability of countries as diverse as Japan, France, the Soviet Union and the United States are outstanding cases in point. This is true both in regard to domestic

development and industrial application and in terms of the international commerce in scientific ideas and proprietary technology. But the differences between the liberal-scientists and the techno-economists can be endured by underdeveloped nations only at a high cost. For the Andean countries, at both the national and the regional levels there are tensions between the two schools of thought that are politically and institutionally divisive in systems whose abilities to make and carry out effective policies are already severely fragmented.

Beyond intellectual differences, which often have an ideological cast, the relative weakness of the Andean Group institutions and the lack of real integration among them constrains regional progress in science and technology. Partial success in building the undoubtedly necessary hybrid policies that combine both the liberal-scientific and the techno-economic modes is crucially dependent on both harmonious, non-threatening interpersonal relations and institutional cooperation which are, in fact, often short-lived. The Andean Group institutions have not grown to the point where they can advocate a hybrid approach to policies for science and technology, for they have neither rationalized relations between the three regional bodies involved with these policies nor found a satisfactory method of negotiation for the new regional policy proposal for technological development. Perhaps the Andean Group institutions are too young to have been more successful in this regard; in any case, they require new mandates and large grants of resources from the member countries to restructure relations between themselves sufficiently to make coordination of a hybrid policy feasible. In addition, at the present time, there is evidence that Vaitsos and his technology policy group have not worked closely enough with national policymakers and institutions involved with science and technology to get regional consensus on the proposal

without considerable exertion.

To overcome intellectual, political, bureaucratic and personal conflict in the elaboration of effective policies for science and technology requires an effort much greater than the Andean nations have yet made. It is clear that only if these problems are favorably resolved will the Andean Group institutions be able to take a more energetic leadership role in the movement toward a common market for science and technology. Yet, these are problems the Andean Group institutions cannot resolve themselves, for the problems exist on external levels, both nationally and internationally, mostly outside of the purview of these institutions. For example, a concerted effort should be made to deal constructively with the important issue of the alienation of the universities and of many liberal-scientists from the political process, a decidedly national concern.

To date, then, Andean regional efforts in science and technology policies have been piecemeal and limited. They have been restricted to minimal communication of information about the international commerce in technology, a few multinational research projects, and a small number of regional exchanges of scholarships and professors. They have been limited to the impact of increasing intraregional trade and ongoing industrial development, both of which will be stimulated by the continuing movement to complete reduction of internal tariffs and to establish a unified external tarif,[1] upon the growth of entrepreneurial competence to deal with technological questions in economic production. In short, the Commission and the Board of the Cartagena Agreement, the Andean Development Corporation and the Andrés Bello Pact are likely to go on doing for some time what they have been doing

1. See Andean Times, 22 March 1974, 4-5, and 12 April 1974, 7-9.

in the areas of policies for science and technology. Moreover, their efforts are likely to continue to be disarticulated, in part because of the weak linkages between them and in part because of the diverse and apparently uncoordinated linkages between each of them and various institutions of the individual member countries of the Andean Group.

The common application of the Andean Foreign Investment Code, the strongest element of the regional technology policy, is likewise problematical, particularly as an instrument for contending with multinational corporations and foreign purveyors of technology. Each government will clearly attempt to lower the cost of imported proprietary technology, but the Andean countries do not constitute a united front that dramatically strengthens their collective ability to negotiate. The multinational corporations have relatively little interest in Peru in comparison with Latin American nations such as Colombia, Brazil and Venezuela, although Peru is attempting most diligently to implement the Foreign Investment Code. Having recently pledged to continue its adherence to the Code, Chile, however, is inviting foreign capital back into the country and, in the immediate future at least, is unlikely to make significant demands on multinational corporations. On the other hand, Colombia and Venezuela, which have potentially the strongest bargaining position with regard to foreign business because of their countries' markets and future economic possibilities, appear the most likely to defect from a strict application of the Foreign Investment Code and its technology policy. This lack of a truly effective common position on the part of the Andean nations toward direct foreign investment and the commerce in proprietary technology, therefore, reveals a real weakness of regional policies.

Two other sets of factors inhibit the growth of an Andean regional common market for science and technology. One of these is the national fragmentation and diversity that has

been described, in part at least, in the preceeding chapters. It is no surprise that national fragmentation makes it difficult for individual countries to "get it together" in terms of policymaking, and to mobilize and to develop limited scientific and technological resources. Given the diversity of the Andean region, if only in terms of current attitudes toward the regional integration scheme, the nations undoubtedly need to resolve their own science and technology policymaking problems before they submit to the discipline and logic of a common market. As the evidence indicates, however, the Andean nations have not yet resolved for themselves basic questions of definition: What are the appropriate conceptions of policies for science and technology that are compatible with national economic, social and institutional development? Precisely what are the purposes of these policies, and what should be their outcomes? In what manner should comprehensive policy planning take into consideration questions of employment creation and factor relationships in production, income distribution and equity, the degree of governmental power required to implement policies effectively, the social and political consequences of making scientific and technological choices, the allocation of resources for technical training and research? What relative weight should be given, for example, to science and technology policies for defense, agriculture, health and industry? How can they increase the flow and effectiveness of non-proprietary technology? Indeed, what do policies for science and technology imply with regard to power relationships within each political economy and with regard to individual human development and freedom? The Andean nations are just at the point of establishing the institutional structures for making policies for science and technology, but have not sufficiently resolved real (and sometimes philosophical) questions such as these.

The second set of factors consists of the many linkages

between foreigners and the various institutions and constituencies of each Andean nation. It is undoubtedly true that the Andean Group has had a significant impact on intraregional travel, commerce and communications. Andean businessmen who formerly have travelled freely through the U.S. or Europe, for example, have for the first time begun to visit neighboring countries to promote their products and to attend regional conferences and seminars that never before took place. However, the international linkages between scientists, universities, research institutes and foundations, governments and the bilateral and multilateral aid agencies on the one hand and foreign capital and multinational corporations on the other are infinitely more numerous and stronger than equivalent intraregional contacts. This is only another of the enormous disparities that an Andean science and technology common market will have to overcome if it is to grow.

It is appropriate to bring this concluding assessment back to one of the points made just a few pages ago. Some hybrid form of policies for science and technology is the most desirable if the Andean nations and the Andean Group are to build comprehensive policy schemes and join them in a common regional effort. However, as we have seen, forces from outside of the region are the strongest proponents of a hybrid formulation, while the nations and the regional institutions have been slow in putting these recommendations into effective action. These international forces have included the U.S. World Plan of Action (1971) and Latin American Plan of Action (1973), the policy and planning work of the OAS and the 1972 Consensus of Brasilia, and the UNCTAD III resolution on technology transfer (1972). These international impulses, no matter how strong, cannot resolve the policymaking fragmentation of the Andean countries; the nations will have to do this themselves, if painfully and slowly. Until they do, an Andean common market for science and technology will be

weak and ineffective.

The Andean nations have made a beginning in the definition and implementation of policies for science and technology. Their efforts may, if sufficiently strenuous and concerted, both impel economic and social development and alleviate dependency. To a large degree, they themselves will have to do what must be done institutionally, ideologically, politically and economically to develop their scientific and technological resources and to take advantage of the world's vast store of non-proprietary scientific and technological knowledge. At the same time they will have to contend with the enormous power and innovative ability of foreign capital and multinational corporations, who are, for many techno-economists, the agents of dependency. They must realize that nations like the United States wish to increase their exports of and returns from capital and technology, and that such explicit policy of the United States, defending as it does proprietary interests in industrial technology,[2] may make even more difficult their quest for a higher degree of national economic independence and "selective interdependency" in both industry and technology. Their future, then, may be either a highly developed common market or an increasing dependency. As Máximo Halty has written concerning an Andean common market for technology,

> . . . either economic integration is accompanied in parallel and closely by technological integration, or the benefits derived from an enlarged market will be

2. See, for example, U.S. Department of State, Bureau of Public Affairs, Office of Media Services, "The Rule of Law in International Economic Affairs," based on an August 7, 1973 address by Under Secretary of State for Economic Affairs William J. Casey; also see Oct. 17, 1973 address by Casey, "Science and Technology and World Economic Affairs," U.S. Department of State, Bulletin, LXIX, Nov. 19, 1973, 630-34.

> lost due to a lack of technical ability to take advantage of them. In that case, foreign sources will take advantage of the common market, both from the technical and the economic points of view.[3]

In short, policymakers, politicians and nations will have to do more than to use "dependency" as a rhetorical scapegoat; they will have to get to the business of making and implementing policies for science and technology that actually support non-dependent national and regional development if that is, in fact, what they really desire.

The Andean Group and the Andean nations, then, have a number of tasks before them: to define more precisely what policies for science and technology can be and what they can do for them, to reconcile the intellectual and functional differences between liberal-scientists and techno-economists, to construct a better integrated institutional structure for policymaking at the national and regional levels that both has more power to act and allows sufficient freedom for scholarly and innovative work, and to learn how their global developmental needs and desires can coexist with the numerous extraregional linkages that often represent dependent relationships. These, indeed, are among the many challenges to the nations of the Andean Group--to their abilities to conduct an effective intraregional diplomacy of integration and an effective international diplomacy of economic relations with foreign powers and corporations, and to their ability to harness rationality and knowledge for the improvement of the human condition of their peoples.

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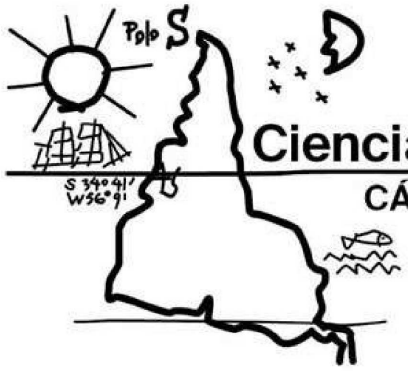
3. Máximo Halty-Carrère, "Sugerencias para una política de desarrollo técnico en la subregión andina," Revista de la Integración, VI, No. 13 (Mayo 1973), 67.



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