

International Development Research Centre

I.D.R.C.

43.

Research in Latin America and the Caribbean and
IDRC Programs in the Region (LARO)

RESEARCH IN LATIN AMERICA AND THE
CARIBBEAN AND IDRC PROGRAMS IN
THE REGION

Regional Report

Regional Office for Latin America
and the Caribbean (LARO)

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I. OBJECTIVES AND SCOPE OF REPORT

The present report has two main objectives. The first one is to provide a general view on research capacities and research activities in the Latin American and Caribbean region. The second one is to analyze IDRC activities in the region during the last decade.

In order to have a clearer view of the context within which research takes place in this region, the second section presents a very brief description of a few general socio-economic indicators, as well as some of the recent development trends that have characterized the region.

Sections 3 and 4 are related to the first objective previously mentioned, the overview of present research capacities and research activities in the Latin American and Caribbean countries. Section 3 provides information on the scientific community and the research community that exists in the region, and on some of the factors that are influencing its development. Section 4 analyzes the present characteristics and orientation of research in Latin America and the Caribbean. In order to do so, this section takes into consideration three major aspects:

- a) General indicators that provide information on the overall level of research activity, in order to have an idea of the magnitude of such activities in the region. Both absolute (i.e. total research expenditure) and relative (i.e. as a percentage of GDP) indicators will be used.
- b) The role played by the different institutional sectors that carry out research (i.e. universities, government research centers, private research centres). The purpose of this analysis is to see who are the principal institutional actors that are responsible for the research that is done in the region. A brief description of each institutional sector is made.
- c) Main areas of concentration of research in the Latin American and Caribbean countries. The objective of this part of the report will be to identify the principal research areas that are being studied in the different countries of the region, as well as the amount of support (financial and otherwise) that is going into each one.

An important part of the information that is presented in sections 3 and 4 has been very kindly provided by the national scientific and technological councils of Mexico (CONACYT), Costa Rica (CONICIT), Peru (CONCYTEC), Venezuela (CONICYT), Chile (CONICYT), Colombia (COLCIENCIAS), Brazil (CNPq) and Ecuador (CONACYT). We wish to express our deep gratitude to these institutions for allowing us access to unpublished data or to studies they are presently doing on this subject. It should also be mentioned that sections 3 and 4 use information that was collected by a consultant, Francisco Sagasti, who worked with the Centre's Regional Office for Latin America and the Caribbean (LARO) in this study.

During the last decade the governments of the region have increasingly become interested in promoting research and in taking into consideration science and technology as a factor of development. This has led to the development of science policy efforts in the region. Section 5 makes a very brief review of the types of science policy organizations that have appeared in the region, and of some of the factors that have influenced their capacity to implement policies and programs in this area.

Finally, section 6 analyzes the activities of IDRC in the region during the last decade (1971-1981). This section only considers research projects that have been supported, or are being supported, by the Centre in the region. It does not include the training of human resources through the Fellowship Program, IDRC publications related to projects in the region (Communications Division), nor the Division Activity Projects (DAPs) through which meetings, seminars, study visits, consultancy studies and other specific activities are supported. Thus this section does not present a complete view of IDRC activities in the region, although it does cover its main component which is the funding of research. We expect to integrate this information in the next couple of months into the final version of this report.

2. SOCIO-ECONOMIC CONTEXT AND DEVELOPMENT TRENDS IN RECENT YEARS

The Latin American and Caribbean region is constituted by 30 countries with a total population of 350 million persons. Of these 30 countries, 3 of them (St. Lucia, Antigua and Belize) became independent states in the last three years (between 1979 and 1981).

Since the region is very heterogeneous in terms of the countries that are part of it, it is not possible to make easy generalizations for the whole region. At an aggregate level, Table 1 presents information on a few general economic indicators that reflect important trends in the development of the region. The time intervals (years) that appear in Table 1 have been selected in such a way as to underline high points and low points in the development of Latin American and Caribbean economies. Some of the trends that appear in Table 1 are the following:

- a) The rate of population growth has been slowly decreasing, the average for the region coming down from 3% (in 1970) to 2.6% (in 1980). In many countries of the region the problem of population growth is not as serious as it used to be.
- b) The Gross Domestic Product (GDP) of the countries of the region has shown very drastic changes during the last decade. Its annual rate of growth (average for the region) between 1970 and 1974 was 7.4%. Midway through the decade (1975) the rate of growth substantially slowed down to 3.1% for the whole region, while it slowly partially recovered between 1976 and 1980. Again the situation deteriorated in 1981, when the average rate of growth for the region dropped to 1.2%. In many countries of the region this rate is reaching the lowest point they have faced in the last 2 or 3 decades !
- c) Inflation rates for the region as a whole are quite high, increasing from a regional average of 12% a year in 1970 to 60% in 1981.
- d) The contribution of the agricultural sector to the GDP of the region as a whole has slowly decreased from 12% (1970) to 10.5% (1980), reflecting more diversified economies and a growing urban population. Nevertheless, food is one of the principal problems for the countries of the region; several countries that were previously self-sufficient in most of their food needs are increasingly becoming food importers.

TABLE 1

4.

LATIN AMERICA AND THE CARIBBEAN : GENERAL ECONOMICS INDICATORS

(1970 - 1981)

	1970 - 1974	1975	1976 - 1978	1979 - 1980	1981
1. Population					
- In thousands	262,090 ^{1/}	303,221	318,967 ^{2/}	344,726 ^{3/}	n.a
- Average annual growth	3.0	2.8	2.6	2.6	n.a
2. Gross Domestic Product					
- In millions of dollars of 1970*	189,779.3 ^{1/}	260,286	284,009 ^{2/}	336,333 ^{3/}	340,369
- Average annual growth	7.4	3.1	4.8	5.8	1.2
3. Contribution of Agricultural Sector to GDP					
- Percentage	12.2	11.3	11.1	10.5	n.a
4. Variation in the Consumer Index Price (Inflation)					
- Annual percentage	12.2 ^{1/}	57.6	40.4 ^{2/}	56.2 ^{3/}	59.8
5. Ratio of External Public Debt Service to Value of Exports of Goods and Services					
- Percentage	13.3 ^{1/}	14.8	18.9 ^{2/}	28.5 ^{3/}	n.a
External Sector (In millions of U.S.\$)					
- Value of exports **	14,879 ^{1/}	37,220	50,318 ^{2/}	94,150 ^{3/}	99,775
- Value of imports **	14,247 ^{1/}	42,261	49,831 ^{2/}	92,630 ^{3/}	99,840
- Trade Balance **	632 ^{1/}	-5,041	487 ^{2/}	1,520 ^{3/}	-45
- Balance of Payments	1,537 ^{1/}	965	4,319 ^{2/}	-2,550 ^{3/}	-1,985
Internal Trade within the Region					
- Percentage of internal trade of the countries of the region that is done with other countries within the region	12.3 ^{1/}	17.6			

* Excludes the Caribbean Countries.

^{1/} This refers only to exports and imports of goods.

^{2/} This refers only to 1970.

^{3/} This refers only to 1977.

^{3/} This refers only to 1980.

NOTE: The regional GDP for 1980 and 1981 has been estimated on the basis of the present trend of annual rates of growth.

SOURCE: Taken from several publications of the U.N. Economic Commission for Latin America (CEPAL), and of the Inter-American Development Bank (IDB).

- e) Foreign trade has increased substantially over the last decade. Several countries changed their previous import-substitution strategy (and strong protectionism) towards the beginning and middle of the seventies. A very important trend that is observable in the last decade is the increase of intra-regional trade (among the countries of the region). In fact, the percentage of intra-regional trade over the total international trade of the countries in the region, increased from 8.7% in 1960 to 12.3% in 1970, and to 17.6% in 1975. It is interesting to note that the increase came mainly in manufactured products, as opposed to primary products (by 1975 manufactured products represented 39% of the intra-regional trade, up from 12.6% in 1969). This is an important new dimension of horizontal cooperation within the region. Nevertheless the balance of payments situation in many countries is quite negative. For the region as a whole, the balance of payment recorded a deficit amounting to almost 2,000 million dollars (in 1980).
- f) One of the serious bottlenecks that the countries of the region are facing is a staggering external public debt problem. The ratio of the external public debt service to the value of exports of goods and services has increased from 13.3% in 1970 to 28.5% in 1980.

Since each national situation changes substantially from one country to another, Annex I provides more detailed information on selected socio-economic indicators by country of the region.

Behind many of these problems is the energy squeeze that the region is facing. As it became dramatically clear by the end of 1981, the decade of the 70's showed the high vulnerability of the Latin American and Caribbean region to cost variations in the supply of hydrocarbons, which represent 75% of the total modern energy it uses. Over the last few decades, this region's development (especially in terms of industry and transport) has been closely related to the use of oil-intensive technologies. These were imported from developed countries and used as substitutes for those based on traditional energy sources, that were relatively abundant and often economical. Large efforts and sizeable investments are being made to develop what appears to be so far the most viable source of energy in this part of the world: hydropower. At the present time, the region is taking advantage only of about 10% of its enormous hydroelectrical potential.

Summarizing, food and energy are among the most pressing needs that the region is facing. The promotion of exports, through the improvement of quality and efficiency in the productive sector, is also a very high priority, given the situation of the external sector.

3. THE SCIENTIFIC COMMUNITY: HUMAN RESOURCES WORKING IN RESEARCH

The development of an indigenous research capacity requires, as one of its basic inputs, the development of adequately trained human resources. Besides formal university training, the development of research skills can only be achieved by actually doing research. This often leads to a vicious circle in developing countries, in which research is not carried out because of a lack of good researchers, but the latter is partly due to the very limited possibilities of doing research at all. This circle can only be broken by improving the quality of university training, specially in those aspects related to research (quite often absent in many universities of the region), and by providing facilities for young professionals to develop research skills by doing research.

The decades of the sixties and seventies witnessed a substantial expansion of university enrollment in Latin America and the Caribbean. Table 2 shows the evolution of university enrollment by country, from 1960 to 1977. For the region as a whole, university enrollment expanded at an average annual rate of growth of 11.5% between 1960 and 1970, and at a rate of 14.3%, between 1970 and 1977. This expansion was even higher in the larger countries of the region (15.4%). These growth rates are substantially higher than those of population growth.

Since Latin America and the Caribbean is really a conglomerate of very heterogenous countries, this and subsequent tables divide the region into five subregions that are more homogeneous in nature (the first category is not a geographic subregion):

- 1) Large countries (Argentina, Brazil and Mexico).
- 2) Andean countries (Bolivia, Colombia, Chile, Ecuador, Peru and Venezuela).
- 3) Central American countries (excluding Mexico).
- 4) Caribbean countries (including Guyana).
- 5) Other countries (Paraguay and Uruguay).

The rapid expansion of university enrollment is also reflected in the higher percentage of the university-age population that is actually enrolled in the university. This percentage for some of the countries in the region is as follows (%): 1/

1/ This index is measured in terms of the percentage of the 20 to 24 age group that is actually enrolled in the university.

T A B L E 2

UNIVERSITY ENROLLMENT BY COUNTRY AND YEAR

Subregion and Country:	1960	1970	1975	1977	Annual rate of growth	
					1960-70	1970-77
1. Large Countries:						
- Argentina	180,796	274,634	596,736	619,950	4.3	12.3
- Brazil	95,691	430,473	1,089,808	1,316,640	16.2	17.3
- Mexico	78,599	247,637	562,056	654,959	12.2	14.9
Sub-Total	355,086	952,744	2,248,600	2,591,549	10.4	15.4
Index	100.0	268.3	633.3	729.8		
2. Andean Countries:						
- Bolivia	12,055	35,250	49,850	51,585	11.3	5.6
- Colombia	23,013	85,560	186,635	237,477	14.0	15.7
- Chile	12,311	78,430	149,647	131,793	20.3	7.7
- Ecuador	9,139	38,692	170,173	180,813	15.5	24.6
- Peru	30,983	126,234	195,641	233,420	15.1	9.2
- Venezuela	26,477	100,767	213,542	265,671	14.3	14.9
Sub-Total	113,978	464,933	965,488	1,100,759	15.1	13.1
Index	100.0	407.9	847.1	965.8		
3. Central America:						
- Costa Rica	3,828	15,423	32,978	38,629	15.0	14.0
- El Salvador	2,360	9,515	28,281	30,371	15.0	18.0
- Guatemala	5,229	15,609	22,881	29,234	11.6	9.4
- Honduras	1,680	4,847	11,907	20,205	11.2	22.6
- Nicaragua	1,267	9,385	13,168	n.a.	22.2	7.0*
- Panama	3,915	8,159	26,289	34,720	7.6	23.0
Sub-Total	18,279	62,938	135,504	153,159	13.2	13.5
Index	100.0	344.3	741.3	837.9		

Cont....

TABLE 2 (Continuation)

Subregion and Country:	1960	1970	1975	1977	Annual rate of growth	
					1960-70	1970-77
4. Caribbean:						
- Barbados	127	763	1,417	n.a.	19.6	13.2*
- Cuba	19,518	26,342	82,688	122,456	3.0	24.6
- Guyana	150	1,112	2,852	n.a.	22.2	20.7*
- Haiti	1,720	1,494	2,881	3,309	-1.4	12.0
- Jamaica	1,593	6,892	8,413	n.a.	15.8	4.0*
- Dominican Republic	3,448	23,546	41,352	n.a.	21.2	11.9*
- Trinidad and Tobago	513	2,375	4,940	n.a.	16.6	15.8*
Sub-Total	27,069	62,524	144,543	125,765	8.7	12.7
Index	100.0	231.0	534.0	464.6		
5. Other countries:						
- Paraguay	3,425	8,172	17,441	20,318	9.1	13.9
- Uruguay	15,433	26,280	32,627	39,392	5.5	6.0
Sub-Total	18,858	34,452	50,068	59,710	6.2	8.2
Index	100.0	182.7	265.5	316.6		
TOTAL	533,270	1,577,591	3,544,203	4,030,942	11.5	14.3
Index	100.0	295.8	664.6	755.9		

n.a. : not available

* This refers only to the 1970-75 period (no information for 1977).

Source: OAS: América en Cifras; Washington, OAS, 1978.

UNESCO: Anuario Estadístico: 1980; Paris, UNESCO.

	<u>1970</u>	<u>1977</u>
Argentina	14.2	28.6
Brazil	5.3	12.6
Mexico	6.1	11.4
Colombia	4.7	9.6
Peru	10.7	15.8
Venezuela	11.7	20.7
Costa Rica	10.3	18.5
Panama	6.6	21.2
Barbados	4.0	7.9
Dominican Republic	6.5	10.1
Trinidad & Tobago	2.9	4.4 (1975)

This rapid expansion of the university population is providing a stronger basis of human resources, not only for research but also for development activities in general. Nevertheless, the following limitations should be pointed out, in terms of the contribution of this process to the development of a research capacity in the region:

- a) The very rapid expansion of university enrollment has in many cases been achieved at the expense of the quality of university training. This is a very dangerous trade-off, specially at the university level.
- b) The Hispanic heritage which is dominant in the region has fostered the development of the liberal arts professions and the predominance of scholastic and intellectual sciences ^{2/}. This tradition continues in the 1970's, despite the modifications imposed by rapidly changing societies. This is analyzed in Tables 3 and 4 and in the following pages.
- c) The research-training aspects of university education are quite often very weak, or even absent, in many of the universities of the region. Because of limited resources and a traditional approach to university education, research plays a very secondary role in many universities (i.e. teaching functions tend to absorb all or most of the time of university professors).

^{2/} A very interesting analysis of this characteristic in the case of Colombia can be found in Frank Safford: The Ideal of the Practical: Colombia's Struggle to Form a Technical Elite. Austin, University of Texas Press, 1976.

- d) Graduate level training (Master and Ph.D.) are still quite limited within the region, although some countries (i.e. Brazil) have had a tremendous expansion of graduate programs. This has created an interesting polemical discussion with respect to the most appropriate strategy for the university training of researchers: should it be done mainly at the graduate level (following the North American pattern), or should undergraduate training be improved in order to make possible the training of researchers at that level? The main reason given for the second alternative is the cost of training a researcher through graduate programs.

The extent to which the previously mentioned limitations and problems are present, varies from one country to another in the region, and from one university to another within the same country. There are several outstanding universities in the region where the level of education has very high standards and where first rate research is carried out. But as a whole, these limitations are very much present throughout the region.

In terms of the distribution of university graduates by discipline, Tables 3 and 4 show the predominance that the liberal arts professions have in Latin America and the Caribbean. The liberal arts disciplines represented 60.3% of university graduates in 1970 and this proportion even increased to 64.9% in 1978. University graduates related to natural sciences, engineering and applied sciences represented only 39.7% of the total in 1970, and this decreased to 35.1% in 1978, (see Table 3). The only two disciplines in the area of applied sciences in which the number of university graduates increased substantially were engineering and agronomy (with average annual growth rates of 13.0% and 14.9% respectively).

If we analyze the differential distribution of university graduates in the several subregions previously mentioned (Table 4), it is interesting to note that the Central American countries have substantially higher percentage of university graduates coming from the natural sciences, engineering and applied sciences (the participation of these disciplines goes up to 48.1% of the total, with 51.9% in the liberal arts). The same is true for Uruguay and Paraguay (other countries). The rest of the region shows a very homogeneous behaviour: the participation of the liberal arts professions is between 61.0% and 66.5% of the total, both in the large countries and in the Caribbean countries (see Table 4). ^{3/}

^{3/} It should be pointed out that if university enrollment is taken as an indicator (instead of university graduates), the picture that emerges is a little more favourable to the engineering and applied sciences. The proportion of the latter increased from 36.3% of university enrollment in 1965 to 43.2% in 1974 (see OAS: "Un ejemplo de cooperación regional en el campo científico y tecnológico: diez años de actividad del PROCT"; Washington, O.A.S., 1979). But a lower proportion of university students graduate in the natural sciences, engineering and applied sciences, than in the liberal arts.

T A B L E 3

EVOLUTION OF UNIVERSITY GRADUATES IN LATIN AMERICA AND THE
CARIBBEAN IN TERMS OF DISCIPLINES: 1970 - 78

Discipline	1 9 7 0		1 9 7 8		Average Annual Rate of Growth
	No. Grad.	%	No. Grad.	%	
1. Natural Sciences	7,009	5.0	9,165	2.6	3.4
2. Engineering and Architecture	19,335	13.9	51,372	14.5	13.0
3. Health Sciences	23,690	17.1	47,955	13.6	9.2
4. Agronomy	5,067	3.7	15,407	4.4	14.9
Sub-Total	55,101	39.7	123,899	35.1	10.7
5. Social Sciences	25,044	18.1	229,644	64.9	13.5
6. Humanities, Law and others	58,548	42.2			
Sub-Total	83,592	60.3	229,644	64.9	13.5
TOTAL	138,693	100.0	353,543	100.0	12.4

T A B L E 4

UNIVERSITY GRADUATES BY DISCIPLINE AND SUBREGION (1978)

Subregion:	Natural Sciences	Engineering	Health Sciences	Agronomy	Social Sciences, Humanities Law and Others	TOTAL
1. Large countries:						
- No. graduates	5,284	37,004	34,649	9,577	171,411	257,925
- Percentage	2.0	14.4	13.4	3.7	66.5	100.0
2. Andean countries:						
- No. graduates	1,916	9,168	8,396	3,104	35,154	57,738
- Percentage	3.3	15.9	14.5	5.4	60.9	100.0
3. Central America:						
- No. graduates	532	1,830	1,730	726	5,201	10,019
- Percentage	5.3	18.3	17.3	7.2	51.9	100.0
4. Caribbean:						
- No. graduates	1,360	3,200	2,260	1,838	17,216	25,874
- Percentage	5.3	12.4	8.7	7.1	66.5	100.0
5. Other countries:						
- No. graduates	73	170	920	162	662	1,987
- Percentage	3.6	8.5	46.3	8.2	33.4	100.0
TOTAL	9,165	51,372	47,955	15,407	229,644	353,543
Percentage	2.6	14.5	13.6	4.4	64.9	100.0

Source: UNESCO: Anuario Estadístico 1980; Paris, UNESCO.
The exact year for each country may vary slightly from 1976 to 1978.

This general analysis of the expansion and structure of university training in Latin America and the Caribbean only provides an insight into one of the factors that shape the formation and growth of a scientific community in the region. But only a very small proportion of university graduates ends up doing research. The research community, which is the main objective of this report, is only a very small component of the professional community that is formed in the universities.

The information on the number of researchers existing in the different countries of the region comes either from national surveys on research activities that have been carried out by several countries, or from information provided by universities and governmental research institutions on ongoing research programs.

This process of data collection at the national level has faced two major practical difficulties. In the first place, the operational definitions of some of the parameters or indicators that are used in these surveys (i.e. research, research project, research expenditure) have not been sufficiently standardized in the different countries. Secondly, even when the formal definitions are quite clear the information that is required is not always available or is difficult to collect. Thus the reliability of the data varies from one country to another. Despite these limitations, the data available does provide a general view of the magnitude, characteristics and distribution (i.e. areas of concentration) of research in the region.

Table 5 presents the number of researchers that in 1978-1979 were engaged in research in the Latin American and Caribbean countries. ^{4/} This data refers to the number of "equivalent full-time researchers" in each country (except in those countries where specifically indicated), and not to the number of physical persons doing research. This indicator is estimated by giving each person or researcher a weight that is equivalent to the proportion of his time that he dedicates to research (one fourth, one half or full-time). This indicator is more reliable since it eliminates the distortion introduced by persons with a very marginal dedication to research.

The heterogeneity of the countries in the region is quite evident from Table 5 in terms of the size of the national research communities. These main categories appear in the region:

^{4/} An operational definition of "researcher" is used in the national surveys: a researcher is any person with a university degree (or equivalent level of experience) who at the time of the survey was actively engaged in a research project, in a formally recognized academic or research centre (formal institutional environment). Thus the data does not provide information on persons who have carried out research in the past, nor on persons who could be considered as potential researchers because of their level of training. It refers only to "active researchers", not including support or auxiliary personnel related to research projects.

TABLE 5
NUMBER OF RESEARCHERS AND SCIENTIFIC AUTHORS
BY COUNTRY

Country	Year	Researchers*		No. of Scientific Authors in 1979		
		No.	Per 100,000 Inhabitants	No.	%	As % of Researchers
1. Large Countries:						
- Argentina	1978	8,250	31	919	17.3	11.1
- Brazil	1978	24,015 ^{1/}	21	1,617	30.5	6.7
- Mexico	1980	10,412 ^{1/}	16	769	14.5	7.4
2. Andean Countries:						
- Colombia	1978	1,449 ^{1/}	6	106	2.0	7.3
- Chile	1979	4,116 ^{1/}	38	494	9.3	12.0
- Ecuador	1979	766 ^{1/}	10	14	0.3	1.8
- Peru	1976	3,760 ^{1/}	23	85	1.6	2.3
- Venezuela	1977	1,718	14	763	14.4	44.4
- Bolivia	n.a.	n.a.	n.a.	25	0.5	n.a.
3. Central America:						
- Costa Rica	1981	411	18	89	1.7	21.7
- El Salvador	1974	802	21	9	0.2	1.1
- Guatemala	1978	549	8	30	0.6	5.5
- Panama	1975	204	12	11	0.2	5.4
- Honduras	n.a.	n.a.	n.a.	7	0.1	n.a.
- Nicaragua	n.a.	n.a.	n.a.	2	0.0	n.a.
4. Caribbean:						
- Cuba	1978	4,972	51	77	1.5	1.6
- Barbados	n.a.	n.a.	n.a.	13	0.2	n.a.
- Jamaica	n.a.	n.a.	n.a.	108	2.0	n.a.
- Dominican Republic	n.a.	n.a.	n.a.	10	0.2	n.a.
- Trinidad and Tobago	1970	(380) ^{2/}	(37)			
	1978	428 ^{2/}	37	57	1.1	13.3
- Other Caribbean Countries	n.a.	n.a.	n.a.	58	1.1	n.a.
5. Other Countries:						
- Paraguay	1971	(134) ^{2/}	(6)			
	1978	173 ^{2/}	6	4	0.1	2.3
- Uruguay	1971	(1,150) ^{2/}	(43)			
	1978	1,226 ^{2/}	43	39	0.6	3.2
TOTAL		63,251	355	5,306	100.0	8.4

* Number of equivalent full-time researchers, except where indicated.

- ^{1/} This refers to the number of physical persons doing research (not equivalent full-time researchers).
^{2/} Projected figures on the basis of the number of researchers per 100,000 inhabitants.

Source:

- a) In many cases (i.e. Mexico, Brazil, Colombia, Costa Rica) the information comes from unpublished studies carried out by the National Science and Technology Councils of these countries.
b) UNESCO: "Estadísticas sobre el personal científico y técnico y los gastos destinados a actividades de investigación y desarrollo experimental en América Latina y el Caribe"; París, UNESCO, 1981.
c) The information on scientific authors comes from Institute for Scientific Information: Current Bibliographic Directory of the Arts and Sciences; Philadelphia, ISI, 1981.

- a) The large countries already have quite a significant research community: 8,250 researchers (Argentina), 10,400 researchers (Mexico) and 24,000 researchers (Brazil).
- b) The medium-sized Andean countries have research communities that fluctuate between 1,500 and 4,000 researchers. If the number of equivalent full-time researchers was available for all countries, the corrected (and more elastic) figures could be between 1,500 and 2,500 (the higher figures for Chile and Peru are due to the fact that the number of physical persons, not equivalent full-time researchers, is the only information available).
- c) The smaller countries of Central America and the Caribbean have research communities that fluctuate between 400 and 800 researchers (with the exception of Cuba).

The relative importance of these research communities in terms of the total population of each country is measured by the number of researchers per 100,000 inhabitants. Colombia has one of the lowest ratios of researchers to population (6 per 100,000 inhabitants), and the highest ones go up to 31 researchers per 100,000 inhabitants (see Table 5). The respective ratios for developed countries range mostly between 100 and 250 researchers per 100,000 inhabitants, with a few cases above that level.

The volume of scientific publications has been quite often used as an indicator of the level of activity of a scientific community. The source that is most commonly used to determine the number of scientific authors (scientists who publish) in different countries is the Science Citation Index, published by the Institute for Scientific Information of Philadelphia. ^{5/} Although this indicator substantially underestimates the volume of scientific publications in developing countries, since its coverage of local scientific journals is very limited (specially those in languages other than English), it is still a valid indicator to measure the participation of local scientific communities in what is called "mainstream science" (as represented by what is published in widely recognized scientific journals).

^{5/} Unless there is a national study with information on the publishing behaviour of the local scientific community. A case in point is the study done in Costa Rica by Miguel Gomez and Vera Bermúdez: Encuesta sobre Científicos Activos en Costa Rica (1978); San José, CONICIT, 1979. Also see Marcel Roche and Yojaira Freites: "Producción y Flujo de Información Científica en un País Periférico Americano: Algunas Implicaciones para la Región"; Caracas, IVIC, 1981.

Table 5 provides information on the number of scientific authors in the Latin American and Caribbean countries, as measured by the Science Citation Index (in 1979). In that year a total of 5,306 scientific authors in the region were registered by that Index. It is interesting to note that the number of scientific authors in the region represents about 8 to 10% of the respective research community in most countries (see Table 5). It should be kept in mind that this is the proportion of those that publish in internationally recognized scientific journals, the total of scientific authors being much higher in each country. In a very few countries, the local scientific community shows a greater propensity (or access) to publish in internationally scientific journals; such is the case of Venezuela and Jamaica (Table 5).

If we compare the research community of Latin America and the Caribbean with the research communities of other regions in the world (both in terms of scientific authors), the following picture emerges: ^{6/}

<u>Country</u>	<u>Researchers</u> <u>1974</u>		<u>Scientific Authors</u> <u>1980</u>	
	<u>Number</u>	<u>%</u>	<u>Number</u>	<u>%</u>
Africa	26,891	0.9	5,320	1.2
Asia ^{7/}	434,510	14.6	40,352	8.9
North America	554,214	18.6	218,343	48.0
Western Europe	384,656	12.9	131,098	28.8
Eastern Europe	324,462	10.9	17,704	3.9
U.S.S.R.	1,169,700	39.3	24,749	5.4
Oceania	28,492	1.0	11,530	2.5
Latin America & the Caribbean	<u>54,279</u>	<u>1.8</u>	<u>5,768</u>	<u>1.3</u>
TOTAL:	2,978,204	100.0	454,864	100.0

^{6/} The data on number of researchers comes from UNESCO: Estimation of human and financial resources devoted to R and D at the world and regional level; Paris, UNESCO, 1979. The data on number of scientific authors for 1980 comes from Institute for Scientific Information Current Bibliographic Directory of the Arts and Sciences; Philadelphia, ISI, 1980.

^{7/} The number of researchers and of scientific authors for Asia include Japan and Israel. This completely distorts the figures for this region, in terms of the developing countries that are part of it.

It is interesting to note that the Latin American and Caribbean research community has a lower propensity to publish in internationally recognized scientific journals than those of other developing regions (i.e. Africa), as measured by the ratio of scientific authors to researchers. The former (Latin America and the Caribbean) has slightly more than twice the number of researchers than the latter (Africa); but the two regions have almost the same number of scientific authors registered in the Science Citation Index. This still holds if we compare the 1974 figures for both parameters. Three factors may partially explain this trend:

- a) Stronger language barriers (Spanish, as opposed to English or French).
- b) The existence of a higher number of local scientific journals in Latin America and the Caribbean, that provide the possibility of publishing locally instead of abroad.
- c) A higher proportion of the researchers in the former are trained within the region (even to some extent at the graduate level), which may provide a stronger local or regional reference group, as well as a more inward orientation in terms of the region.

Finally, Table 6 shows the distribution (or relative concentration) of the scientific community in terms of the five subregions into which we have divided Latin America and the Caribbean. Information on population is included in this table in order to have a point of reference in terms of the relative size of each subregion. The marked concentration of the scientific community in the three large countries of the region is quite evident: 64.3% of university enrollment, 73.0% of university graduates, 67.5% of researchers and 62.3% of the scientific authors. But this merely reflects the population distribution that exists in the region. (See Table 6).

T A B L E 6

RELATIVE CONCENTRATION OF THE SCIENTIFIC COMMUNITY
BY SUBREGIONS

Different Indicators	Large Countries	Andean Countries	Central America	Caribbean	Other Countries	TOTAL
1. Population (1978)						
- In thousands	209,726.0	78,630.0	20,830.0	24,269.0	5,740.0	339,195.0
- %	61.8	23.2	6.1	7.2	1.7	100.0
2. University enrollment(1977)						
- No.	2,591,549	1,100,759	153,159	125,765	59,710	4,030,942
- %	64.3	27.3	3.8	3.1	1.5	100.0
3. University graduates(1978)						
- No.	257,925	57,738	10,019	25,874	1,987	353,543
- %	73.0	16.3	2.8	7.3	0.6	100.0
4. Researchers (1978)						
- No.	42,677	11,809	1,966	5,400	1,399	63,251
- %	67.5	18.7	3.1	8.5	2.2	100.0
5. Scientific Authors (1979)						
- No.	3,305	1,487	148	323	43	5,306
- %	62.3	28.0	2.8	6.1	0.8	100.0

4. PRESENT CHARACTERISTICS AND ORIENTATION OF RESEARCH IN LATIN AMERICA AND THE CARIBBEAN.

4.1 Overall View of Research in the Region

Information on ongoing research programs and ongoing research activities in the region is quite scanty and it only covers certain aspects, mainly aggregate indicators of the overall level of research activity. Information is available at two levels:

- a) Information on annual research expenditures (financial resources devoted to research) is available for most countries of the region. This data comes either from national surveys or from information derived from the national budgets (i.e. governmental expenditures in research through public research institutions or public universities). In this section we will analyze the annual research expenditure of the countries of the region on the basis of this information. Since only very aggregate information is available at this level, it will only be possible to consider three very general indicators:
 - Total annual research expenditure by country.
 - Research expenditure per capita and per researcher (by country).
 - Relative concentration of the research effort (as measured by research funding) in terms of the different subregions.

- b) For a smaller group of countries there is more detailed information available on ongoing research programs in each country, on the basis of national surveys (This is the case of Mexico, Brazil, Colombia, Venezuela and Costa Rica, and to a lesser extent for Ecuador and Chile). For this group of countries we will be able to analyze two additional aspects:
 - The role played by the different institutional sectors that carry out research (i.e. universities, government research centres and private research centres). This aspect will be analyzed in section 4.2.
 - Main areas of concentration of the research effort in these countries. The purpose of this analysis will be to identify the principal research areas that are being studied by the national scientific communities, as well as the magnitude of the effort that is going into each one (in terms of local financial support and number of researchers that are working in each research area). This will be analyzed in section 4.3.

Even for this smaller group of countries the analysis of what is being studied by the research communities in each country will still be at a very aggregate level (i.e. broad research areas), since a more detailed analysis would be very difficult to conduct at a regional level for all research topics. A more substantial analysis of the content, scope and achievements or limitations of the research effort in each research area is only possible at the national level (country study), or at the sectorial level (in-depth analysis of a specific research area in the region). An example of the first case is the country study that CONICIT and IDRC just carried out in Costa Rica. ^{8/} An example of the second case is the study that AFNS, LARO and OPE are planning to carry out in agricultural post-production research in Latin America and the Caribbean during 1982-83.

Table 7 provides information on the total annual research expenditure for most of the countries of the region, both in local currency and in U.S. dollars, as well as the relationship between this expenditure and the Gross National Product (GNP) of each country. Two main aspects emerge from the analysis of this table. In the first place, the total investment in research that is being done by the countries of the region is very low. Most countries spend annually between 0.20 and 0.40% of their GNP in research programs. This is still very far from the target that has been suggested by different international meetings for developing countries, of a research expenditure of 1.0% of their GNP. In most developed countries the annual research expenditure fluctuates between 1.5 and 2.5% of their GNP, with exceptionally higher cases. The two outstanding exceptions in the region are Brazil (0.61% of its GNP goes to research) and Venezuela (0.56%).

Three distinct levels appear in Table 7 in terms of the volume of financial resources that each country dedicates to research:

- a) Small countries have annual research budgets that range between 5 and 10 million annually).
- b) Medium sized countries have annual research budgets that range between 20 and 70 million dollars, with the exception of Venezuela.
- c) Large countries have annual research budgets of over 200 million dollars.

^{8/} See F. Chaparro, F. Vargas, H. Jaramillo and M. Ramirez: Present Situation and Characteristics of Research Activities in Costa Rica; IDRC/CONICIT, 1982.

TABLE 7

ANNUAL RESEARCH EXPENDITURE BY COUNTRY
(In thousands of local currency and US\$)

Countries	Local Currency	Year	Research Expenditure			% of GNP
			Local Currency	U.S.\$	%	
Large Countries:						
- Argentina	Peso	1978	195,278,000	245,386	10.7	0.39
- Brazil	Cruzeiro	1978	20,781,000	1,150,028	50.1	0.61
- Mexico	Peso	1980	8,550,000	371,739	16.2	0.24 **
Sub-Total				1,767,153	77.0	
Andean Countries^{1/}*						
- Colombia	Peso	1978	805,372	20,600	0.9	0.11
- Chile	Peso	1979	2,445,290	65,652	2.8	0.33
- Ecuador	Sucre	1979	290,663	11,627	0.5	0.13
- Peru	So1	1976	2,763,000	48,111	2.1	0.36
- Venezuela	Bolivar	1977	865,435	201,616	8.8	0.56
Sub-Total				347,606	15.1	
Central America:						
- Costa Rica	Colon	1981	81,333	5,186	0.2	0.20 **
- El Salvador	Colon	1974	11,900	4,760	0.2	0.31
- Guatemala	Quetzal	1978	13,504 *	13,504 *	0.6	0.22 *
- Honduras	Lempira	1971	(2,962) ^{1/}	(1,481) ^{1/}		0.20
		1978	11,313 ^{1/}	5,657 ^{1/}	0.3	0.35
- Nicaragua	Cordoba	1971	(7,847) ^{1/}	(1,121) ^{1/}		0.14
		1978	29,972 ^{1/}	4,263 ^{1/}	0.2	0.20
- Panama	Balboa	1975	3,296	3,296	0.1	0.17
Sub-Total				36,666	1.6	
Caribbean:						
- Cuba	Peso	1978	83,113	112,270	4.9	n.a.
- Jamaica	J.dollar	1973	(6,200) ^{1/}	(6,820) ^{1/}		0.36
		1978	16,148 ^{1/}	9,555 ^{1/}	0.4	0.41
- Dominican Rep.	Peso	1972	(1,561) ^{1/}	(1,561) ^{1/}		0.08
		1978	4,923 ^{1/}	4,923 ^{1/}	0.2	0.11
- Trinidad and Tobago	Dollar	1970	(5,171) ^{1/}	(2,586) ^{1/}		0.32
		1978	23,918 ^{1/}	9,966 ^{1/}	0.5	0.31
Sub-Total				136,714	6.0	
Other Countries:						
- Paraguay	Guarani	1971	(167,265) ^{1/}	(1,328) ^{1/}		0.20
		1978	638,872 ^{1/}	5,070 ^{1/}	0.3	0.21
- Uruguay	Peso	1972	(1,858) ^{1/}	(3,437) ^{1/}		0.15
		1978	5,860 ^{1/}	831 ^{1/}	0.0	0.02
Sub-Total				5,901	0.3	
TOTAL				2,294,040	100.0	

* Estimated figures ** % of G.D.P. *** Information not available for Bolivia

1/. The 1978 figures for these countries were calculated on the basis of an annual rate of growth of 21.1% and of the initial information available for the early 1970's. The annual rate of growth of 21.1% was determined on the basis of the Colombian experience, since for that country there is information available for 1971 and 1978.

- Source: a) Unpublished studies done by the National Science and Technology Councils of several countries (i.e. Brazil, Mexico, Costa Rica, Colombia, Ecuador, Chile).
 b) Jan Amnerstedt: "A Survey of World Research and Development Efforts". Institute of Economics and Planning, Roskilde University, Dinamarca.
 c) UNESCO: Anuario Estadístico, 1980.

Brazil is in a category by itself with a total research expenditure of 1,150 million dollars in 1978 (0.61% of its GNP). The case of Brazil is interesting not just because of its high level of research investment, but also because of the tremendous rate of expansion of the research expenditure in that country. This reflects a conscious effort and an explicit decision of the Brazilian government to incorporate science and technology, and specifically research, into the governmental development plans and programs. Although several governments of the region have formally recognized research (and science and technology in general) as an instrument of development, only Brazil has followed this up with substantial financial and budgetary allocations that reflect a political decision. To a lesser extent this is also observable in Mexico and Venezuela, and it is practically absent in the rest of the region.

The evolution of the research expenditure of the federal government in Brazil showed a remarkable increase between 1970 and 1982. The budget allocations for research are as follows (this refers to the Federal Budget alone, not including State Budgets and other internal financial sources): ^{9/}

Year	Millions of Cruzeiros	% of Federal Budget	Millions of Cruzeiros (Constant 1981 Cr.)	Real Annual Rate of Growth: (Average for Period)
1970	165.1	0.84	7,660.6	-
1975	1,730.7	1.53	30,114.2	31.5
1980	18,528.0	2.11	37,426.6	4.4 ^{10/}
1981	43,549.6	2.31	43,549.6	16.4
1982	145,533.8	3.64	90,902.2 ^{11/}	108.7

During this period budget allocations for research jumped from 0.84% to 3.64% of the total federal budget. Even if constant values are used in order

^{9/} Taken from Boletín CNPq de Estadística, Indicadores Básicos de C. y T. Insumos; No. 3, Brasília, CNPq, 1981.

^{10/} The low average annual rate of growth between 1975 and 1980 is due to the fact that between 1976 and 1979 the federal budget's allocation for research was stationary in real terms (constant cruzeiro values). After 1980 the growth of the research budget started again, with a very sharp rise.

^{11/} This figure is estimated on the basis of an expected inflation of 70% for 1982.

TABLE 8

23.

RESEARCH EXPENDITURE PER CAPITA AND PER RESEARCHER BY COUNTRY

(Equivalent full-time Researchers)

Country	Year	Per capita Res. Expenditure		Res. Expenditure per Researcher	
		Local Currency *	U.S.\$	Local Currency *	U.S.\$
Large Countries:					
- Argentina	1978	7,399.7	9.3	23,670,061	29,744
- Brazil	1978	180.1	10.0	865,334	47,888
- Mexico	1980	126.9	5.5	821,168 **	35,703
Andean Countries:					
- Colombia	1978	31.4	0.8	555,812	14,217
- Chile	1979	223.9	6.0	594,094 **	15,950
- Ecuador	1979	36.0	1.4	379,456 **	15,179
- Peru	1976	173.7	3.0	734,840 **	12,795
- Venezuela	1977	67.9	15.8	503,746	117,355
Central America:					
- Costa Rica	1981	35.8	2.3	197,891	12,618
- El Salvador	1974	3.1	1.2	14,838	5,935
- Guatemala	1978	2.0	2.0	24,597	24,597
- Honduras	1978	3.3	1.6	n.a.	n.a.
- Nicaragua	1978	12.5	1.8	n.a.	n.a.
- Panama	1975	2.0	2.0	16,157	16,157
Caribbean:					
- Cuba	1978	8.6	11.5	16,716	22,581
- Jamaica	1978	7.7	4.5	n.a.	n.a.
- Dominican Rep.	1978	1.0	1.0	n.a.	n.a.
- Trinidad and Tobago	1978	20.7	8.6	55,883 **	23,285
Other Countries:					
- Paraguay	1978	221.2	1.8	3,692,901	29,306
- Uruguay	1978	2.1	0.3	4,780	678

*The name of each local currency is found in Table 7.

** In the case of these five countries the indicator is not strictly comparable to the other ones, since the number of physical persons doing research (not equivalent full-time researchers) is the only information available. Thus these figures are slightly underestimated as compared to the other ones.

*** Information not available for Bolivia.

n.a. : not available

to eliminate the influence of the very high Brazilian inflation rate, investment in research on the part of the federal government jumped from 7,660 million cruzeiros to 90,902 million cruzeiros (expressed in 1981 values). It should be kept in mind that the annual rates of growth that appear in the previous paragraph are based on constant 1981 cruzeiro values and thus it refers to real growth. The nominal growth of the research budget is much higher.

Table 8 shows both the research expenditure per capita and the research expenditure per researchers of the different countries of the region. Again Brazil and Venezuela show the highest values of the two indicators. If we exclude the large countries and Venezuela, most of the countries in the region are spending less than US\$5 per capita in research. As a point of reference, the developed countries of Western Europe and North America spend an average of US\$78 per capita in research, and the leading countries spend more than \$150 per capita.

TABLE 9

Relative Concentration of the Research Effort by Subregion

(In Thousands of U.S. \$)

Subregions	Research Expenditure		Researchers	
	U.S. \$	%	Number	%
Large Countries	1,767,153	77.0	42,677	67.5
Andean Countries	347,606	15.1	11,809	18.7
Central America	36,666	1.6	1,966	3.1
Caribbean	136,714	6.0	5,400	8.5
Other Countries	5,901	0.3	1,399	2.2
TOTAL:	2,294,040	100.0	63,251	100.0

The analysis of the previous pages clearly points out the huge difference in research capacity among the countries of the region, as well as the significant level that two or three of the countries are reaching in terms of political decision, financial resources allocated for research and research infrastructure (as measured by number of researchers). This is reflected in the very high concentration of the research effort in the large countries: 77% of the total regional research expenditure, as well as 67.5% of the researchers, are concentrated in these countries (see Table 9).

4.2 Role of the Different Institutional Sectors in Research

The institutional research infrastructure of the countries of the region can be analyzed in terms of three main sectors: 12/

- Universities
- Government Research Centres
- Private Research Centres

Under government research centres we are including three types of research groups: a) governmental agencies that directly engage in research. b) autonomous public research institutes, such as those that exist in agricultural research or in industrial technology; and c) public (and mixed) enterprises that carry out research through their own R and D divisions. The distinction between the second and third category will be made in certain cases in order to analyze the behaviour of public enterprises as agents of scientific and technological development (including research) in developing countries. But all three cases refer to governmental research centres under different institutional or organizational forms. In the Brazilian case this includes the "public foundations", that are an interesting modality that has developed in that country.

The category of private research centres refers to formally constituted research institutes, as a result of private initiative and with private funds. They may receive funds from the State under the form of research grants or research contracts, but they are essentially private in nature and in organizational set-up. In the Latin American and Caribbean region private research

12/ This institutional classification of research institutes or groups is somewhat different from the one used by UNESCO that has been adopted by several countries. Such categories as those of "General Services" and the "Productive Sector" that are used by the previously mentioned classification have faced practical problems, both in terms of classifying institutions and of interpreting their real meaning and significance. The classification that is used in this section is more functional in approach.

centres have tended to develop mainly in two research areas: agricultural research and social science research. This category does not include information on the research carried out by private production enterprises (mainly industrial enterprises), simply because the research surveys that have been carried out in developing countries have not been designed to identify and analyze this area of technological research. A few countries have attempted a limited coverage of industrial technological research in private enterprises in their surveys, but the data is so poor that it can be disregarded. The only studies of interest that have been done in this area are case studies of research and technological innovation that have been carried out in specific industrial enterprises. 13/

The previous consideration clearly indicates that the information on research expenditure in Latin America and the Caribbean underestimates the role of the private sector, mainly in the area of industrial technological research. Very little information is provided by these figures, if any, on the activities of adoptive research and technological innovation that are carried out by private industrial enterprises. In some countries this area of research may be quite insignificant. But in the case of countries like Brazil it is estimated that the private industrial sector of Sao Paulo is spending in research and adaptive innovations an amount equivalent to that of the public research expenditure in that State. In Argentina, Mexico and the Andean countries a significant technological activity has also been detected in the private industrial sector. It should be kept in mind that this part of local research is practically absent from the information that is being analyzed.

Tables 10 and 11 show the distribution of the research effort in terms of the three main institutional sectors we are considering. From these two tables it is quite clear that although the highest concentration of researchers is found in the universities (i.e. 69.4% in Venezuela, 64.6% in Brazil, 57.7% in Costa Rica), as well as the highest number of research projects, the large government research centres constitute the main actors of the research that is being done in these countries. The predominance of the public sector is particularly notorious in Peru (82.3%), Brazil (73.3%) and Venezuela (71.8%). In Mexico, Chile, Colombia and Ecuador government research centres represent between 60 and 64% of the total research effort, as measured by research expenditure (see Table 11). A different instituted pattern appears in Costa Rica, where both the universities and the government research centres play a major role in research, with even a slight predominance of the former (47.6% and 42.8%).

13/ An example of these studies is the work that Jorge Katz has been doing in Buenos Aires. See Jorge Katz et al: Productividad, Tecnología y Esfuerzos Locales de Investigación y Desarrollo; Buenos Aires, BID/CEPAL/BA/23, 1978.

NUMBER OF RESEARCHERS BY INSTITUTIONAL SECTOR IN A GROUP
OF LATIN AMERICAN COUNTRIES

Countries	INSTITUTIONAL SECTOR				TOTAL
	Universities	Govt. Research Centres*	Private Research Centres**	Others	
1. Brazil (1978)					
- No.	15,518	8,497	n.a.	--	24,015
- %	64.6	35.4	n.a.	--	100.0
2. Mexico (1980)					
- No.	3,832 ^{1/}	5,685 ^{1/}	718 ^{1/}	177 ^{1/}	10,412
- %	36.8 ^{1/}	54.6 ^{1/}	6.9 ^{1/}	1.7 ^{1/}	100.0
3. Colombia (1978)					
- No.	638	666	145	--	1,449
- %	44.0	46.0	10.0	--	100.0
4. Ecuador (1979)					
- No.	306	396	64	--	766
- %	39.9	51.7	8.4	--	100.0
5. Peru (1976)					
- No.	2,091	1,346	n.a.	323	3,760
- %	55.6	35.8	n.a.	8.6	100.0
6. Venezuela (1977)					
- No.	2,405	950	109	--	3,464
- %	69.4	27.4	3.2	--	100.0
7. Costa Rica (1981)					
- No.	237	142	32	--	411
- %	57.7	34.5	7.8	--	100.0

* Includes research being carried out in government agencies and public enterprises.

** Includes research being carried out in private enterprises, although the information on the latter is very limited.

^{1/} The distribution of researchers by institutional sector was estimated for this year on the basis of the percentage distribution for 1974.

DISTRIBUTION OF RESEARCH EXPENDITURE BY INSTITUTIONAL SECTOR IN A GROUP OF
LATIN AMERICAN COUNTRIES

(In thousands of local currency and US\$)

Institutional Sector	B R A Z I L (1 9 7 8)			M E X I C O (1 9 7 8) ^{1/}			C H I L E (1 9 7 8)		
	Cruzeiros	U.S.\$	%	Pesos	U.S.\$	%	Pesos	U.S.\$	%
1. Universities	5,548,000.0	307,028.2	26.7	1,541,576.4	67,851.1	24.7	423,271.4	11,364.2	17.3
2. Government Research Centres *									
a) Govt. agencies & Research Institutes	8,791,000.0	486,496.9	42.3	3,775,926.0	166,193.9	60.5	n.a.	n.a.	n.a.
b) Public Enterprises	6,442,000.0	356,502.5	31.0	68,653.2	3,021.7	1.1	n.a.	n.a.	n.a.
Sub-Total	15,233,000.0	842,999.4	73.3	3,844,579.2	169,215.6	61.6	1,525,565.2	40,959.2	62.4
3. Private Research Centres	n.a.	n.a.	n.a.	530,502.0	23,349.6	8.5	496,453.3	13,329.0	20.3
4. Others **	--	--	--	324,542.4	14,284.4	5.2	--	--	--
TOTAL	20,781,000.0	1,150,027.6	100.0	6,241,200.0	274,700.7	100.0	2,445,289.9	65,652.4	100.0

* When no disaggregated information is available in terms of the two categories of government research centres, only the sub-total for the whole sector appears in the Table.

** This refers mainly (when available) to the external sector (i.e. international or regional research institutes located in the country).

^{1/} The distribution of researchers by institutional sector was estimated for this year on the basis of the percentage distribution for 1974.

T A B L E 11

DISTRIBUTION OF RESEARCH EXPENDITURE BY INSTITUTIONAL SECTOR IN A GROUP OF
LATIN AMERICAN COUNTRIES

(In thousands of local currency and US\$)

Institutional Sector	C O L O M B I A (1 9 7 8)			E C U A D O R (1 9 7 9)			P E R U (1 9 7 6)		
	Pesos	U.S.\$	%	Sucres	U.S.\$	%	Soles	U.S.\$	%
1. Universities	215,034.3	5,500.2	26.7	41,127.1	1,645.1	14.1	348,000.0	6,059.5	12.6
2. Government Research Centres *									
a) Govt. agencies & Research Institutes	482,417.8	12,339.4	59.9	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
b) Public Enterprises	3,221.5	82.4	0.4	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Sub-Total	485,639.3	12,421.8	60.3	186,463.9	7,458.5	64.2	2,275,000.0	39,613.5	82.3
3. Private Research Centres	104,698.4	2,678.0	13.0	63,072.3	2,522.9	21.7	140,000.0	2,437.7	5.1
4. Others **	--	--	--	--	--	--	--	--	--
TOTAL	805,372.0	20,600.0	100.0	290,663.3	11,626.5	100.0	2,763,000.0	48,110.7	100.0

**When no disaggregated information is available in terms of the two categories of government research centres, only the sub-total for the whole sector appears in the Table.

**This refers mainly (when available) to the external sector (i.e. international or regional research institutes located in the country).

Cont

DISTRIBUTION OF RESEARCH EXPENDITURE BY INSTITUTIONAL SECTOR IN A GROUP OF
LATIN AMERICAN COUNTRIES

(In thousands of local currency and US\$)

Institutional Sector	VENEZUELA (1978)			COSTA RICA (1981)		
	Bolivares	U.S.\$	%	Colones	U.S.\$	%
1. Universities	244,052.7	56,855.6	28.2	37,367.8	2,466.0	47.6
2. Government Research Centres *						
a) Govt. agencies & Research Institutes	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
b) Public Enterprises	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Sub-Total	621,382.3	144,760.0	71.8	33,632.5	2,219.6	42.8
3. Private Research Centres	n.a.	n.a.	n.a.	10,332.7	500.4	9.6
4. Others **	--	--	--	--	--	--
TOTAL	865,435.0	201,615.6	100.0	81,333.0	5,186.0	100.0

*When no disaggregated information is available in terms of the two categories of government research centres, only the sub-total for the whole sector appears in the Table.

**This refers mainly (when available) to the external sector (i.e. international or regional institutes located in the country).

It should be pointed out that the absence of information with respect to private research centres in Brazil and Venezuela does not mean that they do not exist; it is simply due to the fact that information on their activities and resources is not available. When this information becomes available the percentage distribution will change, but the relationship between universities and government research centres will still be valid.

In the public sector there has been an interesting evolution of the relative importance and the role played by the three types of research units that we are including under the heading "governmental research centres". In an initial stage, government agencies directly engage in research in areas of interest to them (i.e. Ministries, etc.), as a support activity for their own development programs. When the research activity as such becomes sufficiently important, there has been a tendency to create an autonomous public research institute in that research area. This has mainly happened in agricultural research, health research and industrial technological research. To a more limited extent, research on specific natural resources (i.e. mining, fisheries) and more recently on energy, have given rise to such autonomous public research institutes.

Table 12 shows the foundation dates of three important members of this infrastructure of public technological institutes and research centres: the institutes of norms and standards, the agricultural research institutes and the industrial technology research institutes. The first ones appeared in two clearly identifiable historical periods: a first group of countries created institutes of norms and standards in the thirties and forties (countries of earlier industrialization), and a second group of countries created them in the sixties. In the case of agricultural and of industrial technology research institutes, the great majority of them were created in the fifties and early sixties (see Table 12). Although a few of these institutes are private or semi-public (mixed) in terms of their legal nature most of them are autonomous public institutes.

In the last few years another governmental organization has started to play a major role, in certain countries, in research and technological development: this is the public enterprise. Its activities have mainly been identified and studied in Brazil. ^{14/} Public enterprises are mainly linked to the productive and service sector (i.e. state oil companies, siderurgical enterprises, petrochemical enterprises, electricity companies, etc.). This, of course, is limited to those countries in which the public sector is important in those production branches.

^{14/} See for example: Fabio Stefano Erber et al: State Enterprises and Technological Development; Ottawa, IDRC-MR24, 1980. And Erno Paulinyi and Celso U. Costa: "O Esforço Tecnológico na Grande Empresa Estatal"; VI Simposio de Pesquisa em Administracao de Ciencia eTecnologia; Sao Paulo, Universidad de Sao Paulo, 1981.

T A B L E 12

FOUNDATION DATES OF THE MAIN TECHNOLOGICAL RESEARCH INSTITUTES
IN THREE IMPORTANT AREAS

Foundation dates of Institutes of Norms and Standards	Foundation dates of Agricultural Research Institutes	Foundation dates of Industrial Technology Research Institutes
Argentina, 1935	Argentina, 1956	Brazil, 1921
Brazil, 1937	El Salvador, 1956	Brazil, 1934
Uruguay, 1939	Ecuador, 1959	Mexico, 1950
Chile, 1943	Venezuela, 1959	Peru, 1950
Mexico, 1945	Mexico, 1960	Central America, 1956
Venezuela, 1959	Peru, 1960	Argentina, 1957
Peru, 1961	El Salvador, 1961	Chile, 1958
Cuba, 1961	Brazil, 1962	Venezuela, 1958
Central America, 1962	Chile, 1963	Colombia, 1958
Colombia, 1963	Colombia, 1962, 1968	Jamaica, 1960
Paraguay, 1965		Ecuador, 1961
		Trinidad & Tobago, 1970
		Dominican Republic, 1973

Source: Alberto Sanchez Crespo: Esbozo del Desarrollo Industrial de América Latina y de sus Principales Implicaciones sobre el Sistema Científico y Tecnológico; Washington, O.A.S., Studies on Scientific and Technological Development, No. 14, 1972, pp. 9 and 13.

Because of their size and of the strategic importance of the sector in which they are located, these public enterprises are playing an important role in Brazil as agents of technological innovation and as research centres of primary importance. It is interesting to note in Table 11 that 31% of the total research expenditure in that country is being done by public enterprises. In fact in the Brazilian case it is the very active role of public enterprises that is contributing to the predominance of the public sector in research. There is some indication that in Venezuela public enterprises are starting to play an important role in this area, but there is no information available on what proportion of governmental research is in the hands of these enterprises. In the other two countries for which there is specific information on research in public enterprises (Mexico and Colombia), the role they play is much more limited (see Table 11).

As previously pointed out, the category of private research centres refers mainly to formally constituted research institutes. Although they may receive funds from the State under the form of research grants or research contracts, they have been formed as a result of private initiative and are basically funded either by private or by external (foreign) funds. This is not always the case, since in some areas (i.e. agricultural research) "joint ventures" are starting to appear between the government and private research groups.

It should again be emphasized that in the survey data that we are analyzing in this report there is practically no information available on technological research, mainly of an adaptive nature, that is carried out within production enterprises. This is particularly important in the area of industrial technology research, where such activity has been identified and reported in industrial enterprises through several case studies. This implies that the role of the private sector is being underestimated, specially in the area of industrial technology.

Private research centres have tended to appear in two main research areas in the Latin American and Caribbean countries: agricultural research and social science research. In agriculture the relationship between research and production is quite often more visible than in other research areas, and the international rate of return on any investment in this activity is more easy to identify and analyze in the agricultural sector. For this reason associations of growers have, in several cases, decided to collectively set up their own research facilities and research programs. In other cases they fund research of interest to them through existing government research centres, in order to avoid setting up separate facilities. Examples of these private research centres in the agricultural sector are those of the National Federation of Coffee Growers (CENICAFE) and the sugar cane growers (CENICANA) in Colombia, the association of banana growers (ASBANA) in Costa Rica, and the association of wheat and soya growers (FECOTRIGO) and the sugar producers of Sao Paulo (COPERSUCAR) in Brazil.

The nature of the private research centres in the social sciences is very different. They are normally relatively small groups of "researchers/consultants", who try to operate by combining three sources of funding since they rarely have their own funds: a) grants from government funds for specific research projects (in some countries this possibility is relatively limited in the social sciences); b) contract research (or consultancy services); and c) foreign financial support from international or bilateral organizations. Depending on the motivation of the persons who make up these centres and on their ability to mobilize funds from these three sources, some groups tend to become more consultants than researchers (with a very marginal research activity), while others keep tight to their research vocation, refusing to be absorbed by the consultancy market.

In some countries of the region private social science research centres play a predominant role in this research area (i.e. Argentina and Chile). In others, university research groups and private research centres play a similar role. In most countries of the region the public sector has played a relatively minor role in social science research, except as a source of funds. In this research area, private research centres have developed mainly because of a series of factors that have motivated the "migration" of researchers from the universities (i.e. socio-political environment, internal problems in the universities, low salaries), although many of them continue to work as part-time professors in the latter. An additional factor that has facilitated this process is the fact that the establishment of a social science research centre does not need a substantial infrastructure investment, as it does in other research areas.

A third area in which private research centres have also developed, although in a more limited number of countries, is that of industrial technology research. As previously pointed out, there is a substantial amount of minor technological innovations and adaptive research that is carried out within industrial enterprises (in shop). On this there is very little information available (except case studies). But besides this intra-firm research activity, formal technology centres or research centres have been established by the private sector, in a few cases, at the industrial branch level (i.e. metalworking industry, bakeries, textiles), or at the level of a group of firms related to a single financial group. These centres carry out quality control, engineering services and research activities. The information available on these centres in the survey data under analysis is quite scanty; this particular research area is underestimated in the present figures.

Table 11 shows the relative importance of the private research centres in a group of Latin American countries. Although these figures clearly underestimate the importance of this institutional sector for the reasons previously mentioned, the limited information available shows that between 5 and 25% of the research in the region is in the hands of private research centres. This sector is particularly important in Ecuador, Chile and Colombia (see Table 11). Unfortunately no information is available for Brazil and Venezuela,

among the group of countries we have been analyzing. The real importance of this sector in the region is most likely greater than the figures that appear in Table 11.

4.3 Orientation of Research: Main Research Areas that are Being Studied

The last aspect of present research activities in Latin American and Caribbean countries that will be analyzed is that of the main research areas that are being studied. In order to characterize and examine the orientation of research in the region, the following classification of research areas was used:

- a) Natural resources and environment.
- b) Agriculture, forestry and fisheries.
- c) Mining.
- d) Industrial technology.
- e) Energy.
- f) Housing and development of construction technologies and materials.
- g) Transportation and telecommunication.
- h) Health.
- i) Social development (socio-economic development problems and issues).
- j) Basic knowledge.

This classification is an adapted version of the one used by UNESCO and by most of the country surveys that we are using. Its main purpose is to bring out the relationship between research and development problems.

Table 13 summarizes the research profiles of five countries in the region (Brazil, Mexico, Colombia, Venezuela and Costa Rica), in terms of the main research areas that attract the attention of the scientific community (number of researchers per research area), and in terms of the research areas that receive the greatest support from the government and from the research institutions themselves (distribution of research expenditure).

Some interesting patterns emerge from the analysis of these five profiles. In practically all the countries agricultural research is by far the most important research area in terms of the financial support it receives: 48.3% of research funds goes to agriculture research in Brazil, 44.6% in Colombia and 45.7% in Costa Rica. Venezuela and Mexico give a lower relative importance to this research area.

T A B L E 13

MAIN AREAS OF CONCENTRATION OF RESEARCH: DISTRIBUTION OF RESEARCH EXPENDITURE
AND RESEARCHERS IN A GROUP OF LATIN AMERICAN COUNTRIES

(Number of Physical persons doing research)

(In thousands of local currency and US\$)

Research Area	B R A Z I L (1 9 7 8) *			M E X I C O (1 9 7 8)				
	Cruzeiros	U.S.\$	%	Pesos	U.S.\$	%	No. of Res.** 1980	%**
1. Natural resources and environment	955,926.0	52,901.3	4.6	[1,684,100.0	74,124.1	27.0	864	8.3
2. Agriculture, forestry and fisheries	10,037,223.0	555,463.5	48.3					
3. Mining	748,116.0	41,401.0	3.6	[2,060,400.0	90,686.6	33.0	83	0.8
4. Industrial Technology	2,389,815.0	132,253.2	11.5					
5. Energy	2,244,348.0	124,203.0	10.8	445,500.0	19,608.3	7.1	916	8.8
6. Housing and construction	41,562.0	2,300.1	0.2	[534,600.0	23,529.9	8.5	292	2.8
7. Transport and Telecom.	415,620.0	23,000.6	2.0					
8. Health	1,080,612.0	59,801.5	5.2	734,500.0	32,328.3	11.8	1,302	12.5
9. Social Development	2,119,662.0	117,302.9	10.2	622,500.0	27,398.8	10.0	2,759	26.5
10. Basic Knowledge	748,116.0	41,401.0	3.6	159,600.0	7,024.7	2.6	906	8.7
11. Others	--	--	--	--	--	--	218	2.1
TOTAL	20,781,000.0	1,150,028.1	100.0	6,241,200.7	274,700.0	100.0	10,412	100.0

*The percentage distribution by research area was provided by CNPq for 1981. This percentage distribution was applied to the total research investment for 1978 to arrive at the figures in this column.

**The distribution of researchers by research area was estimated for this year on the basis of the percentage distribution for 1974.

MAIN AREAS OF CONCENTRATION OF RESEARCH: DISTRIBUTION OF RESEARCH EXPENDITURE
AND RESEARCHERS IN A GROUP OF LATIN AMERICAN COUNTRIES

(Number of Physical persons doing research)

(In thousands of local currency and US\$)

Research Area	COLOMBIA (1978)					VENEZUELA (1977)				
	Pesos	U.S.\$	%	No. of Res.	%	Bolivares ***	U.S.\$ ***	% ***	No. of Res.	%
1. Natural resources and environment	77,215.0	1,975.0	9.6	335	9.8	49,329.8	11,492.1	5.7	154	4.5
2. Agriculture, forestry and fisheries	359,605.0	9,198.1	44.6	688	20.2	240,590.9	56,049.3	27.8	840	24.2
3. Mining	6,190.0	158.3	0.8	28	0.8	18,174.2	4,233.8	2.1	73	2.1
4. Industrial Technology	60,202.0	1,539.9	7.5	472	13.9	79,620.0	18,548.7	9.2	416	12.0
5. Energy	2,199.0	56.3	0.3	31	0.9	14,712.4	3,427.5	1.7	65	1.9
6. Housing and construction	7,962.0	203.6	1.0	79	2.3	20,770.4	4,838.8	2.4	89	2.6
7. Transport and Telecom.	15,733.0	402.4	1.9	54	1.6	3,461.7	806.5	0.4	11	0.3
8. Health	127,160.0	3,252.5	15.8	932	27.4	192,126.6	44,758.8	22.2	803	23.2
9. Social Development	146,916.0	3,757.9	18.2	762	22.4	102,121.3	23,790.7	11.8	426	12.3
10. Basic Knowledge	2,190.0	56.0	0.3	23	0.7	33,752.0	7,863.0	3.9	166	4.8
11. Others	--	--	--	--	--	110,775.7	25,806.8	12.8	421	12.1
TOTAL	805,372.0	20,600.0	100.0	3,404	100.0	865,435.0	201,616.0	100.0	3,464	100.0

*** The distribution of financial resources by research area was estimated on the basis of available data on the number of research projects and the number of researchers existing in each research area.

MAIN AREAS OF CONCENTRATION OF RESEARCH: DISTRIBUTION OF RESEARCH EXPENDITURE
AND RESEARCHERS IN A GROUP OF LATIN AMERICAN COUNTRIES

(Number of Physical persons doing research)

(In thousands of local currency and US\$)

Research Area	C O S T A R I C A (1 9 8 1)				
	Colones	U.S.\$	%	No. of Res. ^{1/}	%
1. Natural resources and environment	5,014.0	330.9	6.4	33	8.0
2. Agriculture, forestry and fisheries	35,940.0	2,371.8	45.7	153	37.3
3. Mining	427.2	28.2	0.6	3	0.7
4. Industrial Technology	1,608.8	106.2	2.1	10	2.4
5. Energy	4,149.2	273.8	5.3	10	2.4
6. Housing and construction	1,048.6	69.2	1.3	7	1.7
7. Transport and Telecom.	159.2	10.5	0.2	1	0.3
8. Health	11,896.2	785.1	15.1	73	17.8
9. Social Development	17,841.9	996.0	19.2	100	24.3
10. Basic Knowledge	3,247.9	214.3	4.1	21	5.1
11. Others	--	--	--	--	--
TOTAL	81,333.0	5,186.0	100.0	411	100.0

^{1/} This refers to a number of the equivalent full-time researchers.

But besides this common denominator two main patterns emerge. Large countries (Brazil and Mexico) give a very high priority to two research areas: industrial technology research and research on energy. Brazil spends 11.5% and 10.8% of its total research funds in these two research areas respectively. In the case of Mexico industrial technology and mining (mineral resources) is in fact the largest single research area, with 33% of total research funds. Energy research absorbs 7.1% of the funds available and has been rising sharply (see Table 13). In these large countries health research and social science research occupy a third level of priority in terms of the actual distribution of research funds. In Brazil the relative participation of these two research areas is 5.2% (health) and 10.2% (social development). In Mexico it is 11.8% (health) and 10% (social development).

In the medium and small countries the relationship between these two groups of research areas is exactly the opposite. After agriculture research, the next highest priority goes to health research and to research on social development issues (social sciences), both in terms of the number of researchers that work in those areas and in terms of financial support. Health research represents 15.8% of total research funds in Colombia, 22.2% in Venezuela and 15.1 in Costa Rica. Social science research receives 18.2% of the available research funds in Colombia, 11.8% in Venezuela and 19.2% in Costa Rica.

In this group of countries industrial technology research occupies a third level of priority, with research on energy being in a very initial stage (although on the rise). The proportion of research funds going to industrial technology research is 7.5% for Colombia 9.2% for Venezuela and 2.1% for Costa Rica. Energy research receives much less attention, (see Table 13), although in most countries it is expected to increase substantially because of a growing interest on this area.

As it was pointed out in the previous section (4.2), the present information on industrial technology research clearly underestimates in most countries the real importance of this research area in terms of local research effort. The reason for this is that there is very little information available on the research and technological activities of the private industrial sector. The few case studies available on specific industrial branches or firms carried out in some countries of the region do show that the latter plays an important role in this particular research area.

A note of caution should be expressed with respect to the low figures that appear in the first research area of the classification that we are using (natural resources and environment). This area includes, among other things, research on pollution and on other environmental dimensions of human activities. It also includes basic research on flora and fauna,

research on hydrological resources and studies on classification of soils. But many of the applied research programs on specific natural resources are included in one of the other research areas and not in this one. For example, research on marine resources and fisheries, which is a high priority in many of the countries of the region, is included in "agriculture, forestry and fisheries". And research on mineral resources appears in the category of mining. Thus the relatively low figures that appear in the first research area (see Table 13) cannot be interpreted to mean that the countries of the region are not interested in doing research on their own natural resources, although this particular area of research could be especially strengthened. In the case of Mexico it was impossible to distinguish the research area of natural resources and the environment from the other ones.

A more detailed analysis of the content and coverage of each research area would be of great interest, in order to have a clearer view of research in the region. To say that 48.3% of research funds goes into agriculture research, or 11.8% into health research, tells us nothing on what is being done in those areas or on the specific topics that are of interest to local research centres. This aggregate information only provides a general research profile, in terms of very broad research areas and their relative importance.

Unfortunately the information available for the countries of the region in most cases does not permit a more detailed analysis of the content of each research area. This type of substantive analysis is more feasible at two levels: country studies or sectorial studies (the situation of research in a specific research area). An example of the first one is the Costa Rican study that is being presented along with this regional report.^{15/} An example of the second one is the three case studies on agricultural research that were carried out in Brazil, Colombia and Mexico.^{16/} In these three case studies an analysis was made of the main research topics that are being covered in this sector, the relative priority of the principal agricultural products in each country in terms of research, and the process of allocating financial resources to research programs in this sector.

^{15/} See F. Chaparro, F. Vargas, H. Jaramillo and M. Ramirez: Present Situation and Characteristics of Research Activities in Costa Rica; IDRC/CONICIT, 1982.

^{16/} IDRC: Resource Allocation in Agricultural Research in Latin America (Project ARIAL): Colombia, Estudio de Caso (1980); Brazil, Estudio de Caso (1981); Mexico, Estudio de Caso (being revised); IDRC, Manuscript Reports No. 14 and 45.

5. DEVELOPMENT OF SCIENCE POLICY EFFORTS IN LATIN AMERICA AND THE CARIBBEAN

Towards the end of the 1960's and the beginning of the 1970's most countries in the region created science policy organizations for the purpose of promoting research and the use of science and technology as a factor of development. Two types of organizations have appeared in these countries:

- a) National Councils for Scientific and Technological Development.
- b) Science and Technology Offices (or units) within National Planning Agencies.

Annex II provides a list of the science policy organizations of each country, with the respective date in which it was established, classified into one of the two organizational types previously mentioned.

The efficiency of these institutions and their contribution to the promotion of research in the region varies from one case to another. In general terms, these organizations have played an important role in bringing to the attention of governments the importance of research for development, and, to a certain extent, in increasing the budget allocations for such activities. In several cases, they have been able to formulate science and technology policies and development programs, including sectorial research programs in areas of interest to each country. But the extent to which they have been able to implement such policies and programs has been much more limited. Three important factors that have influenced this capacity to implement research programs and science and technology policies have been the following:

- a) The relative position of these organizations within the overall governmental structure.
- b) The existence of a financial mechanism (i.e. national fund or influence on the allocation of financial resources), that allows them to implement the policies and programs formulated.
- c) The influence they are able to exert on the local scientific community and the institutional research infrastructure.

In many cases one or several of these factors have limited the capacity of these organizations to implement the policies and programs that have been formulated. Specially in the cases where the science policy organization has not been linked to a national research fund (or some similar mechanism), science policy formulation and research programs have basically remained at the level of academic exercises. This is particularly important since is

should be realized that external technical and financial assistance (both multilateral and bilateral) can only be a complement to, but not a substitute for, national support for research and technological development.

Despite these limitations, science policy organizations have been one of the principal factors that have contributed to the increasing interest on research and the expansion of scientific and technological activities in the region.

6. I.D.R.C. ACTIVITIES IN THE REGION: 1971-1981

In the last decade (1971-1981) I.D.R.C. has supported financially 402 research projects for a total value of 55 million Canadian dollars in Latin America and the Caribbean. ^{17/} This is not the total investment of I.D.R.C. in the region, since this does not include Division Activity Projects (DAPs) through which meetings, seminars, study visits, consultancy studies and other specific activities are supported. It does not include either the training of human resources through the Fellowship Program, nor the publications activities of the Communications Division. It refers exclusively to research projects funded in the region.

Tables 14 and 15 show the number of projects and the amounts of research grants, by division and by country of the region. In terms of the five operational divisions of I.D.R.C., the Centre's activity in the region during this period can be summarized as follows:

	<u>No. of Projects</u>	<u>%</u>	<u>Research Grants</u> Cdn\$	<u>%</u>
1. Agriculture, Food and Nutrition (AFNS)	101	25.1	\$ 22,023,243	40.3
2. Social Sciences (S.S.)	183	45.5	16,546,775	30.2
3. Health Sciences (H.S.)	70	17.4	8,408,853	15.4
4. Information Sciences (I.S.)	46	11.5	7,645,352	14.0
5. Communications ^{18/}	2	0.5	36,658	0.1
TOTAL:	<u>402</u>	<u>100.0</u>	<u>\$ 54,660,881</u>	<u>100.0</u>

^{17/} All the information in this section is up to December 31, 1981. With respect to the number of projects a methodological note is in order. In the case of regional or international networks with clearly identifiable national components that are being financed by I.D.R.C. (a national research team, with its research plan and budget), each national component is counted as a separate project. This explains the slight discrepancy between the number of projects that appears in this report and the Centre's Projects Information System (PINS), where regional networks are counted as a single project. This is the only way of making compatible the number of projects per country (where the national components of regional networks are separately considered), and the total number of projects or the number of projects by division.

^{18/} Includes only research activity. Does not include publications.

TABLE 14
NUMBER OF PROJECTS SUPPORTED IN EACH COUNTRY BY DIVISION 1971-1981

C O U N T R Y	D I V I S I O N						TOTAL	%
	AFNS	S.S.	H.S.	I.S.	COM.			
1. ARGENTINA	0	25	3	2	0	30	7.4	
2. BARBADOS	0	4	0	0	0	4	1.0	
3. BELIZE	3	0	0	0	0	3	0.8	
4. BOLIVIA	4	8	1	5	0	18	4.6	
5. BRAZIL	3	14	4	1	0	22	5.5	
6. COLOMBIA	14	26	6	3	1	50	12.4	
7. COSTA RICA	6	7	2	10	0	25	6.2	
8. CUBA	1	1	0	0	0	2	0.5	
9. CHILE	7	28	7	11	0	53	13.3	
10. DOMINICA	0	0	1	0	0	1	0.2	
11. ECUADOR	2	2	6	1	0	11	2.7	
12. EL SALVADOR	1	3	0	0	0	4	1.0	
13. GUATEMALA	3	3	3	0	0	9	2.3	
14. GUYANA	3	4	1	0	0	8	2.0	
15. HAITI	0	1	2	0	0	3	0.8	
16. HONDURAS	1	2	1	1	0	5	1.2	
17. JAMAICA	8	10	2	4	0	24	6.0	
18. MEXICO	8	11	11	1	0	31	7.7	

Cont . . .

TABLE 14 (Continuation)

C O U N T R Y	D I V I S I O N						TOTAL	%
	AFNS	S.S.	H.S.	I.S.	COM.			
19. NICARAGUA	0	4	0	0	0	4	1.0	
20. PANAMA	6	1	3	1	0	11	2.7	
21. PARAGUAY	0	5	3	1	0	9	2.2	
22. PERU	13	12	1	0	0	26	6.5	
23. REP. DOMINICANA	1	1	2	1	0	5	1.2	
24. STA. LUCIA	3	0	0	0	0	3	0.8	
25. SURINAM	0	1	0	0	0	1	0.2	
26. TRINIDAD & TOBAGO	10	0	3	1	0	14	3.5	
27. URUGUAY	0	7	0	1	0	8	2.0	
28. VENEZUELA	0	2	2	0	1	5	1.2	
29. CANADA	1	1	0	0	0	2	0.5	
30. E.E. U.U.	3	0	6	2	0	11	2.7	
T O T A L	101	183	70	46	2	402	100.0	

TABLE 15

RESEARCH GRANTS BY COUNTRY AND DIVISION 1971 - 1981 (IN CDN \$)

C O U N T R Y	D I V I S I O N											
	AFNS		S.S.		H.S.		I.S.		COM.		TOTAL	
	GRANTS	%	GRANTS	%	GRANTS	%	GRANTS	%	GRANTS	%	GRANTS	%
1. ARGENTINA	0	0.0	2,013,754	12.2	180,310	2.1	289,320	3.8	0	0.0	2,483,384	4.5
2. BARBADOS	0	0.0	328,940	2.0	0	0.0	0	0.0	0	0.0	328,940	0.6
3. BELIZE	551,600	2.5	0	0.0	0	0.0	0	0.0	0	0.0	551,600	1.0
4. BOLIVIA	1,091,200	5.0	365,730	2.2	117,148	1.4	497,034	6.5	0	0.0	2,071,112	3.8
5. BRAZIL	519,900	2.4	1,062,174	6.4	329,955	3.9	188,350	2.5	0	0.0	2,100,379	3.8
6. COLOMBIA	2,941,898	13.4	1,896,001	11.5	1,782,485	21.2	372,650	4.9	15,290	41.7	7,008,324	12.8
7. COSTA RICA	1,713,500	7.8	609,300	3.7	112,500	1.3	1,456,346	19.0	0	0.0	3,891,646	7.1
8. CUBA	73,700	0.3	50,000	0.3	0	0.0	0	0.0	0	0.0	123,700	0.2
9. CHILE	1,286,500	5.8	2,550,948	15.4	697,540	8.3	3,130,976	40.9	0	0.0	7,665,964	14.0
10. DOMINICA	0	0.0	0	0.0	19,846	0.2	0	0.0	0	0.0	19,846	0.1
11. ECUADOR	459,600	2.1	90,000	0.5	582,630	6.9	74,450	1.0	0	0.0	1,206,680	2.2
12. EL SALVADOR	385,200	1.8	315,413	1.9	0	0.0	0	0.0	0	0.0	700,613	1.3
13. GUATEMALA	247,200	1.1	195,700	1.2	226,860	2.7	0	0.0	0	0.0	669,760	1.2
14. GUYANA	748,010	3.4	654,087	4.0	275,500	3.3	0	0.0	0	0.0	1,677,597	3.0
15. HAITI	0	0.0	34,000	0.2	344,600	4.1	0	0.0	0	0.0	378,600	0.7
16. HONDURAS	226,600	1.0	314,000	1.9	62,700	0.8	64,705	0.8	0	0.0	668,005	1.2
17. JAMAICA	1,552,329	7.0	1,493,172	9.0	163,020	2.0	521,200	6.8	0	0.0	3,729,721	6.8
18. MEXICO	1,564,370	7.1	1,670,235	10.1	798,950	9.5	19,700	0.3	0	0.0	4,053,255	7.4
19. NICARAGUA	0	0.0	338,500	2.1	0	0.0	0	0.0	0	0.0	338,500	0.6
20. PANAMA	1,304,700	5.9	40,000	0.2	251,830	3.0	64,705	0.8	0	0.0	1,661,235	3.0
21. PARAGUAY	0	0.0	389,750	2.4	453,200	5.4	64,705	0.8	0	0.0	907,655	1.7

T A B L E 15 (Continuation)

C O U N T R Y	D I V I S I O N											
	AFNS		S.S.		H.S.		I.S.		COM.		TOTAL	
	GRANTS	%	GRANTS	%	GRANTS	%	GRANTS	%	GRANTS	%	GRANTS	%
22. PERU	4,148,520	18.8	1,413,846	8.5	254,200	3.0	0	0.0	0	0.0	5,816,566	10.7
23. REP: DOMIN.	140,100	0.6	221,000	1.3	50,530	0.6	68,600	0.9	0	0.0	480,230	0.9
24. STA. LUCIA	815,200	3.7	0	0.0	0	0.0	0	0.0	0	0.0	815,200	1.5
25. SURINAM	0	0.0	37,500	0.2	0	0.0	0	0.0	0	0.0	37,500	0.1
26. TRIN. & TOBG.	1,357,700	5.2	0	0.0	631,925	7.5	303,500	4.0	0	0.0	2,293,125	4.2
27. URUGUAY	0	0.0	316,425	1.9	0	0.0	42,834	0.6	0	0.0	359,259	0.7
28. VENEZUELA	0	0.0	59,200	0.4	54,900	0.7	0	0.0	21,368	58.3	135,468	0.3
29. CANADA	15,000	0.1	87,100	0.5	0	0.0	0	0.0	0	0.0	102,100	0.2
30. E.E. U.U.	880,416	4.0	0	0.0	1,018,224	12.1	486,280	6.4	0	0.0	2,384,920	4.4
T O T A L	22,023,243	100.0	16,546,775	100.0	8,408,853	100.0	7,645,352	100.0	36,658	100.0	54,660,881	100.0

The detailed breakdown of the activities of each division, by country of the region, appears in Tables 14 and 15. In general terms, the activities of the Centre have been quite widely distributed throughout the region. The country profile varies from one division to another, and it is within divisions that we find higher relative degrees of concentration in certain countries of the region. For example, Social Sciences concentrates a considerable proportion of its research funds in Chile, Argentina, Colombia, Mexico and Jamaica. (See Table 15). The very high concentration of Information Sciences projects in two countries (Chile and Costa Rica) is due to the presence of international organizations with important information networks in these two countries.

Table 16 summarizes the evolution of IDRC's activities in the region, in terms of the number of projects and the total amount of the research grants that have been committed each year, from 1971 to 1981. This table clearly shows that by 1981 the level of funding in the region for research projects (excluding other types of activities), was of the order of 9 million Canadian dollars a year. The most important increase in the level of funding came between 1979 and 1981.

Three substantive questions will now be briefly analyzed:

- a) What is the main emphasis that is being placed by each division, in terms of the program areas that are receiving the greatest support in the region?
- b) What is the distribution of IDRC's projects in terms of the main subregions analyzed in the previous sections?
- c) What are the types of institutions with which IDRC works?

These three questions are analyzed in Tables 17 and 18.

In the case of AFNS projects in the region a very high proportion of them are concentrated in two program areas: animal sciences (35.7%) and crops and cropping systems (31.5%). In a second level we find fisheries (13.7%) and forestry (12.4%), and with a very low level of activity in the region is post-production systems (6.7%). The latter has concentrated an important part of its activities in Africa and Asia, due to the needs of these regions in this area, playing a low profile in the Latin American and Caribbean region. With an increased financial capacity, the low profile that post-production systems has played in Latin America and the Caribbean is being reviewed. Food losses in the post-harvest phase are very important in the region, as well as other problems related to post-production system, such as the processing of basic crops or agricultural products. In fact, food technology has been a

T A B L E 16

NUMBER OF PROJECTS AND RESEARCH GRANTS BY DIVISION AND YEAR 1971-1981 (IN CDN \$)

Y E A R	D I V I S I O N											
	AFNS		S.S.		H.S.		I.S.		COM.		T O T A L	
	PROJS.	GRANTS	PROJS.	GRANTS	PROJS.	GRANTS	PROJS.	GRANTS	P. GRANTS	PROJS.	GRANTS	
1971	3	354,774	4	425,386	0	0	0	0	0	0	7	790,160
1972	6	591,325	5	434,250	1	19,846	0	0	0	0	12	1,045,421
1973	4	1,225,426	5	519,364	3	436,800	2	68,700	0	0	14	2,250,290
1974	5	530,500	10	992,543	3	1,118,405	1	332,500	0	0	19	2,973,948
1975	7	2,194,198	8	1,229,299	2	247,700	9	1,072,704	0	0	26	4,743,901
1976	9	2,819,570	10	917,847	11	1,111,790	2	261,584	0	0	32	5,110,791
1977	12	2,304,700	13	1,200,803	12	1,599,884	6	1,390,414	2	36,658	45	6,532,459
1978	10	2,159,900	22	1,611,113	6	432,450	6	865,170	0	0	44	5,068,633
1979	14	2,498,100	21	2,053,780	5	689,028	2	480,345	0	0	42	5,721,253
1980	14	2,906,450	29	2,527,346	10	1,368,885	8	902,337	0	0	61	7,705,018
1981	13	3,090,100	39	2,883,904	12	916,925	7	2,065,756	0	0	71	8,956,705
Not Committed *	4	1,338,200	17	1,751,140	5	467,140	3	205,822	0	0	29	3,762,302
T O T A L	101	22,023,243	183	16,546,775	70	8,408,853	46	7,645,352	2	36,658	402	54,660,881

*These are the projects that as at December 31, 1981, had been approved, but the respective MGC had not yet been signed. By March of 1982 more than half of these MGC's have been received duly signed.

T A B L E 17

RESEARCH GRANTS BY DIVISION, PROGRAM AREAS AND SUBREGION 1971 - 1981

(IN CDN \$)

DIVISION AND PROGRAM AREAS	S U B R E G I O N					TOTAL	%
	LARGE COUNTRIES	ANDEAN COUNTRIES	CENTRAL AM. COUNTRIES	CARIBBEAN COUNTRIES	OTHER COUNTRIES *		
<u>1 A F N S :</u>							
1.1 Crops and cropping systems	295,870	3,336,328	1,049,200	2,266,729	0	6,948,127	31.5
1.2 Animal sciences	1,222,400	2,521,370	2,661,400	1,047,700	395,416	7,848,286	35.7
1.3 Post production systems	0	612,500	375,800	10,800	485,000	1,484,100	6.7
1.4 Fisheries	418,900	915,300	310,500	1,361,810	15,000	3,021,510	13.7
1.5 Forestry	147,100	2,542,220	31,900	0	0	2,721,220	12.4
						35,000	2.2
SUB TOTAL	2,084,270	9,927,718	4,428,800	4,687,039	895,416	22,023,243	100.0
%	9.5	45.0	20.1	21.3	4.1	100.0	
<u>2 S.S. :</u>							
2.1 Science and technology policy	1,221,548	1,288,546	549,500	764,549	373,525	4,197,668	25.4
2.2 Population	1,830,815	1,647,849	421,000	569,690	267,750	4,737,104	28.6
2.3 Education	303,900	1,582,110	228,000	738,500	0	2,852,510	17.2
2.4 Economics and rural modernization	882,900	947,500	544,413	0	152,000	2,526,813	15.3
2.5 Development management	0	110,720	70,000	596,460	0	777,180	4.7
2.6 International, national and regional institutions and network.	507,000	799,000	0	149,500	0	1,455,500	8.8
SUB TOTAL	4,746,163	6,375,725	1,812,913	2,818,699	793,275	16,546,775	100.0
%	28.7	38.5	11.0	17.0	4.8	100.0	

Cont ...

T A B L E 17 (Continuation)

DIVISION AND PROGRAM AREAS	S U B R E G I O N					TOTAL	%
	LARGE COUNTRIES	ANDEAN COUNTRIES	CENTRAL AM. COUNTRIES	CARIBBEAN COUNTRIES	OTHER COUNTRIES *		
3. H.S. :							
3.1 Fertility research methods	856,860	1,504,180	49,900	36,080	0	2,447,020	29.1
3.2 Rural health care delivery	38,600	1,362,833	148,600	561,860	400,800	2,512,693	29.9
3.3 Family planning	0	0	0	329,866	0	329,866	3.9
3.4 Rural water supply and sanitation	8,700	245,280	455,390	0	0	709,370	8.4
3.5 Tropical disease	405,055	376,610	0	557,615	472,400	1,811,680	21.6
3.6 Environmental health	0	0	0	0	598,224	598,224	7.1
SUB TOTAL	1,309,215	3,488,903	653,890	1,485,421	1,471,424	8,408,853	100.0
%	15.6	41.5	7.8	17.6	17.5	100.0	
4. I.S. :							
4.1 Information for development							
- Agricultural information	19,700	344,850	1,287,354	438,100	64,705	2,154,709	28.2
- Population and health	54,960	984,080	3,500	11,200	141,900	1,195,640	15.6
- Communication	422,710	74,450	0	0	42,834	539,994	7.1
- Cartography	0	115,089	0	0	0	115,089	1.5
- Industrial information	0	49,500	0	0	0	49,500	0.6
- Educational information	0	446,075	52,405	4,000	0	502,480	6.6
- Environmental information	0	96,400	0	0	344,380	440,780	5.8
- Infrastructure development	0	294,480	0	440,000	0	734,480	9.6
4.2 Information about development	0	1,670,186	242,494	0	0	1,912,680	25.0
SUB TOTAL	497,370	4,075,110	1,585,753	893,300	593,819	7,645,352	100.0
%	6.5	53.3	20.7	11.7	7.8	100.0	
5. Communications							
	0	36,658	0	0	0	36,558	
%	0.0	100.0	0.0	0.0	0.0	100.0	-
T O T A L							
	8,637,018	23,904,114	8,481,356	9,884,459	3,753,934	54,660,881	-
%	15.8	43.7	15.5	18.1	6.9	100.0	-

* Includes projects which are institutionally based in the U.S. and Canada, besides Uruguay and Paraguay.

research area of major concern in the region. For this reason, OPE/LARO and AFNS are planning a study on post-production research and research needs that will be carried out in 1982-83.

The crops and cropping systems program of IDRC has contributed to changing the traditional "crops and disciplines" approach to agricultural research that has predominated in the region. This traditional approach has fostered a limited contact with the farmer's environment and reality. With a cropping systems approach the possibility of addressing the farmer's problems more directly increases substantially. But besides funding specific cropping systems projects in different countries, a strong training component will probably be necessary to make an impact on the agricultural research orientation of the region.

Social science projects in this region show a considerable concentration in two program areas: population (28.6%) and science and technology (25.4%) (see Table 17). The second one is an area in which Latin American social science researchers have had a particular interest in the last decade. Nevertheless the relative importance of the different social science program areas in the region has most likely changed over the last years. Research on education and on economics and rural modernization have increased their share in the last few years, because of increased program activity in these two areas. Moreover, some recent program modifications are not reflected in Table 17. Development management no longer exists as a social science program area, and the new urban studies area, that is presently quite active in the region, is still not differentiated from population and economics in this table.

Health sciences projects in the region show a substantial concentration in three main program areas: rural health care delivery systems (29.9%), fertility control (29.1%) and tropical diseases (21.6%). In the area of tropical diseases in Latin America and the Caribbean, IDRC projects have concentrated on chagas disease, cutaneous Leishmaniasis and the different etiologies of gastroenteritis (i.e. parasitic, viral and bacteriological).

Finally, information sciences projects in the region have concentrated on three major topics: agricultural information (28.2%) information on population problems (15.6%) and information for policy-makers and for decision-making related to development problems (25%). The predominance of these information areas is partly due to the existence of three large information networks in the region that are being supported by IDRC: AGRINTER (Agriculture), DOCPAL (population) and INFOPLAN/CARISPLAN (information for policy-makers). The nature of the information projects in the Latin American and Caribbean region will be analyzed in more detail at the end of this section.

If we raise the question of why certain program areas have received more support than others in the region, two major factors should be taken into consideration. In the first place, since IDRC responds to requests coming from research groups in the different countries, the pattern of the Centre's financial support reflects the demand for research funds coming from the countries in the region. But this is only part of the story. Because of IDRC's style of operation, the presence of a program officer in the region (or with strong interests in the region) has been of primary importance for project-identification and project-development in each program area. This factor, as well as the research orientation of the program officer, has had a major influence in shaping the program areas in which research is supported in the region.

The second question raised above was that of the relative distribution of IDRC's activities in terms of the main subregions analyzed in the previous sections. As Table 17 shows, this varies from one division to another. AFNS has concentrated its efforts in three subregions: Andean countries (45%), Central American countries (20.1%) and Caribbean countries (21.3%). The situation of Social Sciences is quite different: social science projects show a substantial concentration in the Andean countries (38.5%) and in the large countries (28.7%). Both Health Sciences and Information Sciences have concentrated an important part of their activities in the Andean countries (41% and 53% respectively). But in the case of Information Sciences they really consist of regional projects (regional information networks) that happen to have their headquarters in Santiago de Chile (merely because of institutional location). Most Information Sciences projects cannot be really linked to any single country or subregion, because of their regional nature.

The last question raised above was that of the types of institutions with which IDRC works. Following the analysis that has been made of the Latin American and Caribbean institutional research infrastructure (see section 4.2), four major types of research centres or research organizations may be distinguished: universities, government research centres, private research centres and international or regional research centres.

At the centre-wide level, 55% of the research grants in Latin America and the Caribbean has gone to national institutions in the countries of the region (first three categories of the institutional infrastructure mentioned in the previous paragraph), and 45% has gone to international or regional organizations located within the region (see Table 18). Among the national institutions, the principal beneficiaries have been government research centres.

But the situation changes from one division to another. International and regional research centres have played an important role in AFNS projects in the region (45.7%), with government research centres following in a very

TABLE 18
RESEARCH GRANTS BY DIVISION, PROGRAM AREAS AND TYPE OF INSTITUTION 1971 -1981

(IN CDN \$)

DIVISION AND PROGRAM AREAS	TYPE OF INSTITUTION *				T O T A L	%
	UNIVERSITIES	GOVT. RESEARCH CENTRES	PRIV. RESEARCH CENTRES	INT. OR REG. CENTRES		
1. AFNS :						
1.1 Crops & cropping systems	557,400	2,425,800	213,650	3,751,277	6,948,127	31.6
1.2 Animal sciences	1,267,200	3,005,300	0	3,575,786	7,848,286	35.6
1.3 Post production systems	128,900	253,300	0	1,101,900	1,484,100	6.7
1.4 Fisheries	492,800	1,917,910	425,100	185,700	3,021,510	13.7
1.5 Forestry	319,000	1,103,000	147,100	1,439,220	2,721,220	12.4
SUB TOTAL	2,478,200	8,705,310	785,850	10,053,883	22,023,243	100.0
%	11.2	39.5	3.6	45.7	100.0	
2. S.S. :						
2.1 Science and technology	514,780	500,274	1,736,665	1,445,949	4,197,668	25.4
2.2 Population	145,100	1,047,286	1,621,190	1,923,528	4,737,104	28.6
2.3 Education	203,450	1,471,010	662,950	515,100	2,852,510	17.2
2.4 Economics and rural modernization	329,900	366,200	780,813	1,049,900	2,526,813	15.3
2.5 Development management	308,803	0	180,720	287,657	777,180	4.7
2.6 International, national and regional institutions and networks	0	0	540,000	915,500	1,455,500	8.8
SUB TOTAL	1,502,033	3,384,770	5,522,338	6,137,634	16,546,775	100.0
%	9.1	20.5	33.4	37.1	100.0	

TABLE 18 (Cont.)

DIVISION AND PROGRAM AREAS	TYPE OF INSTITUTION *				T O T A L	%
	UNIVERSITIES	GOVT. RESEARCH CENTRES	PRIV. RESEARCH CENTRES	INT. OR REG. CENTRES		
3. H.S. :						
3.1 Fertility research methods.	193,880	1,348,240	74,900	830,000	2,447,020	29.1
3.2 Rural health care delivery	161,648	1,205,150	805,385	340,510	2,512,693	29.9
3.3 Family planning	0	252,846	0	77,020	329,866	3.9
3.4 Rural water supply and sanitation	208,270	305,260	67,440	128,400	709,370	8.4
3.5 Tropical disease	79,125	467,930	287,010	977,615	1,811,680	21.6
3.6 Environmental health	0	0	0	598,224	598,224	7.1
SUB TOTAL	642,923	3,579,426	1,234,735	2,951,769	8,408,853	100.0
%	7.6	42.6	14.7	35.1	100.0	
4. I.S. :						
4.1 Information for development						
- Agricultural information	0	465,937	0	1,688,772	2,154,709	28.2
- Population and health	0	0	0	1,195,640	1,195,640	15.6
- Communication	0	42,834	188,350	308,810	539,994	7.1
- Cartography	0	115,089	0	0	115,089	1.5
- Industrial information	0	49,500	0	0	49,500	0.6
- Educational information	37,965	408,110	0	56,405	502,480	6.6
- Environmental information	0	96,400	0	344,380	440,780	5.8
- Infrastructure development	0	734,480	0	0	734,480	9.6
4.2 Information about development						
	0	103,100	0	1,809,580	1,912,680	25.0
SUB TOTAL	37,965	2,015,450	188,350	5,403,587	7,645,352	100.0
%	0.5	26.4	2.4	70.7	100.0	
5. Communications						
	0	0	0	36,658	36,658	100.0
%	0	0	0	100.0	100.0	
TOTAL	4,661,121	17,684,956	7,731,273	24,583,531	54,660,881	
%	8.5	32.4	14.1	45.0	100.0	

* The first three types of institutions refer to national institutions.

The fourth type refers to international or regional centres located in a country of the region.

close second place (39.5%) (Table 18). Not only in Latin America and the Caribbean, but also in most regions of the world, agriculture research has basically been carried out by these two types of research institutions. This has often led to the discussion of the relative roles these two types of research centres should play (including division of work), and of the relationships and complementarities that should exist between them.

In the case of the Social Sciences, regional institutions also play an important role (37.1%), but the major national customers are private research centres. This reflects the institutional infrastructure of social science research in the region analyzed in section 4.2, although this is heavily influenced by the situation of the southern cone countries.

Government research centres play the major role in Health Sciences projects (42.6%), with international or regional centres appearing in second place (35.1%). Finally, Information Sciences dedicated quite a high percentage of their funds (70.7%) to support information centres and networks that are based in international or regional centres (Table 18). But this is mainly due to the regional scope and nature of the information projects. Given the special nature of the projects in this area, we will devote the last paragraphs of this report to a very brief analysis of the information projects in the region.

Information Projects in Latin America and the Caribbean

There are six types of projects that Information Sciences has supported in the region. The first two are linked to the two major tasks that are involved in developing information systems. One is collecting the information produced, and the other one is processing the information into timely services to users. Obviously, the latter depends upon the former. The first function is carried out by Territorial (Regional) Information Networks, which are mechanisms basically designed to collect bibliographic references from the countries of the region in a cooperative fashion. Examples of Territorial Networks in Latin America are AGRINTER in agriculture, DOCPAL and REPIDISCA in population and health, INFOPLAN and CARISPLAN in social and economic planning, LATINAH in human settlements, etc. Given the importance of this first function, the IS Division has devoted a sizeable proportion of its total investment (4.5 million dollars) to the development of such networks (see Table 19).

On the other hand, the provision of services is a task that requires an in-depth analysis of the documents themselves. Given the very broad thematic coverage of Territorial Networks, this task is more efficiently carried out through Specialized Information Analysis Centres (SIACs), which deal with more manageable volumes of information, and thus they can produce a variety of useful services beyond the mere bibliographic listings. An example of this type of centre is the Cassava Information Centre at CIAT, which has acquired

TABLE 19
INFORMATION SCIENCES GRANTS BY PROGRAM AREA AND TYPE OF PROJECT : 1971-1981 (IN CDN \$)

PROGRAM AREAS	TYPE OF PROJECTS						
	TERRITORIAL NETWORKS	SIACs *	NATIONAL SECTORIAL SYSTEMS	GLOBAL NATIONAL SYSTEMS	SPECIFIC PRODUCTS	RESEARCH	TOTAL %
1. Information for development							
- Agricultural information	962,500	276,250	896,259	0	19,700	0	2,154,709 28.2
- Population and health	1,126,980	0	54,960	0	14,700	0	1,195,640 15.6
- Communication	74,450	0	0	0	0	465,544	539,994 7.1
- Cartography	0	0	0	0	115,089	0	115,089 1.5
- Industrial information	0	0	0	0	49,500	0	49,500 0.6
- Educational information	408,110	42,530	0	0	4,000	47,840	502,480 6.6
- Environmental inform.	440,780	0	0	0	0	0	440,780 5.8
- Infraestructure develop.	0	0	0	734,480	0	0	734,480 9.6
Information about develop.	1,809,580	0	0	0	103,100	0	1,912,680 25.0
TOTAL	4,421,400	318,780	951,219	734,480	306,089	513,384	7,645,352 100.0
%	63.1	4.2	12.4	9.6	4.0	6.7	100.0

* Specialized Information Analysis Centres.

worldwide recognition. 19/ Territorial Networks may, as part of the network, develop Specialized Information Analysis Centres. But this second function is only viable in cases of limited thematic coverage and requires an information-analysis capacity.

International or regional information systems cannot function properly if they do not have adequate national focal points, with a capacity to feed into the system the national bibliographic information, and to serve as a channel to facilitate the effective use of the system by potential users in the different countries. This "linkage mechanism" is essential to increase both the "input capacity" of the countries of the region, as well as the capacity of the system to provide effective services to potential users in these countries. This leads to the third activity that Information Sciences has been supporting in the region: the development or strengthening of National Sectorial Systems (as in the case of national AGRINTERS).

The fourth type of project that IS has supported in the region has been the experiment to set up Global National Information Systems (Bolivia and Jamaica). Several countries of the region have established such systems but mainly with two objectives in mind: coordination of the different information centres and services existing in the country (with very mixed results), and the development of the necessary infrastructure in the area of information (training, etc.). Like most attempts to develop infrastructure, the results will be seen in a rather long term. But the operational capacity of National Information Systems only exists at the level of Specialized Information Centres or at the level of National Sectorial Networks that exist within them. Experience has shown that projects aimed at the establishment or strengthening of Global National Information Systems are very difficult to manage, and have very limited possibilities of achieving practical results in the short term. On the contrary, the support of National Sectorial Systems or Specialized Information Centres could be a much more effective way of strengthening National Information Systems. But this leads us back to the previous type of project.

The last two types of projects supported by IS in the region are related to particular dimensions of the information process. The first one, which may be labeled "Specific Products", refers to rather small projects that are aimed at responding to very specific information needs of a given country or institution. Examples of this are the preparation of a bibliography, or a cartography project for the purpose of elaborating a set of maps. Since these projects respond to very specific needs, they do not (necessarily) form part of a continuous activity, such as an information system.

19/ OPE is presently carrying out an evaluation of this specialized information centre.

The last type of project that has been supported in the region (in the past) refers to research on specific information aspects, mainly on communications and education. This activity was later transferred to the Social Sciences Division, so it no longer forms part of IS projects.

Table 19 summarizes IS activities in the region, by program area and type of project. As previously pointed out, the support of Territorial (Regional) Information Networks has been the main type of project supported by IS in the region (63% of the funds have gone into this activity). More recently, the support of National Sectorial Systems (the national components of the regional networks) has increased, and by now it represents 12.4% of the total investment. The support of National Global Systems has absorbed 9.6% of IS funding in the region. The other types of projects have received less financial support.

On the basis of the previous observations, two main considerations emerge from this analysis in terms of the type of projects that are being supported: a) Given the central role that Specialized Information Analysis Centres (SIACs) play in providing services to users in specific areas or topics, and considering the rather limited investment that has been made in this type of project (only 4.2%), it seems advisable to emphasize this activity in the region. At the same time, a more functional relationship or integration of SIACs with pertinent Territorial Networks should be promoted. Within the Territorial Networks, whose function is basically related to collecting information, a greater development of SIACs should be promoted according to their particular specialty, oriented towards the production and distribution of services to a specialized clientele. b) The recent trend of increasing the support of National Sectorial Systems (national components of regional networks), should be strengthened. Both suggestions are aimed at improving the link between regional information systems and their potential users.

Finally, two outstanding questions that are receiving increasing attention in the region, for which no adequate reply has yet been found, should be mentioned. Both questions are presently being explored by IS. a) How can information centres or systems respond to the non-bibliographic information needs of policy-makers and decision-makers (i.e. quantitative data, factual information on alternative solutions, etc)? This implies developing the capacity of these centres to handle and process that type of information. b) What are the implications for developing countries of the present revolution in information technology, and how can they cope with, or use, these recently developed technologies? The countries of the region will most likely be making major decisions on this aspect in the near future. The question is whether any input can be made into the decision-making process in order to facilitate more rational decisions.

ANNEXES

- Annex I - Selected Socio-Economic Indicators
by Country of the Region, 1980.
- Annex II - Science Policy Organizations in Latin
America and the Caribbean.

ANNEX I

SELECTED SOCIO-ECONOMIC INDICATORS BY COUNTRY OF THE REGION 1980

COUNTRY	Gross Domestic Product			Contrib. of agricult. sector to G.D.P %	Inflation %	External Sector				Ratio of extern. Public debt service to value Exports of Goods & Services ^{1/} (%)
	TOTAL In million U.S. \$	Average Annual Growth	Per Capita			Value of Exports	Value of Imports	Trade Balance	Balance Payments	
	In millions of U.S. \$									
1. Large Countries:										
- Argentina	148,457	1.0	5,491	12.9	87.6	8,026	9,386	-1,360	-2,668	16.1
- Brazil	237,384	8.0	1,941	7.4	95.3	20,133	22,960	-2,828	-3,371	37.4
- Mexico	163,559	8.4	2,345	8.7	29.8	16,299	19,010	-2,711	1,039	65.5
2. Andean Countries:										
- Bolivia	6,266	0.8	1,125	16.1	23.9	942	680	262	-137	29.6
- Colombia	30,465	4.1	1,181	23.4	26.5	4,113	4,332	-219	1,311	13.4
- Chile	28,336	6.5	2,552	8.5	31.2	4,705	5,469	-764	1,331	26.8
- Ecuador	11,730	4.6	1,462	20.2	14.5	2,530	2,204	326	291	30.0
- Peru	19,116	3.1	1,085	11.6	60.8	3,898	3,062	837	722	22.6
- Venezuela	62,637	-1.2	4,010	6.6	21.6	19,281	11,318	7,963	37	10.4
3. Central America:										
- Costa Rica	4,873	1.2	2,202	17.7	17.8	1,017	1,376	-359	33	23.4
- El Salvador	3,763	-9.0	784	24.4	18.6	963	956	7	-140	2.5
- Guatemala	7,896	3.4	1,087	25.2	9.1	1,520	1,472	48	-252	2.2
- Honduras	2,404	1.3	651	28.1	15.0	835	956	-121	-73	13.1
- Nicaragua	2,531	10.7	926	23.2	24.8	532	953	-421	-169	8.3
- Panamá	3,366	4.9	1,776	14.3	14.4	334 ^{1/}	1,105 ^{1/}	-771	-257	35.1

ANNEX I

SELECTED SOCIO-ECONOMIC INDICATORS BY COUNTRY OF THE REGION 1980

C O U N T R Y	Gross Domestic Product			Contrib. of agricult. sector to G.D.P %	Inflation %	External Sector				Ratio of extern. Public debt service to value Exports of Goods & Service ^{1/} (%)
	T O T A L In million U.S. \$	Average Annual Growth	Per Capita			Value of Exports	Value of Imports	Trade Balance	Balance Payments	
	In millions of U.S. \$									
4. Caribbean:										
- Barbados	769	n.a	3,041	10.8	16.1	189	480	-291	22	2.7
- Guyana	579	n.a	655	18.6	8.5	290 ^{1/}	293 ^{1/}	-3 ^{1/}	-52 ^{1/}	24.4
- Haiti	1,677	5.2	289	39.0	15.3	211	294	-83	-26	4.1
- Jamaica	n.a	n.a	n.a	8.6	28.6	960	1,039	-79	82	17.1
- Dominican Republic	6,409	5.2	1,078	16.6	4.2	962	1,514	-552	44	14.1
- Suriname	n.a	n.a	n.a	n.a	n.a	514	454	60	24	n.a
- Trinidad and Tobago	n.a	n.a	n.a	3.4 ^{1/}	16.6	2,720 ^{1/}	1,850 ^{1/}	870 ^{1/}	835 ^{1/}	2.5
5. Other Countries:										
- Paraguay	4,530	11.4	1,430	31.1	8.9	400	675	-275	153	9.3
- Uruguay	9,467	4.5	3,238	12.6	42.8	1,029	1,490	-461	98	10.3

^{1/} This refers to 1979

Source : Taken from several publications of the U.N. Economic Commission for Latin America (CEPAL), and of the Inter-American Development Bank (IDB).

A N N E X I ISCIENCE POLICY ORGANIZATIONS IN LATIN AMERICA AND THE CARIBBEAN1. National Councils for Science and Technology

<u>Country :</u>	<u>Organization:</u>	<u>Established:</u>
Argentina	Secretaría de Estado de Ciencia y Tecnología.	1968
Brazil	Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq)	1951
Barbados	National Council of Science and Technology	1977
Colombia	Fondo Colombiano de Investigaciones Científicas y Proyectos Especiales (COLCIENCIAS)	1968
Costa Rica	Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICIT)	1972
Chile	Consejo Nacional de Investigación Científica y Tecnológica (CONICYT)	1967
Ecuador	Consejo Nacional de Ciencia y Tecnología (CONACYT)	1981
Mexico	Consejo Nacional de Ciencia y Tecnología (CONACYT)	1970
Peru	Consejo Nacional de Ciencia y Tecnología (CONCYTEC)	1968
Trinidad & Tobago	National Council for Technology in Development	1977
Uruguay	Consejo Nacional de Investigaciones Científicas y Técnicas (CONICYT)	1961
Venezuela	Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICYT)	1968

. Cont. . .

II. Divisions or Offices Within National Planning Agencies.

<u>Country :</u>	<u>Organization :</u>	<u>Established :</u>
Costa Rica	Unidad de Ciencia y Tecnología; Oficina de Planificación Nacional y Política Económica (OFIPLAN)	1979
Dominican Republic	Unidad de Ciencia y Tecnología, Secretariado Técnico de la Presidencia.	1974
El Salvador	Departamento de Ciencia y Tecnología; Ministerio de Planificación .	1974
Guatemala	Unidad de Ciencia y Tecnología; Secretaría General del Consejo Nacional de Planificación Económica.	1974
Honduras	Departamento de Ciencia y Tecnología; Consejo Superior de Planificación Económica.	1975
Jamaica	Office of Science and Technology; National Planning Agency.	1976
Panama	Departamento de Ciencia y Tecnología; Ministerio de Planificación y Política Económica.	1975