SCIENTIFIC RESEARCH AND TECHNOLOGICAL DEVELOPMENT PROGRAM

(CO-0134)

EXECUTIVE SUMMARY

BORROWER:	The Republic of Colombia	
EXECUTING AGENCY:	Instituto Colombiano para el Desarrollo de la Ciencia y la Tecnología "Francisco José de Caldas" ["Francisco José de Caldas" Colombian Institute for Scientific and Technological Development] (COLCIENCIAS)	
AMOUNT AND SOURCE:	IDB:	US$100 million (OC)
	Local counterpart funding:	US$119 million
	Total:	US$219 million
FINANCIAL TERMS AND CONDITIONS:	Currency pool:	US$70 million
	Amortization period:	25 years
	Commitment period:	3 years
	Disbursement period:	4 years
	Interest rate:	variable
	Inspection and supervision:	1%
	Credit fee:	0.75%
	Dollar window:	US$30 million
	Amortization period:	10 years
	Commitment period:	21 months (from date of loan approval)
	Disbursement period:	2 years (from date of loan approval)
	Grace period:	5 years
	Interest rate:	fixed
	Inspection and supervision:	1%
	Credit fee:	0.75%

OBJECTIVES:

The program's general objective is to strengthen the country's capacity in science and technology and to increase the competitiveness and productivity of business within a framework of sustainable development.

To that end, the program will be instrumental in developing a modern scientific and technological infrastructure that, as an integral part of the national innovation system, furthers national efforts to develop scientific and technological information and to make science and technology part of the various activities and sectors of society.

DESCRIPTION: The program is organized into four subprograms: (a) innovation and development in the productive sector; (b) promotion of research at nonprofit centers and institutes; (c) training of human resources and strengthening of the scientific community; and (d) support for scientific and technological information and dissemination systems.

ENVIRONMENTAL CLASSIFICATION: The Environment Committee, at its meeting of April 19, 1994, classified this as a Category II operation.

IMPACT ON POVERTY: The program will be specifically geared toward improving and strengthening the national capacity to develop, absorb, adapt and employ science and technology. Therefore, the operation does not meet the criteria defined by the Bank's Eighth Replenishment for poverty-reduction operations.

BENEFITS: The program will strengthen Colombia's capacity in science and technology, by consolidating what was accomplished under the two previous programs. This program was especially designed to heighten the relevance of research projects, encourage associations between research centers and potential users of research findings, and further innovation and technological development within the businesses themselves.

The economic analysis of this operation found that the components or subprograms to be financed yield considerable benefits, an indication of how important it is that Colombia earmark more funds for science and technology, corroborating the findings described earlier about the overall benefits of the program for the country.

As a result of the program, COLCIENCIAS will consolidate its position as a pivotal institution for technological innovation in Colombia.

RISKS: While strengthening the country's scientific and technological capacity is essential to its modern development, that alone will not suffice. The demand and interest among its productive agents will have to be energized for the scientific and technological capacity to bring about the desired benefits. Hence, a set of simultaneous activities have been planned to promote, foster and facilitate the association between businesses, especially the smaller businesses, and the sources of scientific and technological know-how and information.

From the institutional standpoint, the program could be up against two related risks: (i) the current capacity of COLCIENCIAS; and (ii) institutional backing. As for current capacity, the study conducted indicates that with the organizational changes introduced, the proposed strengthening activities, and the hiring of specialized outside assistance, COLCIENCIAS will be able to execute the program within the planned time frames. The program enjoys widespread institutional support. The national government has given science and technology a key role in the Política del Salto Social [Social Leap Policy], as crucial to the internationalization of the economy.

The financial risk for the program is basically whether the counterpart resources will be provided on schedule. The funds for the 1995 and 1996 budgets have already been approved and amply cover the counterpart requirements, thereby reaffirming the government's commitment.

Given the institutional changes already introduced and the financial management measures planned, COLCIENCIAS will be able to absorb the expansion of its operations.

EXCEPTIONS TO BANK POLICY:

It is recommended that consulting services contracts of up to US$50,000 financed with Bank resources be awarded in accordance with national law. The executing agency will inform the Bank of these contracts (see 3.37).

THE BANK'S COUNTRY AND SECTOR STRATEGY:

The program is consistent with the Bank's strategy in the country, which is supportive of the policy of modernizing and opening up the economy. The national government has devised an active policy in science and technology geared toward increasing productivity and upgrading the quality of its productive sectors, both conditions essential to its competitiveness at home and abroad.

SPECIAL CONTRACTUAL CONDITIONS:

1) Prior to the first disbursement of the financing, the borrower, through the executing agency, will present the following evidence to the Bank: (a) that COLCIENCIAS has put into practice the program's operating regulations (see 3.5); and (b) that the borrower has opened a special account in which the proceeds from the loan will be deposited (see 3.1).

2) Prior to the first disbursement of the funds for the component involving scholarship loans for postgraduate studies, the executing agency must

present to the Bank the contract concluded with ICETEX [Colombian Institute for Technical Studies Abroad] for joint administration of this component, and the contracts concluded between COLCIENCIAS, ICETEX and at least two international agencies for management and administration of the scholarship loans awarded (see 3.29).

3) Prior to the first disbursement of the funds from the dollar window for the component involving technological innovation projects, the executing agency must present to the Bank the regulations of the trust fund and the contract concluded between COLCIENCIAS and at least one financial intermediary for management of the financing facility for the productive sector, which must be patterned after the model agreed upon with the Bank (see 3.10).

4) (a) As of the first year of program execution, counted from the date of signature of the loan contract, the executing agency will present annual reports detailing its progress in carrying out each component (see 3.43); (b) the borrower and the Bank will perform interim evaluations of the program 12 and 24 months from the date of the contract to verify fulfillment of the goals and, in particular, the performance of the financing facility for the technological innovation projects component, and will recommend measures to be taken and any necessary adjustments and corrections (see 3.43); and (c) beginning with the second year from the date of the final disbursement of the financing, the executing agency will submit an ex post evaluation report on the results of the program, conducted by an independent agency, using methodology and guidelines agreed upon with the Bank (see 3.45).

5) The Bank may recognize up to US$15 million in expenditures incurred after May 24, 1994, against the local contribution (see 3.40).

6) Within six months after the date of the contract, evidence will be provided that the external advisory and monitoring committee (CEAS) has been formed, which will meet each year from the date of the contract for the duration of program execution (see 3.44).

7) The financial statements of the program and of the executing agency, audited by the Office of the Comptroller General of the Republic or by a firm of

independent public accountants acceptable to the Bank, are to be submitted within 180 days after the close of the executing agency's fiscal year (see 3.46).

Note: The draft loan contract is available to the Executive Directors upon request.

I. FRAME OF REFERENCE

A. Introduction

1.1 At the end of the last decade, Colombia embarked upon an ambitious program to open up and modernize the economy. It adopted a new development model based on internationalization of its economy, reorganization and modernization of the State apparatus and the private sector's leading role in increasing the national productive sector's competitiveness.

1.2 The initial macroeconomic results of this openness are, in general, quite favorable. The rate of economic growth increased significantly, from 2.0% in 1991 to 5.7% in 1994; investment began to grow rapidly in 1992 and by 1994 was over 20% of GDP, one of the highest levels in 25 years; the unemployment rate dropped from 10.5% in 1990 to 8.9% in 1994, with a parallel decline in the numbers of those working in the informal sector in the major cities; the budget improved significantly, from a deficit of 0.3% of GDP in 1990 to a surplus of 2.6% in 1994, while inflation dropped from 32.4% to 22.6% in the same period.

1.3 The country's relative economic and financial stability in recent decades is also evident in the marked improvement in the major social indicators. For example, infant mortality dropped from 123 per 1,000 live births in 1970 to 29.4 per 1,000 in 1986-89; the gross coverage rate for elementary education increased from 69.4% in 1970 to 87.7% in 1990; and the percentage of the population with unmet basic needs dropped from 72.5% in 1972 to 34.2% in 1994, although the gap between rural and urban incomes widened.

1.4 The long-term sustainability of the new economic model and consolidation of the social advances achieved depends in large part on the Colombian economy's capacity to cope with the new challenges posed. That capacity, in turn, relies on Colombian businesses' ability to compete in an ever more dynamic global economy. This means that the country has to develop an infrastructure able to generate and collect information, support increased investment in technological innovation, and help educate the qualified human capital needed to carry the productive modernization process forward.

1.5 To enhance businesses' capacity for technological management so that they can do more in the area of investment and in the development of new products and processes, an innovation system has to be devised that provides businesses with the technological support and productive services they need and promotes interaction with universities and other entities that generate knowledge. It also means strengthening the national quality system and the intellectual property protection system.

B. The National Science and Technology System

1.6 Created in 1968, the main function of Instituto Colombiano para el Desarrollo de la Ciencia y la Tecnología [Colombian Institute for Scientific and Technological Development] (COLCIENCIAS) has been to finance projects in basic and applied research. The National Science and Technology Council is the government agency responsible for establishing policies and coordinating activities in this field.

1.7 Law 29, enacted in 1990, created the National Science and Technology System [Sistema Nacional de Ciencia y Tecnología] (SNCT), which made the productive sector part of a network consisting of various sectors of the State and public and private institutions and centers of scientific research and technological development.

1.8 Under this institutional scheme, the National Science and Technology Council is responsible for coordinating the SNCT and preparing policies and programs in scientific and technological development. Eleven national councils were also created, classified by productive sector or area of science, and serve as the pipeline for an increasing percentage of public funding for research. In the changes introduced since 1990, COLCIENCIAS was attached to the National Planning Department [Departamento Nacional de Planeación] (DNP) and became the technical secretariat of the National Science and Technology Council.

C. Summary of the diagnosis of the existing situation

1.9 In the last year, several more analyses were done of the state of scientific and technological development in Colombia and its capacity to affect the country's development. First, the Science, Education and Development Mission (hereinafter "the mission"), appointed by President Gaviria, did a detailed sector study whose chief recommendations have been incorporated into the present administration's plans. Evaluations were done of the results and effects of the earlier programs financed with Bank participation. In addition, an IDB technical-cooperation operation financed a group of Canadian consultants who did a study of the areas of action that COLCIENCIAS is presently funding, the development plans under way and the proposals for a third program with Bank financing.

1.10 All the studies agree that while Colombia has been making important efforts to improve its capacity to generate and apply scientific and technological knowledge and know-how – with major support from the Bank – the challenges of the new development model are such that immediate action must be taken to correct certain significant weaknesses in the SNCT and its performance.

1.11 The mission summarized its diagnosis with a list of the main factors inhibiting scientific and technological development in Colombia. Prominent among them was the low level of investment in science and technology, the insufficient number of researchers and qualified human resources, the productive sector's low capacity for innovation and the limited correlation between the supply and demand for information and technology.

1.12 According to current estimates, there are nearly 5,000 scientific and technological researchers in Colombia (180 per million inhabitants), fewer than half of whom have postgraduate education. This figure is less than one tenth of what it is in the industrialized countries and less than what it is in the newly industrialized countries of East Asia, where there are over 1,000 researchers for every million inhabitants. It is also lower than the ratio in countries like Argentina, Brazil, Chile and Mexico (see Annex I-1).

1.13 The development of the newly industrialized countries shows how important it is to build national innovation systems that not only support the education of qualified human resources and scientific and technological research, but also the modernization of their productive apparatus by a set of measures aimed at promoting technological dissemination and innovation, particularly among their small and medium-sized businesses.

1.14 Colombia's agricultural sector, led by Instituto Colombiano Agropecuario [Colombian Agricultural Institute] (ICA) 1/ and the Federación de Cafeteros [Coffee Growers' Federation], has made the greatest efforts in applied research and has seen the best returns. The sector also has specialized centers, such as Centro Nacional de Investigaciones del Café [National Coffee Research Center] (CENICAFE), Centro Nacional de Investigaciones de la Caña de Azúcar [National Sugarcane Research Center] (CENICAÑA) and Centro Nacional de Investigaciones de la Palma [National Palm Research Center] (CENIPALMA). In the industrial sector, Instituto de Investigaciones Tecnológicas [Technological Research Institute] (IIT) was closed in 1991 and only recently have efforts gotten under way to promote the creation of specialized technology centers sponsored by business associations.

1.15 There are still some problems with the way in which the SNCT is operating. These include: a limited capacity for planning, monitoring and evaluating the research being funded through the SNCT; compartmentalization of sector research budgets; the slow pace at which applications for funding are processed and approved;

1/ Recently ICA was reorganized and its research activities were transferred to Corporación de Investigación Agropecuaria [Agricultural Research Corporation] (CORPOICA), set up as a mixed enterprise with business-sector participation.

and the fact that the national sector councils are not adequately integrated into the programming units of the corresponding ministries.

1.16 Investment in Colombia's scientific and technological development, the size of the scientific community and its technological infrastructure are clearly inadequate for a country of its size and level of relative development. Public investment in this field has hovered at barely 0.3% of GDP in recent years. When public investment is combined with private investment in science and technology, technology transfer programs, international technical cooperation and the costs of operating the system, the investment represents only 0.5% of GDP. This is quite low when compared with the investment figures in industrialized countries with more dynamic economies (where investment levels range between 2% and 4% of GDP); it is even low in comparison with investment in some Latin American countries, where it approaches 1% of GDP.

D. The government's science and technology policy

1.17 One of the linchpins of the present government's development strategy, called "El Salto Social" [the Social Leap] is promotion of scientific and technological development as a critical element in the policy of economic competitiveness and internationalization. Under this policy of promoting competitiveness, five special programs are being launched and consolidated: the national science and technology policy; the strategic export plan; the agricultural and rural modernization policy; the industrial modernization policy; and infrastructural strengthening.

1.18 With that framework, the government devised the current 1994-1998 science and technology policy, which the Consejo Nacional de Política Económica y Social [National Economic and Social Policy Institute] (CONPES) approved in November 1994. This new policy picks up on the recommendations made by the mission carried out between November 1993 and August 1994 and involves five main strategies: (i) development and strengthening of the national capacity in science and technology; (ii) innovation, competitiveness and technological development; (iii) enhancement of the capacity to improve social services and generate information about the situation of the country; (iv) generation of knowledge for sustainable development; and (v) integration of science and technology into Colombia's society and culture.

1.19 Using the strategies of the new science and technology policy, a plan of action has been devised that includes, *inter alia*, the following components:

a. Total investment (public and private) in science and technology is to increase from 0.5% of GDP to 1% of GDP between 1994 and

1998. As part of that effort, COLCIENCIAS' 1995 and 1996 budgets have been substantially increased and their continued increase thereafter is planned.

b. An ambitious high-level training program in various areas of science and technology will help educate some 2,000 people at the postgraduate level (mainly doctorates) in the next four years.

c. The programs to consolidate Colombia's scientific community will be strengthened by supporting research centers and groups and by establishing a program of incentives for researchers.

d. Colombian researchers will have access to international networks and collaborative research programs.

e. Financing facilities for innovation and technological development in the productive sector, available at COLCIENCIAS, Instituto de Fomento Industrial [Industrial Development Institute] (IFI) and other agencies in the financial system, will be increased.

f. Innovation networks will be developed to provide technological support to businesses. Centers of productivity and technological development that perform research- and information-related functions or supply technological services and training will be promoted.

g. A system of fiscal incentives will be devised to promote private innovation, quasi-fiscal funds will be created and cofinancing mechanisms will be established to strengthen relations between universities and businesses.

h. Programs to improve the efficiency and effectiveness of policies in social development, conservation and sustainable use of the environment, and biodiversity will be supported.

i. Scientific and technological activities will be decentralized to ensure more balanced regional development and to make the benefits of science and technology more accessible.

j. The national scientific and technological information system will be developed and consolidated and research on the impact of technological changes on Colombian society and its economy will be fostered.

k. Wider dissemination and social understanding of science and technology and its use in the daily life of Colombian society and culture will be developed and promoted.

E. Previous Bank programs

1.20 The Bank has financed two operations for Colombia's scientific and technological development: 109/IC-CO, 588/OC and 835/SF-CO, both through COLCIENCIAS. The first of these loans, primarily for financing projects in universities and other academic institutions, helped create and consolidate the institutional bases of scientific activity in the country. The second program was broader in scope and, in addition to financing for research in academic institutions, included funding for projects in private enterprise, for educating researchers in doctoral programs and for launching a program to disseminate and popularize the sciences. Annex I-2 includes a summary of the activities carried out under this program.

1.21 Both programs were adequately executed. Their results and impacts have been evaluated by consultants hired for that purpose by COLCIENCIAS and the DNP 2/. The consultants all agree that scientific activity in Colombia has grown, developed and matured in the last ten years; however, they also point out that the scientific work being done does not address the demands of the productive sector, which until just recently showed little interest in developing its capacity for innovation.

1.22 Execution of these programs was aided by a remarkable continuity in the policies of the Colombian government's four administrations. The first program was launched during the administration of President Betancourt. When that program was completed, the administration of President Barco designated a science and technology mission to examine the status of the sector and propose a medium-term strategy. The mission's chief proposals, which included an institutional reorganization and creation of the National Science and Technology System, were adopted by the next administration. As explained earlier, in the last year of the administration of President Gaviria, an education, science and development mission was formed. Its findings laid the groundwork for the present administration's policy on science and technology, including the proposal of a third operation with the Bank in this field.

1.23 The process of strengthening COLCIENCIAS as an agency that promotes and coordinates scientific and technological research in Colombia began with the first program. The funding of research through

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2/ Reports of the *Centro Nacional de Consultoría* [National Center for Consulting Services] *Evaluación del Programa BID – Primera Etapa* [Evaluation of the IDB Program – Phase One] and *Evaluación del Programa BID – Segunda Etapa* [Evaluation of the IDB Program – Phase Two]; Adriana Cuervo and David Melo, *Seguimiento y Evaluación Ex Post del Crédito BID II* [Follow-up and Ex Post Evaluation of IDB Loan II]. Copies of these reports are in the files of RE3/SO3.

projects subject to peer review was one of the factors most instrumental in helping research groups to mature.

1.24 The second program built upon the first program's achievements and launched an ambitious program to educate researchers, which will continue under the program proposed in this document. As mentioned earlier, Colombia's scientific community is relatively small for a country of its size and the government has decided to promote a set of measures to correct this anomaly. With the consolidation of research groups in Colombia, doctoral programs have been launched in such disciplines as chemistry, physics, biomedical sciences, chemical engineering and hydraulic engineering.

1.25 The second program financed 50 technological innovation projects presented by businesses, thereby establishing COLCIENCIAS' association with the productive sector, which will grow in the years ahead. However, the research groups in universities did not develop ties with businesses, something that COLCIENCIAS hopes to correct with policies designed for that purpose.

F. Preparation of the program

1.26 The experience gained under the previous programs and the papers done to review and put together the national science and technology policy, described in previous sections, were all used in the process of designing this program. COLCIENCIAS was in charge of developing a proposal that would make that science and technology policy part of a plan of action aimed at promoting technological development and innovation in the productive sector, strengthening Colombia's scientific community, supporting the scientific and technological information systems, and expanding activities to popularize and disseminate science and technology in society.

1.27 To prepare the program, consulting services were hired using resources of COLCIENCIAS and the Bank. COLCIENCIAS hired consultants who examined the size of the program based on estimated demand and the changes needed in the agency's structure for it to manage and execute the program with optimum efficiency; the Bank financed consulting services to advise COLCIENCIAS in how to prepare its proposal to fit into the Colombian government's scientific and technological development plan. COLCIENCIAS did a thorough analysis of the program's features and made specific recommendations regarding its design, organization and execution.

1.28 The program's design takes into account the need to take action on the major problems identified, through specific subprograms for: (i) promoting innovation and technological development within the productive sector; (ii) developing research capability both quantitatively and qualitatively, by strengthening universities and research centers; (iii) strengthening and expanding the Colombian

scientific community; (iv) developing a scientific and technological information system; and (v) promoting the dissemination and popularization of science and technology within Colombian society.

II. THE PROGRAM

A. Objectives of the program

2.1 The program's general objective is to strengthen the country's capacity in science and technology and to increase businesses' competitiveness and productivity, all in the context of sustainable development.

2.2 To that end, the program will be instrumental in developing a modern scientific and technological infrastructure that supports national efforts to generate information and to integrate science and technology into the various activities and sectors of society.

B. Organization of the program

2.3 To accomplish the objectives, the activities of the program are organized into four subprograms:

a. support for technological development and innovation in the productive sector;
b. promotion of research at nonprofit centers and institutes;
c. training and strengthening of the scientific community; and
d. dissemination and popularization of science and technology and scientific and technological information systems.

2.4 Each subprogram and its dimensions are described below:

1. Subprogram I: Support for technological innovation and development in the productive sector (US$60 million)

2.5 The purpose of this subprogram is to promote technological modernization and innovation in the country's businesses. The subprogram includes the following components: reimbursable financing for technological development and innovation projects in private businesses, nonreimbursable financing to create a network of sectoral technological centers put together with the help of the respective business sectors, and cofinancing of research and development projects carried out jointly by businesses and universities or other research centers.

a. Reimbursable financing for technological innovation projects (US$45 million)

2.6 The resources of the program will be used to operate a reimbursable financing facility on market terms for projects in innovation, technological development or modernization of the infrastructure needed to introduce new technologies. This facility can be used by Colombian businesses for any of the following activities: developing new products or processes or improving or modernizing

existing ones, establishing experimental technological development units in businesses, creating standardization or quality certification programs, and developing specialized software or installing specialized data systems.

2.7 This financing facility will supplement existing facilities in Colombia that target other aspects associated with technological modernization, but preferably with a focus on the productive phases. This component is restricted to the precommercial phases of technological development that are not being addressed by other entities within the financial system.

b. Sectoral technological centers (US$7 million)

2.8 This component will help create a system of sectoral technological centers sponsored by business groups or trade associations within a given productive sector.

2.9 The technological centers promoted by COLCIENCIAS will address the technical support needs of businesses in various branches of production, with particular emphasis on the needs of small and medium-sized business establishments. At the outset, they will have a minimum physical infrastructure and will serve mainly as specialized technical information centers and will match businesses' needs with the specialized technological capacity available in research centers, universities, consulting firms and other businesses.

2.10 The centers will begin with a minimum corps of professionals that can be developed to meet the businesses' demands. Their future evolution will depend on the sector's technological needs and specific problems.

2.11 These centers are being created to fill the void left when IIT closed. The success of the sectoral technological centers in the agricultural and agroindustrial fields, such as CENICAFE, CENICAÑA, and CENIPALMA, was also a consideration.

2.12 As the program was being prepared, COLCIENCIAS called for tenders for establishment of sectoral technological centers. The best designed and developed technically and financially were selected. Particular attention was given to the sponsor group's pledges of matching contributions and to evidence of financial sustainability. The following sectoral centers have been selected: Centro Tecnológico en Metalmecánica y Metalurgia [Technological Center in Machine Tooling and Metallurgy]; Centro de Servicios Tecnológicos para la Industria del Cuero y el Calzado [Technological Services Center for the Leather and Footwear Industry]; Centro de Investigaciones y Desarrollo Tecnológico Textil [Textile Research and Technological Development Center]; Centro Tecnológico de Pulpa y Papel [Pulp and Paper Technological Center]; Centro de Productividad y Desarrollo Tecnológico de la Industria Gráfica [Graphics Industry Productivity

and Technological Development Center]; Centro de Investigación y Desarrollo Tecnológico en Alimentos [Foodstuffs Research and Technological Development Center]; and Instituto de Capacitación e Investigación del Plástico y del Caucho [Plastics and Rubber Training and Research Institute]. During the program's execution, centers can be added to address other sectors of production.

2.13 The system of sectoral centers that the program will cultivate will be in addition to the business development centers created in the country's five major cities with technical-cooperation funding from the MIF to develop services that make small businesses more competitive.

2.14 COLCIENCIAS will promote coordination among the various sectoral technological centers and between the latter and the business development centers. Among the various coordination activities, COLCIENCIAS will sponsor the training of technical and management personnel for the network of centers. To organize these courses, COLCIENCIAS has requested assistance from similar networks of technological centers in other countries and will contract specialists so that it can offer a set of courses especially planned to form the technical basis of the network of centers.

c. Cofinancing of projects carried out jointly by businesses and research centers (US$8 million)

2.15 To promote the association between the research centers and businesses, COLCIENCIAS will grant nonreimbursable cofinancing for a portion of the cost (matching grants) to projects presented by private businesses that would be carried out in universities, research centers or other nonprofit institutions in Colombia.

2. Subprogram II: Promotion of research at nonprofit academic centers and institutions (US$74 million)

2.16 The purpose of this subprogram is to build up the research capacity and to generate information useful to society. The financing will be largely geared toward promoting applied research related to the specific demands of the potential users of the research findings. However, recognizing how important it is to stay current in the principal scientific disciplines, up to 20% of the subprogram's resources will be earmarked to finance basic research.

2.17 The subprogram is targeted at nonprofit public and private institutions, including universities, research institutes and public and private technological development centers. In all cases, the loans will be granted through competitive selection processes that will be decided on the basis of peer review by Colombian and foreign specialists.

2.18 The subprogram includes two components: (i) support for research projects and programs; and (ii) institutional support to strengthen research groups.

a. Support for research projects and programs (U$66 million)

2.19 This component will fund basic and applied research projects identified from proposals presented either at the initiative of the scientific community or in research competitions organized on specific themes. The themes of the competitions will be decided by the SNCT's national program councils. Projects must be presented according to procedures and deadlines that COLCIENCIAS will announce with sufficient notice.

2.20 The selection of the projects to be funded will be made on a competitive basis, following routine practices for activities of this type. Proposals found to meet the formal requirements will be sent to two or three Colombian or foreign experts for review. To facilitate this process, COLCIENCIAS will keep an up-to-date record of evaluators, classified by their area of specialization.

2.21 While the program was being prepared, COLCIENCIAS analyzed a sampling of projects evaluated according to the criteria that will be used during program execution.

b. Institutional support to strengthen research groups (US$8 million)

2.22 The project financing just described will be the principal method that COLCIENCIAS will use to promote, steer and coordinate scientific research. To further the consolidation of research groups comprising specialists in related disciplines, special institutional supports will be arranged that are not to be used to finance specific projects but rather to purchase equipment the group will share, additional reading materials and computer equipment and to underwrite the expenses of exploratory research work that may serve as the basis for future projects.

2.23 In selecting which groups will receive institutional support, the following factors will be weighed: the relevance of a group's research, the group's impact on its respective discipline, the quantity and quality of the researchers, publications and patents, record of research findings passed along to society, experience in training young researchers, the group's involvement in national and international research networks, skill in resource management and a commitment to negotiate sources of funding that will ensure the group's continuity and sustainability.

3. Subprogram III: Training of human resources and strengthening of the scientific community (US$40 million)

2.24 This subprogram has been designed to strengthen the Colombian scientific community's research capacity, in accordance with the guidelines of the science and technology policy approved by CONPES and the plan of action adopted by the National Science and Technology Council. The subprogram includes the following components: support for training researchers by awarding scholarship loans to pursue postgraduate studies in Colombia and abroad; institutional support to consolidate doctoral programs to educate researchers; financing of internships and nondegree training programs to help researchers and experts pursue specialized studies; strengthening of the researchers' incentives program; and promotion of an association between foreign researchers and Colombian researchers living abroad.

a. Scholarship loans for postgraduate studies (US$23.6 million)

2.25 The program will provide financing to 550 researchers to pursue postgraduate degrees in Colombia and abroad. These two methods will complement each other. Study within the country, when feasible, has cost advantages and allows the degree candidate to stay in contact with the national community, thereby obviating the problems associated with rejoining and readapting to one's community after a period abroad. However, advanced degrees are not available in Colombia in a number of disciplines and areas of specialization. In such cases, candidates would study at prestigious international centers. For many candidates, "sandwich" programs can be organized, whereby arrangements are made so that part of the training is done in Colombia and the other in a suitable institution abroad. This method was successfully employed during the execution of the COLCIENCIAS-IDB II program.

b. Nondegree training and specialization programs (US$5.7 million)

2.26 The program will finance postdoctoral internships at foreign institutions for periods ranging from six to 24 months, short internships to attend seminars or for training in special techniques, and internships for advanced students or young graduates at national laboratories recognized for their training of researchers.

c. Institutional support for Colombian postgraduates (US$2.8 million)

2.27 Program resources will be used to provide institutional support for doctoral programs accredited by Instituto Colombiano para el Fomento de la Educación Superior [Colombian Institute for the Advancement of Higher Education] (ICFES), in accordance with

recently enacted legislation. Also, COLCIENCIAS will evaluate the quality of the doctoral programs designed to train researchers. Based on that evaluation, program resources may be used to provide institutional support. In 1994, COLCIENCIAS used a total of US$1 million of its own funds to support 11 programs, including doctoral programs in physics, chemistry, biomedicine, and chemical and hydraulic engineering. During the program's execution, doctoral programs in mathematics, biology, agricultural sciences, education and economics would be instituted that could be eligible to receive institutional support.

d. Researchers' incentives program (US$5.2 million)

2.28 In 1994 COLCIENCIAS introduced a program of financial incentives to researchers, designed to ensure that talented researchers are able to continue their work by means of a system that rewards productivity. In 1994, 158 researchers were selected after their qualifications were reviewed by peer committees. With proceeds from the program, the number of researchers who receive incentives will gradually be increased, while strict eligibility requirements are maintained. An annual net increase of 50 researchers is planned for the years from 1995 to 1999.

e. Visiting researchers program (US$2.7 million)

2.29 The program will finance relatively lengthy visits by some 55 researchers, either Colombians or foreigners, who have been absent from the country for over five years. The program will finance the travel and a one-to-two-year stay in Colombia. This program complements others that are financed exclusively with COLCIENCIAS' resources, such as the Caldas Network – used to stay in constant touch with Colombian scientists abroad – and the repatriation and immigration programs for researchers.

4. Subprogram IV: Science and technology information and dissemination systems (US$18.7 million)

a. National scientific and technological information system (US$8.7 million)

2.30 This component will further the development and consolidation of the national scientific and technological information system by financing the following activities: development of specialized sectoral scientific and technical information systems; further development of statistics and indicators on scientific and technological activities; support for scientific and technical information services; expansion of the telematic infrastructure for scientific and technical information from the Scientific Educational, and Technological Network [Red de Ciencia, Educación y Tecnología] (CETCOL); and research projects on information policies.

b. Dissemination and popularization of science and technology (US$10 million)

2.31 The objective of this component is to increase society's understanding of science and technology and to publicize the scientific and technological work being done in Colombia. The activities financed under this component include: designing specialized materials to improve science teaching and educational software; promoting scientific and technological dissemination programs in the mass media; supporting science fairs and science museums; and improving the quality and scope of Colombia's scientific and technical publications.

C. Size of the program

1. Support for technological development and innovation in the productive sector

2.32 The size of the subprogram for technological innovation in the productive sector, for a total of US$60 million, including US$45 million for loans, was determined on the basis of a representative sample of projects received and processed by COLCIENCIAS, in combination with a survey of 480 businesses in the industrial and agricultural sectors. The sample includes a total of 100 innovation projects presented, the total amount requested being US$25 million (more than 40% of the subprogram). COLCIENCIAS has already processed 45 of these projects, involving US$15 million (25% of the component); the outside technical evaluations required under the existing project evaluation system have already been completed. Out of this set of projects, an economic analysis was done of a representative sample that was equivalent to 8% of the reimbursable financing component and 13% of the nonreimbursable financing components, selected on the basis of size and sector of economic activity. The results of the economic evaluation of the representative sample were positive, with high economic internal rates of return anticipated in all the cases examined. Based on the business survey conducted, there are 235 profiles of projects valued at over US$75 million, so that the demand for credit is definitely sufficient to warrant the scale of the subprogram.

2. Research at nonprofit centers and institutes

2.33 The scale of the subprogram to finance research projects at nonprofit institutions (academic sector) was determined by analyzing the portfolio of projects presented this year.

2.34 Between November 1994 and April 1995, COLCIENCIAS received 287 proposals from universities and other nonprofit research institutions applying for contingent-recovery loans. They totalled US$30 million. Of that amount, projects valued at US$14 million have already been given a favorable evaluation and are eligible for

funding. Based on statistics, it is estimated that when the evaluation process is completed another US$12 million in projects will be eligible to receive funding.

2.35 The analysis of this representative sample found a projected demand for financing of US$26 million per semester. During execution of the program, as the researchers who are completing their doctorates return, demand for project funding is expected to increase gradually. Therefore, the size of the component, planned at US$66 million, is conservative, well below the anticipated demand, so that a good selection system can be instituted.

3. Training

2.36 The goal of the science and technology policy approved by the government for 1994-1998 is to educate 2,000 professionals at the doctoral level through all the programs planned in Colombia and abroad. With this program, COLCIENCIAS will help finance one quarter of this goal. The rest will be covered under ICETEX programs or international cooperation programs. During the program's preparation, a study was done of the anticipated demand among Colombian universities for researchers and professors with doctorates. Using surveys and interviews, this study examined the requirements of 14 Colombian universities and found a demand for 500 new professors with doctoral degrees. It is important to bear in mind that only 2.4% of Colombia's university professors have doctoral degrees and 12.8% have master's degrees. A process has gotten under way to evaluate and rank universities and raise the academic qualifications required of their teaching staff. The demand figures in this study should be regarded as only a small portion of the total demand. Apart from university demand, one must also consider the demand arising from the technological modernization programs launched by businesses and public institutions.

4. Science and technology information and dissemination system

2.37 To determine the scale of this subprogram, the costs of the previously identified activities were computed and were found to be reasonable.

D. Cost and financing of the program

2.38 The program's total cost was estimated at the equivalent of US$219 million. The US$100 million that the Bank would lend includes US$70 million from the ordinary capital resources and US$30 million from the "dollar window" to be used for loans to the productive sector. Table II-1 breaks down those costs and their sources of financing:

TABLE II-1
PROGRAM COSTS
(Figures in thousands of US$ equivalent)

Category	TOTAL BY SOURCE				%
	IDB		LOCAL	TOTAL	
	Ordinary capital	Dollar window			
1. ADMINISTRATION	1,520	0	2,780	4,300	2.0
2. DIRECT COSTS	63,350	30,000	99,350	192,700	88.0
2.1 Support to the productive sector	0	30,000	30,000	60,000	27.4
2.2 Support to the academic sector	42,000	0	32,000	74,000	33.8
2.3 HR training	15,000	0	25,000	40,000	18.3
2.4 Information and dissemination	6,350	0	12,350	18,700	8.5
3. ASSOCIATED COSTS	2,130	0	870	3,000	1.4
3.1 Institutional strengthening	2,130	0	870	3,000	1.4
SUBTOTAL	**67,000**	**30,000**	**103,000**	**200,000**	**91.3**
4. UNALLOCATED	2,000	0	1,829	3,829	1.7
4.1 Contingencies	650	0	806	1,456	0.7
4.2 Cost escalation	1,350	0	1,023	2,373	1.1
5. FINANCIAL COSTS	1,000	0	14,171	15,171	6.9
5.1 Interest	0	0	12,587	12,587	5.7
5.2 Credit fee	0	0	1,584	1,584	0.7
5.3 Inspection and supervision	1,000	0	0	1,000	0.5
TOTAL	**70,000**	**30,000**	**119,000**	**219,000**	**100.0**
% per source	32.0	13.7	54.3	100.0	

III. INSTITUTIONAL FRAMEWORK AND EXECUTION OF THE PROGRAM

A. Institutional framework

1. Borrower and executing agency

3.1 The borrower will be the Republic of Colombia and the executing agency Instituto Colombiano para el Desarrollo de la Ciencia y la Tecnología "Francisco José de Caldas" ["Francisco José de Caldas" Colombian Institute for Scientific and Technological Development] (COLCIENCIAS). Prior to the first disbursement, the borrower is to provide evidence, to the Bank's satisfaction, that an agreement has been reached on the mechanism to be used to transfer the proceeds from the loan to COLCIENCIAS, through a special, foreign currency account in the executing agency's name at Banco de la República. The proceeds from the loan will be deposited in that account.

3.2 The program will be carried out in the context of the SNCT (see paragraphs 1.6 to 1.8). The 11 national councils will participate and will be responsible for selecting projects and determining the direction of the activities in each technical area.

3.3 COLCIENCIAS will execute the program's activities through the various units in its organizational structure. That structure will be amplified by hiring specialized services to evaluate and manage the loans, administer grants, and evaluate projects. In late 1994 COLCIENCIAS was reorganized to strengthen its capacity to handle the increased functions and responsibilities involved in executing policy in this field. The new structure is better suited to its programmatic nature and to the additional internal and external coordination required. Apart from a new organizational structure, the reorganization has introduced changes in methodological approaches and administrative practices, all designed to make operations more efficient.

3.4 COLCIENCIAS was executing agency for two earlier programs involving IDB financing. While the evaluations of these programs indicate that COLCIENCIAS' performance was adequate, the role that the Colombian government has given to it under the "Salto Social" program will mean a substantial increase in the resources to be managed by the institution. Therefore, in preparation for the program, the operating structure of COLCIENCIAS was evaluated for its future program of operations and found to be adequate to its needs.

2. Modalities of financing

3.5 The resources of the program will be channeled to the beneficiaries via four different modalities: (i) loans that must be repaid; (ii) contingent-recovery loans; (iii) mixed; and (iv) cofinancing.

All four modalities will be used to finance projects in technological development and innovation in the productive sector, while the contingent-recovery approach will be used for the projects under the remaining subprograms. The operating regulations will govern the corresponding applications and will include the standards, guidelines and procedures for execution of each subprogram. These regulations have already been prenegotiated with the executing agency and must be in force prior to the first disbursement.

3. Administration of the program and institutional strengthening of COLCIENCIAS

3.6 COLCIENCIAS will be in charge of the program's administration, having established the responsibilities of each internal unit and identified the activities that the outside experts, both individual and institutional, will perform. Technical assistance agreements are expected to be concluded with various universities so that experts in different areas may assist in the evaluation of research programs. Evaluators will also be hired for the technical aspects and for the economic, financial and institutional evaluation. Activities are planned to promote the borrowing facilities. The services of a financial intermediary will be retained for administration of the financial-management aspects of the subloans.

3.7 Consulting services will be contracted for the two lines of action planned to strengthen COLCIENCIAS: to reinforce the institution's strategic planning and to put together new manuals of procedures established during the organization and for accounting and operations audits.

B. Execution of the subprograms

1. Support for technological development and innovation in the productive sector

3.8 The activities to be supported under this subprogram will be financed by means of the different credit modalities described earlier and will be governed by the corresponding operating regulations.

3.9 Execution will be the responsibility of the Office of Business Development and Innovation Programs, established in the recent reorganization of COLCIENCIAS. The office has a staff of 15 professionals and five administrative staff, distributed among four program units and a productive sector relations office, established in view of the importance that COLCIENCIAS attaches to the sector.

3.10 The IDB II program had a similar component that financed 50 projects valued at approximately US$8 million. The present program, involving an estimated US$60 million for 200 projects, represents a substantial increase in the anticipated volume of

operations, especially in financial-management activities that are not part of COLCIENCIAS' routine functions. Given this fact, plans are to contract out the functions associated with financial management and loan administration. Prior to the first disbursement, the executing agency must submit the trust regulations and the contract concluded between COLCIENCIAS and at least one financial intermediary for financial administration of the lending facility for the productive sector, patterned after the model agreed upon with the Bank.

3.11 The subprogram includes promotional activities that will publicize the program nationwide. The internal processing of the applications received will be done by assigning a professional to be the "project executive". This position, which is a new idea, will mean that a COLCIENCIAS professional will constantly be tracking the projects' progress; it also means that applicant agencies will have a single contact within COLCIENCIAS while their proposal is being processed. The technical and scientific evaluation of the projects will be reinforced by outside consultants who are part of a "network of evaluators", both national and international, that COLCIENCIAS has established over the course of earlier programs and that it will keep current.

3.12 In addition to the evaluation that the financial intermediary will perform of the loan applicant, COLCIENCIAS will use its own staff or consultants to do an institutional and financial evaluation, and an economic evaluation where appropriate, of the applications and projects. The project team examined the method that will be used for these evaluations and found it adequate to the program's needs. As of the date of the analysis, 45 applications had been evaluated involving approximately US$15 million.

a. Reimbursable financing for technological innovation projects (US$45 million)

3.13 Execution of this component will be governed by the specific operating regulations, the principal features of which are as follows: Beneficiaries: regardless of its size, geographic location or economic activity, any business and/or entity that engages in projects and activities that fall within the framework of the National Policy on Technological Development and Innovation may apply for a loan. Projects eligible for financing: projects involving technological research and innovation, institutional development and development of data systems may qualify for financing. Conditions of the loans: the subloans will be made in dollars, at an interest rate that covers the costs of the loan resources, the administrative costs and financial intermediation fees, and that is consistent with the interest rate charged on similar financing facilities available in the country. The interest rate will be updated semiannually and has been set at

12.5% for the beginning of the program. The maximum repayment period will be seven years, including a grace period of up to three years.

3.14 Applications submitted to COLCIENCIAS will undergo a technical and financial evaluation. The technical evaluation will examine the project's feasibility, the fitness and experience of the executing group, the proposal's innovative contribution and the contribution it makes toward improving the competitiveness and productivity of the sector or productive chain of which the business is part. The financial evaluation will examine the proposal's viability and the collateral put up by the applicant business.

b. Sectoral technological centers (US$7 million)

3.15 The financing from COLCIENCIAS could represent as much as 50% of the respective centers' investments and expenditures in their first two years of operation. The rest should come from services rendered, research and development contracts, and contributions from the businesses and organizations sponsoring the center. When evaluating the proposals, consideration will be given to the center's sustainability, based on its projected flow of income and expenditures once the period when it is cofinanced with program resources has ended.

c. Cofinancing for projects carried out jointly by businesses and research centers (US$8 million)

3.16 The program will finance up to 50% of the cost of project activities carried out at a university or research center. The business contribution will be in cash, earmarked to finance the project activities at the research center or within the business itself.

2. Support for research in the academic sector

3.17 The subprogram will be subject to a set of rules and standards set forth in the program's operating regulations, among them the following: (a) the financing must be nonreimbursable unless the results obtained yield verifiable earnings, in which case the beneficiary entity and COLCIENCIAS will share the profits; (b) the not-immediately-transferable research projects must be evaluated for the contribution they make toward developing the country's capacity in the area in question.

a. Support for research projects and programs (US$66 million)

3.18 The programs and projects to be financed will be selected by means of periodic competitions in which the scientific community will be invited to submit quality proposals in a given thematic area. The topics of the competitions will be decided in two ways: (i) the national program councils of the SNCT will identify the topics; and

(ii) ministries, government agencies or productive sector agencies will submit proposals that meet the criteria and are not being funded by other institutions in the country. In each competition, the program councils will recommend to the Office of the Director of COLCIENCIAS the projects to be financed. Once the loans are approved, these councils – in cooperation with the Office of Scientific and Technological Development Programs – will be responsible for monitoring the projects' execution.

3.19 The Office of Scientific and Technological Development Programs will be responsible for executing this component and will coordinate the competitions and the evaluation and selection of the projects to be funded, and then the supervision and monitoring. This office currently has 26 professionals and six administrative support staff.

3.20 Analysis of the projects submitted will be the responsibility of the respective program council, which will rely on the evaluations done by Colombian or foreign specialists. To select the projects that qualify for financing under each program, the following will be taken into account: the quality of the proposal and the qualifications of the group submitting it, the pertinence and relevance of the research and the resources available.

3.21 The technical and scientific evaluation of the projects will be done through the network of outside evaluators. The institutional and financial evaluations will be done internally. The economic evaluation, when needed, will be contracted out. During execution of the IDB I and II programs, COLCIENCIAS financed a total of 1,004 projects (369 and 635, respectively). With the organizational changes already introduced, execution of the nearly 900 projects anticipated for this component is not expected to pose a problem.

b. Institutional support for consolidating research groups (US$8 million)

3.22 The evaluation of the proposals presented will be the job of the Office of Scientific and Technological Development Programs, assisted by an ad hoc advisory committee. Each center's presentation will be examined by three national or international specialists. The office will also solicit the opinion of the national program council for the discipline in which the center works. To add to the information supplied in the applications, ad hoc committee members may visit the research groups. Anyone selected in the first competition will be ineligible for the second.

3.23 The resources can be used to purchase scientific equipment, remodel premises, purchase computer equipment and software, help underwrite the salaries of one or two researchers for the duration of the institution-support financing, purchase reading materials, finance

small exploratory projects, and defray the expenses of seminars and working meetings held to plan joint work with other groups and short-term training for the group's researchers.

3. Training of human resources

3.24 The Office of Strategic Programs will be responsible for executing this subprogram and will coordinate all the planned activities through its Human Resources and Scientific Community Strengthening Division. The division's capacity and the quality of its present staff were evaluated by the project team and found to be adequate to the program's needs. Two modalities of resource management are planned: a scholarship loan component targeted at degree programs and financial support components that target the other training programs described in chapter II.

a. Scholarship loans for postgraduate studies (US$23.6 million)

3.25 Specialized agencies will be hired for the administrative and financial management of the loans, for placement and admissions at the universities, and for monitoring the academic performance of the scholarship loan recipients. Up to two competitions will be held each year to select the recipients. Candidates must be sponsored by an institution that will guarantee the candidate a place of work once the training program is completed. The sponsoring institutions must show how their candidates will fit into the institutional development plan.

3.26 The selection of the scholarship loan recipients will be the job of a training committee appointed by COLCIENCIAS' Board of Directors, which will be advised by specialists in the candidates' disciplines. The selection guidelines will include a candidate's academic record, the quality and relevance of the work program proposed and how it relates to the human resource development programs of the respective national program council, and the caliber of the institution proposed for the candidate's training.

3.27 The beneficiaries will receive scholarship loans. The loans will be written off if the recipient's academic performance is up to par and if he or she honors the commitments undertaken to return to Colombia and work in the sponsor institution for a period that is twice the duration of the scholarship period.

3.28 Under Colombian law, any program of scholarships abroad must be handled through the Instituto Colombiano de Estudios Técnicos en el Exterior [Colombian Institute for Technical Studies Abroad] (ICETEX). Because of operational problems, ICETEX has been making changes in its organization, especially within its executive ranks. To streamline and control the management of the resources in its custody, ICETEX has signed a contract with a well-known bank with international operations. COLCIENCIAS will also conclude a

contract with ICETEX and the two together will sign special cooperation agreements with the national and international agencies that will directly administer the scholarship loans awarded.

3.29 To handle study abroad scholarships, agreements with the following agencies are expected to be concluded: (i) the Colombia-USA Educational Exchange Commission (Fullbright Commission) 3/; (ii) the Organization of Ibero-American States for Education, Science, and Culture (OEI); (iii) the British Council; (iv) the German Academic Exchange Service (DAAD); and (v) the Conseil National de la Recherche Scientifique [National Scientific Research Council] (CNRS). ICETEX will administer any scholarships not covered under the above agreements. Prior to the first disbursement, the executing agency must present evidence that an agreement has been signed with ICETEX for joint management of this component and that the agreements with at least two of the agencies mentioned here have been duly concluded. COLCIENCIAS and ICETEX will form a program monitoring committee whose main functions will be to conduct periodic reviews of the scholarship program and analyze and resolve specific cases. Personal contacts will be kept up through the Caldas Network, which is made up of Colombians living abroad. Since some scholarship loan recipients will not have completed their training program by the end of the disbursement period, COLCIENCIAS will advance, to each agency, the resources needed to cover these expenses.

b. Nondegree training and specialization programs (US$5.7 million)

3.30 COLCIENCIAS will hold periodic competitions, announcing the type of financing and the qualifications and conditions required to apply. It will evaluate the applications with the help of the national science and technology programs and outside specialists.

c. Institutional support to national postgraduates (US$2.8 million)

3.31 Every year, COLCIENCIAS will hold competitions to select the programs that will receive institutional support. With assistance from the Office of Strategic Programs and advice from a specially appointed postgraduates committee, the Office of the Director of COLCIENCIAS will evaluate the applications presented each year, taking the following into account: candidates enrolled in the doctoral program, publications by the teachers and candidates participating in the program, research projects under way, institutional development plan, and ties with other institutions.

3/ The Commission will promote this agreement with the help of the Latin American Scholarship Program of American Universities (LASPAU).

3.32 To evaluate the proposals, the quality of the academic group associated with the program will be considered, together with its research papers and productivity (measured by the number of articles published, patents registered, research and service contracts won), ties with other academic institutions and the participation of visiting professors and researchers, the number of candidates enrolled and the quality of the dissertation work.

d. Other components

3.33 COLCIENCIAS will execute the components involving incentives to researchers and support to visiting researchers. Whenever necessary, it will be assisted by other entities and ad hoc committees relevant to the planned activities. The operating regulations describe in detail the procedures, entities and committees that will control execution of these components. It is important to note that the division of COLCIENCIAS that will be in charge of the component will have the assistance of the national program councils of the SNCT, especially for the technical aspects.

4. Scientific and technological information and dissemination systems

a. Support for scientific and technological information systems (US$8.7 million)

3.34 Execution of this component will be the responsibility of the Information Systems Division, under the direct supervision of the Office of Strategic Programs. The funding will be in the form of contingent-recovery loans. A financial intermediary will be engaged to manage the finances and the portfolio. The proposals for all the components will be processed according to the guidelines set forth in the corresponding operating regulations. COLCIENCIAS will receive and evaluate applications for support received individually or through periodic competitions. The technical evaluation will be done by national and international experts. The Office of the Director of COLCIENCIAS or one of the national science and technology program councils will decide on the individual proposals. In the case of competitions, an evaluation and selection committee composed of COLCIENCIAS experts will make the selection, assisted by leading researchers in the area of information sciences.

b. Dissemination and popularization of science and technology (US$10 million)

3.35 The Division of Science, Communications and Culture of the Office of Strategic Programs will coordinate execution. COLCIENCIAS is experienced in carrying out activities of this type, since the IDB II program had a similar component.

C. Contracting for construction of works and procurement of goods and services

3.36 The program does not provide for the construction of civil works or new buildings. The projects financed may include small additions and remodeling work on existing facilities, which in no case will exceed US$1 million. Therefore, no international competitive bidding is planned for these works. Purchases of goods valued at over approximately US$250,000 will be done according to the bidding procedure that appears as Annex B to the loan contract.

3.37 Consulting services will frequently have to be retained for the program's administration. In most cases individual consultants will be contracted for short periods of time, to conduct various types of studies and project evaluations. To facilitate the contracting and simplify processing within the Bank, it is recommended that the contracts financed with proceeds from the loan, the cost of which does not exceed the equivalent of US$50,000, be let in accordance with the national laws. The executing agency will inform the Bank of any contracting activity. For contracts involving larger sums, the procedures shown in Annex C to the loan contract will be followed.

D. Maintenance of works and equipment

3.38 The borrower, through the executing agency, undertakes to include in the loan agreements concluded with the beneficiaries a commitment to the effect that the works and equipment financed with program resources will be operated and maintained in accordance with generally accepted technical standards and that the resources necessary for their efficient operation will be available. During execution of the program and for up to three years following its completion, COLCIENCIAS must present to the Bank a report on the maintenance done the previous year.

E. Disbursement timetable

3.39 According to the program of execution, the tentative timetable for disbursing the proceeds from the loan and the local counterpart contribution is as follows:

Table 3.2
Annual disbursements from the program, by source
(figures in millions of US$ equivalent)

Source	Year 1	Year 2	Year 3	Year 4	Total	%
Bank	15.6	22.0	31.7	30.7	100.0	45.7
Local	20.4	38.9	38.9	20.8	119.0	54.3
Total	**36.0**	**60.9**	**70.6**	**51.5**	**219.0**	**100.0**
% per year	16.4	27.8	32.2	23.6	100.0	

F. Recognition of expenditures and advance of funds

3.40 The borrower has asked the Bank to recognize the expenditures it has made and plans to make up to the date of the resolution of the Board of Executive Directors whereby the loan would be approved. The project team reviewed the amounts committed and to be committed for proposals received, and the regulations and procedures that were applied when selecting the beneficiaries. Based on this review, and to ensure the programs' continuity, the project team believes that the Bank could recognize up to US$15 million in expenditures incurred after May 24, 1994, charged against the local contribution.

3.41 Because of the types of activities to be carried out and the pace of execution planned, it is recommended that an advance of funds be made in an amount of up to the equivalent of 10% of the loan, or US$10 million.

G. Environmental impact

3.42 At its meeting of April 19, 1994, the Environment Committee classified this as a Category II program. As provided in the operating regulations, through its evaluation and monitoring system COLCIENCIAS will ensure that the projects financed and their results have no adverse environmental effects.

H. Bank monitoring during program execution

3.43 The Bank's Country Office will monitor the general progress of the program. At the end of each year, the executing agency will present a report detailing the progress made in executing each component and the status of each of the planned annual goals. The project team and executing agency will do interim evaluations of the program, 12 months and 24 months into program execution, in which the accomplishment of the goals will be verified and any necessary adjustments and corrections will be recommended. In particular, performance of the reimbursable financing facility for the productive sector's technological innovation projects under subprogram I will be analyzed.

3.44 In keeping with a practice successfully tested in similar programs, a seven-member external advisory and monitoring committee (CEAS) will be formed and will meet each year from the date of the contract during program execution. The members of the committee, who are to be specialists of recognized standing not directly associated with government institutions, will be designated by COLCIENCIAS in consultation with the Bank. Four of the members will be Colombians and three will be foreigners. Each year, CEAS will produce a report containing recommendations on the program's evolution. The following will be taken into account when preparing the report: (i) COLCIENCIAS' annual reports and the program monitoring indicators; (ii) the analysis of the processes whereby the program beneficiaries are evaluated and selected; (iii) an analysis of a small number of projects chosen at random; and (iv) visits to institutions executing program-financed projects.

3.45 At the end of the second year, counted from the date of the final disbursement of the Bank's financing, COLCIENCIAS will submit an ex post evaluation report on the results of the program, conducted by an independent agency acceptable to the Bank using the methodology and guidelines agreed upon with the Bank.

I. External auditing

3.46 Every year for the duration of program execution, the executing agency will present the financial statements of the program and of COLCIENCIAS, duly audited by a firm of independent auditors acceptable to the Bank or by the Office of the Comptroller General of the Republic. Financial statements are to be submitted within 180 days after the close of the executing agency's fiscal year.

IV. BENEFITS AND RISKS OF THE PROGRAM

A. Expected results

4.1 The program will strengthen Colombia's scientific and technological capacity by consolidating the achievements of the previous two programs. This program was especially designed to promote the relevance of the research projects, ties between research centers and potential users of research findings, and technological development and innovation in the businesses themselves.

4.2 Strengthening the country's scientific and technological capacity is essential to its modern development, but that alone will not suffice. Demand and interest must also be increased among Colombia's productive agents if that capacity is to yield the expected benefits. Therefore, a set of simultaneous actions has been planned to promote, foster and facilitate ties between businesses — especially smaller businesses — and sources of scientific and technological know-how and information. Apart from the activities planned under the program, the government has proposed fiscal incentives to get businesses to invest more in technological activities and is carrying out other programs as part of its policy of promoting competitiveness.

4.3 As there are no adequate financial facilities in Colombia for technological development and innovation by private businesses (especially the small and medium-sized businesses), the establishment and operation of a COLCIENCIAS-operated financing facility will give a considerable boost to technological innovation in productive activities.

B. Socioeconomic benefits

4.4 This section presents the main benefits identified in the economic analysis done of each component.

1. Support for technological development and innovation in the productive sector

4.5 A total of nine projects for a requested sum of US$3.5 million in reimbursable financing and US$2 million in cofinancing were examined. The amount involved represents over 9% of this subprogram. All the projects have important economic benefits, with anticipated internal rates of return that range from 22% to 88%. The projects for which a cost-benefit analysis was done were analyzed for their sensitivity to the variables that were the most unpredictable. In general, the most sensitive variables in the economic analysis of the projects in this component were: the expected prices of the products; the demand levels; the uncertainty on the international market; and the results of technological development.

2. Support for research in the academic sector

4.6 The economic analysis of this subprogram was based on a sample that reasonably reflects the composition of demand in terms of the project types, priority areas, applicant entities and project costs. The not-immediately-transferable projects will likely accomplish their objectives and establish a subsequent nexus between the research findings and productive projects. The surveys of researchers were instrumental in identifying potential users of the research findings and in ascertaining the chances of accomplishing results that the private sector can ultimately use. All the projects analyzed in this subprogram came out favorably in terms of their relevance to the research proposals. A cost-efficiency analysis was done of the not-immediately-transferable projects, which were found to be viable from this standpoint. A cost-benefit analysis was done of the immediately transferable projects; in those projects where a risk analysis introduced added value to the exercise, a vector of the probabilities of achieving the expected research findings and of the productive sectors adopting those findings was established. In these cases, the anticipated merit of the project under conditions of uncertainty was estimated. The economic results were favorable in all the cases of projects of this type analyzed.

3. Training of human resources

4.7 To ascertain the economic efficiency and rationality of the component, the following was done: (i) a cost-efficiency analysis; and (ii) a cost-benefit analysis of the master's and Ph.D. programs.

a. Cost-efficiency analysis

4.8 To establish the efficiency of the outlay for the component, the annual unit costs of pursuing master's degree and Ph.D. studies in Colombia were reviewed and compared with the costs of pursuing these studies in other countries. This exercise found that a master's and Ph.D. education in Colombia is cost-effective, since the costs are 63% lower than studies abroad (United States and Europe). However, this type of comparison would only be valid when the programs being compared are similar in quality. To determine that, a review of the quality of programs in different countries, by area of study, would have to be done, as well as an analysis of salary differences among graduates in different countries, to obtain a quality estimate. The "sandwich" type of doctoral studies also proved to be more cost-effective (32% lower) than pursuing a doctorate abroad, with higher economic return rates. This modality has other advantages to offer, such as dissertation research done on issues of national concern and less likelihood of brain drain.

b. Cost-benefit analysis

4.9 Five areas of study were distinguished for purposes of the economic analysis: basic sciences, social and human sciences, environment and habitat, engineering, and health sciences, with their respective master's and Ph.D. studies. The economic evaluation of the master's and doctoral programs was based on the following: (i) in addition to the direct costs of the programs, forgone earnings were also included as indicative of the opportunity cost to the country for the duration of the studies; and (ii) the benefits were figured as the salary difference among the graduates. For master's degree studies, the areas with the highest return were the social and human sciences and the health sciences, with internal rates of return of 25% and 23%, respectively. As for the doctoral studies, the most viable areas from the economic standpoint were basic sciences and environmental sciences, both of which had returns of 22%. The economic return on the "sandwich" type doctoral studies was even higher because their costs are lower. In conclusion, the subprogram will produce high social benefits, not only because overall it yields very favorable economic indicators, but also because of the anticipated impact in terms of the quality and capacity of the country's highly educated human capital.

4. Scientific and technological information and dissemination systems

a. National scientific and technological information system

4.10 In this component, the establishment of new regional and institutional management centers in the Colombian Scientific, Educational and Technological Network (CETCOL) was evaluated. CETCOL's goal is to be the basic network for the scientific, academic, governmental and business communities in Colombia, offering an international connection to the Internet as well. The following are among the many effects the project will have: (i) provide access to more information through the network for businesses, which can improve the quality of their products by learning the leading-edge technology that can be introduced into their production process; (ii) provide an additional source of efficient technology transfer, with no major costs; (iii) streamline inventory and procurement systems; (iv) strengthen the State's modernization process; and (v) open up new channels of communication and participation for businesses and the public in general. A cost-benefit analysis was done of the project. To estimate the demand (willingness to pay for the service) and its coverage, a 1994 study of rates done by CINTEL and communications demand statistics from academic institutions prepared by the Universidad de los Andes were used. For the structure of the project's costs, a number of recent studies on the topic were used. The analysis found that Colombia will gain important benefits once it sets up

the network, with an anticipated internal rate of return of 15%, which is sensitive to the various rate and coverage scenarios considered. The fact that only 1% of the estimated demand for access to the Internet is met, through various institutions, is a good indication of how much the network could grow in the years ahead.

b. Dissemination and popularization of science and technology

4.11 In this component, the first projects evaluated were those of the magazines *Colombia Ciencia y Tecnología* and *Innovación y Ciencia*. The first is published by the Asociación Colombiana para el Avance de la Ciencia [Colombian Association for the Advancement of Science] (ACAC), and the second by COLCIENCIAS. Next, the *Expociencia* project was analyzed as a mechanism for disseminating and popularizing the successes achieved by researchers at various academic institutions.

4.12 The cost-benefit analysis found that both publications are profitable. The anticipated internal rate of return for the magazine published by COLCIENCIAS is 61%, while the one published by ACAC is in the area of 44%. As for the *Expociencia* project, the benefits were estimated on the basis of the willingness to pay to participate in the event. The number of visitors expected to attend the fairs is conservatively estimated at 150,000, which yields an IRR of 12%, although it is very sensitive to the number of visitors anticipated.

4.13 **In conclusion**, the economic analysis of the present operation found that the components or subprograms to be financed produce very good benefits, indicating how important it is that Colombia earmark more resources to the area of science and technology. This corroborates the conclusions already presented about the program's global benefits for the country.

C. Institutional benefits and risks: lessons learned

4.14 With execution of the two earlier programs, COLCIENCIAS has developed extensive experience in promoting and administering research projects, in both the academic and productive sectors. Using the experience gained with programs involving smaller loans, a system for using external resources has been designed that maximizes COLCIENCIAS' technical participation while ensuring proper financial administration. That experience has also pointed up problem areas, which have led to fundamental changes in the institution's organization and the inclusion of strengthening activities in the program that will help make its execution as effective as possible. With the program, COLCIENCIAS will consolidate its position as a central institution for technological innovation in Colombia.

4.15 From the institutional standpoint, the program would face two related risks: (i) COLCIENCIAS' current capacity; and (ii) the institutional backing. As for its current capacity, the analysis done indicates that with the reorganization, the strengthening activities planned and the contracting of specialized outside support, COLCIENCIAS will be prepared to carry out the program's execution within the planned time frames.

4.16 Institutionally speaking, the program enjoys widespread backing. In the context of the "Salto Social" policy, the national government has given science and technology a pivotal role as crucial factors in furthering the internationalization of the economy. Within the context of the SNCT, COLCIENCIAS has developed as an institution of recognized drawing power, under whose leadership the coordination and participation of the principal agents in the SNCT are promoted. COLCIENCIAS also has a critical mass of researchers and institutions that make the execution of the program's activities viable.

D. Sustainability and financial risks of the program

4.17 Continuation of the activities started under this program basically depends on sustained contributions from the nation and on the contributions from portfolio recoveries, both from the previous program and from this program. If the government maintains its contributions at the counterpart contribution level under this program, COLCIENCIAS could be handling investments on the order of US$32 million annually between 1999 and 2004. Portfolio recoveries from IDB programs would represent approximately 22% of this amount. COLCIENCIAS' plan, approved by the DNP, targets investments of approximately US$56 million annually during the same period.

4.18 From the standpoint of associated costs, the program does not involve considerable increases because the administration and financial management areas, which will be contracted out, are variable in nature and will adjust to the level of operations that would continue following execution of this program. In terms of fixed costs, the reorganization of COLCIENCIAS, which involved a 12% increase in personnel services costs, will necessitate an increase in its operating budget of approximately US$130,000 each year, a manageable figure given the government investments already approved for 1995 and 1996.

4.19 The financial risk that the program involves basically concerns timely provision of the counterpart resources. From the standpoint of the government's capacity to put up the counterpart funds, it is important to note that the funds for the 1995 and 1996 budgets have already been approved and amply cover the counterpart requirements, thereby confirming the government's commitment to the program. In addition, official documents show that the government's goal is to increase public investment in science and technology so that the

total investment in the sector increases from 0.5% of GDP to 1% of GDP between 1994 and 1998 (see Annex I-1).

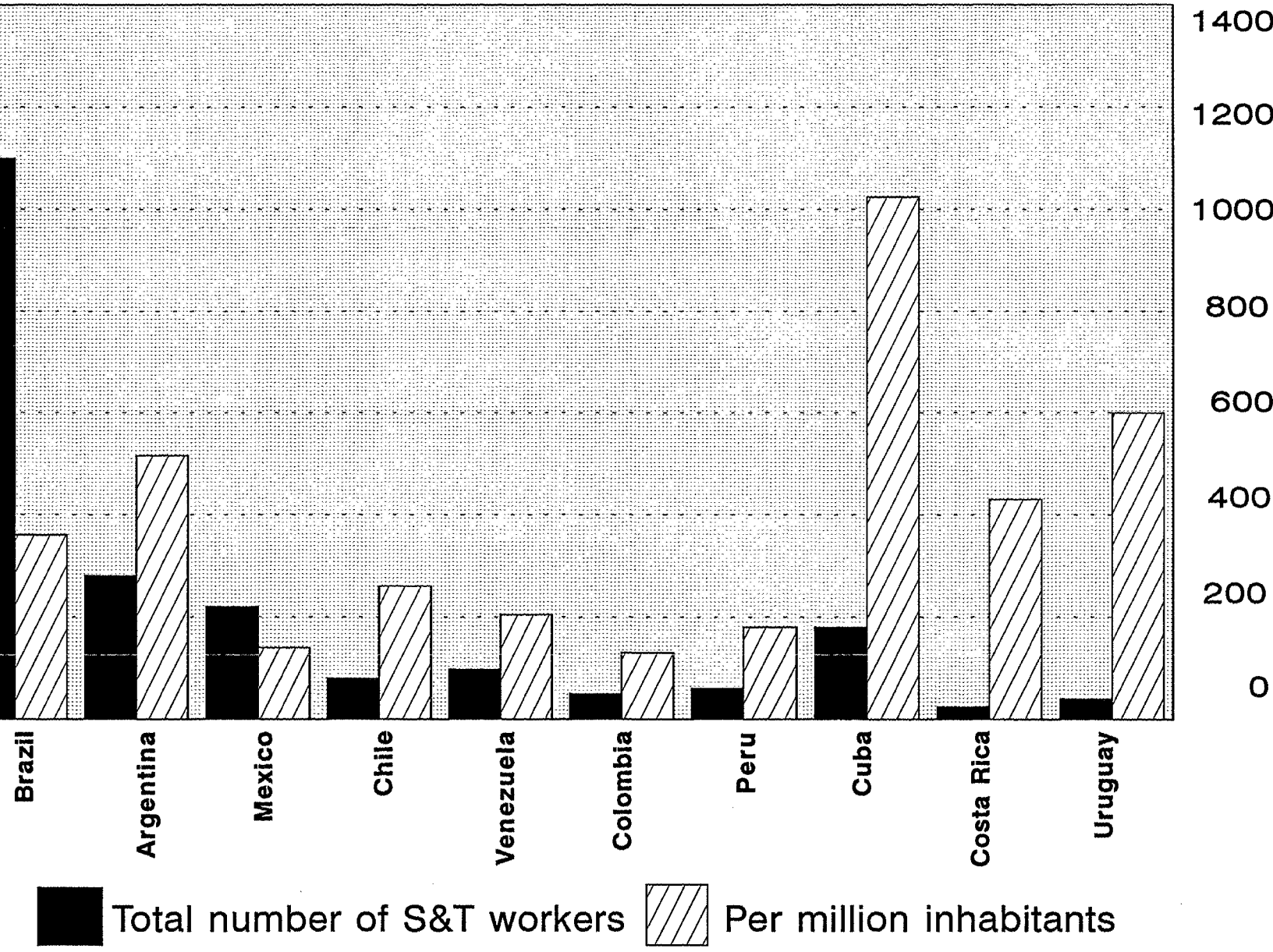
4.20 In the last five years, COLCIENCIAS' budget has increased considerably, having almost tripled 4/ between 1990 and 1994. There was a sizeable increase in 1991 when the investment budget practically doubled with the investments made under the COLCIENCIAS-IDB II program. Since that year, the resources from the IDB loans have represented, on average, nearly 45% of COLCIENCIAS' operations. During this period, the contributions from the government have kept up the required disbursement rate and the institution was able to absorb the increase.

4.21 At the present time, the COLCIENCIAS-IDB II program is practically fully disbursed and COLCIENCIAS needs new infusions of capital to cope with the demand for financing identified. The projected investments for the next 10 years entail a further increase in COLCIENCIAS' volume of operations, which will mean additional investments from the country. The budget appropriations reflect the government's commitment to contribute not only the required counterpart but also the additional resources needed to enable COLCIENCIAS to perform the important role it has been given. As a result of this increase in the contributions from the nation, the proceeds from the IDB loans will account for a smaller share of the total during the program's execution, dropping from 45% to 36%. The institutional changes that have been adopted and the measures to be taken for financial management indicate that COLCIENCIAS will be able to absorb the increase in its level of operations.

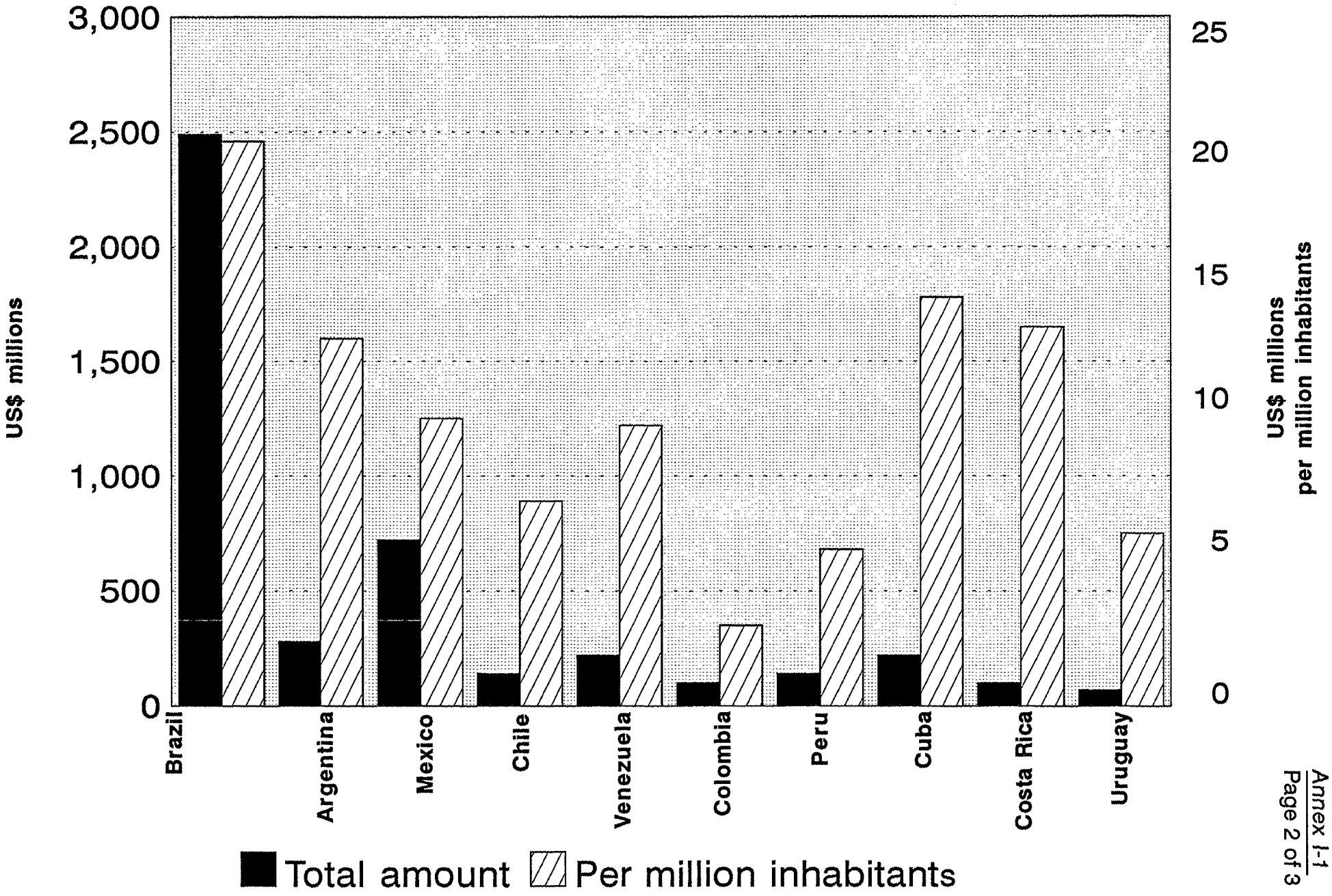
4/ In terms of constant 1994 pesos.

SCIENCE AND TECHNOLOGY IN LATIN AMERICA
COMPARATIVE CHARTS

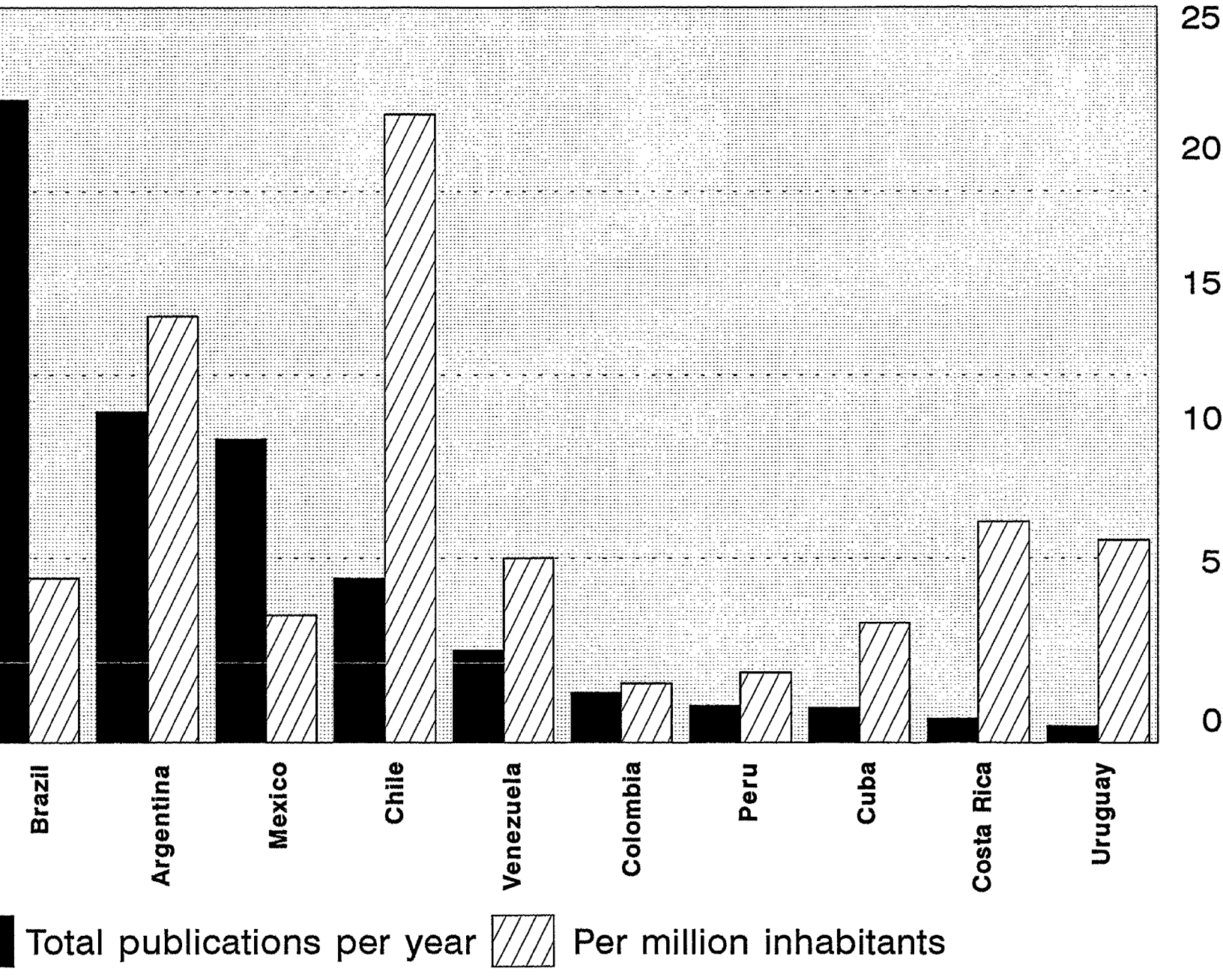
SCIENCE AND TECHNOLOGY WORKERS (1991)



INVESTMENTS IN SCIENCE AND TECHNOLOGY IN LATIN AMERICA



SCIENTIFIC PUBLICATIONS IN LATIN AMERICA (1991)



EXECUTION OF THE COLCIENCIAS-IDB II PROGRAM
(588/OC-CO; 835/SF-CO)
(US$ thousands)

		BUDGETED		COMMITTED		DISBURSED	
		IDB	COUNTERPART	IDB	COUNTERPART	IDB	COUNTERPART
1	Administration	750	470	460	1,208	405	1,208
2	Project financing	24,100	15,070	24,290	15,070	20,812	7,605
3	Training	14,500	500	14,500	500	8,689	402
4	Information and dissemination	250	4,265	350	4,265	297	5,127
5	Financial costs	400	6,365	208	3,500	208	3,178
	TOTALS	**40,000**	**26,670**	**39,808**	**24,543**	**30,412**	**17,520**

The contract was signed on December 20, 1990, and the program was eligible for disbursement in November 1990. The deadline for the final disbursement is December 20, 1995.

APENDICE

PROPOSED RESOLUTION

COLOMBIA. LOAN ____/OC-CO TO THE REPUBLIC OF COLOMBIA
SCIENTIFIC RESEARCH AND TECHNOLOGICAL DEVELOPMENT PROGRAM

The Board of Executive Directors

RESOLVES:

That the President of the Bank, or such representative as he shall designate, is authorized, in the name and on behalf of the Bank, to enter into such contract or contracts as may be necessary with the Republic of Colombia, as Borrower, for the purpose of granting it a financing to cooperate in the execution of a program for scientific research and technological development. Such financing will be for the amount of up to US$100,000,000 or its equivalent in other currencies, except that of Colombia, which are part of the Ordinary Capital resources of the Bank, and will be subject to the "Special Contractual Conditions" and the "Financial Terms and Conditions" of the Executive Summary of the Loan Proposal. From the amount of the loan, up to US$30,000,000 may be financed under the modalities indicated in Document FN-483-3, "Proposal for the Establishment of a U.S. Dollar Window", approved by the Board of Executive Directors on May 11, 1994.