Document of
The World Bank

Report No: 19853

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED LEARNING AND INNOVATION LOAN

IN THE AMOUNT OF US$5 MILLION

TO THE BOLIVARIAN REPUBLIC OF VENEZUELA

FOR THE

MILLENNIUM SCIENCE INITIATIVE PROJECT

April 28, 2000

Latin America and Caribbean Region
Country Department Unit for Colombia, Ecuador and Venezuela
Latin America and the Caribbean Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective)

Currency Unit = Bolivares (Bs.)
Bs. 1.00 = US$ 1/660.25
US$ 1.00 = Bs. 660.25

FISCAL YEAR
January 1 December 31

ABBREVIATIONS AND ACRONYMS

BD	Board of Directors
CAS	Country Assistance Strategy
CE	Centers of Excellence
CENAMEC	National Center for Improving of Science Teaching
CDSHyT	Board for Scientific and Technological Development
CNU	Consejo Nacional de Universidades
CONAC	National Council for Culture
CONACYT	National Science and technology Council (Mexico)
CONICIT	Consejo Nacional de Investigaciones Científicas y Tecnológicas
CPAR	Country Procurement Assessment Review
CQ	Consultant Qualifications
FMS	Financial Management System
FGMA	Fundación Gran Mariscal de Ayacucho
GDP	Gross Domestic Product
GNP	Gross National Product
IADB	Inter-American Development Bank
IBRD	International Bank for Reconstruction and Development
ICR	Implementation Completion Report
IDA	International Development Association
IMU	Implementation and Management Unit
IVIC	Instituto Venezolano de Investigaciones Cientificas
LIL	Learning and Innovation Loan
M&E	Monitoring and Evaluation
MS&T	Ministry of Science and Technology
MSI	Millennium Science Initiative
NCB	National Competitive Bidding
NER	Nuclei for Excellent Research
NIS	National Innovation System
OECD	Organization for Economic Cooperation and Development
OPSU	Oficina de Planificación del Sector Universitario
PAD	Project Appraisal Document
PC	Program Committee
Ph.D.	Doctor of Philosophy degree
PI	Principal Investigators
PPI	Programa de Promoción del Investigador
PPP	Purchasing Power Parity
QCBS	Quality and Cost Based Selection
R&D	Research and Development
S&T	Science and Technology
SCI	Science Citation Index
SIL	Sector Investment Loan
SOE	Statement of Expenditures
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
US NSF	United States National Science Foundation
WDR	World Development Report

Vice President:	David de Ferranti
Country Director:	Andrés Solimano
Sector Director:	Xavier Coll
Task Team Leader:	Lauritz B. Holm-Nielsen

VENEZUELA
MILLENNIUM SCIENCE INITIATIVE PROJECT

CONTENTS

	Page
A. Project Development Objective	
1. Project development objective	2
2. Key performance indicators	3
B. Strategic Context	
1. Sector-related Country Assistance Strategy (CAS) goal supported by the project	3
2. Main sector issues and Government strategy	4
3. Learning and development issues to be addressed by the project	7
4. Learning and innovation expectations	8
C. Project Description Summary	
1. Project components	8
2. Institutional and implementation arrangements	8
3. Monitoring and evaluation arrangements	10
D. Project Rationale (This section is not to be completed in a LIL PAD)	
E. Summary Project Analysis	
1. Economic	12
2. Financial	12
3. Technical	12
4. Institutional	12
5. Environment	13
6. Social	14
7. Safeguard Policies	14
F. Sustainability and Risks	
1. Sustainability	16
2. Critical risks	16
3. Possible controversial aspects	16
G. Main Loan Conditions	
1. Effectiveness Condition	17
2. Other	17

H. Readiness for Implementation 17

I. Compliance with Bank Policies 17

Annexes

Annex 1: Project Design Summary
Annex 2: Project Description
Annex 3: Estimated Project Costs
Annex 4: Assumptions and Expected Benefits
Annex 5: Economic Analysis and Related Issues
Annex 6: Procurement and Disbursement Arrangements
Annex 7: Project Processing Schedule
Annex 8: Documents in the Project File
Annex 9: Statement of Loans and Credits
Annex 10: Country at a Glance
Annex 11: Indicators and Description of Venezuela's S & T Sector

MAP(S)

VENEZUELA

MILLENNIUM SCIENCE INITIATIVE PROJECT

Project Appraisal Document

Latin America and Caribbean Region
LCSHE

Date: November 2, 1999	**Team Leader:** Lauritz B. Holm-Nielsen
Country Manager/Director: Andres Solimano	**Sector Manager/Director:** Xavier E. Coll
Project ID: P066749	**Sector(s):** ET - Higher Education
Lending Instrument: Learning and Innovation Loan (LIL)	**Theme(s):**
	Poverty Targeted Intervention: N

Project Financing Data

☒ Loan ☐ Credit ☐ Grant ☐ Guarantee ☒ Other (Specify)

Learning and Innovation Loan

For Loans/Credits/Others:

Amount (US$m): 5 Million

Proposed Terms: Variable Spread & Rate Single Currency Loan (VSCL)

Grace period (years): 5 **Years to maturity:** 15

Commitment fee: 0.75%

Front end fee on Bank loan: 1.00%

Financing Plan: Source	Local	Foreign	Total
GOVERNMENT	15.00	-5.00	10.00
IBRD	0.00	5.00	5.00
Total:	15.00	0.00	15.00

Borrower: BOLIVARIAN REPUBLIC OF VENEZUELA

Responsible agency: MINISTRY OF SCIENCE AND TECHNOLOGY
CONICIT

Estimated disbursements (Bank FY/US$M):

FY	2000	2001	2002				
Annual	0.5	1.5	3.0				
Cumulative	0.5	2.0	5.0				

Project implementation period: 07/01/2000 - 12/31/2002

Expected effectiveness date: 09/30/2000 **Expected closing date:** 06/30/2003

A. Project Development Objective

1. Project development objective: (see Annex 1)

The purpose of the project is to strengthen the Bolivarian Republic of Venezuela's (Venezuela) R&D capacity so that the country can gain access to global knowledge and improve its knowledge base in areas that are key to its economic and social development. This would be accomplished through the support of advanced training of human capital and research activities with high potential. **The objective of the project is to demonstrate the effectiveness of transparent, merit-based allocation procedures and investigator autonomy in improving the quality and efficiency of scientific research and training.**

The *Millennium Science Initiative (MSI) Project* has two phases: (1) a learning and innovation phase supported by a *Learning and Innovation Loan (LIL)* for two-and-one-half years, and (2) a follow-on phase related to the potential improvements in the sector which will follow if the LIL leads to successful follow-on activities, for an additional eight years.

The **specific project development objective** is to demonstrate how to revitalize Venezuela's science and technology (S&T) system. The project is supported by a LIL and is expected to energize the R&D sector, which, in many cases, is characterized by excessive bureaucracy. It will demonstrate and stimulate adoption of transparent quality assessment mechanisms and efficient merit-based allocation procedures. The project will encourage investigator autonomy by improving the quality and efficiency of scientific research and training, and it will reward research system productivity and efficiency. The project will also promote integration and partnership with more scientifically advanced countries as well as with Venezuela's regional partners.

An important objective of the LIL is to show that, under proper procedures, Venezuela can perform S&T research at high international standards of quality and productivity, and that the high quality, international level, scientific research can be expanded and sustained within Venezuela's S&T research budget. The LIL is therefore planned as an initial phase of a larger MSI program, which would, in a period of eight to ten years, spread positive experiences from the LIL phase to the rest of the S&T system in Venezuela.

As part of a region-wide initiative, the MSI is specifically designed to suit the particular country needs and circumstances within the same conceptual framework. The LIL further draws on experiences and lessons from the first MSI Project in Chile currently under implementation, which were transferred to the Venezuelan context.

The **follow-on development objective**, to be pursued during the second phase, is to revitalize the Venezuelan National Innovation System (NIS), a complex system of institutions and practices (see Annex 3), by increasing the country's capacity to produce, gain access to, and adapt scientific and technological knowledge. More Ph.D. students would be trained at a higher quality and within the country, increasing the cost-effectiveness of the training. More and higher quality scientific output is expected, as is greater incorporation of research results into production. The cumulative effect of increased human capital and knowledge stocks would, in the long term, move Venezuela closer

to parity with the world's more knowledge-based economies.

The LIL will partly finance: **(a) capacity building** for the new Ministry of Science and Technology, technical support to set up national S&T policies, and a light management structure for the MSI; and **(b)** a **competitive fund** for scientific excellence to support: (i) established international level research groups, with investigator autonomy and adequate levels of longer-term funding, known as "Centers of Excellence" (CE), and about 8-12 emerging groups of high quality, younger researchers, with investigator autonomy and adequate levels of medium-term funding, known as "Nuclei for Excellent Research" (NER); (ii) national and international networking and outreach activities for the promotion of scientific excellence that promote exchange of knowledge and spread the benefits of top-quality research to potential collaborators and benefactors, be they students, fellow researchers, and/or partners from business and industry.

An important feature of the LIL will be a selective process for granting awards. This process is planned to include participation of high level international scientists, and fund only researchers whose work is deemed to be at a high standard of quality and productivity.

2. Key performance indicators: (see Annex 1)

The project will have two sets of performance indicators.

In the **short term**, selected indicators will measure whether the S&T policies and funding processes are in place and functioning, and if the proposed CE and NER have been created. The indicators of success will be (a) established and implemented national S&T policies at the Ministry of Science and Technology, with a light administrative structure to oversee the selection and funding process, linked/integrated with CONICIT; (b) established technology fund, supporting (i) 3 Centers of Excellence and 8-12 Nuclei for Excellent Research, and an increased pool of Ph.D. students working in CE and NER; and (ii) a regional/international network for the promotion of research excellence and transfer of knowledge (outreach programs). In the **medium term**, a series of measures will indicate whether the research and training being conducted are in accordance with high international standards. This important indicator will be monitored both quantitatively and qualitatively, by high level international evaluation teams composed of top international researchers.

In the **long term**, the initiative as a whole will be evaluated continuously throughout its projected 10 year life span. Regular evaluations will measure the output and impact of the research and training conducted, through the number of new Ph.D. researchers, through bibliometric indicators, patents, new products and processes, and tracer studies of employment patterns of individuals trained. Scientific research is by nature a long-term endeavor, and the initiative must be long-term enough to accommodate. The LIL, by contrast, has a short time horizon: it will fund only the first phase of the Millennium Science Initiative. It is expected that a follow-on project will be requested by the Venezuelan Government.

B. Strategic Context

1. Sector-related Country Assistance Strategy (CAS) goal supported by the project: (see Annex 1)
Document number: 16471 VE **Date of latest CAS discussion:** 04/08/97

The sector-related Country Assistance Strategy (CAS) for Venezuela states that the Government' s development agenda is focused towards: "(a) enhancing sustainable growth with stability by strengthening the fundamentals for economic growth and by fostering a competitive environment for small and medium enterprises (para.10); (b) promoting social development by improving the quality and coverage of basic social services – education, health, housing, water, and sanitation ... (para. 11); (c) modernizing the public sector by strengthening public administration to improve governance and increase the effectiveness of public programs ...(para. 12)."

In the long term, the project outcomes would support all three core themes stated in the CAS. Specifically, the MSI project would raise the quality and enlarge the stock of a critical segment of human capital contributing to Venezuela's research and development. It has the potential to positively influence S&T policies and R&D strategies in Venezuela, by demonstrating and stimulating transparent quality assessment procedures and incentives, rewarding research productivity, and promoting research groups in Venezuela whose work is at internationally accepted standards. The project would complement other Bank efforts to improve advanced training and human capital formation, most notably the effort to stimulate the quality, efficiency and performance of the higher education sector. It would also support Venezuela's efforts to improve its integration into the world's knowledge base and knowledge production system.

2. Main sector issues and Government strategy:

Main sector issues

The government-sponsored S&T research system in Venezuela consists of 19 public universities and several research institutes, with *Instituto Venezolano de Investigaciones Cientificas* (IVIC) being the largest. In spite of some recent efforts to improve the quality of research, such as the " Researcher Promotion Program" (*Programa de Promoción del Investigador* -PPI), and " University Extension Programs", the Venezuelan S&T system is still constrained in ways that substantially hinder its performance. For instance, major bottlenecks to advanced training keep Venezuela's supply of human resources for S&T insufficient for renewal and growth. Resources for R&D are generally scarce and fragmented. Funding and implementation procedures do not appropriately support good research output. Planning for the sector is weak and uncoordinated. Together, these factors perpetuate a system that is small, inefficient and inflexible, and relatively isolated rather than integrated on national and international levels. The main constraints can be classified into two groups: (a) procedures and practices that inhibit optimal performance in research and training, and (b) scarcity of resources, both human and capital.

(a) Procedures and practices that inhibit optimal performance in research and training

Quality and relevance of research are often inadequate. In 1999, the research system in Venezuela consisted of approximately 5,000 researchers. Of these, only about one-third met the standards set by the Venezuelan Researcher Promotion Program *(Programa de Promoción del Investigador* - PPI) and qualified as international-scale researchers, with publications in journals included in the Science Citation Index (SCI). According to the PPI statistics, Venezuelan scientists publish 600-700 scientific papers in internationally recognized journals per year (in

average each PPI researcher publishes one paper per two years) and the number of patents is very low. According to Cetto & Vessuri, the Bolivarian Republic of Venezuela contributes less than 0.05% of world's scientific articles, which is far less than Chile (0.2%), Mexico (0.3%), Argentina (0.4%), and Brazil (0.6%).

Efficiency and quality of research are not stimulated enough, and are not systematically evaluated and rewarded. Except for some notable voluntary efforts, there are no quality assessment mechanisms, or direct financial or promotional incentives for researchers and university teachers in the **public** sector to improve the quality, relevance and efficiency of research. By contrast, most **private** higher education institutions (except for a few traditional private universities, such as *P. Universidad Catolica de Venezuela*) are driven by profit, and therefore most often do not undertake research at all.

Conditions and quality of research are disparate. At present, more than eighty percent of PPI qualified researchers work in the five strongest research and education institutions. Almost all PPI researchers come from the public universities and institutes which have the longest scientific tradition, while S&T research groups are practically non-existent at private higher education institutions. The main reason for this is government financial policy which supports only national (public) educational and research institutions.

Excessive bureaucratic constraints hamper researchers. Bureaucratic procedures significantly diminish researcher effectiveness. One example of these restrictions is that research groups at public universities and institutes are not free to replace a retired member of the group, or to enlarge the number of Ph.D. students in the lab, even if they work in a rapidly expanding field and have a promising research program. On the other hand, there may be a surplus of researchers and teachers in another field. Cooperation between different faculties, universities and research institutes is also very difficult and rare, which makes interdisciplinary research almost impossible.

Insufficient long-term planning. Policy and long-term planning for the S&T sector has been generally weak and uncoordinated. Until recently, the responsibility for S&T policy has not been clearly assigned to any agency or institution. Recently, a new Ministry of Science and Technology (MS&T) has been created, which will be responsible for science and technology policy, for coordination of activities, and for the implementation of policy instruments.

(b) Scarcity of resources

Number of researchers in S&T is too small. In 1995, according to UNESCO statistics, Venezuela had 208 scientists and engineers in R&D per million inhabitants. This is about ten times less than in industrialized countries.

The present influx of new Ph.D. graduates cannot cover the needs. The higher education sector in Venezuela is in a period of rapid expansion. Total enrollment in higher education increased by 66.4% in ten years. Currently, only about 100 Ph.D. students graduate per year. This number is not even sufficient to fill the vacancies at tertiary institutions created by retiring professors. Additionally, more highly qualified S&T specialists are needed to build a solid knowledge base in

research institutes and in industrial R&D departments in areas that are key to the economic and social development of Venezuela.

Scarcity of funds for necessary equipment limits the scope of research in Venezuela and virtually excludes Venezuelan scientists from working on cutting edge research problems in advanced areas in many disciplines. They simply cannot afford the equipment needed for such work.

Government strategy

Research in Venezuela has been mainly limited to those public universities with the longest tradition and to large research institutes such as IVIC. Until recently, long-term planning for S&T has been uncoordinated, and the resources for R&D have been relatively scarce and fragmented. The result was a S&T system with limited scope, reduced flexibility and efficiency, and which was isolated rather than integrated on national and international levels. The goal of the present government and the newly established Ministry of Science and Technology (MS&T) is to improve the S&T system, both in quality and in quantity, with the concomitant social and economic impacts, to be able to better support the country's development efforts.

The new S&T Minister's vision is to (i) establish coherent policies in the national science and technology sector, (ii) consolidate a National Innovation System (NIS), (iii) introduce incentives for the formation of a critical mass of high quality researchers, and (iv) support research and development in priority technological areas (food production, sustainable development, new materials and processes, and communication and information technology).

The MS&T has two Vice Ministries: (1) the *Vice Ministry for Planning and Policy*, responsible for S&T production, policy analysis and formulation, planning, institutional cooperation (with universities, research laboratories, national institutes and R&D entities of other ministries) and international cooperation; and (2) the *Vice Ministry for Research and Innovation*, responsible for human resources, research and development, technology transfer, monitoring and evaluation. The Ministry will further establish cross-cutting task forces or working groups that will work across sectors and directorates in the selected areas of research such as biotechnology.

The MS&T also anticipates the need to modernize the *modus operandi* of the *Consejo Nacional de Investigaciones Científicas y Tecnológicas* (CONICIT) and its funding instruments and strategies. The linkage of the Project with CONICIT, critical for sustainability and maximum impact, is based on experiences with the first Millennium Science Initiative in Chile.

The World Bank has responded to the Government's request for assistance with a proposed LIL. The LIL would assist (a) in the initiation of new policies, and (b) with the establishment of a technology fund (*Fondo Tecnológico*) which would support the Minister's agenda by establishing a competitive environment for state-of-the-art S&T research and incentives for national and international networking.

The proposed World Bank investment complements a recent *Second Science and Technology*

Program loan from the Inter-American Development Bank (IADB) for US$100 million (total project cost is US$200 million). The objective of the IADB loan is to support the actions of CONICIT to strengthen the National Innovation System through capacity building and training of new researchers in priority fields, and to facilitate interaction and cooperation among the various stakeholders in the NIS. The World Bank project, by comparison, is investing in capacity building for the new MS&T and in the creation of Centers and Nuclei of Excellence, which will eventually lead to the production of S&T research of high international standards of quality and productivity. This is expected to introduce a culture of reform that will lead to a positive change in existing rules and practices, and promote transparent and fair competition throughout the system.

3. Learning and Development issues to be addressed by the project:

The proposed LIL will address the two groups of constraints described above: (a) procedures and practices that inhibit optimal performance in research and training, and (b) scarcity of high quality, relevant research in S&T. The Centers and Nuclei of Scientific Excellence will be designed to be free from these constraints. Neither the increased investment in human resources nor reform of the rules and procedures alone would significantly improve performance. A principal value of the Centers and Nuclei of Scientific Excellence will be the demonstration of large performance gains resulting from the combination of increased investment and an improved set of rules for the allocation and use of these resources.

The benefits from investments in S&T research could be greatly increased in a system that operates under internationally proven procedures for best practice in research funding and administration. As part of a region-wide initiative with lessons learned from the Chilean experience, the Millennium Science Initiative requires that the following basic principles guide the further development of this concept:

- The core activity would be the selection of the most creative scientists available to the country for training of high quality human resources through the performance of high quality research. Individuals selected to conduct this training must have an internationally recognized reputation for excellence and achievement in their fields.
- Activities and individuals involved would be selected from multi-investigator proposals in fair, open, and transparent competition. The selection process would include high-level international peer evaluation. The selected research directors must exhibit strong leadership qualities.
- The resources made available to the Centers and Nuclei of Scientific Excellence must be appropriate to the objectives and under the control of the investigators (free from bureaucratic constraints).
- The centers must reach out to, and interact with other entities, be they in industry or in the education and social sectors.

The different benefits are expected to accrue to the initiative at different stages. The impact of transparent, objective, merit-based procedures should be felt immediately and consolidate over time as the initiative gains a reputation for funding in this manner. International experience strongly suggests that the existence of these effective procedures create peer pressure for the

elimination of remaining non-transparent funding systems. Benefits due to advancement of knowledge do not obey a strictly predictable timetable; they may appear or be realized immediately, or, more usually, increase over time as the quantity of high quality research increases. Benefits due to improved human resources training conform to the time schedules for degree and study programs (5 years in the case of Ph.D.s, less time for post-doctoral training). Finally, the impact of improved human capital occurs when the trained human resources are absorbed into the labor market. This last benefit depends on several concomitant factors outside the control of the initiative. It is important to note that the accrual of benefits is not linear - 10% of the initiative's benefits will not appear when the project is 10% complete. For this reason, the initiative should be undertaken in an appropriate time frame - a minimum of ten years - if it is undertaken at all.

4. Learning and innovation expectations:

☐ Economic ☒ Technical ☒ Social ☐ Participation
☒ Financial ☒ Institutional ☐ Environmental ☐ Other

C. Project Description Summary

1. Project components (see Annex 2 for a detailed description and Annex 3 for a detailed cost breakdown):

Component	Sector	Indicative Costs (US$M)	% of Total	Bank-financing (US$M)	% of Bank-financing
A. Capacity Building: A1. Institutional Strengthening A2. Capacity for Change and Management Structure	Institutional Development	1.02	7.0	0.50	10.6
B. Competitive Fund for Scientific Excellence: B1. Centers and Nuclei of Scientific Excellence Funding of research projects at about 3 CE and about 8-12 NER	Institutional Development	12.00	82.5	3.47	73.5
B2. Network for the Promotion of Scientific Excellence Funding of visits, exchange programs for researchers, post-docs and graduate students, design and delivery of international advanced courses, dissemination of lessons learned	Institutional Development	1.52	10.5	0.75	15.9
Total Project Costs		14.54	100.0	4.72	100.0
Front-end fee		0.00	0.0	0.00	0.0

Total Financing Required	14.54	100.0	4.72	100.0

2. Institutional and implementation arrangements:

Implementation period: The LIL phase of this project would be implemented over a period of two-and-one-half years, as the first phase of the ten-year Millennium Science Initiative. During the first 6 months, a management structure for the MSI would be created, the grant selection process would take place, and the grant contracts would be signed. During the remaining 24 months, awards would be disbursed, research conducted, the project networking and outreach activities would be implemented, and a second round of competition would take place.

Implementing agencies: A light administrative structure, attached to the new Ministry of Science and Technology, would implement the MSI. The MS&T would establish an agreement with CONICIT and utilize personnel from CONICIT to perform implementation duties as necessary and appropriate. The structure would be comprised of: (a) a Board of Directors, chaired by the Minister of Science and Technology, which would provide broad management oversight; (b) a Program Committee, composed of six distinguished individuals of international stature and representative of Venezuelan R&D priority fields, which would direct and execute the grant award selection process and other activities that require scientific expertise; (c) an Implementation and Management Unit (IMU), composed of an Executive Director, a Deputy Director, an Accountant, an Executive Secretary, and others as deemed necessary. The IMU would have responsibility for all day-to-day administration of the selection process, grant contracting, and grant management. Procurement would be decentralized, with most decisions and actions taken by CE and NER, but under the supervision and aegis of the IMU. In general, individuals who exercise decision-making power with respect to the work of the MSI must excuse themselves when they have interests that directly compete with the objectives of the MSI. This includes members of the Board of Directors, the Program Committee, the IMU, and peer reviewers. Overall, CONICIT, following technical and policy decisions by the Board of Directors, would be responsible for the Competitive Fund, Network for the Promotion of Scientific Excellence, and Project Management, while the MS&T would carry out Institutional Strengthening.

Key policies. The present Venezuelan Government supports the development of a national vision for S&T and the establishment of a coherent set of policies. This is evident from the recently established Ministry of Science and Technology (MS&T) which was made responsible for science and technology policy, coordination of activities, and for the implementation of policy instruments. According to the new minister's agenda, the key challenge for the new ministry will be to establish a critical mass for innovation and research and to consolidate a National Innovation System (NIS). The Ministry intends to establish a task force with the productive sector to support technology transfer to production. It also intends to work with the Ministry of Education to support universities in postgraduate training and research, and support centers of excellence in scientific research and technology. By investing sufficient resources in advanced human capital, the Ministry intends to establish incentives for the formation of a critical mass of research excellence, which will focus on selected priority fields in food production, sustainable development, new materials and processes, and communication and information technology. The Ministry also plans to modernize CONICIT and its funding instruments to support the strategies

and goals of the National Innovation System.

Institutional reform always presents a challenge. Some Venezuelan S&T research and higher education institutions are more prepared to implement and benefit from proposed changes than others. The same is true for individual researchers within each institution. However, the LIL, with centers and nuclei of excellence, will permit the selected leading institutions to advance. This will serve as an example for other institutions still preparing to enter the competition, and lead to changes and improvements. Additionally, with the creation of the new Ministry for Science and Technology and the appointment of a Minister for S&T, there will be a redefining of responsibilities for CONICIT. The Ministry of Science and Technology will be responsible for setting, implementing and monitoring new and current S&T policy. CONICIT will be responsible for funding S&T through competitive mechanisms. Reforms of this nature may require a bit of time while institutions adjust to their respective roles, but it is anticipated that this reform will lead to a positive change in existing rules and practices, and promote a culture of transparent and fair competition.

The **benefits** of adequate S&T capacity are well recognized: economic growth based on productivity improvements that well-trained S&T human capital can make possible, plus the potential positive externalities that may accrue to civil society in sectors such as food production, sustainable development, new materials and processes, and communication and information technology. Venezuelan society would also expect to benefit through the better return on the public investment made in R&D.

The **target populations** are qualified potential doctoral and post-doctoral S&T candidates, creative young researchers, established scientists and top quality research groups who are currently hindered by scarcity of resources and by rigid or inefficient procedures and practices that inhibit optimal performance in research and training.

3. Monitoring and evaluation arrangements:

Accounting, Budgeting and Financial Reports. CONICIT's general internal control environment was reviewed, including its organization, planning, budgeting, accounting records, financial reporting, supervision and auditing. The Implementation and Management Unit (IMU) will incorporate competent financial, accounting and procurement staff, and would be established at CONICIT to control the project's financial resources and disbursements, maintain accounting and budgeting records, and produce the financial reports according to the project's administration needs and Bank's requirements.

Use of Statements of Expenditures (SOE). Initial deposits into the Special Account and the replenishments, up to the Authorized Allocations set out in the Disbursement Letter, will be made on the basis of Applications for Withdrawals (Form 1903), accompanied with the supporting and other documentation as specified in the Disbursement Handbook. Once the integrated project financial management system is implemented at the IMU in accordance with LACI requirements and is certified as such by the Bank, a migration to a PMR-based type of disbursements may occur.

Auditing. An independent audit firm, acceptable to the Bank, should be appointed in sufficient time to carry out periodic reviews of the sources and application of funds and other financial statements required by the Bank. The audit should be performed in accordance with generally accepted international auditing standards, and the Guidelines and Terms of Reference for Audits of Projects with Financing by the World Bank in Latin America and Caribbean Region, published May 1999. Audit reports would be presented to the Bank no later than six months after the closing date of the previous calendar year.

Monitoring and Evaluation Arrangements: The IMU would be responsible for coordinating M&E activities, under the guidance and oversight of the Program Committee, where appropriate. They would monitor both the conduct and the output of the funded research and related data from the project and S&T indicators as a whole. The main M&E tasks would be: (a) to establish the baseline data for both long and short term indicators; (b) to collect information and data as required on the project and the R&D sector as a whole; (c) to work with the Program Committee and oversee any special studies or M&E activities contracted to consultants; and (d) to coordinate and facilitate the work and site visits of the panels that conduct the annual external evaluations.

Annual Reports: The Director or Principal Investigator of each CE and NER would prepare an annual report prior to April 1 of each calendar year. These reports would contain a self evaluation on the implementation progress of the research, the scientific results and their dissemination and impact, the progress of the training of students and post-docs, and the extent, nature, and success of the network and outreach activities. The Program Committee would generate a consolidated annual report for the MSI by June 1, integrating the results of all monitoring and evaluation activities, including its own evaluation of project progress. These may contain recommendations for policy changes and mid-course corrections, subject to Bank approval. Data related to the sector as a whole would be collected either by the IMU or through targeted studies commissioned by the Program Committee.

External Evaluation: During the learning phase of the MSI, a small team of three independent reviewers would visit Venezuela for one week to make an evaluation report on the progress of all project components. This visit would occur in 2001 and essentially be a mid-term review. The evaluation report would be ready prior to October 1. The panelists would conduct brief site visits to all sub-projects. Prior to their visit, the panelists would review the annual reports submitted by the CEs and the NERs, plus any other relevant M&E data produced by the IMU or its consultants. The panelists would produce a report evaluating, among other things, the scientific, economic, financial, and cost/effectiveness aspects of the project. The purpose of these evaluations would be to subject the project's own M&E data to outside scrutiny, to gain an independent view of impact, and to summarize lessons learned. The specific purpose of the review would be to gather all relevant experience from the first year of operation and to provide the Government and the Bank with detailed recommendations. The evaluation would review the establishment of the management structure of the MSI, the selection process of the CEs and the NERs and the initiation of training and research activities at the CEs and NERs. The evaluation would identify bottlenecks in the administrative process, including organizational, disbursement, procurement, and financial management procedures. The Government would then decide on how to continue into the next phase of the MSI. The reports of the panelists would serve as input into

the Implementation Completion report. Panelists would generally be non-Venezuelans with experience in research funding and science policy. Peer reviewers of subprojects may serve as review panelists, if appropriate.

D. Project Rationale

[This section is not to be completed in a LIL PAD. Rationale should be implicit in paragraph B: 3.]

E. Summary Project Analysis (Detailed assessments are in the project file, see Annex 8)

1. Economic (see Annex 4):
[For LIL, to the extent applicable]
○ Cost benefit NPV=US$ million; ERR = % (see Annex 4)
○ Cost effectiveness
● Other (specify)

There are positive economic consequences expected to all the proposed improvements to be piloted (efficiency in selection and administration, improved working conditions in S&T research groups, and increased training for young researchers). In the short term, one can expect to profit and learn most from the increased efficiency and better use of resources. The assumption is that in the absence of the project, resources are still too small to lead to world class research output, and that the most productive researchers are being deprived of the resources they need to work properly. In the longer term, one expects to see a stimulating effect of the project on innovation trends and positive labor market responses to those trained in connection with the funded research. One also expects to see more collaboration between firms and public sector (university-based) researchers, and, as a result, commercialization of more research outputs. The assumption is that the skills gained through research would produce knowledge that can be translated into goods and services.

2. Financial (see Annex 5):
NPV=US$ million; FRR = % (see Annex 4)
[For LIL, to the extent applicable]

In the short term, it will become apparent whether improved administrative efficiency makes investigators more productive. Clear international benchmarks on the speed, efficiency, and effectiveness of science administration institutions exist, and the IMU would be measured against these. These benchmarks deal primarily with the percentage of overall funding spent on administration, and the speed and efficiency with which resources are passed to researchers.

3. Technical:
[For LIL, enter data if applicable or 'Not Applicable']

The key technical issue is whether presence of high-level international scientists in the selection process, and more open and merit-based selection criteria would create a system that functions at the level of the best international systems (generally from OECD countries). Much of the effectiveness of the best systems comes from the knowledge and the strict adherence to the

highest procedural standards, embodied in the people who comprise it. The assumption is that lack of such people in the selection processes in countries like Venezuela is a key constraint and that inserting them would catalyze improved research performance.

4. Institutional:

4.1 Executing agencies:

In the short term, the institutional issues relate to the extent to which the new mechanisms are perceived as improvements and thereby diminish a perception of lack of incentives for higher quality in Venezuela's R&D system. It is possible that the MSI will function well, but that the project success could be frustrated at the level of the research institutions. This might occur through stakeholder resistance to change, or simply through the influence of inflexible bureaucracies. The long term question is, to what extent will institutions adopt improved procedures introduced by the project. This may occur through a type of social learning, discussed in section (5) below.

4.2 Project management:

The Implementation and Management Unit (IMU) will incorporate competent financial, accounting and procurement staff, and would be established at CONICIT to control the project's financial resources and disbursements, maintain accounting and budgeting record and produce the financial reports according to Project's administration needs and Bank's requirements.

4.3 Procurement issues:

The IMU's capacity to implement procurement actions for the project has been assessed and approved by the Regional Procurement Advisor. A new procurement law was issued in September 1999. Special provisions to make its provisions consistent with Bank guidelines were incorporated in the loan documents and will also be reflected in regulations to the new law to be enacted effectively. A detailed procurement plan covers the procurement of goods and consultant services according to the Project Operational Manual and with conditions acceptable to the Bank. Procurement records are foreseen to keep track of time taken to implement key steps and to monitor all activities.

4.4 Financial management issues:

Conditions of financial management of the MSI have been assessed by a Financial Management Specialist. The project satisfies the Bank requirements for financial accounting and auditing, puts arrangements for internal control mechanisms in place, and provides for Project Management Reporting. A two-phase time-bound Financial Management Action Plan is planned, with Phase A to be completed prior to effectiveness and Phase B not later than January 30, 2001.

5. Environmental: Environmental Category: C (Not Required)

5.1 Summarize the steps undertaken for environmental assessment and EMP preparation (including consultation and disclosure) and the significant issues and their treatment emerging from this analysis.

While successful technology development and transfer has the potential to impact positively as well as negatively on the environment, in the case of Venezuela, through its support of environmentally sound research projects (one of Venezuela's priority research areas) and through

practices for laboratory safety and disposal of hazardous materials, the project is expected to have a positive or neutral impact on environment.

5.2 What are the main features of the EMP and are they adequate?

n/a

5.3 For Category A and B projects, timeline and status of EA:
Date of receipt of final draft: n/a

n/a

5.4 How have stakeholders been consulted at the stage of (a) environmental screening and (b) draft EA report on the environmental impacts and proposed environment management plan? Describe mechanisms of consultation that were used and which groups were consulted?

n/a

5.5 What mechanisms have been established to monitor and evaluate the impact of the project on the environment? Do the indicators reflect the objectives and results of the EMP?

n/a

6. Social:

6.1 Summarize key social issues relevant to the project objectives, and specify the project's social development outcomes.

The possibility exists that researchers who do not win awards in the beginning of a LIL project would actively resist attempts to generalize its improvements to the system as a whole. By the same token, evidence suggests that stakeholders in key institutions may adopt MSI-type procedures early and widely appear on equal footing with this high-profile project.

Two other learning issues can be examined in the social realm. First, the extent to which the MSI produces new collaboration between Venezuelan and international scientists, through their higher recognition under the MSI, as well as via international dissemination catalyzed by the participation of high-level international scientists in the selection process. Second, increased numbers of non-Venezuelan graduate students can be expected, via potential regional scholarships designed to attract the best young brains in the region, and in general, due to the improved quality of work. One measure of longer term success can be the extent to which students from OECD countries, who traditionally choose Europe and North America for their training, would be attracted to Venezuela.

Finally, the expected influence of the MSI may act as a type of social learning. This phenomenon occurs when the introduction of fair and open competition for resources, merit-based awards and recognition, and rational and efficient administration, creates an intolerance for the traditional, less efficient means of awarding and administering research grants. The intolerance in turn creates pressure for change, and eventually change itself. Thus, the poorer performing system is driven out by a better performing one. This type of social learning has occurred, for instance, in Brazil, and, to a lesser extent, in Mexico, under Bank-supported S&T projects. If successful, the changes should stimulate scientists to return to or remain in Venezuela, reversing the current brain drain.

6.2 Participatory Approach: How are key stakeholders participating in the project?

Consultations were carried out with the main stakeholders of the S&T sector, including Ministry of Science and Technology, Ministry of Education, Ministry of Finance, Ministry of Planning, University Rectors, research groups, and representatives from industry. All stakeholders were supportive of the initiative.

6.3 How does the project involve consultations or collaboration with NGOs or other civil society organizations?

N/A

6.4 What institutional arrangements have been provided to ensure the project achieves its social development outcomes?

N/A

6.5 How will the project monitor performance in terms of social development outcomes?

N/A

7. Safeguard Policies:

7.1 Do any of the following safeguard policies apply to the project?

Policy	Applicability
☐ Environmental Assessment **(OP 4.01, BP 4.01, GP 4.01)**	☐ Yes ☒ No
☐ Natural habitats **(OP 4.04, BP 4.04, GP 4.04)**	☐ Yes ☒ No
☐ Forestry **(OP 4.36, GP 4.36)**	☐ Yes ☒ No
☐ Pest Management **(OP 4.09)**	☐ Yes ☒ No
☐ Cultural Property **(OPN 11.03)**	☐ Yes ☒ No
☐ Indigenous Peoples **(OD 4.20)**	☐ Yes ☒ No
☐ Involuntary Resettlement **(OD 4.30)**	☐ Yes ☒ No
☐ Safety of Dams **(OP 4.37, BP 4.37)**	☐ Yes ☒ No
☐ Projects in International Waters **(OP 7.50, BP 7.50, GP 7.50)**	☐ Yes ☒ No
☐ Projects in Disputed Areas **(OP 7.60, BP 7.60, GP 7.60)**	☐ Yes ☒ No

7.2 Describe provisions made by the project to ensure compliance with applicable safeguard policies.

n/a

F. Sustainability and Risks

1. Sustainability:

This section is not to be completed in LIL PAD.

2. Critical Risks (reflecting assumptions in the fourth column of Annex 1):

Risk	Risk Rating	Risk Minimization Measure
From Outputs to Objective		
Lack of commitment and willingness to scale up and follow-up on the project in the long term	N	After the completion of a 2-year LIL, an 8-year follow-on phase is planned to consolidate positive experiences in the rest of S&T sector
Lack of commitment to continue funding over the long term	M	LIL supports and complements incentives for the improvement of research quality, introduced by the Researchers Promotion Program. This program has been sustained since 1990.
Inadequate society demand/absorption capacity for new Ph.D.s and top level researchers	M	Increased collaboration between advanced research institutions and firms will result in better transfer of knowledge and increased employability of Ph.D. level researchers in industries.
From Components to Outputs		
Research groups might view the initiative as preferential treatment for a select few from which they gain nothing	S	Centers and Nuclei of Scientific Excellence must be integrated into the existing system in such a way that they are seen as beneficial to the whole system (e.g. sharing of scarce and costly equipment)
Universities might view the initiative as a top-down pressure, conflicting with the institutional autonomy	S	Centers and Nuclei of Scientific Excellence must maintain and support researchers' autonomy
The initiative could be viewed as subtraction or deviation from teaching and other research priorities	M	High quality teaching on undergraduate and postgraduate levels and high quality research other than leading to international publications must also be valued and rewarded
The process may be perceived as biased, collusive, or non-transparent. For instance, regional inequalities can be exacerbated by an apparent accumulation of resources in the metropolitan area	N	This potential problem should be minimized through strong efforts to disseminate the transparency and openness characteristics of the process
Fresh resources might not be used to fund the initiative	M	Mechanisms have to be designed and introduced to ensure that financial resources are sustainable.
Overall Risk Rating	M	

Risk Rating - H (High Risk), S (Substantial Risk), M (Modest Risk), N(Negligible or Low Risk)
Overall Risk Rating: Modest

The proposed MSI project total cost, over a two-and-one-half year period, is US$15.0 million, with US$5.0 million in Bank financing. The research budget for public universities in the Boliviarian Republic of Venezuela was US$56.1 million in 1998 and US$55.3 million in 1999. The proposed project represents approximately 13.5 percent of total S&T investment in Bolivarian Republic of Venezuela, with Bank investment representing 4.5 percent of the research budget per year.

3. Possible Controversial Aspects:

none

G. Main Loan Conditions

1. Effectiveness Condition

A project implementation plan has been agreed upon with the Borrower. Prior to effectiveness, the following conditions need to be met:

(i) The Ministry of Science and Technology and CONICIT established the Board of Directors, the Program Committee, and the IMU;
(ii) Appointment of the Executive Director and Deputy Director for the IMU;
(iii) Operational Manual for the Millennium Science Initiative, issued by the Ministry of Science and Technology and approved by the Bank;
(iv) Agreement with CONICIT regarding project implementation entered into;
(v) Implementation of Financial Management Action Plan;
(vi) Procurement plans for the first six months of the project;
(vii) Issuance of Regulations, satisfactory to the Bank, to Procurement Law 296.

2. Other [classify according to covenant types used in the Legal Agreements.]

(i) Mid-term review;
(ii) Biannual procurement audits;
(iii) Special provisions of NCB procedures;

H. Readiness for Implementation

☐ 1. a) The engineering design documents for the first year's activities are complete and ready for the start of project implementation.
☒ 1. b) Not applicable.

☐ 2. The procurement documents for the first six months' activities are complete and ready for the start of project implementation; and a framework has been established for agreement on standard bidding documents that will be used for ongoing procurement throughout the life of LIL
☒ 3. The LIL's Implementation Plan has been appraised and found to be realistic and of satisfactory quality.
☐ 4. The following items are lacking and are discussed under loan conditions (Section G):

THE PROJECT WILL BE READY FOR IMPLEMENTATION UPON MEETING EFFECTIVENESS CONDITIONS (SECTION G1)

I. Compliance with Bank Policies

☒ 1. This project complies with all applicable Bank policies.
☐ 2. The following exceptions to Bank policies are recommended for approval. The project complies with all other applicable Bank policies.

Lauritz B. Holm-Nielsen	Xavier E. Coll	Eduardo Wallentin, Acting
Team Leader	**Sector Manager/Director**	**Country Manager/Director**

Annex 1
Millennium Science Initiative Project - Project Design Summary

Hierarchy of Objectives	*Key Performance Indicators and Milestones*	*Monitoring and Evaluation*	*Critical Assumptions*
Sector-related CAS goals: The development agenda of the Venezuelan government is focused towards: "(a) enhancing sustainable growth, (b) promoting social development, (c) modernizing the public sector by strengthening public administration to improve governance and increase the effectiveness of public programs".	**Sector indicators:** The cumulative effect of increased human capital and knowledge stocks brings Venezuela closer to parity with the world's more knowledge-based economies. Long-term indicators are: • More commercially-viable new products and processes • Advances in public health, nutrition, environment, etc.	• Independent client survey reports • National, World Bank, IMF data	• Political stability • Sound and stable R&D policies
Follow-on development objective: To revitalize Venezuela's National Innovation System (widespread).	**Medium term indicators:** • Transparent quality assessment procedures and incentives in all S&T sector • More high quality Ph.D. researchers • Increased employment of them, also in the private sector • Increased quantity and quality of scientific output, some has direct implications for industry • Increased exchange of knowledge and mobility of researchers	• IMU data and opinion surveys • International comparison and "benchmarking" of S&T performance • Tracer studies of employment patterns	• Society, incorporates local and foreign know-how, and demands Ph.D.s and top quality research
Specific project development objective: To demonstrate how to revitalize Venezuela's science and technology (S&T) system by demonstrating and stimulating adoption of transparent quality assessment mechanisms and efficient merit-based allocation procedures.	**Outcome / Impact indicators:** • More Ph.D. and post-docs are trained in Venezuela • Increase in number and quality of research outcomes in CEs and NERs • Surveyed scientists perceive positive change and appreciate transparent quality-assessment mechanisms and merit-based allocation procedures. • Increased national and international scientific collaboration	**Project reports (combined for all indicators):** • IMU data • Grantee's annual reports • International comparisons of S&T indicators • Program committee self-evaluation • Panel evaluation reports	**(from objective to goal)** • The grantees perform at the level of internationally recognized scientific standards • Other public funding mechanisms adopt the lessons learned from MSI
Output: A demonstration through a Millennium Science Initiative that high quality research is possible in Venezuela, with improved scientific performance: • Support to Ministry of S&T and a light MSI administration structure • Grant Centers and Nuclei of Scientific Excellence and promote partnership in scientific excellence in the Region	• Consolidated capacity for S&T policy at MS&T • 3 centers and 8-12 nuclei of scientific excellence consolidated by the end of the project • Increased enrollment in doctoral programs, more Ph.D. research performed in the Venezuelan S&T centers • Established more international/regional research linkages	• Basic evaluation of the initiative as a whole carried out by external/ international panel from scientific community • Mid-term review and ICR • IMU gathered data and grantee's annual reports	**From outputs to objective:** • The Initiative is integrated in the S&T system in Venezuela • Client commitment to scale-up and follow-up on the project in the long term

Activities (project components and sub-components):	**Inputs (budget for each component):**		**From components to outputs:**
1. Capacity building of the Ministry of S&T and organization of the Venezuelan Millennium Science Initiative: • Technical support for Ministry of S&T • Board of Directors • Program Committee • Implementation and Management Unit • Scale-up studies **2. Competitive Fund for Scientific Excellence:** *2A. Selection and support of centers and nuclei of scientific excellence:* Selection: • Development and publication of the guidelines to call for proposals • Pre-selection and selection of proposals by the Program Committee, assisted by international peers, and according to the developed criteria Support of research, human resources formation and outreach activities • Expansion of doctoral programs in Venezuela's S&T centers of excellence • Outreach activities[1] *2B. Establishment of a network for the promotion of scientific excellence:* • Research visits to establish formal and informal connections to top centers and institutions • Coordination of research activities • Programs for exchange of researchers and graduate students • Regional doctoral courses • Dissemination of results and lessons learned	(US$ 1.0 Million) • Consolidation of MS&T and the reorganization of CONICIT • S&T policies enacted • Budget line defined • BD, PC and IMU established • Proposal, based on LIL experiences, for the whole Science and Technology system in Venezuela (US$ 12.0 Million) • Guidelines to call for proposals developed and published • Evaluation teams active • Proposals evaluated • Modern scientific equipment purchased • Fellowships for Ph.D. and post-doctoral students to conduct research in Venezuela's S&T centers of excellence • Outreach programs established (US$ 1.5 Million) • Fellowships for researchers and students distributed	• Disbursement reports (quarterly) • Supervision missions (bi-annually)	• Universities and research institutes clearly benefit from the Initiative • Fresh resources are used to fund the Initiative

[1] Each Center of Excellence must reach out to and interact with other entities, be they in industry, or in the education and social sectors.

Annex 2
Millennium Science Initiative in the Bolivarian Republic of Venezuela
Detailed Project Description

The project will have two components:

(A) **Capacity building:** Capacity for Change and Management Structure for Millennium Science Initiative "Ministry, CONICIT and the MSI Directorate" and

(B) **Competitive Fund for Scientific Excellence:**
B1. Centers and Nuclei of Scientific Excellence
B2. Network for the promotion of Scientific Excellence

Project Component A: Capacity building: Ministry, CONICIT and the MSI Directorate - US$ 1.0 million (total cost of component)

This component includes the following: (i) capacity building for the new Ministry of Science and Technology, with technical support to set up national S&T policies, (ii) establishment and operations of Board of Directors, Program Committee and Implementation and Management Unit; (iii) technical assistance for selection of CE and NER; (iv) development of a proposal to scale-up and institutionalize the project; and (v) Monitoring and Evaluation studies. Under this component, the program would finance studies, publications, remuneration of Program Committee and IMU's personnel, and administrative costs.

Capacity building for the new Ministry of Science and Technology will provide technical support for (i) establishment of coherent policies in the national science and technology sector, (ii) consolidation of a National Innovation System (NIS), (iii) introduction of incentives for the formation of the critical mass of high quality researchers, and support to research and development in priority technological areas (food production, sustainable development, new materials and processes, and communication and information technology), and (iv) modernization of the *Consejo Nacional de Investigaciones Científicas y Tecnológicas* (CONICIT) and its funding instruments and strategies.

The *Board of Directors* would consist of highly qualified experts interested in the advancement of science and technology from the scientific community, academia, the business world, and/or public life. The Board would renew at least a third of its membership every five years. Term of office is five years for initial members, and two years for new members, renewable for two-year periods. The function of this high level board is to oversee the project and the implementation of the programmatic activities selected by the program committee. The Chairman of the Board of Directors is the Minister of Science and Technology.

The *Program Committee* will be established by a Ministerial order and will consist of six experts of international stature and representative of Venezuelan R&D priority fields. The Committee members would be subject to no objection to the Bank. One committee member would be selected as its chair. The function of this committee is to select from among the proposals submitted in response to widely distributed and transparent calls-for-proposals. In this process, the committee would use inputs from expert international peer reviewers.

The *Implementation and Management Unit* would be headed by an Executive Director, with a Deputy Director and a staff consisting of an Auditor, an Executive Sectary, and other individuals as necessary. The IMU would perform all necessary support activities, including dissemination of calls-for-proposals, receiving the resulting submissions, submitting these to the program committee for selection of peer reviewers, and assisting in the notification and implementation of awards.

Project Component B: Competitive Fund for Scientific Excellence
US$ 13.5 million (total cost of component)

Project Sub-component B1: Centers and Nuclei of Scientific Excellence
US$ 12.0 million (total cost of sub-component)

This sub-component consists of the funding of research projects at 3 Centers of Excellence (CE) and 8-12 Nuclei for Excellent Research (NER). The CEs and NERs would carry out the following activities: (i) scientific research (ii) expansion doctoral and post-doctoral training programs; and (iii) networking, outreach[2]; and special activities to promote scientific excellence. Under this component, the program would finance high-level scientific equipment, infrastructure rehabilitation (including laboratories), fellowships for doctoral and post-doctoral students, and publications.

The research proposals will be subject to pre-selection and selection by the Program Committee, assisted by international peers, and according to the developed criteria. The resources requested in each application should be appropriate for achieving its goals, and may include state-of-the-art scientific equipment and its maintenance, chemicals and supplies, graduate student and postdoctoral fellowships under the control of the investigators, funds for national and international travel and cooperation, and other necessary funds. The proposals should be analyzed on the basis of their scientific excellence and the ability and track records of the principal and co-investigators. In accordance with standard international practice, the funding for all these components should be considered in the review process, so that the investigators do not have to apply to different sources of funds for the different elements of the proposal. The criteria for selection of the applications for an institute or center should include:

- The number of major investigators. At least 3 and preferably more should be involved
- The qualifications of the principal and co-investigators
- The excellence of the proposed research
- The utilization and training of graduate students and post-doctoral fellows

In addition, at least one of the following criteria should be considered:

- Proposed regional outreach activities
- Relation to Venezuela's priority R&D fields
- Relation to other societal needs, such as health or utilization of natural resources
- Connection to industry and other productive sectors

[2] Each CE must reach out to and interact with other entities, be they in industry, or in the education and social sectors.

Some specifics for the CE and NER are as follows:

Centers of Excellence - CE (3), composed of Venezuelan scientists of international stature performing high quality research work in one or more of the Venezuela's priority research fields. One scientist from each center would be that center's head. The resources made available for the centers would be commensurate with the research to be performed (as described in the selected grant proposals) and with levels received by analogous groups internationally. These centers are expected to be able to compete scientifically in high level international arena. Requests for short preliminary proposals for these centers would be generated by the Program Committee and would spell out transparent rules of open competition for the available resources. The range, size, and parameters chosen for these available resources would be described in the request-for-proposals. The Program Committee would prepare a short list of proposals; the principal investigators would be invited to submit full (significantly more detailed) proposals. The full proposals would each be reviewed by at least three international peer reviewers, who are to be selected by the Program Committee. The Program Committee would then select awardees on the basis of these reviewers' recommendations. Centers of Excellence would be supported for five-year renewable periods, subject to satisfactory performance.

Nuclei for Excellent Research - NER (8-12), each comprised of young promising scientists with the potential to evolve into researchers of the stature of those supported under the centers of excellence grants. The corresponding requests-for-proposals would likewise be generated by the Program Committee (through a similar process), and evaluated under similar procedures. The amount of resources for research nuclei would be smaller, the resource parameters narrower, and the selection criteria less extensive than those for the CE. Nonetheless, the merit of the proposals and the quality of the proponents would be of central importance, just as it would be for the CE. The NER would be supported for one, non-renewable three year period.

Project Sub-component B2: Network for the Promotion of Scientific Excellence
US$ 1.5 million (total cost of sub-component)

Networking activities will include: (i) research visits to establish formal and informal connections to high level international institutions; (ii) coordination of appropriate Initiative-wide activities with Directors of CEs, NERs, and principal investigators; (iii) programs for exchange of researchers, post-graduate, and graduate students; (iv) design and delivery of international advanced courses; and (v) dissemination of lessons learned. Under this component, the program would finance remuneration for researchers, fellowships for doctoral and post-doctoral students, travel expenditures, and publications.

Annex 3
Assumptions and Expected Benefits

The ability of a society to produce, select, adapt, and commercialize knowledge is critical for sustained economic growth and improved quality of life. In its most basic form, a Millennium Science Initiative Project is a competitive fund for research support with a light administrative structure. Aside from increased scientific outputs such as training opportunities and integration with the international scientific community, three main benefits are expected from the initiative: (i) contributing to stem "brain drain"; (ii) forging cultures of quality; and (iii) pressuring for transparency and merit-based allocation procedures. The first pilot MSI project for Chile was approved by the World Bank on April 30, 1999.

Background and Assumptions

1. **Knowledge is a critical determinant of economic growth and standard of living.** A strong consensus, reflected in recent policy statements from the OECD, the World Bank, and others, is emerging: *knowledge is the most important factor in economic development.* The OECD concluded that "underlying long-term growth rates in OECD economies depend on maintaining and expanding the knowledge base."[3] The World Bank's 1998/99 World Development Report states that "Today's most technologically advanced economies are truly knowledge-based...creating millions of knowledge-related jobs in an array of disciplines that have emerged overnight," and "the need for developing countries to increase their capacity to use knowledge cannot be overstated." Improving this capacity is becoming a pre-requisite for sustained economic growth and improved quality of life. World Bank senior management is committed to working with clients who are developing strategies to narrow knowledge gaps with the advanced countries.

2. **Social Rates of Return to Innovations and R&D.** Mansfield, 1977; Griliches and Lichtenburg, 1984; Bernstein and Nadiri, 1998 have concluded that the social rates of return to innovations and to R&D in developed countries are high (on average over 20%, and for some industries above 70%). Commercially viable innovations tend to lower the cost of production, leading to lower prices (consumer surplus) and/or resource savings which increase output elsewhere in the economy. In addition, close links have been established between academic research and the development of new products and processes (Nelson, 1986; Jaffe, 1989; Mansfield, 1991). In several industries, a substantial proportion of new products and processes (10%-20%) could not have been developed (or, not without substantial delay) in absence of academic research that had been carried out within the previous two decades. Further work by Francis Narin in 1997 found that 73% of papers cited in US industry patents were from publicly-funded research conducted either at universities or public research institutions.

3. **Knowledge is transformed into goods and services through a country's National Innovation System.** Knowledge by itself does not transform economies. Its benefits appear when it is employed within a complex system of institutions and practices known as a National Innovation System (NIS). An NIS is a web of: (i) knowledge producing organizations in the education and training system (such as universities and research institutes);

[3] OECD 1998, "Technology, Productivity, and Job Creation: Best Policy Practices." P.4.

(ii) the macroeconomic and regulatory framework, including trade policies that affect technology diffusion; (iii) communications infrastructures; and (iv) selected other factors, such as access to the global knowledge base or certain market conditions that favor innovations. A NIS is effective to the extent that these elements are developed and work in harmony.

4. **Cutting-edge scientific research is an essential part of an effective NIS.** New knowledge drives innovation. In most cases,[4] there are several reasons why at least some of a country's researchers should be at the forefront of their disciplines. First, even in cases where innovation policy is primarily concerned with adaptation rather than production of knowledge, the intellectual rigor required usually results from "pursuing the leader" at the forefront of discipline. Second, since so much of scientific knowledge creation involves the "free exchange" of ideas among colleagues worldwide [all of whom are seeking recognition and prestige], countries integrate best and benefit most when they have knowledge to offer. For countries of a basic level of scientific development, it is not impossible to be an absolute follower and taker from the world's knowledge base—but neither is it efficient or a sustainable. In the long-term, countries that wish to use knowledge must also get involved in its production. Third, university-based research—relatively small compared with other university activities—has a disproportionately large effect that energizes both educational and innovation systems.

5. **University research and the NIS.** Mansfield (1993) found that most important contributions to industrial innovation came from university research done at the departments that were world-leaders in their domain. This same study found geographical proximity of university-based research to be another important factor contributing to industrial innovations. Among the study's findings were that, "there are many advantages to firms working with, and keeping abreast of, developments at local universities." Furthermore, students were found to play an important role as transfer agents: studies of the US NSF's Industry/University Cooperative Research Program found better personnel recruitment to be one of the principal benefits of their participation in the program. Both Mansfield (1993) and Peters and Fusfeld (1982) found students to be a strong transfer mechanism in innovation; citations in patent applications of the work of former mentors by students who had taken jobs in private research labs were well above the general average of citations.

6. **Trained human brains are the most effective knowledge transfer and adaptation mechanism.** Innovation is not a linear process of "science push" leading to applications. The idiosyncratic nature of scientific and technological advance is best promoted by individuals who are comprehensively trained in their disciplines. Proper incentive systems are necessary, and discrete actions such as tech transfer via trade in goods also contribute. But, in the long run, the expertise gained through training is the decisive factor in the economic impact of technology transfer.

---

[4] Depending on stage of development. Among the most impoverished countries, there a certainly more pressing priorities than developing research excellence. Other countries must decide very selectively how they will spend their limited resources on national knowledge strategies. These countries may be too poor to be effective participants in the global knowledge system. Above a certain level of economic development [that typically found in most Latin American countries, for instance], it becomes essential to take part in global knowledge production and use.

7. Science and technology are intertwined. There is still much truth in the common view that the most important technological breakthroughs occurred because scientists were investigating nature—not because they were looking for applications of their research [e.g., Faraday's and Maxwell's work was pure science, but it facilitated Marconi's and other's work on wireless communication]. However, because it is increasingly true that new technologies give rise to new sciences and disciplines [e.g., chemical engineering], it is most accurate to view science and technology as intertwined. According to Richard Nelson[5], this intertwining is the principal reason why technology is advanced through the work of men and women who have university training in science and engineering. It is also "the principal reason why, in many fields, university research is an important contributor to technological advance, and universities as well as corporate labs are essential parts of the innovation system. Thus the problems that originate in industry are not explored only by industrial scientists. They feed into, and stimulate, the entire scientific community."

8. Good science is international. Nature does not respect political boundaries. In response, science has evolved as an international endeavor. Those who work at the forefront of their disciplines seek to interact and collaborate with their peers regardless of where they are. Conversely, researchers need access to global interchange of knowledge to avoid obsolescence and insularity.

9. Anonymous peer review and competitive funding facilitate quality and productivity in science and technology. Allocation practices that rely on anonymous review by qualified scientific peers and open, transparent, merit-based competition for resources are nearly universally acknowledged as the most effective means of distributing research resources. In such systems, scientific recognition is the foundation upon which careers are built, and access to resources is the means to recognition. This creates
strong incentives for researchers to maximize their productivity, by adding graduate students and spending their budgets wisely. As a result, in such systems *the most- highly selected researchers tend to be the most efficient and productive.*

The World Bank's Millennium Science Initiative - MSI

10. The guiding principles for the Millennium Science Initiative are as follows: (i) the Centers of Excellence / Nuclei for Excellent Research concept has Bank support as an integral part of policies that can assist countries to reach the "knowledge society" (WDR 1998); (ii) the Centers of Excellence will be designed to develop human capital, to provide vibrant research environments where state-of-the-art scientific research can be performed, be linked to the private sector in order to assist countries in their development process, and be part of an international network; (iii) the Bank will be responsive to requests from individual countries for assistance to develop concrete actions in the area of Centers of Excellence. Such actions could eventually call for Bank financial assistance in the form of LILs, SILs, amendments to ongoing projects, etc.; (iv) the Banks response to requests for assistance from governments in further developing the Centers of Excellence concept would be flexible, recognizing differences in national circumstances, and hence not prescribe a particular modus-operandi. In some cases, for example, support of Centers of Excellence would be "institutionalized" (Princeton Model) in other cases Centers of Excellence could be networks of excellent research teams (Hughes Model);

---

[5] R.Nelson, National Innovation Systems: A Comparative Analysis, New York: Oxford University Press, 1993. P.7.

(v) the Bank would suggest the names of specific international experts who could participate in the process of further developing the Centers of Excellence concept, tailored to meet national needs and priorities. The Bank would assist countries in establishing national/international advisory panels as appropriate, however, there would be no international advisory superstructure; and (vi) the Bank would actively seek the participation of private foundations and international organizations, and trust funds in further developing an international network of Centers of Excellence.

While the MSI will be adapted to the particular needs of the individual client countries that participate, all initiatives will share some basic common characteristics:

11. **Support for top-quality science through a competitive fund.** Many developing countries get low returns from their R&D investments because, inter alia, they do not follow best practice in selection, allocation, and implementation procedures. The Millennium Science Initiative seeks to test the extent to which higher returns can be induced through the introduction of state-of-the-art selection and funding criteria.

12. **Involvement of the international community in the selection process.** All MSI-funded activities will be vetted through selection processes that involve world-class international peers. Where appropriate, some high qualified scientists will provide general direction and oversight, and help facilitate networking and exchange.

13. **Increased training opportunities.** In countries where the MSI will operate, there is typically found a dearth of quality graduate training opportunities for bright young minds; training systems often lack quality and dynamism, taking a long time to produce a few graduates. All research funded through the MSI be directly connected to increase provision of training opportunities for graduate students. In connection with their research—and as a requirement for selection--investigators will be expected to train and advise the maximum feasible number of graduate students.

14. **Global and regional connections to other researchers.** The selection process itself will help disseminate the activities of the MSI host countries abroad. The research projects will similarly provide opportunities for international collaborations through long-term and visiting professorships, post-doctoral and doctoral positions. In addition, each funded group will cooperate with the overall Program Committee on a series of targeted activities which integrate with national and international partners.

Expected Benefits

Aside from increased scientific outputs such as training opportunities and integration with the international scientific community, three main benefits are expected from the initiative:

15. **Contributing to stem "brain drain".** In the U.S. 40% of university faculty are foreign born, and this percentage is rising. Brain drain is not new, but it is predictable: the most talented individuals will get their education and pursue their careers wherever they find the best opportunities to do quality work and secure funding. Because geographic isolation is still extremely detrimental to research careers, the best will not stay in their countries unless a critical mass of quality researchers appears. The MSI would contribute toward creating this by providing career opportunity to the most qualified national scientists and researchers and by attracting top-quality international talent.

Expected Benefits

Aside from increased scientific outputs such as training opportunities and integration with the international scientific community, three main benefits are expected from the initiative:

15. Contributing to stem "brain drain". In the U.S. 40% of university faculty are foreign born, and this percentage is rising. Brain drain is not new, but it is predictable: the most talented individuals will get their education and pursue their careers wherever they find the best opportunities to do quality work and secure funding. Because geographic isolation is still extremely detrimental to research careers, the best will not stay in their countries unless a critical mass of quality researchers appears. The MSI would contribute toward creating this by providing career opportunity to the most qualified national scientists and researchers and by attracting top-quality international talent.

16. Forging cultures of quality. In under-performing research systems, it is common to find an aversion to the difficult choices necessitated by true competition for resources. Typically, anyone with reasonable scientific credentials can "survive", when survival means bad infrastructure, obsolete equipment, and inadequate professional autonomy. By contrast, advanced scientific countries will usually have flagship funding agencies in which only the top researchers get considered for funding, but those who are funded are given the resources and freedom to do their best work. As countries attempt to transition from one system toward the other, researchers must become accustomed to abiding by decisions [of qualified peers] that nourish the best scientists and starve the inadequate among them. Resistance to this change is common, but perseverance for a sustained period (10 years or more) typically results in research community that is healthier and much more dynamic.

17. Pressuring for transparency and merit-based allocation procedures. This is a corollary to the social learning process that leads to a culture of quality. The introduction of allocation procedures that favor the most qualified scientists tends to create a vocal group that seek to maintain fair, open processes. This group wants the opportunity to compete and be rewarded according to their objectively-evaluated merits. The sense of resignation to an unfair status quo can be overcome through this type targeted intervention.

Annex 4
Millennium Science Initiative Project in the Bolivarian Republic of Venezuela
Estimated Project Costs

Project Component	Local	Foreign	Total
	----------US $ million----------		
1. Management Structure for the Millennium Science Initiative	**0.5000**	**0.5000**	**1.0000**
a) Technical support for the new Ministry for S&T	0.1000	0.1000	0.2000
b) Board of Directors	0.0125	0.0125	0.0250
c) Program Committee	0.0500	0.0500	0.1000
d) Peer Reviewers	0.0150	0.0150	0.0300
e) Implementation and Management Support Unit	0.2350	0.2350	0.4700
f) Studies: scale-up, M&E, surveys, baseline and tracer studies	0.0875	0.0875	0.1750
2. Competitive Fund for Scientific Excellence	**8.5250**	**3.4750**	**12.0000**
a) Centers of Excellence	6.4000	2.6000	9.0000
b) Nuclei for Excellent Research	2.1250	0.8750	3.0000
3. Network for the Promotion of Scientific Excellence	**0.7500**	**0.7500**	**1.5000**
a) Visits to establish the network	0.0250	0.0250	0.0500
b) Exchange programs for researchers, post-docs, and graduate students	0.5500	0.5500	1.1000
c) International advanced courses	0.1500	0.1500	0.3000
d) Dissemination of lessons learnt	0.0250	0.0250	0.0500
Total Baseline Cost	**9.7750**	**4.7250**	**14.5000**
Physical Contingencies	**0.1500**	**0.1500**	**0.3000**
Price Contingencies	**0.0750**	**0.0750**	**0.1500**
Front End Fee	**0.0000**	**0.0500**	**0.0500**
Total Project Cost	**10.0000**	**5.0000**	**15.0000**

Annex 5
Economic Analysis and Related Issues

Background: Social Rates of Return to Innovations and R&D. A number of studies (Mansfield, 1977; Griliches and Lichtenburg, 1984; Bernstein and Nadiri, 1998) have concluded that the social rates of return to innovations and to R&D in developed countries are high (on average over 20%, and for some industries above 70%). Commercially viable innovations tend to lower the cost of production, leading to lower prices (consumer surplus) and/or resource savings which increase output elsewhere in the economy. In addition, close links have been established between academic research and the development of new products and processes (Nelson, 1986; Jaffe, 1989; Mansfield, 1991). In several industries, a substantial proportion of new products and processes (10%-20%) could not have been developed (or, not without substantial delay) in absence of academic research that had been carried out within the previous two decades. Further work by Francis Narin in 1997 found that 73% of papers cited in US industry patents were from publicly-funded research conducted either at universities or public research institutions.

Perhaps most relevant to this project, Mansfield (1993) found that most important contributions to industrial innovation came from university research done at the departments that were **world-leaders** in their domain. This same study found **geographical proximity** of university-based research to be another important factor contributing to industrial innovations. Among the study's findings were that, "there are many advantages to firms working with, and keeping abreast of, developments at local universities." Furthermore, **students were found to play an important role as transfer agents:** studies of the US NSF's Industry/University Cooperative Research Program found better personnel recruitment to be one of the principal benefits of their participation in the program. Both Mansfield (1993) and Peters and Fusfeld (1982) found students to be a strong transfer mechanism in innovation: citations in patent applications of the work of former mentors by students who had taken jobs in private research labs were well above the general average of citations.

These findings argue very strongly for investments in improving the quality of the best researchers in the Venezuela's universities and research institutes, and of prioritizing human resources training for the sake of technology transfer. However, some important caveats must be considered: (a) the results of academic research are utilized in many places, and appear in the economic sphere two or three steps removed from where they were created (with an average time interval of seven years, which may extend up to two decades in some cases); (b) industries in developing countries may lack private R&D facilities, may produce very few innovations (concentrating on adaptations instead), may have weak design capacity, and low or negligent private investment in R&D, and; (c) the economic context in developing countries may be characterized by distorted prices and markets, lack of competition, and irrational or short-sighted legal and regulatory frameworks.

Even without these conditions, precise measurement of the returns to R&D is hampered by at least two important conceptual constraints: (a) the long time between the conduct of research and the appearance of results, and (b) the difficulty in valuation of factors such as the contributions of strong basic science education in secondary and at the undergraduate level, or mature communications information and communications infrastructures.

For these reasons, and consistent with the LIL guidelines, no full-scale formal cost-benefit analysis was conducted during preparation. Under the project itself (and under the follow-on activities), information will be collected and analysis will be performed principally on efficiency and productivity gains in research and improvements to the stock of highly-trained human capital. This will be in preparation for an eventual formal cost-benefit analysis, in the appropriate time frame.

The Short-term Goal: Measuring Cost-effectiveness and Private Returns to Researchers. The Program Committee and the Implementation and Management Unit (PC and IMU) would conduct or oversee the collection of data on the efficiency and productivity of MSI-funded researchers and research. This would be compared with baseline data for the sector as a whole. A value would be computed for both the direct saving under the MSI, and for any other saving induced by the MSI's influence on the rest of the Venezuelan system. Efficiency savings are expected to come from: (i) focusing resources on the best researchers - those of proven merit and record of past performance - as identified through the high-level selection process; (ii) introducing a "light model of administration" which decreases the bureaucratic burden on investigators; and (iii) providing sufficient resources to allow investigators to staff their labs and purchase the necessary equipment needed to work on the most relevant research problems.

Private returns to those trained in connection with MSI-funded research would give an important initial indication of the potential market value of increased investment and improved quality of research. Again, time horizons are long, but detailed data will be collected on: (i) collaborations (especially if they are remunerative) by MSI researchers with private firms; (ii) job offers, salaries, nature of (public or private) and time-to-first employment for all graduate students and post-doctoral fellows connect to the MSI (as well as for grad students and post-docs in the Venezuela as a whole); and (iii) increases in training opportunities, and changes in the profile (especially the quality) of students selecting careers in research. Clearly, several independent variables other than the project will influence these factors. Nonetheless, carefully conducted analysis should yield insight on whether the MSI is providing human resources training that is valuable in the labor market and the economy. Because of the present dearth of Ph.D.s, the private return to those trained under the project will be monitored versus that of those trained abroad, to gauge the perceived value of the training. Likewise, the returns will be tracked over time to see if they diminish as the project adds additional highly-trained individuals.

The Long-term Goal: Measuring the Specific Impact on the Venezuelan Economy. Over the very long term (ten years or more) the goal is to measure the direct effect of the activities and outputs of the project on the Venezuelan economy. Increased productivity and output in the economy may result from greater success in commercialization of fundamental and applied research. This is likely to result from: (a) increased absolute numbers of researchers working in private firms; (b) better skills of S&T researchers (both in firms and the public sector); and (c) a greater focus of R&D on economically relevant areas. The impact in the economy could appear as greater output from existing firms, the creation of new, technologically-oriented firms, a shift toward higher quality products, and/or improved socioeconomic performance, (improvements in health, environments, etc.).

Once again, one should not expect drastic changes in the economy because: (i) the investment is very small compared to the size of the economy; (ii) the project encourages private sector cooperation, but does not mandate it; (iii) the purported economic relevance of the research is only one criterion for selection; and (iv) several independent variables (e.g., worsening regional macroeconomic conditions) could mitigate or nullify the positive impact of the project.

Annex 6
Millennium Science Initiative Project in the Bolivarian Republic of Venezuela
Procurement and Disbursement Arrangements

General. Goods and works shall be procured in accordance with the provisions of the "Guidelines for Procurement under IBRD Loans and IDA Credits", published by the Bank in January 1995 and revised in January and August 1996, September 1997 and January 1999 (the Guidelines).

Procurement methods. The methods to be used for the procurement described below, and the estimated amounts for each method, are summarized in Table A. The threshold contract values for the use of each method are fixed in Table B.

A. Competitive Fund for Scientific Excellence - to support CEs and NERs (The Fund)

The Fund will award grants for research, human resource formation and outreach activities. The total amount of grants is estimated at US$12.0 million. Principal Investigators (PI) at universities and non-university centers will apply for these grants. Applications will include a program of activities, general services and technical assistance through **individual consultants or single source selections** whenever only one individual or firm is qualified or has experience of exceptional worth for the assignment [Clause 5.1 (c) and 3.9 (d) of the Guidelines]. Other contracting of consultants will follow Quality Cost-Based Selection (QCBS) or Consultant's Qualifications procedures (CQ). The terms of the grants will be established in the Grant Agreements and in accordance with the Operational Manual. Thresholds for procurement methods, including goods and works for subprojects, are established in Annex 6 Table B.

B. Other Components

Any procurement of goods and contracting of consultants for the other components of the project will be carried out according to Bank Guidelines and the procedures outlined below. The aggregated amounts indicated below **do not include** amounts assigned to the Fund.

Civil Works: The Project does not foresee any procurement of civil works with Bank financing other than those contemplated by the CEs and NERs for carrying out rehabilitation / construction of research facilities.

Goods: The Project does not foresee any procurement for goods above US$50,000. In case of procurement above US$50,000, NCB procedures shall be applied, and special provisions for NCB will be stated in the Loan Agreement.

Goods: Goods estimated to cost up to US$50,000 shall be procured using National Shopping procedures up to an aggregate amount of US$150,000.

Consultant Services: Consultant's services shall be procured in accordance with the provisions of the "Guidelines: Selection and Employment of Consultants by World Bank Borrowers" published by the Bank in January 1997, revised in September 1997 and January 1999 (the Consultants Guidelines).

Firms, regardless of the contract cost, may be contracted under Quality-and-Cost-Based Selection (QCBS) procedures, except as indicated below. Other services to be contracted by the IMU, such as surveys, background studies, study-tours, technical assistance, audits, estimated to cost less than US$100,000 may be selected based on Consultant's Qualifications.

Individual's specialized advisory services would be provided by individual consultants selected by comparison of qualifications of three candidates and hired in accordance with the provisions of paragraph 5.1 through 5.3 of the Consultant Guidelines, up to an aggregate amount of US$1,000,000, and single source selection whenever only one individual or firm is qualified or has experience of exceptional worth for the assignment (Clause 3.9 (d) of the Consultant Guidelines).

Operational Costs: Sundry items, office rental and utilities would be financed and procured using the MST administrative procedures, which were reviewed and found acceptable to the Bank.

Advertising: A General Procurement Notice for procurement of consultant services is scheduled to be published in the United Nations Development Business paper, by July 1, 2000. The Notice will be updated annually for outstanding consultant services.

Prior Review Thresholds: In accordance with the institutional learning expectations for this LIL, prior review by the Bank would include (i) procurement arrangements to be in accordance with Appendix 1, Paragraph 2 of the Bank Guidelines; (ii) the first two NCB contracts for goods and works; (iii) the first two Shopping contracts for goods and small works. The balance of works and goods would be subject to ex-post review by the Bank and procurement audits, and (iv) for consultants, the Bank would review all terms of reference, as well as contracts over US$35,000.00 for individuals, US$100,000.00 for firms, any amendment of contracts resulting in the increase of the contract value beyond the review limits set in above and all single source selection if needed. To facilitate this process, the IMU would submit to the Bank at the beginning of each semester, a plan for the hiring of consultants with their terms of reference and estimated cost, as part of the Biannual Operating Plan. At the end of each trimester, CE and NER will submit to the IMU a report of expenditures and the Bank supervision missions will carry out an assessment of the procurement processes described above. Biannual procurement audits will be carried out by independent auditors, as described in the next paragraph, and submitted to the Bank during the three months following the audit to assure the required controls. The PIs and the IMU should keep records of all procurement actions executed to allow the Bank to carry out its post-reviews and audits. They should also submit to the Bank every six months a list of all contracts signed indicating the name of the contracted firm, the amount and the objective of the contract. Prior review of approximately 30% of the loan is expected under these arrangements. Although the level of prior review would be relatively low, this would be compensated for in several ways: (i) every six months, external auditors, contracted by MST under the loan, would conduct performance audits covering: technical, environmental, managerial and procurement aspects on a sample of subprojects satisfactory to the Bank as part of the ex-post evaluation of subprojects; (ii) audit of procurement aspects would include physical audits and procurement procedures used, so that the Bank can judge whether procurement implementation is satisfactory;

(iii) the project information and monitoring system would be used to compare costs of similar subprojects in order to detect possible discrepancies which might indicate procurement problems and the need for further analysis; accuracy of the data in the project information system will be checked through the audits and (iv) Bank supervision missions will conduct random reviews, including frequent field visits and reviews of procurement documentation. Additionally, the systemic review of the two first contracts of each type each year would help monitor quality and consistency in the application of Bank Guidelines and procurement procedures agreed for the project.

In addition to this prior review of individual procurement actions, the plan and budget for the IMU Operating Costs will be review and approved by the Bank. Efforts would be made for a procurement specialist/procurement consultant to be part of the supervision missions.

Procurement Responsibility

The project implementation will require procurement of a limited quantity of goods (about 1.5% of the project total cost), but significant technical assistance services for studies and other consultant assignments. MST's project implementation and management unit (IMU) will be responsible for the overall project procurement activity, including compliance with procedures and timetables agreed with the Bank. The IMU will have the capability to carry out the project procurement. Its manager, a lawyer from the MST, will establish a procurement team of two staff. One has already been hired and is a qualified operational officer, who successfully managed similar procurement activity under the recently completed Bank financed project, the Student Loan Reform Project, Loan 3494-VE. During the project's appraisal mission, this officer was involved in all of the project's procurement aspects and has since then, been actively preparing the procurement plan and the procurement chapter of the Operations Manual. The second member of the team will be recruited soon, under TORs acceptable to the Bank.

The team was in place prior to the Loan negotiations. The team with assistance of consultants for procurement, if required, will prepare working instructions closely reflecting Bank procedures and outlining all aspects of procurement under the project. The working instructions are an integral part of the project's Operational Manual, which is under preparation. The Project Operational Manual is to be finalized and adopted prior to the Project's effectiveness and a draft will be required for the workshop of the project that is scheduled before effectiveness. The OM would be updated by the MST to include specific operating and control mechanisms agreed under the financial and physical monitoring system (FMS).

Assessment of the Agency's Capacity to Implement Procurement. An assessment of the capacity of the MST to implement procurement actions for the project has been carried out and was approved by the Regional Procurement Advisor on May 2, 2000. There has been no Country Procurement Assessment Review (CPAR) for the Venezuela. A key aspect for defining the level of prior review has been the procurement capacity assessment of the IMU. The assessment involved officials from MST completing data collection questionnaires about laws and regulations. With regard to the IMU, since the unit's staffing is yet to be completed and its procurement team yet to be organized, the Bank mission worked with the IADB unit's manager (CONICIT) and the procurement staff hired recently by the MST, collecting data, analyzing procurement performance under previous IADB Loan and reviewing how the IMU procurement will be organized.

Based on the assessment, and taking into account that: i) the Bolivarian Republic of Venezuela's new procurement Law 296 does not include an Article stipulating that the procurement policies and procedures of the international financiers apply to their respective projects, ii) the MST lack of experience in World Bank projects due to its recent creation and iii) the number of special provisions that need to be reflected in the regulations and have been stipulated in the Loan Agreement applicable to NCB, ***the project's procurement risk rating assessment is high***. The special provisions are as per Guidelines: i) registration as a condition of submission of bids; ii) the use of two envelopes; iii) submission periods in NCB; iv) requests by bidders for confidentiality of parts of bids; v) the publication of cost estimates; vi) the use of cost estimates for the disqualification of bids; vii) declaring a bid null because two or more bids were not received, viii) fragmentation of the subject of procurement, ix) and bid evaluation. Issuance of regulations satisfactory to the Bank will take place prior to loan effectiveness. A detailed Action Plan was presented to the MST. Agreement on this Action Plan was reached during negotiations.

Procurement Plan

Key instruments for carrying out the procurement by the IMU were completed, during the project appraisal mission. They involve a detailed (i) procurement plan for goods and a consultant plan and process scheduling for the project and (ii) guidelines for the Project Operational Manual, including procurement process. The procurement plan, satisfactory to the Bank, for the first six months of implementation of the project (not including the Fund) should be submitted by effectiveness. Thereafter, biannual procurement plans will be submitted. The IMU shall create the procurement plan by consolidating the plans from the CEs and NERs. The plan shall specify the aggregate amounts for each type of expenditure (equipment, reagents, fellowships, etc.), procurement procedures (national competitive bidding and local shopping) and process scheduling used for acquisition of goods and applicable procedures, selection criteria, and so forth for services during a given six-month period. The plan includes i) a list of contracts completed, under execution, under procurement, to be procured in the upcoming calendar semester; ii) costs of completed and under execution contracts, estimated costs for upcoming contracts; iii) schedule of bidding; and iv) particular methods of procurement of goods or selection of consultants. Standard Documents for national procurement and contracting of consultants will be developed by the IMU for the use of PIs (grant recipients) and approved by the Bank before the first request for proposals. Participating CEs and NERs will follow procurement procedures detailed in an Operations Manual, satisfactory to the Bank, which is to be completed before the awarding of the first grant. The Manual also details reporting and auditing requirements to ensure proper use of resources and coordination with the IMU. In cases where justification may be required, the IMU will liaison with the CE or NER to assure compliance with procedures. In general, the IMU will oversee procurement and notify the Bank of any situations warranting attention. A procurement planning tool and information systems as well as assignment of procurement personnel are foreseen as part of a Financial Management Action Plan. A project launch workshop will be organized before effectiveness (no later than June 30, 2000) to familiarize the implementing unit and other institutions involved in the execution of projects with Bank procedures. The workshop will cover procurement policy and procedures and their application to the procurement arrangements planned for project implementation, disbursement, reporting and auditing requirements.

Procurement Records

Detailed procurement records, reflecting the project's supply of goods and consultant services, including records of time taken to complete key steps in the process and procurement activities related to supervision, review and audits, will be maintained by the IMU. These records will be maintained for at least two years after the project's closing date. The records for goods will include public notices, bidding documents and addenda, bid opening information, bid evaluation reports, formal appeals by bidders and outcomes, signed contracts with related addenda and amendments, records on claims and dispute resolution, and any other useful information. The records for consultants services will include public notices for expression of interest, request for proposals and addenda, technical and financial reports, formal appeals by consultants and outcomes, signed contracts, addenda and amendments, records on claims and dispute resolution and any other useful information. The procurement team will be responsible for organizing the Unit and establishing procedures following Bank requirements. The existing filing conditions for the IADB project are acceptable.

Frequency of Procurement Supervision

In addition to the prior review supervision to be carried out from the Bank office, the capacity assessment of the MST has recommended two full supervision mission to visit the field to carry out post-review of procurement actions during the first year of the project.

Procurement Audits

The IMU will provide the Bank, no later than two months after the end of each semester, procurement records audited by independent procurement experts, acceptable to the Bank. The records will be in accordance with internationally accepted standards.

Annex 6, Table A: Project Costs by Procurement Arrangements \a
(In US$ million equivalent)

Expenditure Category	Procurement Method			Total Cost (including contingencies)
	NCB	Other	N.B.F	
A1. Competitive Fund for Scientific Excellence (goods and services)		**12.000 (3.475) c/**		**12.000 (3.475)**
B. Other Components				
2. Goods				
Communication and Computer Equipment, Publications		**0.150 a/ (0.075)**		**0.150 a/ (0.075)**
3. Services				
Consultants, Technical Assistance, Training, Studies		**2.300 (1.150) b/**		**2.300 (1.150)**
4. IMU Operating Expenses		**0.500 (0.250) a/**		**0.500 (0.250)**
5. Front-end Fee		**0.050 (0.050)**		**0.050 (0.050)**
Total		**15.000 (5.000)**		**15.000 (5.000)**

Note: N.B.F. = not Bank-financed
Figures in parenthesis are the amounts to be financed by the Bank loan.

a. National shopping
b. Consultant's guidelines.
c. By individual grant holders in accordance with Grant Agreements acceptable to the Bank.
d. A total of US$ 1 million will be used for hiring individual consultants, not including fellows and research assistants under the subprojects.

Annex 6, Table B: Thresholds for Procurement Methods and Prior Review
(In US$ million)

Expenditure Category	Contract Value (Threshold)	Procurement Method	Contracts Subject to Prior Review
COMPETITIVE FUND FOR SCIENCE EXCELLENCE			
(a) Works	>350-5,000 <350	NCB Three Quotations	First two First two
(b) Goods -Scientific Equipment	Regardless of Value	International/National Shopping	First two
-All other goods in Proposals	Regardless of Value	International/National Shopping	First two
(c) Services \a - Firms	Regardless of Value	Consultants' Qualifications, Single Source Selection	All over 100
- Individuals	Regardless of Value	Individuals Consultants	All over 35
OTHER COMPONENTS \b			
(a) Goods Communication and Computer Equipment Publications	<50 >50	National Shopping NCB	First two First two
(b) Services - Firms	>200 <100	QCBS Consultants Qualifications	All All over 100
	Regardless of Value	Single Source Selection	All over 100
- Individuals	Regardless of Value	Individual Consultants	All over 35
Total value of contracts subject to prior review:			US$1.5 (30% of the Loan amount)

a. There are no contracts expected to cost over $100,000 with firms or over $50,000 with individuals within the Grants.
b. No Civil Works are foreseen other than those contemplated under the Fund programs.

Annex 6, Table C: Allocation of Loan Proceeds

Expenditure Category	Amount in US$ million	Disbursement Percentage
Fund for Scientific Excellence	3.475	50% of amount disbursed under each grant agreement
Goods: Communication and Computer Equipment and Publications	0.075	50%
Services: Consultants, Technical Assistance, Studies, Training	1.150	50%
IMU-Operating Expenditures[6]	0.250	50%
Front End Fee	0.050	100%
Total	**5.000**	**33%**

Disbursement

The Project is expected to be completed over a two-and-one-half year period with a closing date of June 30, 2003. IBRD funds will be disbursed according to the categories and percentages shown in Table C of this Annex. Government's counterpart funds needed for each fiscal year to cover the share of total project expenses not financed by IBRD will be allocated in each year's budget made available for the project.

Use of Statement of Expenditures

Disbursements of the loan proceeds for research grants, and for contracts valued at less than US$200,000 for goods and works, and less than US$100,000 for consulting firms (US$35,000 for individual consultants), local training, and operating costs will be made against Statements of Expenditures (SOEs). The documentation supporting claims under SOEs will be retained by CE, NER and the IMU and made available for review and examination by auditors and Bank supervision mission members.

Special Account

To facilitate disbursements and timely project implementation, the Government will open, maintain and operate a Special Account in US dollars, under terms and conditions satisfactory to the Bank, to cover the Bank's share of eligible expenditures. The *Fondo de Inversion de Venezuela* is considered an acceptable financial institution where a Special Account can be opened in US dollars in the name of the executing agency. The executing agency will have immediate and direct access to this account to pay for the expenditures under the loan. Disbursements out of the Special Account will be made against grant agreements twice a year for each grant agreement. The Authorized Allocation and initial deposit to the Special Account will be US$500,000.00. Further replenishments will be made on the basis of applications documenting the amounts actually expended from the Special Account. In addition, a Transitory Account might be opened for registration purposes at the Central Bank. However, the transition period of these funds in US dollars should not take more than three days.

[6] "Operating Expenditures of the Project Unit" means the cost of remuneration of IMU and Program Committee personnel, secretarial services, office leasing, utilities, office supplies and materials.

Annex 7
Millennium Science Initiative Project
Project Processing Budget and Schedule

	Planned (At final PAD stage)	**Actual**
Project Budget (in US$)	58,333	58,333
Project Schedule		
Time taken to prepare the project (months)	6	
First Bank mission (identification)	10/02/1999	10/04/1999
Appraisal mission departure	02/10/2000	02/14/2000
Negotiations	03/10/2000	03/02/2000
Planned Date of Effectiveness	07/01/2000	

Prepared by: Ministry of Science and Technology

Bank staff who worked on the project included:

Name	**Specialty**
Lauritz B. Holm-Nielsen	Task Team Leader
Michael Crawford	Science and Technology Specialist
Marta Molares-Halberg	Legal Counsel
César Granados	Team Assistant
Robin De Pietro-Jurand	Consultant
Bojana Boh	Consultant
Birgit Zischke	Consultant
María Lucy Giraldo	Procurement Specialist
Efraim Jimenez	Procurement Specialist
Livio Pino	Financial Management Specialist
German Escobar	Certified Financial Management Consultant
Issam Abousleiman	Disbursement Officer
William Saint	Peer Reviewer
Carl Dahlman	Peer Reviewer
Robert T. Watson	Peer Reviewer

Annex 8
Millennium Science Initiative Project in the Bolivarian Republic of Venezuela
Documents in the Project File

A. Project Implementation Plan

1. Plan de Implementación del Proyecto Mejoramiento de la Calidad de la Educación Superior en Venezuela, Banco Mundial, October 22, 1999.

B. Other Documents

2. Agroplan C.A., Estudio del Mercado Laboral. Fundayacucho, Coleccion Estudios 2, 1998.
3. Ailes Catherine P.; Pardee, Arthur E., Jr., Cooperation in Science and Technology – An Evaluation of the U.S. Soviet Agreement.
4. Anuario Estadístico de Venezuela 1997. República de Venezuela, Presidencia de la República, Oficina.
5. Birdsall, Nancy; Changyong Rhee. Does Research and Development Contribute to Economic Growth in Developing Countries? Policy Research Working Paper 1221.
6. Cardoza, Guillermo. Higher Education, Scientific Research and Sustainable Development in Latin America: Elements for a New Agenda. Harvard International Institute for Development, 1996.
7. Central de Estadística y Informática. Caracas, Noviembre 1998.
8. Characteristics of the Higher Education and Research System in Venezuela, The World Bank LCSHD, November 12, 1999.
9. CNU/OPSU statistical data on Higher Education and Research in the Venezuela (data sheets).
10. CNU/OPSU, Ley de Universidades. Universidad de los Andes, Merida, 1973.
11. CNU/OPSU. Separata del Boletin Estadistico de Education Superior 1989-1995.
12. CNU/OPSU/OCOAES, Oportunidades de Estudio en las Instituciones de Educacion Superior de Venezuela. Caracas, 1999.
13. CNU/OPSU/OCOAES/CAN, Boletin de Informacion General Proceso Nacional de Admision, years 1999, 1998, 1997.
14. Committee on Science, Engineering, and Public Policy, Capitalizing on Investments in Science and Technology National Academy Press, Washington, D.C. 1999.
15. Coordinacion Central de Extension UCV. Extension Universitara en la UCV. Universidad Central de Venezuela, 1998.
16. Crawford, Michael F., Review of World Bank Lending for Science and Technology 1992-98, The World Bank, TechNet Working Paper, 1999.
17. Dagger, Fracehuli, Fundacion Universidad Central de Venezuela, 1999.
18. Datanalisis, Evaluacion Opinatica para la Jerarquizacion de las Instituciones Venezolanas con Estudios de Postgrado en las Areas de Medicina, Economia, Gerencia, Ingenieria y Educacion de Acuerdo a la Opinion de Estudiantes, Egresados y Empleadores. Fundayacucho, Coleccion Estudios 3, 1998.

19. Datanalisis, Evaluacion Opinatica para la Jerarquizacion de las Instituciones Venezolanas con Estudios de Postgrado en las Areas de Ciencas Basicas, Ciencias del Agro y del Mar y Humanidades de Acuerdo a la Opinion de Estudiantes, Egresados y Empleadores. Fundayacucho, Coleccion Estudios 4, 1998.
20. Diretorio de Centros de Investigacion Cientifica y Technologica de Venezuela.
21. El Mercado de Valores – Desarrollo Industrial y Cambio Tecnologico, Nacional Financiera, Febrero de 1999.
22. El Programa de Promocion del Investigador. http://www.ppi.org.ve/
23. Engineers for the 21st Century, Royal Swedish Academy of Engineering Sciences.
24. Fundayacucho/APICE, El Credito Educativo - Una Alternativa para la Education Superior. 1997.
25. Galvis, Hernando Salcedo; Ruzza Aura T., Zerpa, Arminda. Estado Actual del los Estudios de Postgrado en Venezuela. Fundayacucho, Caracas, 1998.
26. Gonzales, Luis F. Marcano, Sistema de Promocion del Investigador. Fundacion PI, Caracas, 1999.
27. Guadilla, Carmen Garcia. Situacion y Principales Dinamicas de Transformacion de le Education Superior en America Latina. IESALC/UNESCO and Fundayacucho, Caracas, 1998.
28. Holm-Nielsen, Lauritz B., Back to Office Report (BTOR) for the Venezuela Millennium Science Initiative Project , February 23, 2000.
29. Holm-Nielsen, Lauritz; Crawford, Michael and Saliba, Alcyone (Eds.). Institutional and Entrepreneurial Leadership in the Brazilian Science and Technology Sector, The World Bank Discussion Papers #325.
30. Holm-Nielsen, Lauritz B. and Crawford, Michael F.: The World Bank's Millennium Science Initiative: Assumptions and Expectations, The World Bank LCSHD and EMTIN, 1999.
31. Inter-American Development Bank, Venezuela Second Science and Technology Program, Operation no 1220/OC-VE, November 1999.
32. Khanna, Anupam, Knowledge Creation and Management in Global Enterprises, The World Bank DEC Discussion Paper, 2000.
33. Korea Science and Engineering Foundation. Centers of Excellence (SRC, ERC).
34. Les Sciences hors d'Occident au Xxeme Siecle, 19-23 Septembre 1994, Orstrom, Paris.
35. Levy, Daniel C. Building the Third Sector. Latin America's Private Research Centers and Nonprofit Development, Pittsburgh, 1996.
36. Lira, Amalio Sarco; Bonucci, Mario. La Politica de Admision en Venezuela. CNU/ OPSU/ CNA, La Habana, 1998.
37. Macilwain, Colin. World Bank backs Third World Centres of Excellence Plan. Nature, 1998.
38. Mansfield, Edwin, Economic Returns From Investments in Research and Training, HRO Working Paper HROWP 19, World Bank, Washington, D.C., 1994.
39. McMahon, Matthew. Getting Beyond the National Institute Model" for Agricultural Research in Latin America – A Cross-Country Study for Brazil, Chile, Colombia and Mexico. August 1992.
40. Mayorga, Román. Cerrando la Brecha. Inter-American Development Bank, 1996.
41. Mejia, Elizabeth; Ortega, Joaquin. Sistema Nacional de Estadistica Universitaria. Fundayacucho, Coleccion Estudios 1, 1998.
42. Memorandum from Mr. Robert T. Watson to Mr. James Wolfensohn briefing the status of the Millennium Institutes Project. October 15, 1998.

43. Memorandum to Mr. Ismail Serageldin, Vice-President ESD, from Michel Petit, Director ESDAR on Back to office report of Foundation Meeting of the Commission on Science and Technology for Sustainable Development in the South (COMSATS), Islamabad, October 4-5, 1994.
44. Mervis, Jeffrey D.; Dennis Normile. Science in Southeast Asia. Science, March 1998.
45. Project Appraisal Document, Brazil Science and Technology Reform Support Project, November 26, 1997.
46. Minutes of Meeting with Messrs. J. Wolfensohn, Shahid Javed Burki, Robert T. Watson, Lauritz Holm-Nielsen, Phillip Griffith (Institute for Advanced Studies at Princeton) on October 15, 1998.*
47. Muller, Juan Antonio. El Credito Educativo Alternativa para la Participation de los Usuarios en el Financiamiento de la Education Superior. Fundayacucho, Coleccion Estudios 5, 1998.
48. National Science Board, National Science Foundation, Science & Engineering Indicators 1996, Washington, D.C.
49. Popper et al., New Forces at Work; Industry Views Critical Technologies, Rand/Critical Technologies Institute, Washington, D.C. 1998.
50. Project Appraisal Document on a Proposed Learning and Innovation Loan (LIL) in the Amount of US$5.0 Million to the Republic of Chile for a Millennium Science Initiative Project. April 1, 1999.
51. Propuesta de Préstamo: Argentina - Programa de Modernización Tecnológica. Inter-American Development Bank.
52. Realizing the Globalization of Discovery. Report of the International Advisory Group on Science and Technology. June 4-5, 1998.
53. Reinach, Fernando C. Article of Nature magazine Adapting to change in Latin America.
54. Roessner, J. David, Alan L. Porter; Huaidong Xu. National Capacities to Absorb and Institutionalize External Science and Technology. Technology Analysis & Strategic Management, Vol. 4, No. 2, 1992.
55. Science and Engineering Indicators 1998, National Science Foundation.
56. Salazar, Miguel Alfonso. Talento Venezolano en los Estados Unidos, Canada y Japon. Fundayacucho, Coleccion Estudios 6, 1998.
57. Science and Technology Program Evaluation – Project Performance Review. Brazil: Science and Technology Program Loan 620/OC-BR. Inter-American Development Bank, Evaluation Office.
58. Science and Technology Program Evaluation – Synthesis Report. Inter-American Development Bank, Evaluation Office. January 1998.
59. South American Science at a Crossroads. Nature, April 16, 1998, Volume 392, No. 6677.
60. Universidad Central de Venezuela, Construyendo la Universidad del Futuro. Caracas, 1998.
61. Villarroel, Cesar, Universidad, Estado y Evaluacion. Nuevas Relaciones y Compromisos. Fundayacucho, Caracas, 1998.
62. World Bank Development Report: Knowledge for Development, 1998/99, The World Bank & Oxford University Press, 1999.

Annex 9
Statement of Loans and Credits
Status of Bank Group Operations in the Bolivarian Republic of Venezuela: Operations Portfolio

Project ID	Fiscal Year	Borrower	Purpose	Original Amount in US$ Millions				Difference Between expected and actual disbursements a/		Last PSR Supervision Rating b/	
				IBRD	IDA	Cancel.	Undisb.	Orig	Frm Rev'd	Dev Obj	Imp Prog
Number of Closed Projects: 23											
Active Projects											
VE-PE-8216	1990	GOVERNMENT OF BOLIVARIAN REPUBLIC OF VENEZUELA	PRE-INV & INSTIT DEV	30.00	0.00	0.00	7.80	7.80	7.80	S	S
VE-PE-8233	1993	GOV	JUD.INFRA DEV	30.00	0.00	0.00	16.35	16.37	16.37	S	S
VE-PE-8227	1993	MIN OF HEALTH	ENDEMIC DISEASE CONT	94.00	0.00	20.00	7.36	27.35	.19	S	S
VE-PE-8223	1993	GOVERNMENT	HWY MGMT	150.00	0.00	40.00	84.21	124.20	24.20	S	S
VE-PE-8218	1994		BASIC EDUC	89.40	0.00	20.00	31.76	51.77	4.89	S	S
VE-PE-8210	1994	GOVT OF BOLIVARIAN REPUBLIC OF VENEZUELA ELA	URBAN TRANSP.	100.00	0.00	20.00	43.78	63.78	23.78	S	S
VE-PE-8237	1995	GOVERNMENT	INPARQUES	55.00	0.00	0.00	45.99	35.99	25.07	S	S
VE-PE-8222	1995	GOVERNMENT	AG EXT	39.00	0.00	0.00	32.62	12.22	7.73	S	S
VE-PE-8215	1995	REPUBLIC OF VEN.	HEALTH SERVICE REFOR	54.00	0.00	0.00	27.03	21.42	7.62	S	S
VE-PE-8224	1996	GOVERNMENT	MONAGAS WATER	39.00	0.00	0.00	21.54	14.75	-.23	S	S
VE-PE-44325	1998	GOVERNMENT	SUPREME COURT STRGTH	4.70	0.00	0.00	3.10	.89	0.00	HS	HS
VE-PE-41807	1998	REPUBLIC OF BOLIVARIAN REPUBLIC OF VENEZUELA	PUB SEC MOD & DECEN	8.00	0.00	0.00	8.00	.60	0.00	S	S
VE-PE-35743	1998	GOVT OF BOLIVARIAN REPUBLIC OF VENEZUELA	ENV MGT	28.00	0.00	0.00	27.22	27.22	0.00	S	S
VE-PE-57601	1999	REPUBLIC OF BOLIVARIAN REPUBLIC OF VENEZUELA	PUBLC EXPNDITURE MGT	20.00	0.00	0.00	19.54	0.00	0.00		
VE-PE-40174	1999	GOVT OF BOLIVARIAN REPUBLIC OF VENEZUELA	CARACAS SLUM UPGRADE	60.70	0.00	0.00	60.70	4.24	0.00	S	S
Total				801.80	0.00	100.00	437.00	408.60	117.42		

	Active Projects	Closed Projects	Total
Total Disbursed (IBRD and IDA):	264.33	2,025.54	2,289.87
of which has been repaid:	48.35	1,018.87	1,067.22
Total now held by IBRD and IDA:	653.45	1,007.03	1,660.48
Amount sold :	0.00	27.54	27.54
Of which repaid :	0.00	27.54	27.54
Total Undisbursed :	437.00	.36	437.36

a. Intended disbursements to date minus actual disbursements to date as projected at appraisal.
b. Following the FY94 Annual Review of Portfolio performance (ARPP), a letter based system was introduced (HS = highly Satisfactory, S = satisfactory, U = unsatisfactory, HU = highly unsatisfactory): see proposed Improvements in Project and Portfolio Performance Rating Methodology (SecM94-901), August 23, 1994.

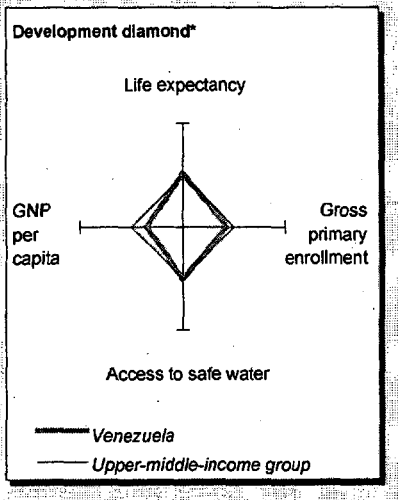
Note:
Disbursement data is updated at the end of the first week of the month.

Bolivarian Republic of Venezuela
STATEMENT OF IFC's
Committed and Disbursed Portfolio
As of 31-Jul-99
(In US Dollar Millions)

		Committed				Disbursed			
		IFC				IFC			
FY Approval	**Company**	**Loan**	**Equity**	**Quasi**	**Partic**	**Loan**	**Equity**	**Quasi**	**Partic**
1990	Pralca	10.66	7.51	0.00	0.00	10.66	7.51	0.00	0.00
1991	ECV	3.00	0.00	1.61	0.00	3.00	0.00	1.61	0.00
1991/92	Corimon	0.00	10.98	0.00	0.00	0.00	10.98	0.00	0.00
1991/94	Zuliano	0.00	14.07	0.00	0.00	0.00	14.07	0.00	0.00
1992	Jose Methanol	18.12	6.80	0.00	26.45	18.12	6.80	0.00	26.45
1992	MAVESA	0.00	9.00	0.00	0.00	0.00	9.00	0.00	0.00
1993	BVC-FPM	.90	0.00	0.00	0.00	.90	0.00	0.00	0.00
1994	BVC-Sidetur	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
1995/00	SET	0.00	.04	.50	0.00	0.00	0.00	.50	0.00
1995/98	COMSIGUA	35.00	0.00	10.00	121.00	35.00	0.00	10.00	121.00
1996	CANTV	0.00	0.00	25.00	0.00	0.00	0.00	25.00	0.00
1997	Minera Loma	65.00	6.42	3.08	50.00	43.63	4.42	3.08	33.57
1997	Movilnet	35.00	0.00	0.00	60.00	35.00	0.00	0.00	60.00
Total Portfolio:		168.68	54.82	40.19	257.45	147.31	52.78	40.19	241.02

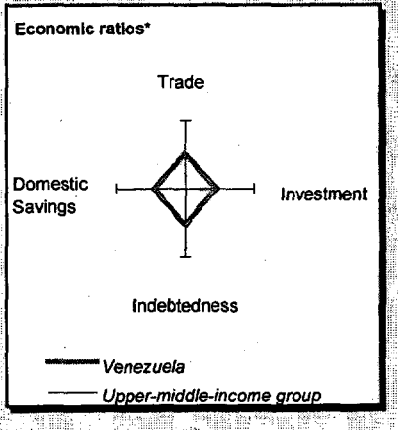
		Approvals Pending Commitment			
		Loan	**Equity**	**Quasi**	**Par**
1999	CERAVEN	15.00	0.00	0.00	25.00
1999	EDC	40.00	0.00	0.00	35.00
2000	FORESTALTRILLIUM	16.80	6.00	0.00	38.00
1999	PROFALCA	24.00	0.00	0.00	31.00
Total Pending Commitment:		95.80	6.00	0.00	129.00

POVERTY and SOCIAL	Venezuela	Latin America & Carib.	Upper-middle-income
1998			
Population, mid-year *(millions)*	23.2	502	588
GNP per capita *(Atlas method, US$)*	3,500	3,940	4,860
GNP *(Atlas method, US$ billions)*	81.3	1,978	2,862
Average annual growth, 1992-98			
Population *(%)*	2.1	1.6	1.4
Labor force *(%)*	3.0	2.3	2.0
Most recent estimate (latest year available, 1992-98)			
Poverty *(% of population below national poverty line)*	..	..	..
Urban population *(% of total population)*	87	75	77
Life expectancy at birth *(years)*	73	70	70
Infant mortality *(per 1,000 live births)*	21	32	27
Child malnutrition *(% of children under 5)*	5	8	..
Access to safe water *(% of population)*	79	75	79
Illiteracy *(% of population age 15+)*	8	13	11
Gross primary enrollment *(% of school-age population)*	91	113	108
Male	90	..	..
Female	93	..	..

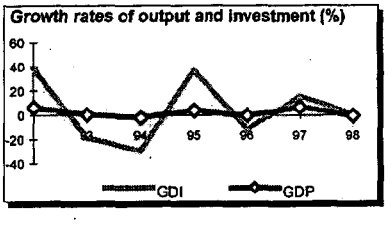


KEY ECONOMIC RATIOS and LONG-TERM TRENDS	1977	1987	1997	1998
GDP *(US$ billions)*	43.8	48.0	88.4	95.0
Gross domestic investment/GDP	43.1	24.6	17.5	19.6
Exports of goods and services/GDP	23.2	22.1	29.1	20.0
Gross domestic savings/GDP	36.3	25.1	26.6	19.6
Gross national savings/GDP	35.8	24.9	24.6	17.8
Current account balance/GDP	-7.3	-2.9	5.5	-2.8
Interest payments/GDP	0.6	5.1	2.3	2.3
Total debt/GDP	24.5	72.0	40.2	38.9
Total debt service/exports	8.4	37.8	31.3	28.5
Present value of debt/GDP	..	..	39.6	..
Present value of debt/exports	..	..	126.9	..

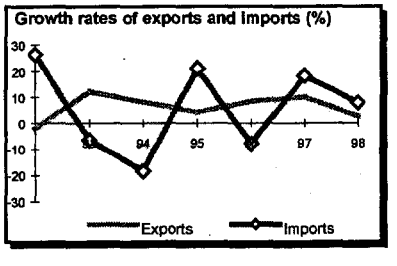
	1977-87	1988-98	1997	1998	1999-03
(average annual growth)					
GDP	-0.3	2.5	6.5	-0.7	3.1
GNP per capita	-3.4	0.2	6.6	-2.4	1.3
Exports of goods and services	-1.7	6.6	9.9	2.6	5.5



STRUCTURE of the ECONOMY	1977	1987	1997	1998
(% of GDP)				
Agriculture	4.9	6.1	4.5	5.0
Industry	44.6	40.5	40.3	34.0
Manufacturing	15.3	20.6	16.1	14.9
Services	50.5	53.4	55.2	61.0
Private consumption	51.5	64.7	67.2	72.9
General government consumption	12.2	10.2	6.2	7.5
Imports of goods and services	30.0	21.6	20.0	20.1



	1977-87	1988-98	1997	1998
(average annual growth)				
Agriculture	2.7	0.7	2.6	-0.7
Industry	-0.2	3.9	7.6	-2.0
Manufacturing	4.4	1.7	4.9	-3.9
Services	-0.7	1.3	5.6	0.9
Private consumption	2.3	1.2	5.9	-1.7
General government consumption	1.3	0.1	2.1	5.8
Gross domestic investment	-7.2	2.8	15.1	0.5
Imports of goods and services	-3.6	4.6	18.3	7.9
Gross national product	-0.8	2.6	8.8	-0.4

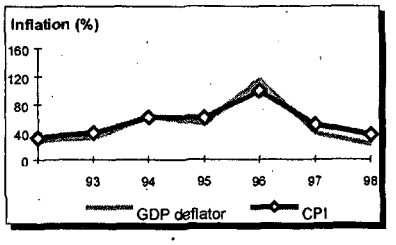


Note: 1998 data are preliminary estimates.

* The diamonds show four key indicators in the country (in bold) compared with its income-group average. If data are missing, the diamond will be incomplete.

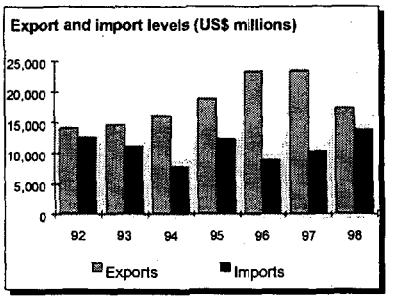
PRICES and GOVERNMENT FINANCE

	1977	1987	1997	1998
Domestic prices				
(% change)				
Consumer prices	7.7	28.4	50.0	35.8
Implicit GDP deflator	9.9	37.5	38.4	21.2
Government finance				
(% of GDP, includes current grants)				
Current revenue	21.6	21.6	23.2	17.9
Current budget balance	8.5	4.4	5.5	1.6
Overall surplus/deficit	-4.4	-0.1	1.6	-2.5



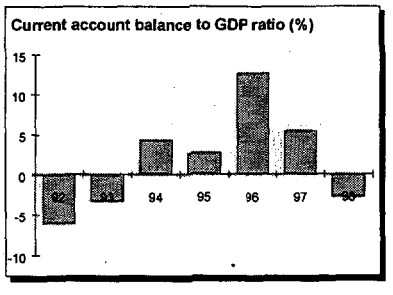
TRADE

	1977	1987	1997	1998
(US$ millions)				
Total exports (fob)	9,551	10,577	23,457	17,320
Petroleum and derivatives	9,221	9,054	18,448	12,028
Steel	..	523	939	947
Manufactures	..	..	2,315	1,543
Total imports (cif)	9,886	8,832	10,369	13,889
Food	902	..	466	578
Fuel and energy	66	..	..	..
Capital goods	3,202	3,057	4,414	2,872
Export price index *(1995=100)*	..	..	107	74
Import price index *(1995=100)*	..	..	104	102
Terms of trade *(1995=100)*	..	..	103	73



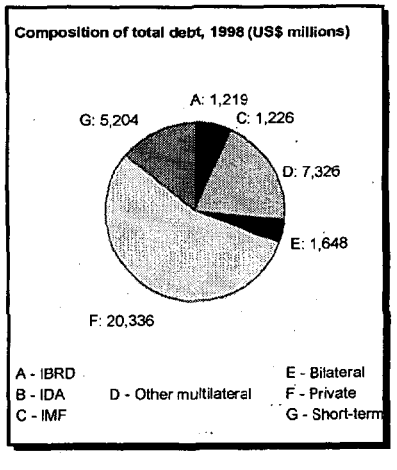
BALANCE of PAYMENTS

	1977	1987	1997	1998
(US$ millions)				
Exports of goods and services	10,165	11,428	25,120	18,883
Imports of goods and services	13,149	11,108	18,282	20,094
Resource balance	-2,984	320	6,838	-1,211
Net income	88	-1,619	-2,031	-1,468
Net current transfers	-283	-91	21	30
Current account balance	-3,179	-1,390	4,828	-2,649
Financing items (net)	3,978	455	-2,173	133
Changes in net reserves	-799	935	-2,655	2,516
Memo:				
Reserves including gold *(US$ millions)*	8,213	9,402	19,039	16,528
Conversion rate *(DEC, local/US$)*	4.3	14.5	488.6	547.6



EXTERNAL DEBT and RESOURCE FLOWS

	1977	1987	1997	1998
(US$ millions)				
Total debt outstanding and disbursed	10,731	34,570	35,541	36,959
IBRD	196	11	1,213	1,219
IDA	0	0	0	0
Total debt service	915	4,872	8,634	6,092
IBRD	37	17	259	256
IDA	0	0	0	0
Composition of net resource flows				
Official grants	1	1	11	..
Official creditors	-59	66	-254	381
Private creditors	2,012	-1,780	765	-1,943
Foreign direct investment	-3	-16	4,462	3,450
Portfolio equity	-41	0	-569	736
World Bank program				
Commitments	0	0	41	69
Disbursements	5	0	91	187
Principal repayments	22	16	172	179
Net flows	-17	-16	-81	8
Interest payments	15	1	87	76
Net transfers	-32	-17	-168	-68



Annex 11
Indicators and Description of the Bolivarian Republic of Venezuela's S&T sector

1. **Basic indicators.** The Bolivarian Republic of Venezuela (Venezuela) consists of 23 states and one federal district (Caracas). It covers an area of 916,445 km^2 and has a population of 23 million, 4 million of whom live in Caracas. The annual population growth from 1990-97 was 2.2 percent - higher than in comparable Latin American countries. In 1997, the GNP was US$78.7 billion, GNP per capita was US$3,450, and PPP GNP per capita was US$8,530. The structure of output in 1997 indicated that services represented 49%, industry 47%, manufacturing 18%, and agriculture 4%. Approximately 11.8% of the population lived below the poverty line of US$1 per day [World Development Indicators, 1999] .

Country	*Population (Millions, 1997)*	*Population growth rate 1990-1997 (%)*	*GNP per capita ($, 1997)*	*PPP GNP per capita ($, 1997)*	*Labor force growth rate, 1990-97 (%)*	*Under 5 mortality rate, 1996, (per 1,000)*	*Adult illiteracy rate, 1995 (M and F)*
Argentina	36	1.3	8,570	9,950	2.1	25	4 4
Brazil	164	1.4	4,720	6,240	1.7	42	17 17
Chile	15	1.6	5,020	12,080	2.1	13	5 5
Colombia	38	1.8	2,280	6,720	2.7	31	9 9
Denmark	5	0.4	32,500	22,740	0.0	6	.. ..
Germany	82	0.5	28,260	21,300	0.3	6	.. ..
Japan	126	0.3	37,850	23,400	0.6	6	.. ..
Mexico	95	1.8	3,680	8,120	2.8	36	8 13
USA	268	1.0	28,740	28,740	1.1	8	.. ..
Venezuela	**23**	**2.2**	**3,450**	**8,530**	**3.0**	**28**	**8 10**

[World Bank Development Report: Knowledge for Development, 1998/99, The World Bank & Oxford University Press, 1999]

Education

2. **Primary education** takes nine years and is compulsory. In 1996, the primary gross enrolment rate was 91% with a net enrolment rate of 84%. Male and female pupils were equally represented (50:50%). The percentage of the cohort reaching grade 5 was 86 % for males and 92% for females. Expected years of schooling in 1996 were ten years for males and eleven years for females[World Development Indicators, 1999] .

Country	*Public expenditure on education, 1995 (% of GNP)*	*Primary net enrolment, 1995 (% of age group)*	*Secondary net enrolment, 1995 (% of age group)*	*Expected years of schooling, 1992 (M and F)*	*Scientists and engineers in R&D, 1981-95 (per million people)*	*High technology exports, 1996 (% of manufacturing exports)*
Argentina	4.5	..	59	13 14	350	17
Brazil	..	90	19	9 9	165	18
Chile	2.9	86	55	12 12	364	18
Colombia	3.5	85	50	.. ..	39	21
Denmark	8.3	99	86	15 15	2,647	25
Germany	4.7	100	88	15 14	3,016	25
Japan	3.8	100	96	.. ..	5,677	39
Mexico	5.3	100	..	.. ..	95	32
USA	5.3	96	89	16 16	3,732	44
BR of Venezuela	**5.2**	**88**	**20**	**10 11**	**208**	**14**

[World Bank Development Report: Knowledge for Development, 1998/99, The World Bank & Oxford University Press, 1999]

3. **Secondary education** is unusually short. Most programs are of two years duration with some vocational programs requiring three years of study. Students are divided into two tracks: (1) a science and humanities curriculum, that prepares students for higher education (*media diversificada*), and (2) a vocational curriculum (*media profesional*). According to the World Bank Development Report, *Knowledge for Development* (1998/99), net enrolment in secondary education in the Venezuela was only 20% (and 27.2% gross enrolment according to Anuario Estadistico 1997), which while similar to Brazil, is substantially lower than in other Latin American countries. In secondary schools, male students were fewer (42%) than female students (58%).

4. **Tertiary** gross enrolment in 1996 was 25%[World development indicators, 1999][7]. Students can choose between short (3 years) or long study programs (5 years). Universities are the only higher education institutions recognized by present law, and have a leading function in the Venezuelan education, culture and science. In practice, degree granting Research Institutes also conduct basic and applied research in various areas of science, humanities and technology, and serve as technical assistance centers and advanced training centers for postgraduate students. University institutes and colleges usually conduct shorter (or less demanding) higher education programs than universities. In public higher education institutions all undergraduate studies are free, while students pay tuition fees for post-graduate courses. Private institutions charge tuition fees at both levels. In 1998, there were 140 institutions of higher education in the Venezuela: 19 public and 19 private universities, and 48 public and 54 private University Institutes and Colleges. In ten years (1986/87 to 1996/97) the total enrolment in higher education increased by 66.4% (from 440,734 students to 733,294 students) [Statistical data CNU/OPSU]. Total public spending on education has fluctuated over the last 20 years. In 1995, it was 5.2% of GDP. Higher education receives a greater share of the budget than any other level (approx. 40%). However, all public universities are financed from the federal budget, while a large proportion of primary and secondary school financing comes from the budgets of states and communities.

5. **Postgraduate programs** began emerging in 1970 and are now rapidly expanding. According to the statistics of the Fundación Gran Mariscal de Ayacucho, there were a total of 1,322 postgraduate programs was in 1998 - 658 Specialization, 575 Masters and 89 Doctoral programs. Of these, only 194 of postgraduate programs were officially accredited (49 Specialization, 112 Masters and 33 Doctoral programs). By area of knowledge, 31% of postgraduate studies belong to the social and economic sciences; 19% to health; 18% to education; 14% to engineering, architecture and technology; 7% to basic sciences; 5% to agricultural and marine sciences; 4% to humanities and arts; 2% to interdisciplinary areas and 0.07% to military arts and sciences[Fundación Gran Mariscal de Ayacucho, 1998] .In 1998 there were 46,249 active postgraduate students (57% at public, 39% at private universities and 4% at non university institutions) and 20,848 professors [Fundación Gran Mariscal de Ayacucho, 1998] , which suggests a ratio of approximately two students per professor. However, considering the various factors involved (part time dedication), this number should be taken cautiously.

[7] Data from *Anuario Estadistico de Venezuela* (1997) show gross enrollment in higher education to be 29.5%.

6. **Shortage of specialists with Ph.D's.** The structure of the teaching faculty appointed to postgraduate programs by level of education shows that only about one third (5,865) of them have a Ph.D. The remaining two thirds of postgraduate faculty have a Master's degree (9,171), a Specialization (4,224), or other education (415) [Fundación Gran Mariscal de Ayacucho, 1998] . This clearly suggests a shortage of specialists with Ph.D's. For instance, just to replace the professors with a Ph.D. (assuming that each year 1/25 of professors retire), Venezuela will need 235 Ph.D. specialists for postgraduate teaching. To replace each retired member with a new Ph.D. member, Venezuela would need 787 new Ph.D. professors per year just to maintain the present postgraduate programs. In 1999, the Fundación Gran Mariscal de Ayacucho (Fundayacucho) had 851 active postgraduate loans, of which 301 were for Ph.D. students. If each of these students graduate in three years, this will still result in only 100 new Ph.D.s per year. Knowledgeable observers note that the present policy of Fundayacucho for supporting graduate students contributes to this problem by denying scholarships to a large proportion of Ph.D. candidates who apply for support, and that many students and their supervisors wait for several years (more than five) for financial support from Fundayacucho or elsewhere.

7. **Postgraduate students costs and support.** The average **cost per student** depends on the higher education institution and type of study being undertaken. Specialization and masters degree studies at different public and private universities rang from US$235 at the *Universidad Pedagógica Experimental Libertador* to approx. US$1,500 at the *Universidad Central de Venezuela* and US$11,000 at IESA, an authorized non-university higher education institution. Doctoral studies cost from US$330 at the Universidad de Oriente to US$3,100 at the Venezuelan Institute for Scientific Research (IVIC) [Fundación Gran Mariscal de Ayacucho, 1998] . In the 1990s, postgraduate student **grants** were gradually replaced with **loans** .The majority of them were granted for postgraduate studies abroad. For instance, in 1997 out of 851 new loan recipients, 344 studied in the Venezuela and 507 in foreign countries (266 in the USA, 80 in Spain, 56 in UK, 29 in France, 13 in Mexico, 9 in Brazil and 54 in other countries) [*Fundayacucho, Anuario Estadístico de Venezuela* 1997] .

Research and development system

8. **R&D indicators.** According to the World Bank Development Report *[Knowledge for Development*, 1998/99] , Venezuela had 208 **scientists and engineers** in R&D per million inhabitants in 1995 and ranked higher than Colombia (39), Mexico (95) and Brazil (165), but lower than Argentina (350) and Chile (364). Compared to the industrialized countries, the number of researchers in the Venezuela is more than ten times smaller (e.g. 2,647 in Denmark; 3,016 in Germany; 5,677 in Japan; 4,358 in Russian Federation, 1,098 in Spain, and 3,732 in the USA). High technology products, which may be taken as an illustration of technological development, play a minor role in the Venezuelan economy. Venezuelan **high technology exports** in 1996 were only 14% of manufacturing exports, which was lower than in other countries of the region (Argentina 17%, Brazil and Chile both 18%, Colombia 21%, Mexico 32%), and substantially lower than in the OECD countries (e.g. Denmark and Germany 25%, Ireland 62%, Japan and Korea 39%, Singapore

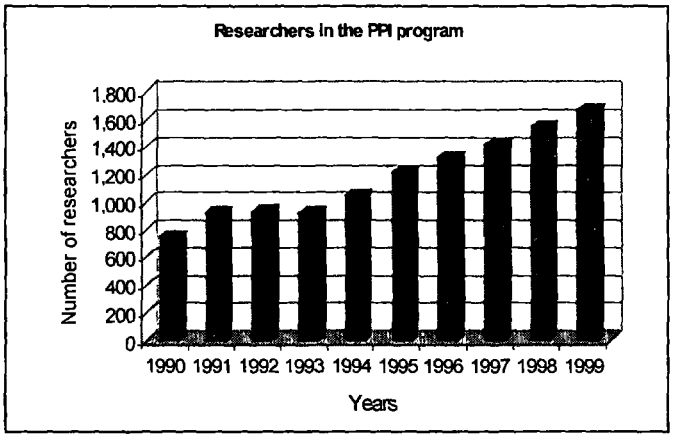
71%, USA 44%) [World Development Report, 1998/99]. Venezuela allocates **0.35% of GDP for research** [Cetto & Vessuri, 1998; data from CYTED/RICYT 1997] , which is believed to be insufficient (the target is about 2.0%).

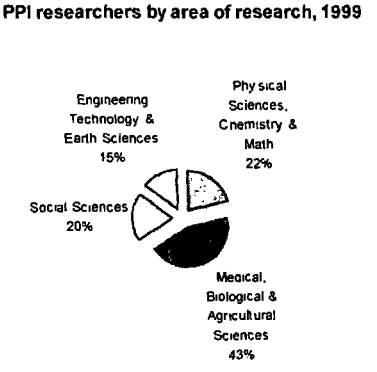
Country	*GDP 1995 ($ billion)*	*GERD[1] as % of GDP*	*% investment 1993-94 public/private*	*Government R&D expenditure 1994-95 (%)*	*Enterprise R&D expenditure 1994-95 (%)*	*High.Educ. R&D expenditure 1994-95 (%)*	*Private R&D expenditure 1994-95 (%)*
Argentina	280.2	0.37[2]	85/15	51.9[2]	10.6[2]	36.0[2]	1.5[2]
Bolivia	6.6	0.37[2]	64/36	62.0	-	19.0	14.0
Chile	51.3	0.78	70/30	41.4	17.7	40.9	0
Ecuador	18.0	0.08	87/13	44.9	9.1	38.2	7.8
Mexico	286.9	0.35	80/20	37.2	18.3	40.4	4.1
Panama	6.2	0.10	-	38.4	0	61.6	0
Venezuela	**55.8**	**0.35**	-	**50.5**	**26.9**	**22.6**	**0**
Canada	639.4	1.52	44/56	15.4	59.1	24.3	1.2
USA	7116.5	2.4	36/64	9.8	71.0	15.7	3.5
Spain	482.4[4]	0.93[4]	52/48	21.4	45.9	31.6	1.1
Portugal	109.3	0.59	59/41[3]	27.0	20.0	34.0	20.0

[Source: Cetto & Vessuri, 1998; data from CYTED/RICYT 1997] [1] GERD = Gross domestic expenditure on R&D in relation to GDP (Gross domestic product): [2] expenditure on S&T; [3] 1991/92; [4] 1994

The opinion is that industries, especially the oil industry, do not contribute enough to research. In 1997, the total income of oil industry was US$32 billion. According to the agreed upon 0.4% which is to be dedicated for research, they should contribute US$128 million. However, in practice, only one-fourth of this amount was allocated and spent for their own research[*Fundacion P.P.I*] .

9. Researcher Promotion Program. In 1999, the research system in the Venezuela consisted of approximately 5,000 researchers. However, only 1,668 of them qualified as international scale researchers according to the high standards of the Researcher Promotion Program (*Programa de Promoción del Investigador – PPI).* The PPI was established in 1990 as a program to reduce brain drain of Venezuelan researchers, to promote scientific and technological activities in the country, to stimulate the efficiency and quality of research, and to establish a scientific and technological information system. In 1991, a foundation was established which provided financial incentives, in the form of individual grants, for high quality researchers from non-profit (public) research groups. The foundation budget (allocated by the government) was US$3.2 million in 1998, with a proposed budget for FY1999 of US$7.5 million. The system is voluntary and based on five categories of researchers: Candidates (younger than 35, preparing their Ph.D. thesis), Level I (Ph.D. and at least 1 publication **or** without Ph.D. and 8 publications), Level II (20 publications in international journals), Level III (30 publications, international recognition, and supervision of postgraduate students), and level "Emeritus" (senior scientists over 60, with great international recognition) [Table 92] . Financial incentives for researchers are individual grants. The grant for a Candidate equals the minimal government salary (about US$150). Grants for other categories are proportionally higher - US$300 for the Level I, US$450 for Level II, US$600 for Level III and US$850 for the "Emeritus"(Level IV) level. In practice, because of the relatively low social recognition accorded researchers and the low basic salaries of researchers in the public sector, grants are being used to complement salaries. The categories are not permanent. In cases of insufficient scientific performance of a researcher, demotion to a lower category occurs. The performance of Candidates is peer-reviewed after three years, of researchers in Level I after two years, of Level II researchers after three years, and of Level IV researchers after four years.





Because of its high quality standards, the program has several advocates; however, it has even more opponents – their main criticism being that PPI supports only a scientific elite, and that it conflicts with the autonomy of universities. Efforts are being made by some research groups to expand the PPI research quality criteria to the entire research sector, including higher education institutions, and to introduce financial incentives/rewards for top quality research groups and outstanding research achievements.

10. Scientific publications. According to the PPI statistics, Venezuelan scientists publish 600-700 scientific papers in internationally recognized scientific journals per year (in average each PPI researcher publishes 1 paper per two years). The number of patents in very low. According to Cetto & Vessuri, 1998 [data from CYTED/RICYT 1997] , Venezuela contributes less than 0.05% of world's scientific articles, which is far less than Chile (0.2%), Mexico (0.3%), Argentina (0.4%), and Brazil (0.6%).

11. Research fields and institutions. The largest proportion of PPI qualified researchers work in the field of medical, biological and agricultural sciences, followed by physics, chemistry and mathematics. PPI statistics show that most of the high quality research in the Venezuela comes from the public universities with the longest scientific traditions. The first three universities in the table below are the ones with the longest (more than one hundred years old) tradition, while the fourth one enjoys the reputation of being one of the very top quality universities in the country. IVIC is the largest non-university research institution, founded in 1959, and conducts basic and applied research in biology, medicine, physics, mathematics and chemistry. It also serves as a center of expertise in these fields and is involved in higher education on the postgraduate level.

Researchers in the Researcher Promotion Program by Scientific Field, 1999 (source: FUNDACION P.P.I.)

Instituion	Physical Sciences, Chemistry & Math	Medical, Biological & Agricultural Sciences	Social Sciences	Engineering Technology & Earth Sciences	Total
Universidad Central de Venezuela	67	215	116	39	437
Universidad de Los Andes	90	97	69	47	303
Universidad del Zulia	32	111	63	36	242
Universidad Simón Bolívar	62	36	36	75	209
Instituto Venezolano de Investigaciones Científicas	68	84	11	4	167
Universidad Centro Occidental "Lisandro Alvarado"	5	28	2	2	37
All others	42	144	37	50	273
Total	**366**	**715**	**334**	**253**	**1,668**

12. **Extension programs.** Besides teaching and research, almost all public and some larger private universities have been involved in extension programs, organized as projects for technical assistance and dissemination of knowledge. Extension projects take different forms, such as (1) educational programs, seminars, discussions and dissemination of knowledge about specific problems of the country, (2) regional community participation projects in cooperation with local governments, in medicine, agriculture, engineering, natural and social sciences, education and in interdisciplinary fields, (3) institutional projects as technical and advisory assistance to individual institutions, (4) technical and scientific assistance, laboratory analysis and services. Many extension projects rely on voluntary participation from professors and students and are free of charge. In other cases, small autonomous enterprises are created as university spin-offs, and part of the profit returns to the university as additional income for research, cultural activities and sports [Fundación Universidad Central de Venezuela, 1999] .There are no (or very small) direct financial or promotional incentives for the members of teaching faculty to participate in non-profit extension programs. However, the recent government supports extension programs and there are hopes for an increase of financial resources for their growth and progress. Due to the deteriorating position of university employees, full-time university teachers and researchers have been allowed to spend up to four hours per week consulting in their field of expertise, which brings them some individual additional income.

13. **Commercialization of research.** A well known example, linked with university extension programs, is the *Fundación Universidad Central de Venezuela (UCV)*, created in 1982 to promote the commercialization of research products developed at the university, and to act as a recipient for any donations made by the public and private sectors to the University. The Foundation acts as the Headquarters to a group of companies which offer advice and services, develop new products, apply and transfer new technologies to the production of goods and services, provide the possibility for post graduate and undergraduate students to get practical experience, and strengthen the relationship between the UCV and the productive sector. For instance, 23 new companies were formed in 1999 at the *Universidad Central de Venezuela*; three of them were closed down very soon, four do not operate, but 16 of them are active.

The turnover of the *Fundacion UCV* in 1997 was US$335,000, and US$1,565,000 in 1998 (a 367% increase). The foundation's profit was US$196,000 in 1997 and US$1,196,500 (a 510% increase). Recently, a cooperative relationship was established between the CONAC (National Council for Culture), the CENAMEC (National Center for the Improving of Science Teaching) and PDVSA (a petroleum industry) [Fundación Universidad Central de Venezuela, 1999] .

14. CDSHyT. The *Consejo de Desarrollo Científico, Humanístico y Tecnológico* (Board for Scientific and Technological Development) is responsible for managing the 8% of the public universities budget which is allocated to research. The research budget for public universities was US$56.1 million in 1998 and US$55.3 million in 1999 (of which US$25-26 million was allocated to the UCV each year) [CNU/OPSU data] .Approximately 20% of national experimental universities have substantial research programs, while private universities have almost no research, primarily because of financial constraints (financing of research comes from their own budget).

15. CONICIT. The main governmental agency supporting scientific research and development activities is the *Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICIT).* In 1997, it had a total budget of US$91.6 million which was used for, among other things, the promotion of research and development, the support of innovation, and the modernization of science and technology sectors.

Program	*CONICIT Budget of expenses in 1997 (millions of US$.)*
Board of Directors	11.48
Material and Financial Resource Planning	5.18
Policies, Plans and Strategies for Communication and International Cooperation	0.76
Research and Development Promotion	26.74
Support to Innovation	17.61
Activation, Drive and Modernization of the Science and Technology Sector	14.59
Amount not allocated to Programs	15.21
Total	**91.58**

[*Anuario Estadístico de Venezuela* 1997. *Oficina Central de Estadística e Informática.* Caracas, 1998]

CONICIT supports research groups through grants. In 1997, 285 grants were distributed to basic sciences (93), agricultural sciences (57), engineering and technology (57), social sciences (56) and health sciences (22). CONICIT financing awarded through subvention programs to *scientific research projects* was US$6.47 million in 1997, of which about 90% was allocated to the five largest research institutions – four universities and IVIC. Technology and Medical Sciences received 41 % of the money. CONICIT grants for *technological development* in 1997 (US$2.3 million in total) were focused primarily on biotechnology, science of technology and engineering, informatics, and engineering.

*CONICIT grants for **scientific research projects** at the national universities and research institutes in 1996/1997*	
Total	**6,470,000 $**
By receiving institutions	
Universidad Central de Venezuela	35.30 %
Universidad Simón Bolívar	6.20 %
Universidad de Los Andes	12.60 %
Universidad del Zulia	13.40 %
Instituto Venezolano de Investigaciones Científicas	21.60 %
All other Institutions	10.90 %
By research fields	
Natural Sciences	18.70 %
Technology and Medical Sciences	41.40 %
Architecture and City Planning	18.30 %
Technology and Agricultural and Veterinary Sciences	4.40 %
Social Sciences	10.80 %
Environment	6.30 %

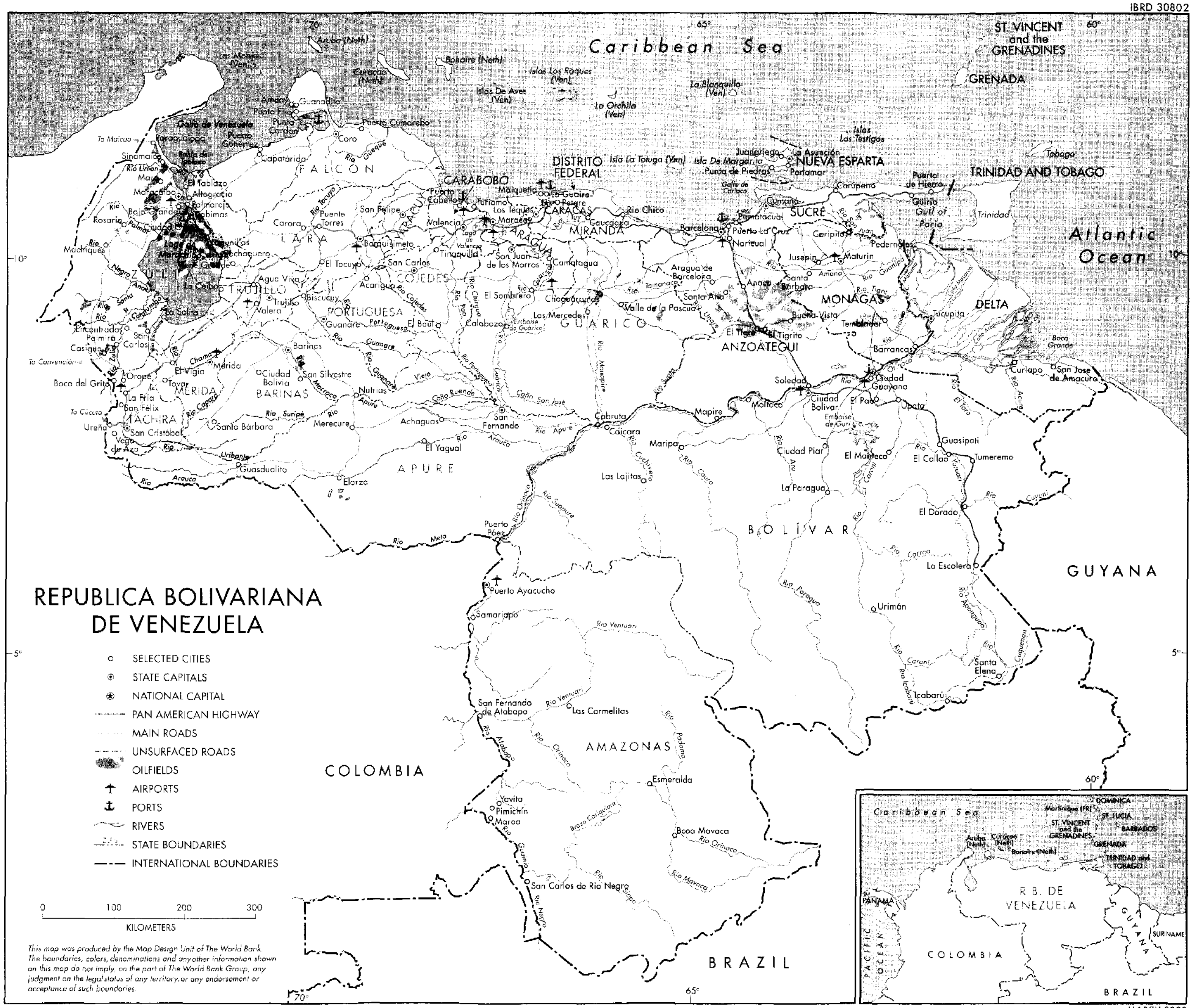
[Anuario Estadístico de Venezuela 1997. Oficina Central de Estadística e Informática. Caracas, 1998]

*CONICIT grants for **technological development** in 1996/1997*	
Total	**2,300,000 $**
By technological fields	
Science of Technology and Engineering	23.60 %
Informatics	14.64 %
Engineering	8.88 %
Material Construction	0.10 %
Biotechnology	49.77 %
Agricultural and Veterinary Sciences	0.31 %
Other Technologies	2.70 %

[*Anuario Estadístico de Venezuela* 1997. *Oficina Central de Estadística e Informática.* Caracas, 1998]

16. Competition for grants. According to interviews conducted with researchers, a typical CONICIT grant amounts to between US$100,000 to US$130,000 per research group. There is approximately a 30% rejection rate of research proposals. Quality and research performance parameters have not as yet been used as a financial incentive. However, a group of academic research scientists is emerging who are known for the quality and relevance of their work. They are trying to introduce mechanisms which would link the quality of a group or individuals scientific work to the level and sources of funding available and to the professional recognition and prestige accorded the field and the researchers. They are becoming increasingly involved in international scientific exchange of knowledge, publishing in recognized journals, and are willing to compete with other contenders for research funding, as well as participate in the formation of priority national programs for academic research. However, these academics are estimated not to exceed 10-30% of the teachers/researchers in higher education and research institutes in the Venezuela.

IBRD 30802



MARCH 2000