Document of
The World Bank

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PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED LOAN

IN THE AMOUNT OF US$25 MILLION

TO THE

REPUBLIC OF COLOMBIA

FOR THE STRENGTHENING THE NATIONAL SYSTEM OF SCIENCE, TECHNOLOGY AND INNOVATION PROJECT

IN SUPPORT OF
THE FIRST PHASE OF THE

SCIENCE, TECHNOLOGY AND INNOVATION PROGRAM (APL-1)

June 10, 2010

Human Development Sector Unit
Mexico and Colombia Country Management Unit
Latin America and the Caribbean Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective March 23, 2010)

Currency Unit = Colombian Peso (COP)
US$1 = COP$1,907.56

FISCAL YEAR
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

ACTI	Science, Technology and Innovation Activities *(Actividades de Ciencia Tecnología e Innovación)*
APL	Adaptable Program Loan
CGR	National Auditor's Office *(Contraloría General de la República)*
CNCyT	National Council for Science and Technology
COLCIENCIAS	Administrative Department of Science, Technology and Innovation *(Departamento Administrativo de Ciencia, Tecnología e Innovación*)
CONPES	National Council of Economic and Social Policy *(Consejo Nacional de Política Económica y Social*)
CPS	Country Partnership Strategy
CVLAC	Resume Database of Latin America and the Caribbean *(Currículum Vitae Latinoamericano y del Caribe*)
CY	Calendar Year
DA	Designated Account
DANE	National Statistics Department (*Departamento Administrativo Nacional de Estadística*)
DNP	National Planning Department *(Departamento Nacional de Planeación*)
ECA	Eastern Europe and Central Asia
EDIT	Development and Innovative Technology Survey *(Encuesta de Desarrollo e Innovación Tecnológica)*
FDI	Foreign Direct Investment
FM	Financial Management
FJC	*Francisco José de Caldas*
FONACyTI	National Fund for Science, Technology, and Innovation Financing *(Fondo Nacional de Financiamiento a la Ciencia, la Tecnología y la Innovación*)
GDP	Gross Domestic Product
GoC	Government of Colombia
GRUPLAC	Directory of Researchers of Latin America and the Caribbean *(Grupo Latinoamérica y del Caribe*)
HD	Human Development
ICETEX	Colombian Institute of Educational Credit and Technical Studies Abroad

	(Instituto Colombiano de Crédito Educativo y Estudios Técnicos en el Exterior)
ICFES	Colombian Institute for the Promotion of Education *(Instituto Colombiano para el Fomento de la Educación)*
ICR	Implementation Completion Report
ICT	Information and Communication Technologies
IDB	Inter-American Development Bank
IES	Higher Education Institutes *(Instituciones de Educación Superior)*
IFI	International Financial Institutions
IFR	Interim Financial Report
ILO	International Labor Organization
IPPF	Indigenous Peoples Planning Framework
IPRs	Intellectual Property Rights
IT	Information Technology
KAM	Knowledge Assessment Methodology
KEI	Knowledge Economy Index
LASPAU	Academic and Professional Programs for the Americas
M&E	Monitoring and Evaluation
MCIT	Ministry of Commerce, Industry and Tourism *(Ministerio de Comercio, Industria, y Turismo*)
MHCP	Ministry of Finance *(Ministerio de Hacienda y Crédito Público)*
MESEP	Mission to Link Employment, Poverty, and Inequality Series *(Misión para el Empalme de las Series de Empleo, Pobreza y Desigualdad*)
OCyT	Colombian Observatory of Science and Technology *(Observatorio Colombiano de Ciencias y Tecnología*)
OM	Operational Manual
PCU	Project Coordination Unit
PISA	Program for International Student Assessment
PNCyT	National Science and Technology Programs
R&D	Research and Development
RICYT	Science and Technology Indicators Network *(Red de Indicadores de Ciencia y Tecnología*)
SAI	Supreme Audit Institutions
SBD	Standard Bidding Documents
SCI	Science Citation Index
SENA	National Training Service *(Servicio Nacional de Aprendizaje*)
SEPA	Procurement Plan Execution System (*Sistema de Ejecución de Planes de Adquisiciones)*
SIC	Industry and Commerce Superintendence *(Superintendencia de Industria y Comercio*)
SIIF	Integrated Financial Information System
SIL	Specific Investment Loan
SME	Small and Medium Enterprise
SNCTI	National Science, Technology and Innovation System *(Sistema Nacional de Ciencia Tecnología e Innovación)*
SNIES	Higher Education National Information System *(Sistema Nacional de*

	Información de Educación Superior)
STI	Science Technology and Innovation
SWAp	Sector-Wide Approach
TIMSS	Trends in International Mathematics and Science Study
TFP	Total Factor Productivity
TSA	Treasury Single Account
USPTO	US Patent and Trademark Office
WBG	World Bank Group

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STRENGTHENING THE NATIONAL SYSTEM OF SCIENCE, TECHNOLOGY AND INNOVATION

PROJECT APPRAISAL DOCUMENT

LATIN AMERICA AND CARIBBEAN

LCSHE

Date: June 10, 2010 Country Director: Gloria M. Grandolini Sector Manager/Director: C. Lee / E. Javier	Team Leader: Alejandro Caballero Sectors: Tertiary education (40%); General industry and trade sector (40%); Central government administration (20%) Themes: Education for the knowledge economy (30%); Technology diffusion (20%); Export development and Competitiveness (20%); Other financial and private sector development (20%); Other public sector governance (10%)
Project ID: P117590 Lending Instrument: Adaptable Program Loan	Environmental category: B

Project Financing Data

[X] Loan [ ] Credit [ ] Grant [ ] Guarantee [ ] Other:

For Loans/Credits/Others:
Total Bank financing (US$m.): 25.00
Proposed terms: U.S. Dollar, commitment-linked, Fixed Spread Loan with a 17.5 year grace period for a total maturity period of 18 years. Front-end fee is 0.25 per cent.

Financing Plan (US$m)

Source	Local	Foreign	Total
Counterpart[1]	16.50	0.00	16.50
International Bank for Reconstruction and Development	22.00	3.00	25.00
Total:	38.50	3.00	41.50

Borrower:
Republic of Colombia
Responsible Agency:
Departamento Administrativo de Ciencia, Tecnología e Innovación (COLCIENCIAS**)**
Carrera 7B Bis No. 132-28, Bogota DC, Colombia

[1] Counterpart funding does not refer to fiscal resources but to funding from universities, firms and other private entities.

Estimated disbursements –Phase I only- (Bank FY/US$m)					
FY	2010	2011	2012	2013	2014
Annual	0.0	4.5	8.7	8.6	3.2
Cumulative	0.0	4.5	13.2	21.8	25.0

Project implementation period: Start: October 1, 2010 End: December 31, 2013
Expected effectiveness date: October 1, 2010 (estimated)
Expected closing date: December 31, 2013

Does the project depart from the CAS in content or other significant respects? ***Ref. PAD I.C.***	[ ]Yes [X] No
Does the project require any exceptions from Bank policies? ***Ref. PAD IV.G.*** Have these been approved by Bank management? Is approval for any policy exception sought from the Board?	 [ ]Yes [X] No [ ]Yes [ ] No [ ]Yes [X] No
Does the project include any critical risks rated "substantial" or "high"? ***Ref. PAD III.E.***	[ ]Yes [X] No
Does the project meet the Regional criteria for readiness for implementation? ***Ref. PAD IV.G.***	[X]Yes [ ] No

Project development objective ***Ref. PAD II.C., Technical Annex 3***

The Program (Calendar Year (CY) 2010-2019) would seek to enhance the Borrower's ability to generate, identify, disseminate, apply, and integrate knowledge among its citizens to foster economic growth and diminish inequities. The Project Development Objective (PDO) for Phase I of the APL (CY 2010-2013) would be to: (i) strengthen COLCIENCIAS' capacity to promote human capital for the knowledge economy, research and development (R&D) and innovation; and (ii) raise awareness of science, technology and innovation in the Colombian society.

Program description ***Ref. PAD II.D., Technical Annex 4***

The Program (CY 2010-2019) is proposed to be an Adaptable Program Loan (APL) structured in two phases to be implemented over a period of approximately 9 years. The first phase (CY2010-2013) would be financed through a loan of US$25 million. The second phase (CY2014-2019) would be financed through a loan of US$225 million.

COLCIENCIAS would manage and implement the Program. The Republic of Colombia (the Borrower) would provide COLCIENCIAS with the proceeds of the Loan through budgetary transfers. The proposed Project (Phase I, CY 2010-2013) would include the following four components:

Component 1: Strengthening COLCIENCIAS' operational and policy-making capacity; institutional strengthening of the Science, Technology and Innovation National System

Strengthening of COLCIENCIAS' operational and policy-making capacity including: (a) the enhancement of its organization, human resource capabilities and business processes; (b) the improvement of its strategic and sector planning and policy-making; and (c) the improvement of its capacity to monitor, evaluate and manage the Project.

Component 2: Strengthening COLCIENCIAS' capacity to promote development of human

capital for science and technology

Strengthening of COLCIENCIAS' capacity to promote the development of human capital for the knowledge economy through:

(a) The financing of Investment Pilots to promote: (i) the labor market insertion of doctoral graduates; (ii) linkages between Colombian and non-Colombian scientists and the Colombian *diaspora*; and (iii) the provision of technical assistance.

(b) (i) The financing of Investments to promote the development of scientific skills in basic and secondary education; and (ii) the provision of technical assistance.

Component 3: Strengthening COLCIENCIAS' capacity to promote research and innovation; investment for research and innovation.

Strengthening of COLCIENCIAS' capacity to promote Research and Development (R&D) and innovation through the financing, including matching grants, of Investment Pilots to promote and support, *inter alia*: (a) the development of innovation-management capabilities in firms; (b) R&D and innovation subprojects in strategic knowledge areas; (c) subprojects under revisions of existing COLCIENCIAS' instruments for *recuperación contingente* and *cofinanciación*; and (d) the provision of technical assistance to develop and implement plans and carry out evaluations therefore.

Component 4: Promoting Social Dissemination of Science, Technology and Innovation and Institutional Communication

Carrying out and financing of Investments to: (a) Increase awareness and disseminate knowledge of science, technology and innovation among the Borrower's public and private sectors; and (b) Increase COLCIENCIAS' visibility in the Colombian society.

Which safeguard policies are triggered, if any? ***Ref. PAD IV.F., Technical Annex 10***

The project triggers the Bank's Environmental Assessment (OP/BP 4.01) and Indigenous People's Policy (OP/BP 4.10).

Significant, non-standard conditions, **if any**, for:
Ref. PAD III.F.
Board presentation: None

Conditions of Effectiveness:

(a) The Project Operational Manual has been adopted in a manner satisfactory to the Bank and formally approved by COLCIENCIAS' *Dirección General*.

Covenants applicable to project implementation: ***Ref. PAD III.F***

(a) A Management Information System satisfactory to the Bank shall have been established by COLCIENCIAS no later than December 31, 2012.
(b) The Borrower shall maintain, at all times, during the implementation of the Project, COLCIENCIAS as its *Departamento Administrativo* responsible for the effective technical, fiduciary and supervisory activities related to the Project.

(c) The Borrower shall: (a) make the proceeds of the Loan available to COLCIENCIAS through budgetary transfers and; (b) make budgetary provisions in COLCIENCIAS' annual budgets for calendar years 2011 and thereafter in amounts equivalent to at least seventy five per cent (75%) of expected Project expenditures for each such calendar years as provided for in the relevant Project Annual Operating Plan.

(d) The Borrower, through COLCIENCIAS, shall: (a) adopt and thereafter apply and cause to be applied in the carrying out of the Project the Project Operational Manual under terms and conditions which shall been approved by the Bank; (b) carry out the Project, or cause to be carried out, in accordance with the provisions of: (i) the Project Operational Manual; (ii) the Annual Operating Plans; (iii) the Environmental Management Framework; (iv) the Indigenous Peoples Planning Framework; and (v) the Anti-Corruption Guidelines.

(e) The Borrower, through COLCIENCIAS, and COLCIENCIAS shall undertake that no physical or economic involuntary displacement of people (as interpreted in accordance with the Bank's Operational Policy 4.12) shall take place as a consequence of Project implementation.

(f) The Borrower, through COLCIENCIAS, shall finance Sub-projects under Parts B, C and D of the Project on a grant basis (the Grant) to Beneficiaries pursuant to the provisions established in the *Convocatoria* and in separate grant agreements (the Grant Agreement) under terms and conditions approved by the Bank and set forth in the Project Operational Manual which shall include the following key provisions: (a) the identification of the Beneficiary; (b) the contract value assigned to each Beneficiary by COLCIENCIAS; (c) the duration of the activities to be financed by the Grant; (d) the terms of the counterpart funding to be provided by the Beneficiary to carry out its respective Subproject; (f) the scope and nature of the activities to be financed under Parts B, C, and D of the Project; (g) the provisions of the Anti-Corruption Guidelines, the Environmental Management Framework, the Indigenous Peoples Management Framework; and (h) the commitment of the Beneficiary and/or the Financial Institution, if applicable, to take all necessary measures, as required by the Borrower, through COLCIENCIAS, to comply with its obligations as provided under Parts B, C, and D of the Project. Each Grant Agreement shall be entered into between a Beneficiary and the Borrower, through COLCIENCIAS, and/or through a Financial Institution on behalf of the Borrower, through COLCIENCIAS. Said Financial Institution shall have been selected through a public competitive process (*licitación pública*) under terms and conditions and bidding documents acceptable to the Bank.

(g) In the event that the Grants are provided to Beneficiaries through a Financial Institution on behalf of COLCIENCIAS, the Borrower, through COLCIENCIAS, shall: (a) comply and cause the Financial Institution to comply with the terms of the existing Financing Agreement and the relevant terms and conditions set forth in the Project Operational Manual; or (b) if determined by the Borrower, through COLCIENCIAS, enter into a new Financing Agreement with a new Financial Institution selected through a public competitive process (*licitación pública*) under terms and conditions and bidding documents acceptable to the Bank, as set forth in the Operational Manual.

I. STRATEGIC CONTEXT AND RATIONALE

A. Country and sector issues

1. **Prior to the onset of the global economic crisis, Colombia had experienced high economic growth rates**. In sharp contrast to its weak performance during the late 1990s, Colombia experienced strong and sustained growth over the 2003-2007 period. Driven by increased domestic demand, abundant liquidity, fiscal incentives for investment, and the strong performance of the construction, retail, and manufacturing sectors, annual growth rates averaged 6 per cent over this period, and peaked in 2007 at 7.5 per cent. In 2008, real Gross Domestic Product (GDP) growth slowed to 2.5 per cent, due mainly to the sharp decline of exports and private investment. The shock was transmitted through weaker export revenues, lower oil prices, lower worker remittances, and lower capital flows. Manufacturing and retailing were the worst hit sectors with output contractions of 10 and 4 per cent, respectively. Current estimates indicate that real GDP contracted 0.1 per cent in 2009.

2. **Compared to other Latin American countries, Colombia has been in a better position to confront the global economic crisis**. In Colombia, external shocks have been cushioned by a flexible exchange rate backed by adequate international reserves, a strong financial sector, and effective counter-cyclical monetary and fiscal policy. None of these shock absorption mechanisms would have been possible without the sound macroeconomic policies implemented in recent years. In the medium term, real GDP is expected to perform better than the regional average, with growth reaching 3.9 per cent in 2011. The country may remain vulnerable to reductions in global commodity prices and the economic slowdown of its main trading partners, Venezuela and the United States. However, Free Trade Agreements in effect, signed or under negotiation may have a positive impact on Colombia's future exports.

3. **Recent improvements in the business environment, as well as in security, also contribute to an improved medium-term economic outlook**. Colombia has earned a spot among the top ten reformers in the Doing Business report for the past two years, leading the ranking in Latin America. Both the enactment of investor-friendly legislation and an improved security situation, evidenced by the decrease in the homicide rate from 67 homicides per 100.000 inhabitants in 2002 to 33 in 2008, have led to an important inflow of foreign resources for investment. Foreign Direct Investment (FDI) increased from US$1.7 billion in 2003 to US$10.6 billion in 2008. Despite these achievements, there is ample opportunity for Colombia to further improve its investment environment, for example by implementing reforms to faciliate contract enforcement, strengthen the protection of property rights, reduce the tax burden on corporations and promote international trade.

4. **Despite its relative resilience to the crisis, Colombia's ability to achieve sustainable long-term growth depends on improving firms' productivity**. Since the 1950s, economists have argued that long-term growth must be fueled by technological change, not just factor accumulation. Recent literature suggests that roughly half of cross-country differences in per capita income and growth are driven by differences in total factor productivity (TFP). While private firms in Colombia achieved robust labor productivity growth in the period 2001-2007, exceeding 5 per cent annually, hourly remuneration grew faster still, with wages increasing by more than 7 per cent per year. In terms of TFP, between 1960 and 2000, Colombia's TFP relative

to that of the United States declined from 81 to 64 per cent. In addition, Colombia's TFP in 2000 lagged behind that of Uruguay, Mexico, Chile, Argentina, and Brazil.

5. **Export sophistication remains low in spite of its potential to positively support growth**. Colombia relies heavily on the export of traditional products such as oil products, coffee, coal and nickel. The share of these to total exports has remained almost unchanged at around 47 per cent since 1997. Moreover, in 2007 only 3 per cent of manufactured exports were high technology exports. Although a number of countries have built successful economies on the basis of natural resource exports (i.e. Australia, Canada, Finland, Sweden, and the United States), they have done so by adding value to their natural resources before they are exported and by building their Science, Technology and Innovation (STI) capacity to compete effectively in the more knowledge-intensive segments of the natural resource value chain. Given the long distance from the technology frontier at which current traditional exports in Colombia are located, the role of the government in implementing innovation-enhancing or distance-shortening policies gains relevance. Examples of such policies are targeted fiscal incentives for innovation, R&D, and Foreign Direct Investment (FDI) for technology transfer and targeted investments in human capital for the knowledge economy. Efforts to increase investments in STI and R&D in Colombia are expected to have positive spillover effects for the technological success of industries and their future economic growth.

6. **Colombia has intensified its support for STI in the past two decades, but is still lagging behind other Latin American countries in total investments in STI activities**. Actions to increase the stock of advanced human capital, stimulate R&D and innovation, and increase the dissemination of science throughout society have led to (a) a significant increase in the number of articles published in SCI Expanded and Scopus; (b) the existence of innovative firms in specific economic sectors; (c) high levels of firms' certification through quality assurance processes; and (d) growing examples of successful collaboration between universities and firms.[2] However, investment in STI activities in 2009 amounted to only 0.4 per cent of GDP, with R&D reaching only 0.16 per cent,[3] significantly lower than in neighboring Brazil.[4] Typically, less than half of R&D and STI spending in Colombia is financed by the private sector.[5] In countries with high rates of STI expenditure, such as Japan, the United States, Sweden, Finland, Ireland, and Germany, high levels of public investment in STI early on in the process brought about subsequent increases in industry-related STI spending , which today ranges from 65 to 70 per cent of the total. Colombia's low levels of public and private investment in STI are reflected in its low ranking in the World Bank's Knowledge Economy Index[6] (KEI) relative to Latin America and other middle income countries.

7. **Since 2008, the National Council for Economic and Social Policy (CONPES) has issued two policy documents that have included diagnoses of the Colombian STI sector**: The

[2]Examples include Tecnnova in Antioquia and the collaboration between SOFASA-Renault and the University of Antioquia.
[3]OCyT (2009)
[4] World Economic Forum (2009)
[5] OCyT (2009)
[6] This Index evaluates whether the environment is conducive for knowledge to be used effectively for economic development.

National Competitiveness and Productivity Policy (CONPES 3527) and the National STI Policy (CONPES 3582). Furthermore, the World Bank developed a policy note (*Colombia: A Window of Opportunity*) in 2006 that includes an initial analysis of STI Policy. The following key sector issues have been identified by the Government of Colombia (GoC) and the World Bank:

8. **Budget fluctuations, institutional fragmentation and weak sector leadership**. Colombia's National STI System comprises a diverse set of institutions that have developed over the past four decades. While the system achieved relevant milestones, such as the creation of specialized policy-making capabilities and the early use of modern financing instruments, shifting macroeconomic conditions and policy priorities have led to instability in budgetary allocations to the sector. Also, as budgets fluctuated, the agencies and ministries responsible for the implementation of STI activities in specific sectors changed, hindering policy continuity. Currently, 16 ministries and governmental agencies have direct or indirect responsibilities for implementing STI policy. This has led to the development and funding of separate and sometimes overlapping programs, as well as the exclusion of a number of important areas. Colombia has progressively addressed this issue by strengthening the role of the national agency for STI, the *Departamento Administrativo de Ciencia, Tecnología e Innovación* (COLCIENCIAS), which is by law the STI sector coordinator. However, in order to effectively lead STI policy, COLCIENCIAS must be strengthened further. Specifically, it must continue to improve its management practices, upgrade its information technology systems, streamline its core processes, and increase the policy-making capabilities of its human resources.

9. **Limited degree of development of scientific skills at the lower levels of the education system**. Promoting scientific competencies in basic and secondary education remains a pending issue in Colombia. Colombia has recently participated in two important international evaluations that compare students' performance in science: the Program for International Student Assessment (PISA) in 2006 and Trends in International Mathematics and Science Study (TIMSS) in 2007. PISA results show that while Colombia's performance among lower middle-income countries is roughly average in reading, it is below average in mathematics and science. According to TIMMS, the average science performance of Colombian eighth-graders in 2007 was lower than that of other middle income countries such as Jordan, Thailand, Malaysia, and Indonesia. Furthermore, only 1 per cent of Colombian eighth-graders reached the TIMSS advanced international benchmark in science, compared to 5 per cent in Jordan and 3 per cent in Turkey, Ukraine, Thailand and Malaysia. This weak performance in science and mathematics at lower levels of the education system ultimately leads to low enrollment ratios in scientific, technical and technological programs in tertiary education and to a low percentage of individuals able to perform innovation-related tasks in the labor market.

10. **Inadequate stock of advanced human capital**. Research shows that increasing the share of educated employees has a positive impact on introducing new products or processes within a firm. However, in Colombia, there is a lack of advanced human capital to promote innovation within the productive sector at the level required in a middle-income country aspiring to become a knowledge economy. Only 13.7 per cent of the country's labor force had completed higher education[7] by 2005, and most higher education students during the period 2002-2008 were

[7] Higher education refers to university and vocational and technical post-secondary programs.

enrolled in universities (71 per cent) rather than technical and technological programs (24 per cent). The number of engineers in strategic industries remains insufficient, and, with fewer than 2,700 active researchers with doctoral degrees, Colombia lags significantly behind other Latin American countries in the per capita number of doctoral graduates and researchers. This results in a low proportion of university professors with a doctoral degree (12 per cent) and of PhDs contributing to innovation activities (only 2.5 per cent of doctoral graduates work in the private sector).[8] There is also a very low share of employees with doctoral degrees in sectors of high economic relevance: for instance, only 0.06 per cent of those working in the manufacturing sector hold a PhD.

11. **Low economic relevance and limited international linkages of existing public research**. Colombia produces 9.3 scientific and technical journal articles per million inhabitants,[9] versus 21 in Latin America and 590 on average in most developed countries. According to the Colombian Observatory for Science and Technology (OCYT), research is highly concentrated in humanities and social sciences, which account for almost half of the indexed publications. Limited attention is given to the areas of natural sciences and technology. Universities and research centers remain the key actors in research production, hosting more than 95 per cent of research groups and employing the majority of national researchers. According to the Colombian manufacturing innovation survey, only 9 per cent of firms have an R&D unit within their corporate structure and only 1 per cent of all employees work in R&D- related activities. As a result, research rarely generates knowledge inputs that directly contribute to increasing the productivity of the economy. Translating the existing research base into economically productive commercial applications remains a missing link.

12. **Weak links between local researchers and the Colombian *diaspora***. The experience of countries such as India and Scotland has shown that *diaspora* populations hold tremendous potential to facilitate access to knowledge for researchers and firms in the home country. However, collaboration between the Colombian *diaspora* and Colombia-based researchers remains low. This is true despite the fact that Colombian migrants to the United States have three more years of education than the average Colombian and that 46.2 per cent of them have tertiary education training, compared to only 14 per cent in the case of Mexican migrants,. During the 1990s, Colombia created the Network for Colombian Researchers Abroad (*Red Caldas*). This network was successful in piloting the formulation and development of collaborative work with the *diaspora,* but its initial momentum was halted in 1998 due to the reduction in COLCIENCIAS' budget. Today, the *diaspora* is generally disengaged and only occasionally involved in collaborative projects.

13. **Weak links between the private sector and knowledge institutions (i.e. universities, research centers, technology development centers)**. A likely cause for the perceived lack of economic impact of Colombia's research is the limited collaboration between the private sector and knowledge institutions. Like many other emerging countries, Colombia lacks a culture of

[8] According to the Network of Indicators of Science and Technology (RICYT), only 2.5 per cent of PhD graduates work in business, while 80.5 per cent work in higher education.

[9] This refers to scientific and engineering articles published in the following fields: physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, and earth and space sciences. 2005 data.

cooperation between the private sector and universities and research centers. Limited awareness of the benefits of such collaboration on both sides, the mismatch of industry needs with academic knowledge, and weak incentives for faculty and students to engage with firms have all prevented effective collaboration. Today, only 1 per cent of firms in Colombia collaborate with universities, in sharp contrast to countries with innovation-led growth, such as Finland and the United Kingdom. Furthermore, a World Bank commissioned report[10] concluded that "most universities are financially and institutionally poorly equipped to meet the triple objective of high quality research, teaching excellence and effective interaction with local industries." The same report found a persistent lack of trust between firms and universities.

14. **Low capacity of firms to undertake commercially-oriented innovations leading to the introduction of new products and services**. The innovation capacity of Colombian firms is constrained by their limited capacity to fund internal R&D units, to hire personnel dedicated to managing R&D and innovation within the firm and to provide innovation-related training to employees. According to the 2003-2004 innovation survey (EDIT II), only 6 per cent of manufacturing firms invested in R&D. In terms of innovation outputs, only 8.3 per cent of firms introduced a new product or process into the international market. Most investments in innovation activities are still undertaken by large firms. Investments by small firms account for only around 6 per cent of the total in the case of broadly-defined innovation activities and 2.5 per cent in the case of R&D activities. These percentages are drastically lower than small and medium enterprises' (SMEs) share of gross value added, production, employment, or number of establishments in Colombia.

15. **Low levels of awareness of Science, Technology and Innovation in society**. Recent surveys on the public perception of science show that, in Colombia, general access to content and information related to STI is relatively low, especially outside the most important urban areas. This reinforces previously discussed issues, such as low enrollment ratios in scientific, technical and technological degree programs and the lack of a corporate culture that values innovation. Furthermore, only 4.7 per cent of people interviewed in Bogota thought public investment in Science and Technology should be a priority. In such a context, it is difficult to elicit support for increasing investment in STI activities.

16. **Limited diffusion of current public incentives**. While a number of financial incentives to promote STI have been in place for some time, many are not well-known to most firms. In the past, incentives were not successfully targeted and advertised to the private sector. A study commissioned by the National Planning Department (DNP) emphasized that the lack of an effective public communication strategy to promote the diffusion of the existing STI incentives prevented firms from more systematically undertaking publicly-funded commercial innovation.[11] This is particularly true for SMEs, which do not typically have the specialized human resources in-house to effectively tap into these funding opportunities. Therefore, it is crucial that Colombia effectively increases awareness of public incentives and communicates the benefits to firms' personnel.

[10] Vestergaard (2005) p. 78
[11] CONPES 3582, National Science, Technology and Innovation Policy

Government Strategy

17. **During the period 2006-2009, a series of political developments in Colombia highlighted the increased relevance of STI policy as a fundamental tool to promote productivity growth and increase welfare**. Most importantly, the GoC established a long-term plan for social and economic policy (*"Visión 2019")* that identified productivity growth through STI as a key strategy to achieve sustained economic growth and a greater level of welfare.

18. **During the last four years, and under the vision and initiative of its current leadership, COLCIENCIAS, in coordination with the DNP, has taken substantial steps towards developing a reform agenda for the STI sector**. COLCIENCIAS prepared a policy document titled *"Colombia Construye y Siembra Futuro"* that proposes a national STI policy responding to the challenges of Colombia's competitiveness. COLCIENCIAS' funding also increased: in the last two years, its budget increased by 46 and 59 per cent in real terms, respectively, and the government is committed to continue increasing its funding.

19. **In parallel, the GoC and the private sector developed the National Competitiveness and Productivity Policy and Colombia's *Productive Transformation Strategy,* which includes STI as one of its key pillars.** The development of this strategy has been led by the Ministry of Trade, Industry and Tourism (MCIT); it supports sectors with high potential for technological upgrading and productivity growth. It informed STI policy as it specifically highlighted: (a) the need to create a pool of human capital with the skills to create and transform knowledge to the advantage of the productive sector; (b) the need to support knowledge creation in areas that support sectors in which Colombia can successfully compete in international markets; and (c) the need to promote alliances between knowledge centers and the private sector and to encourage R&D and innovation activities.

20. **In 2009, *Law 1286* established Colombia's legal framework for the STI sector**. Early in 2009, *Law 1286* was enacted, transforming COLCIENCIAS from an Institute for the development of science and technology into an Administrative Department directly reporting to the President and in charge of coordinating all actors in the STI sector. The law also created the Francisco José de Caldas (FJC) fund to raise public, private, international development, and philanthropic resources to finance the sector and allow a multi-year execution of STI resources.

21. **Later in 2009, COLCIENCIAS and the DNP prepared and CONPES approved a new STI Policy**. This policy has six key objectives: (a) strengthening COLCIENCIAS and promoting the institutional consolidation of the National Science, Technology and Innovation System (SNCTI); (b) strengthening human resources for research and innovation; (c) promoting R&D and innovation in the productive sector; (d) promoting social dissemination of knowledge in specific audiences that can act as multipliers to increase social dialogue in scientific and technological issues; (e) focusing public action on strategic areas in order to complement the national competitiveness policy and (f) developing and strengthening STI capabilities regionally and promoting the internationalization of Colombian STI activities (for more detail on the contents of this document see Annex 1).

22. **COLCIENCIAS has begun leading the implementation of this new regulatory and policy framework, starting with its own transformation process**. In line with its role as STI

sector coordinator, COLCIENCIAS embarked on a reform process to strengthen its internal capacity and increase its financial autonomy. To effectively manage anticipated sector-wide funding increases, COLCIENCIAS will also need to become a more results-oriented and efficient Administrative Department with the ability to guide STI policy implementation in priority sectors. COLCIENCIAS plans to increase its internal capacity to develop and influence STI policy making in Colombia.

23. **In line with these priorities, COLCIENCIAS directed recent resource increases toward financing three main lines of action**: (i) funding of national and international doctoral studies; (ii) competitive funding for R&D projects; and (iii) competitive funding for collaborative innovation projects between knowledge institutions and the productive sector. Complementarily, COLCIENCIAS launched a comprehensive plan for human capital formation called *Generación Bicentenario,* which integrates three initiatives across the education system. First, it seeks to promote scientific skills in children by increasing the coverage of *Ondas,* a program that finances research activities undertaken by basic and secondary education students and their teachers. Second, it will increase funding for the *Young Researchers* Program, which provides funds for young professionals to complete internships in universities and research centers as a way to stimulate their interest in becoming researchers. Finally, at the PhD level, the program plans to support 500 doctoral students annually through scholarships and labor market insertion mechanisms. The goal for this latter activity is to train current and future Colombian researchers in the best national and international universities and programs, under a long-term, multi-year funding commitment approved by the GoC.

24. **In addition, COLCIENCIAS seeks to increase support to other existing programs with significant demand**: As in other Latin American countries, there is growing demand for support for activities that aim to promote science popularization, citizen participation in technology-oriented capacity building, and other activities meant to increase awareness of STI among non-traditional population segments. As would be expected in a relatively new area of work for COLCIENCIAS, measuring the long-term impact of this new set of activities is a priority for the near future.

25. **To support the implementation of the new STI policy, increase funding for the sector, and achieve budget stability, the GoC requested in June 2009 the preparation of two independent loans from the Inter-American Development Bank (IDB) and the World Bank**. The two Banks have coordinated intensely during project preparation to avoid potential overlaps and to maximize synergies (see Annex 4 for details on specific activities to be undertaken by each Bank). Given its renewed role as STI sector coordinator, COLCIENCIAS would be the implementing entity for the two loans. COLCIENCIAS is currently strengthening its internal capacity to manage loan resources, with support from the IDB and the World Bank.

B. Rationale for Bank involvement

26. **The proposed operation is fully aligned with the World Bank Group's (WBG) Country Partnership Strategy (CPS) 2008-2011 (Report 42847-CO) discussed by the Executive Directors on March 4, 2008**. The 2008 Colombia CPS focuses WBG efforts on six main areas that are aligned with the pillars established in the National Development Plan 2006-2010. The operation would specifically support two of them: (i) Sustained Equitable Growth and (ii)

Governance. The former aims at improving Colombia's competitiveness and private sector productivity to maintain high and sustainable GDP growth over the medium term. Increasing knowledge generation, absorption, and utilization in Colombia is paramount to achieving the desired productivity leap. Improving governance across the public entities of the national STI system would allow these entities to more effectively stimulate the supply of and demand for knowledge, as well as link knowledge institutions and the private sector more efficiently.

27. **The proposed operation would build on the well-established cooperation between the GoC and the World Bank in the STI and tertiary education sectors**. Following the preparation of a World Bank policy note for the STI sector covering the period 2006-2010 under the title *Colombia: A Window of Opportunity*, the GoC increased its attention to the sector. A number of recent institutional, legal, and policy developments are aligned with the policy recommendations made to the GoC in this document. In 2007 and 2009, the World Bank organized the first and second Global Forums on STI capacity-building. Colombia sent delegations to these events and Colombian officials made relevant presentations during the Forums. The proposed operation is also linked to the Bank's recent engagement with Colombia's tertiary education system through Loan 7155-CO, which closed on December 31, 2008 and whose main objective was to increase access, quality and coherence in the tertiary education subsector. COLCIENCIAS was a co-implementing agency for this loan, which financed national doctoral scholarships, the acquisition of robust research equipment, and researchers' mobility programs.

28. **The Bank has accumulated international experience in the development and implementation of STI strategies world-wide**. Since 2005, the Bank has financed STI interventions in a number of middle-income countries in Latin America and the Caribbean (i.e. Argentina, Uruguay, Chile, and Mexico) and other regions (i.e. Turkey, Croatia, Armenia) focusing on both increasing the supply of knowledge and its demand by the private sector to increase competitiveness and boost firms' productivity. In addition to its operational experience, the Bank has also been involved extensively in knowledge activities related to STI globally. For example, it has recently carried out an assessment of innovation practices in China, Malaysia and Russia.

C. Higher level objective to which the Program contributes

29. **The proposed Program would enhance the competitiveness and productivity of Colombian firms to foster sustainable growth and reduce economic disparities**. The Program would link specific STI investments to promote knowledge generation and absorption in Colombia to the national strategy for competitiveness and productivity and to the development of priority industrial sectors under the Productive Transformation Strategy.

II. PROGRAM DESCRIPTION

A. Lending instrument

30. **The Program (Calendar Year (CY) 2010-2019) would be financed by an Adaptable Program Loan (APL) with two phases to be implemented over a period of approximately 9 years**. The proposed Project (Phase I of the APL to be implemented in CY 2010-2013) would be financed through a loan of US$25 million. The second phase (CY 2014-2019) would be financed through a loan of US$225 million. The Program (Phases I and II) would be managed and implemented by COLCIENCIAS. The Republic of Colombia would be the Borrower.

B. Program objective and Phases

31. The **Program objective** would be to enhance the Borrower's ability to generate, identify, disseminate, apply and integrate knowledge among its citizens to foster economic growth and diminish inequities.

32. Phase I of the APL (CY 2010-2013) would focus on strengthening COLCIENCIAS' capacity to promote human capital for the knowledge economy, R&D, and innovation. COLCIENCIAS' support to individuals, universities, research centers, and firms has typically been channeled through a portfolio of financial *instruments*. *Instruments* are the specific financing mechanisms to be applied for the promotion of human capital, R&D, and innovation. A specific *instrument* is defined by a set of eligibility criteria and financing terms and conditions.

33. In particular, *instruments* financing R&D and innovation activities would finance *subprojects*. *Subprojects* are a clearly defined set of activities to be carried out in accordance with a previously approved proposal. Proposals typically describe the team and budget to carry out the activities.

34. COLCIENCIAS generally allocates financing resources through pre-established, public and competitive *processes*. These processes typically include an initial *convocatoria*,[12] followed by proposal reviews by national expert panels and national and international peer reviewers, and by funding award recommendations made by a Committee (for a more detailed description of COLCIENCIAS' current processes, please see Annex 4). Once proposals are approved for funding, COLCIENCIAS monitors the implementation and evaluates the results of these subprojects.

35. Phase I of the APL would specifically aim at supporting two distinct areas: (i) the institutional strengthening of COLCIENCIAS, by enhancing its general operational and policy-making capacity and improving its current portfolio of *instruments;* and (ii) the financing of *investments* in a subset of COLCIENCIAS' existing programs, including the establishment of a strong monitoring and evaluation framework for these programs.

[12] "*Convocatoria*" means a call for proposal widely disseminated _by the Borrower, through COLCIENCIAS, pursuant to terms satisfactory to the Bank, inviting, inter alia, eligible individuals, institutions or firms, to submit Subproject proposals, for the purposes of competitively selecting Beneficiaries under Parts B, C and D of the Project. In some cases, Colciencias' processes include a preliminary step called "call-for-concept notes."

Box 1: Potential improvements to COLCIENCIAS' existing *processes*
In line with successful experiences (e.g. the Millennium Science Initiative projects in countries including Chile, Brazil, Mexico and Uganda), Phase I would include a revision of existing processes. This revision could potentially include, among other aspects: (a) increasing support to applicants in proposal preparation; (b) increasing transparency of the selection criteria and competitiveness of the selection procedure; (c) reinforcing the existing anonymous peer reviewing process with a larger peer reviewer database that contains a more representative number of international experts; and (d) exploring the potential usefulness of post-selection debriefing for unsuccessful applicants.

36. ***Institutional Strengthening***: The transformation of COLCIENCIAS from an institute to an administrative department brings increased responsibilities, new roles, and substantial budget increases. Therefore, COLCIENCIAS needs to strengthen its infrastructure, human resources and managerial capacity as well as redesign core processes. To help COLCIENCIAS address these challenges, Phase I of the APL would place a strong focus on increasing the organization's operational and policy-making capacity.

37. ***Investment pilots***: In addition to improving its operational and policy-making capabilities, COLCIENCIAS must also strengthen its current portfolio of *instruments*. Therefore, Phase I of the APL would also seek to finance specific *investment pilots* that are expected to help COLCIENCIAS extract relevant *lessons* to upgrade its current portfolio of instruments, while financing other competitive instruments. The *investment pilots* would focus on three types of new approaches: (i) the development of new *instruments*; (ii) modifications to existing *instruments*, based on international best practices; and (iii) the development of the strategic sector *selectivity* approach that concentrates financial resources on specific knowledge areas and industries.

38. In many cases, prior to the implementation of the investment pilots, a *planning* phase would finalize the design of the instruments and/or help allocate resources more strategically. For some R&D and innovation subprojects, financing priorities would be defined up front in specific *plans* that would be prepared through technical assistance, as explained in section *D. Project description*.

39. Each *investment pilot* carried out in Phase I would require an *evaluation* to distill key *lessons learned.* Taking into consideration the limited duration of Phase I and the difficulty this poses to measuring the long-term impact of *investment pilots* during Phase I, *evaluations* would mainly focus on analyzing: (i) demand in response to the call-for-proposals; and (ii) satisfaction of applicants and beneficiaries with COLCIENCIAS' competitive processes, from the call-for-proposals to the funding decision.

40. ***Investments***: In addition to institutional strengthening, Phase I of the APL would also make selective *investments* in a subset of existing COLCIENCIAS activities. The selected activities would meet two requirements: (i) they enjoy significant demand; and (ii) they are innovative approaches to STI policy and have the potential to be scaled up in Colombia and other low and middle income countries (i.e. as is the case, for instance, with *Ondas* and with activities promoting awareness and social dissemination of knowledge). By the end of Phase I, it is expected that COLCIENCIAS will have established an improved monitoring and evaluation

framework for these activities. The rationale for this is to increase COLCIENCIAS' ability to measure results prior to the expected scaling up in Phase II.

41. Subsequently, Phase II of the APL (CY 2014-2019) would selectively and significantly scale-up *investments* to promote human capital, research, and innovation in Colombia based on the results of the *evaluations* of the *investment pilots* and of the *investments* carried out during Phase I.

C. Project development objective, key indicators and triggers

42. The project development objective (PDO) for Phase I would be to: (i) strengthen COLCIENCIAS' capacity to promote human capital for the knowledge economy, R&D and innovation; and (ii) raise awareness of science, technology and innovation in Colombian society.

43. The Colombian Observatory of Science and Technology (OCyT) has compiled an extensive group of indicators to monitor the development of STI in Colombia. A selection of these indicators, combined with indicators developed by COLCIENCIAS, would be used to measure progress towards meeting the Project (Phase I) objectives. Key indicators would include: (i) Percentage of COLCIENCIAS' annual investment budget committed by the end of the second quarter of the calendar year; (ii) Number of instruments designed or redesigned[13] and approved by COLCIENCIAS' Board of Directors; (iii) *Lessons learned* summary completed, including the results of the monitoring and evaluation of *Ondas* and activities promoting the social dissemination of knowledge; (iv) Total grant applications for R&D and innovation subprojects received yearly by COLCIENCIAS; and (v) Ratio of proposals for innovation-management capacity-building subprojects received to proposals financed.

44. **The APL would include triggers to enter into Phase II**. Given the significant increase in funding expected for Phase II, progress from Phase I to Phase II would be contingent on COLCIENCIAS meeting specific *milestones* on institutional development and operational efficiency, on effectively completing the revision of existing *instruments,* and on compiling specific *lessons learned* from the *investment pilots* to scale-up selected activities based on the evidence derived from Phase I. Triggers would also include a minimum level of disbursements under the *investment pilots* to ensure that the new and revised *instruments* have been sufficiently tested prior to scaling-up.

45. Phase II would be triggered when **both conditions** presented below are **met**:

46. **Condition I**: The following three conditions are met: (i) design or redesign of at least three new or existing financing *instruments* approved by COLCIENCIAS' Board of Directors; (ii) *evaluations* completed for the *investment pilots* effectively carried out and *lessons learned* summary completed; and (iii) at least 75 per cent of loan proceeds have been disbursed.

47. **Condition II**: 2 out of 4 of the following actions are met: (i) at least 50 per cent of COLCIENCIAS' staff trained according to the new competencies model; (ii) at least 80 per cent

[13] Instruments should be redesigned by incorporating the results of the technical assistance carried out for instrument revision.

of COLCIENCIAS' management units[14] using the Balanced Scorecard[15] or an equivalent performance management tool; (iii) revised COLCIENCIAS' *convocatoria* processes, from call-for-proposals to subproject monitoring, developed[16] and approved by COLCIENCIAS' Board of Directors; (iv) at least one research paper completed by the *internal policy analysis unit*.

D. Project components

48. The Project (Phase I) would include four components organized according to COLCIENCIAS' existing organizational structure:

Component 1: Strengthening COLCIENCIAS' operational and policy-making capacity; institutional strengthening of the Science, Technology and Innovation National System (Bank financing: US$5.8 million)

49. Strengthening of COLCIENCIAS' operational and policy-making capacity including: (a) the enhancement of its organization, human resource capabilities and business processes, through, *inter alia*, the provision of staff training, technical assistance and operating costs; (b) the improvement of its strategic and sector planning and policy-making, through, *inter alia*, the creation of a specialized internal policy analysis unit and the provision of goods, services, operating costs, and technical assistance required therefore; and (c) the improvement of its capacity to monitor, evaluate and manage the Project, through, *inter alia*, the provision of goods, services, training, operating costs, and technical assistance required therefore.

Component 2: Strengthening COLCIENCIAS capacity to promote development of human capital for science and technology (Bank financing: US$ 7.2 million)

50. Strengthening of COLCIENCIAS' capacity to promote the development of human capital for the knowledge economy through:

(a) The financing of Investment Pilots to promote: (i) the labor market insertion of doctoral graduates by, *inter alia*, providing stipends to public and private knowledge institutions and firms to hire doctoral graduates, including Colombian and non-Colombian researchers residing outside the Republic of Colombia; (ii) linkages between Colombian and non-Colombian scientists and the Colombian *diaspora* by, *inter alia*, (A) providing matching grants for collaborative subprojects, and (B) training, forums and seminars; and (iii) the provision of technical assistance to develop and implement plans and carry out evaluations therefore.

[14] Today, Colciencias is structured around 10 management units: 4 technical divisions, 4 support offices for the general director, the deputy director's office, and the general director's office.

[15] The Balanced Scorecard is a strategic planning and management system that is used extensively in business and industry, government, and nonprofit organizations worldwide to align business activities with the vision and strategy of the organization, to improve internal and external communications, and to monitor organization performance against strategic goals.

[16] The new process should be developed by incorporating the results from the technical assistance carried out for process revision.

(b) (i) The financing of Investments to promote the development of scientific skills in basic and secondary education by, *inter alia*, providing grants for research activities of students and their teachers; and (ii) the provision of technical assistance to, *inter alia*, establish and implement a monitoring and evaluation framework therefore.

Component 3: Strengthening COLCIENCIAS' capacity to promote research and innovation; investment for research and innovation (Bank financing: US$8.5 million)

51. Strengthening of COLCIENCIAS' capacity to promote R&D and innovation through the financing, including matching grants, of Investment Pilots to promote and support: (a) the development of innovation-management capabilities in firms; (b) R&D and innovation subprojects in strategic knowledge areas; (c) subprojects under revisions of existing COLCIENCIAS' instruments for *recuperación contingente* and *cofinanciación*; and (d) the provision of technical assistance to develop and implement plans and carry out evaluations therefore.

Component 4: *Promoting Social Dissemination of Science, Technology and Innovation and Institutional Communication (Bank financing: US$3.5 million)*

52. Carrying out and financing of Investments to:

(a) Increase awareness and disseminate knowledge of science, technology and innovation among the Borrower's public and private sectors, including the provision of (i) goods, including the rental, acquisition and operation of vehicles for mobile classrooms; (ii) training, forums and seminars, including training of mediators and facilitators; and (iii) technical assistance for, *inter alia*, the development and implementation of a monitoring and evaluation framework therefore; and

(b) Increase COLCIENCIAS' visibility in the Colombian society, including the preparation and carrying out of plans, seminars and mass media investments, and the provision of goods, services, operating costs and technical assistance therefore.

Box 2: Plans and evaluations under the *Investment Pilots* in Components 2 and 3

The ***plans*** to be carried out prior to the implementation of the *investment pilots* would seek to, *inter alia*: (a) establish specific recommendations to improve the design of an instrument to promote scientific collaboration with the Colombian research *diaspora*; (b) identify existing bottlenecks and prepare action plans for improving human capital and promoting R&D and innovation in strategic knowledge areas defined by the GoC that directly relate to specific priority industries; (c) analyze and assess options for redesigning COLCIENCIAS' existing instrument to finance R&D, based on international best practices (for a description of the existing *recuperación contingente* R&D instrument, see Annex 4).

The ***evaluations*** would seek to measure the preliminary results of the *investment pilots* implemented through Components 2 and 3 and would analyze, *inter alia*: (i) the number and type of applications received in response to the call-for-proposals for each instrument; (ii) the levels of satisfaction of applicants and beneficiaries with COLCIENCIAS' *processes*, from the call-for-proposals through the award of funding.

53. **Links to IDB operation**. The IDB and the World Bank would finance two independent operations in the STI sector in Colombia, under the umbrella of CONPES 3582. A special effort has been made during Project preparation to ensure coordination. In particular, the IDB would be financing activities in the areas of institutional strengthening, R&D and innovation and social dissemination of knowledge that would complement activities financed by the World Bank under Components 1, 3 and 4 of the proposed Project (Phase I). However, the PDO of the Bank-financed Project can be achieved independently of the IDB-financed operation, and both operations remain fully independent. A detailed description of the division of responsibilities is included in Table 1.

Table 1: WB assisted Project (Loan Amount) vs. IDB assisted Project (Loan amount), Million US$. IDB amounts are preliminary and subject to change.

Area of support	World Bank	IDB
Strengthening COLCIENCIAS' operational and policy-making capacity, and project management.	5.8	
Strengthening COLCIENCIAS' capacity to promote human capital	7.2	
Strengthening COLCIENCIAS' capacity to promote research and innovation	8.5	
Promoting social dissemination of STI	3.5	
TOTAL World Bank	**25.0**	
Information systems for STI decision-making		6.2
Governance of the National STI system		3.8
Improvement of the design, monitoring, and evaluation of the STI policy system		4.1
Financial Management of the FJC fund		0.5
Competitive fund for research and innovation		8.9
Social dissemination of knowledge and communications		1.0
Project management		0.5
TOTAL IDB		**25.0**

E. Lessons learned and reflected in the project design

54. **The proposed Project reflects lessons learned from previous World Bank operations and analytical work in the STI sector in Latin America, Asia and Eastern Europe**. Based on these lessons learned, the proposed Project would incorporate the following features:

55. **An integrated supply and demand approach**: A review of World Bank lending for Science and Technology from 1980-2004 emphasized the importance of strengthening the demand for knowledge and technology in the private sector to be able to accommodate and reap full benefits from investments that increase the supply of knowledge. Implementation Completion Reports (ICRs) for projects that focused exclusively on increasing the supply of or the demand for knowledge in a number of countries found that these projects could have yielded better results if a more integrated approach had been taken. As a result, the Investment Pilots and Investments to

be financed through the proposed Project are a combination of supply and demand-side public incentives.

56. **Strong project ownership and commitment**: Previous Bank experience has demonstrated that the probability of success for programs seeking to strengthen STI capacities is higher when such programs support a coherent, pre-existing government STI policy. In addition, given the long-term horizon of most STI interventions, program continuity is critical for successful implementation. The proposed Project integrates these findings into its design as it supports the goals of Colombia's *Visión 2019*, the National Development Plan (NDP), COLCIENCIAS' policy document *Construye y Siembra Futuro*, Law 1286/2009, and CONPES 3582/2009.

57. **Addressing institutional bottlenecks that might hinder successful implementation**: As emphasized by a study on the knowledge economy in the Europe and Central Asia region, in order to implement successful STI projects, interventions should be logically sequenced to address institutional bottlenecks that may pose implementation risks. The proposed Project has been designed to include initial components focused on COLCIENCIAS' institutional strengthening to ensure that the implementing agency will be able to address any potential shortcomings in time to manage the future stream of resources successfully.

58. **Competitive financing**: Allocating funding for universities, research centers and firms through competitive processes increases efficiency and has a positive effect on outputs and outcomes. It also favors quality institutions and channels resources towards entities with the highest potential. Thus, the proposed operation would channel resources for labor market insertion and research and innovation subprojects through competitive funds. At the same time, there would be a strong focus on ensuring that current allocation procedures are aligned with international best practices for competitive financing.

59. **Balancing neutrality and selectivity**: A review of Bank operations highlights the desirability of designing neutral instruments to avoid capture of funding by special interest groups, clusters, political actors, or implementing agencies. At the same time, the Bank's recent experience in STI projects suggests that focusing financing on specific knowledge areas can help develop a critical mass of knowledge with high potential for growth and spillovers. Therefore, the Project would implement a combination of neutral and selective competitive funding mechanisms and include a coherent monitoring and evaluation framework that ensures objectivity in the selection process.

60. **Special support for Small and Medium Enterprises (SMEs)**: Conducting frontier R&D is often unrealistic for technologically-limited SMEs, yet these enterprises could greatly benefit just by adopting existing technologies. However, SMEs often lack the information and expertise required to prepare an application that allows them to compete with larger companies for public funding for R&D and innovation. This results in very low levels of public support for technological upgrading of SMEs. To address this shortcoming, COLCIENCIAS' traditional funding instruments would be complemented with a new instrument aimed at promoting innovation-management and technology-adoption capacities in firms, with a special focus on SMEs, as described in Component 3.

61. **Ensuring adequate sequencing in the design of instruments**: In the innovation field, adequate instrument sequencing that matches the steps in the innovation process can contribute to a program's long-term success. Given the current low levels of innovation-related activities in Colombia, Phase I of the APL would finance instruments to support the first two stages of the innovation process: *matching grants* to create capacity and develop technology and innovation management skills in firms and *matching grants* for R&D and the initial development of new products and processes. Phase II of the APL could potentially move into the provision of support for the commercialization stage, for example through venture capital funding or patent services.

F. Alternatives considered and reasons for rejection

62. **A Specific Investment Loan (SIL) instead of an APL**: Alternative lending instruments such as a SIL were considered, but an APL was the most appropriate way to support a long-term Program aligned with the GoC strategy for the sector as presented in CONPES 3582. In addition, the APL's two-phase structure would allow COLCIENCIAS to focus first on its internal institutional strengthening and on revising existing instruments through evidence-based processes, and then transition toward the scaling-up of key instruments once specific organizational and implementation milestones have been achieved.

63. **Pooling of funds between GoC, IDB, and the Bank**: Given the involvement of both the IDB and the World Bank in the sector and the complementarities of their operations, a theoretical alternative was to pool donor and/or government funds through jointly agreed channels. In the case of Colombia, the country procurement system is being harmonized, but to date common procedures with the IDB have only been developed for certain procurement methods. It is therefore not possible to achieve a complete pooling of funds.

64. **Fully independent loans by the IDB and the Bank**: Although recent operational experience in other countries (e.g. Argentina, Uruguay) suggests that an efficient approach could be to prepare independent operations, the existence of a common sector document (CONPES 3582) setting clear GoC priorities for the sector led to significant coordination between the two banks in Project design. Additionally, COLCIENCIAS recommended harmonizing, to the extent possible, the procedures of the two banks in order to simplify and minimize the administrative burden of having to interact with two funding partners.

65. **Results-based financing**: The proposed Project would provide funding for a number of R&D and innovation subprojects of great diversity that cannot be standardized on the basis of resource usage, beneficiaries covered or outputs generated. Given that a significant portion of Project funding would be allocated to these subprojects through competitive funds, results-based financing was not considered a suitable approach under the operation.

III. IMPLEMENTATION

A. Partnership arrangements

66. Both the IDB and the World Bank have committed to ensuring coordination throughout implementation and to maintaining an ongoing dialogue, keeping each other informed of the progress in their respective operations. Project implementation would be harmonized through:

(a) a common operational manual that reflects the particularities of two independent operations; (b) joint financial management reports; and (c) when appropriate, joint annual supervision missions. In addition, IDB and the Bank would make efforts during implementation to further harmonize arrangements, including procurement procedures such as the use of Colombia's System for the Execution of Procurement Plans (SEPA). In areas where differences persist, the IDB's and the Bank's specific policies would continue to apply.

B. Institutional and implementation arrangements

67. **The Borrower, through COLCIENCIAS, would have primary responsibility for implementation of the four components under the operation, including procurement and financial management**. COLCIENCIAS is the national public STI entity in Colombia and was transformed into an Administrative Department reporting directly to the President following the enactment of Law 1286 in 2009. From a legal perspective, COLCIENCIAS operates under the Colombian *Administrative Law* as part of the Executive Branch of Government. The Director of COLCIENCIAS is appointed by the President of the Republic of Colombia and is a member of the CONPES. He/she can be called upon by the President to participate in the Council of Ministers. The internal capacity of COLCIENCIAS has been assessed during preparation, and key capacity constraints related to Project management were identified. Proposed action plans to overcome these constraints are being addressed through technical cooperation currently in progress and would continue to be addressed under Component 1, particularly during Phase I of the APL.

68. **In order to utilize and strengthen COLCIENCIAS' existing organizational capacity, no project coordination unit (PCU) would be established**. A full-time Project Leader with qualifications and experience and terms of reference satisfactory to the Bank would be retained and maintained for the duration of the Project. The Project Leader would report directly to COLCIENCIAS' Director and link to a larger team including staff from the different divisions within COLCIENCIAS' current organizational structure (i.e. General Secretariat, Planning Office, Resource Management and Logistics Directorate, Knowledge Networks Directorate, Technological Development and Innovation Directorate, Research and Development Directorate, Institutional Communications Area). Members of this larger team would have a double reporting line, reporting to the heads of their divisions and to the Project Leader. In many cases, they would have prior experience in operations with multilateral banks, including the World Bank. The Project Leader will be responsible for coordinating the day-to-day management of the Project, including (a) the effective implementation of procurement, financial management and auditing; (b) monitoring and evaluation activities pursuant to the provisions of this Agreement and the Project Operational Manual; and (c) preparation and submission to the Bank, for its review and approval of Project Annual Operating plans and related budgets. On December 9, 2009, the Borrower, through COCIENCIAS, appointed a Project Leader whose qualifications and experience and terms of reference were reviewed and found acceptable by the Bank.

69. **Funds under Components 2, 3 and 4, for subprojects or stipends, would, in principle,[17] flow through the FJC fund**. This flow would occur under the terms and conditions stated in the Project Operational Manual (see Annex 6). The fund was created by *Law 1286* in 2009 with the goal of attracting public, international and private sector funds for the STI sector. It is fully controlled and overseen by COLCIENCIAS, but operated under a trust fund (*Contrato de Fiducia Mercantil)* with a private firm that acts as a financial institution on behalf of COLCIENCIAS. The fund can only operate under the direct and exclusive mandate of COLCIENCIAS' Director.

70. **Alternatively funds for Components 2, 3 and 4, for subprojects or stipends could also be disbursed directly through COLCIENCIAS to the beneficiaries, without the use of a financial institution**. This flow would occur under the terms and conditions stated in the Project Operational Manual (see Annex 6).

71. ***Ondas*. The *Programa Ondas*, under Component 2 (b), would, in principle, be financed through the FJC fund and co-managed by COLCIENCIAS and 32 Departmental Coordination Units (i.e. in most cases, a local university)**. Agreements would be entered into between COLCIENCIAS, the FJC fund, each of the Departmental Coordination Units, and the Department.[18] These agreements would be renewed annually and would include all the relevant operational and financial details to operate *Ondas* in that administrative unit pursuant to the provisions of the Project Operational Manual. Based on the agreement, each Coordination Unit would present an annual action plan and budget during the first quarter of the Calendar Year, to be approved by COLCIENCIAS. The allocation of funds for subprojects under *Ondas,* with amounts typically ranging between US$400 and US$800, would be competitive and based on calls-for-proposals launched at the Departmental level by the Coordinating Unit. Proposals would be prepared by research groups formed by students and teacher(s). The selection process would be carried out by a Committee integrated by COLCIENCIAS, the Coordinating Unit, the Department and, when relevant, other program donors (i.e. private sector entities). Once the selection process is completed and subprojects have been approved, COLCIENCIAS and the Coordinating Unit would assign a pedagogical advisor to each subproject to provide support to the group in preparing a budget. Upon budget approval by the committee, COLCIENCIAS' Director would order the transfer of resources from the FJC Fund to the Coordinating Units. The operational model of the *Programa Ondas* would be reflected in the *Programa Ondas* Operational Manual. Financial monitoring would be regularly carried out by the advisor. The flow of funds is described in Annex 7.

C. Monitoring and evaluation of outcomes/results

72. **The implementation of a coherent monitoring and evaluation (M&E) framework is essential to ensure that the activities undertaken under the proposed Project consistently contribute to achieving the PDOs**. Continuous feedback channels are required to allow the implementing agency to identify and address potential design shortfalls.

[17] As this is the initial flow of funds options to be described in the Project Operational Manual, which may be amended from time to time with prior agreement by the Bank.

73. **At the *component level*, the Project would systematically collect information about Project activities**: for example, researchers' labor market insertion stipends or funding of R&D and innovation subprojects. Indicators would capture outputs and intermediate outcomes to ensure that activities are completed and have yielded the expected results. Component 1 would finance the implementation of an M&E system, including impact evaluations of the instruments administered by COLCIENCIAS. In addition, Components 2, 3 and 4 would finance the evaluations of the *investment pilots* and the development of monitoring frameworks for *Ondas* and for the activities related to the social dissemination of knowledge.

74. **At the *Project level*, output and outcome indicators for each component, as well as information about the underlying factors driving demand for funds, would be collected**.[19] This type of information would allow COLCIENCIAS to assess progress towards the proposed sector goals and also possible unintended outcomes. The institutionalization of systematic monitoring of national targets at the President's level (SIGOB) has enabled the country to produce regular information about policies, programs, and agencies' performance, including that of COLCIENCIAS. Whenever possible, the M&E framework for the proposed Project has been aligned with SIGOB policy indicators. Information from the Colombian Observatory of Science and Technology (OCyT) or other relevant national or international sources (i.e. National Statistics Department (DANE)), would supplement COLCIENCIAS' internal information.

D. Sustainability

75. **The proposed Program is expected to have a catalytic effect on increasing the private sector contribution to STI through the provision of specific incentives**. It might also leverage additional public resources. The CONPES 3582/2009 policy document establishes the target of increasing investment in STI activities to 2 per cent of GDP by 2019. Combined IDB-World Bank loan resources (US$500 million) would represent around 5.7 per cent of the additional budgetary effort that Colombia would have to make in the 2010-19 period in order to increase STI funding to 2 per cent of GDP.[20] However, it is expected that, as COLCIENCIAS improves its internal and policy-making capacity and portfolio of instruments, it would be able to leverage additional public and private resources. COLCIENCIAS currently leverages around 1.5 pesos for every peso it grants to research and innovation subprojects. If COLCIENCIAS manages to at least maintain this ratio, with the resources provided by the multilateral loans, the sum of these resources would represent approximately 5.4 per cent of the additional combined public-private effort necessary to increase STI funding to 2 per cent of GDP by 2019. (For more details, see Annex 9).

[19] Goldberg, 2006
[20] It is expected that the IDB project will have a second phase in parallel to the World Bank's APL-II.

E. Critical risks and possible controversial aspects

Description of risk	*Risk Mitigation measures*	*Risk Rating with mitigation*
Operation-Specific Risks		
Weak culture of collaboration between the private sector and knowledge institutions In Latin America, promoting stable public-private or private-private consortia for collaborative research and innovation has been more complicated than initially envisaged. Formalizing consortia agreements involving more than two partners or including an international partner has been even more challenging. The risk is that demand for these types of instruments may be limited.	Parallel to Project preparation, the Bank has engaged with the GoC through non-reimbursable technical cooperation. One of the objectives would be to revise and reformulate existing STI instruments so that they are more attractive to firms and provide incentives to create stable consortia based on results from an international policy benchmark.	M
COLCIENCIAS' historical lack of influence over its budget allocation Prior to the enactment of *Law 1286*, COLCIENCIAS depended administratively on DNP, and thus had little direct voice in budget negotiations, and a limited ability to influence sector-wide policy dialogue. At the national level, it was perceived that COLCIENCIAS' capacity to manage funding increases needed to improve. To be able to influence policy at the national level, COLCIENCIAS must improve its management practices and IT systems and allocate a larger share of personnel time to mission related tasks.	Beginning in 2006, COLCIENCIAS started to take initial steps toward addressing some of these issues. In the last 12 months: (i) it has undergone an initial organizational restructuring; (ii) it has started to put in place the legal and financial mechanisms to operationalize the FJC fund; (iii) it has started to develop a plan to upgrade its operational processes and IT infrastructure; and (iv) it has recruited a Project manager with experience in working with multilateral funders. Furthermore, Phase 1 of the APL would place a strong focus on institutional strengthening.	M
Financial Management Increased complexity of COLCIENCIAS' procedures: As a result of its transformation into an Administrative Department, COLCIENCIAS will be facing changes in budget management, as well as in other accounting and operational procedures. A higher level of complexity can be expected, especially during the transition period. Complex implementation arrangements related to the project: The project involves a variety of expense categories with different, and in some cases complex, implementation arrangements. Under Components 2, 3 and 4 grants for subprojects and stipends would be transferred to very different types of beneficiaries and would require considerable effort for follow-up in terms of financial and technical monitoring. Complex institutional arrangements for the flow of funds: In principle, it is expected that most funds related to subprojects would be by-passed using FJC fund. Although this is a positive development; transitioning to these new	The country's public financial management arrangements are generally strong and apply to the Project, as it is integrated into the national budget; the entity operates under a defined set of operating rules, which are documented in manuals of policies and procedures. COLCIENCIAS has experience in the implementation of projects financed by multilateral organizations, including the Bank. It was a co-implementing agency under Colombia: Higher Education Improving Access (LN 7155, approved in December 2002), and it was also an implementing entity for 3 IDB projects. The administrative staff of COLCIENCIAS is reasonably familiarized with the FM policies of the Bank. In addition to the reviews of the independent external auditing and internal control unit, the National Auditor's Office (*Contraloría General de la Nación*) regularly conducts performance, financial and compliance audits for the Project.	M

Description of risk	*Risk Mitigation measures*	*Risk Rating with mitigation*
arrangements would require substantial learning and adaptation of operational procedures.		
Procurement Given that the Project would finance grants for subprojects to be implemented by a broad array of beneficiaries, including private sector recipients, there is a risk that these beneficiaries would have difficulties in following Bank procurement procedures.	A revision of procurement procedures by COLCIENCIAS' beneficiaries carried out by the Bank during Project preparation revealed that a significant part of the procurement is practiced by universities that follow strict requirements. Both these practices and commercial practices by private sector beneficiaries were found to be acceptable by the Bank.	M
Overall Risk Rating		M

Risk scale is: Substantial (S), Moderate (M) and Low (L).

F. Loan/credit conditions and covenants

76. **Conditions of Effectiveness:**

(a) The Project Operational Manual has been adopted in a manner satisfactory to the Bank and formally approved by Colciencias' *Dirección General*.

77. **Covenants applicable to project implementation**:

78. A Management Information System satisfactory to the Bank shall have been established by COLCIENCIAS no later than December 31, 2012.

79. The Borrower shall maintain, at all times, during the implementation of the Project, COLCIENCIAS as its *Departamento Administrativo* responsible for the effective technical, fiduciary and supervisory activities related to the Project.

80. The Borrower shall: (a) make the proceeds of the Loan available to COLCIENCIAS through budgetary transfers and; (b) make budgetary provisions in COLCIENCIAS' annual budgets for calendar years 2011 and thereafter in amounts equivalent to at least seventy five per cent (75%) of expected Project expenditures for each such calendar years as provided for in the relevant Project Annual Operating Plan.

81. The Borrower, through COLCIENCIAS, shall: (a) adopt and thereafter apply and cause to be applied in the carrying out of the Project the Project Operational Manual under terms and conditions which shall been approved by the Bank; (b) carry out the Project, or cause to be carried out, in accordance with the provisions of: (i) the Project Operational Manual; (ii) the Annual Operating Plans; (iii) the Environmental Management Framework; (iv) the Indigenous Peoples Planning Framework; and (v) the Anti-Corruption Guidelines.

82. The Borrower, through COLCIENCIAS, and COLCIENCIAS shall undertake that no physical or economic involuntary displacement of people (as interpreted in accordance with the Bank's Operational Policy 4.12) shall take place as a consequence of Project implementation

83. The Borrower, through COLCIENCIAS, shall finance Sub-projects under Parts B, C and D of the Project on a grant basis (the Grant) to Beneficiaries pursuant to the provisions established in the *Convocatoria* and in separate grant agreements (the Grant Agreement) under terms and conditions approved by the Bank and set forth in the Project Operational Manual which shall include the following key provisions: (a) the identification of the Beneficiary; (b) the contract value assigned to each Beneficiary by COLCIENCIAS; (c) the duration of the activities to be financed by the Grant; (d) the terms of the counterpart funding to be provided by the Beneficiary to carry out its respective Subproject; (f) the scope and nature of the activities to be financed under Parts B, C, and D of the Project; (g) the provisions of the Anti-Corruption Guidelines, the Environmental Management Framework, the Indigenous People's Management Framework; and (h) the commitment of the Beneficiary and/or the Financial Institution, if applicable, to take all necessary measures, as required by the Borrower, through COLCIENCIAS, to comply with its obligations as provided under Parts B, C, and D of the Project. Each Grant Agreement shall be entered into between a Beneficiary and the Borrower, through COLCIENCIAS, and/or through a Financial Institution on behalf of the Borrower, through COLCIENCIAS. Said Financial Institution shall have been selected through a public competitive process (*licitación pública*) under terms and conditions and bidding documents acceptable to the Bank.

84. In the event that the Grants are provided to Beneficiaries through a Financial Institution on behalf of COLCIENCIAS, the Borrower, through COLCIENCIAS, shall: (a) comply and cause the Financial Institution to comply with the terms of the existing Financing Agreement and the relevant terms and conditions set forth in the Project Operational Manual; or (b) if determined by the Borrower, through COLCIENCIAS, enter into a new Financing Agreement with a new Financial Institution selected through a public competitive process (*licitación pública*) under terms and conditions and bidding documents acceptable to the Bank, as set forth in the Operational Manual.

IV. APPRAISAL SUMMARY

A. Economic and financial analyses

85. **Productive innovation is a key driver of TFP growth, and in turn an important source of sustained economic and employment growth**. Empirical literature provides estimates of social returns to R&D that range from 30 to 90 per cent. Lederman and Maloney (2003) suggest that economic returns to R&D for Colombia are as high as 80 per cent.

86. **Market failures in the creation and diffusion of knowledge lead to underinvestment in innovation and justify government intervention and Bank support in this area**. First, firms that invest in generating knowledge cannot reap all the benefits from their activities. As a result, their investments tend to be less than socially optimal, both when it comes to new knowledge generation and adoption of foreign technologies. Second, even if private returns to innovation were fully appropriable, investments in knowledge generate positive externalities and social returns that exceed private returns. Therefore, without government interventions, firms would

systematically invest less than the socially optimum level.[21] Third, investments in R&D are usually large, long-term, and risky, so less developed financial markets seldom provide adequate instruments and term structures for financing them. Fourth, innovation activities entail a fundamental information asymmetry where the firm has tacit knowledge of the innovation and capacity to develop it compared to the external financing agent, such as a bank, which would lack the capacity to verify it. Fifth, innovation and its application often require costly collaboration among many institutions and firms and no single agent has the incentives to bear those costs, given that the benefits of such coordination are not fully appropriable.

87. **All of the Project components would encourage innovative activities either directly or indirectly**. The components would encourage researchers and business people to carry out knowledge-generating activities that would not have been undertaken at a socially optimal level in the absence of Project support given the market failures discussed above (see Annex 9 for more details, including a quantitative analysis of STI expenditure in Colombia).

B. Technical

88. **The Project design conforms to the most recent and traditional literature on STI[22] and is appropriate to the Borrower's needs, as it targets the complex mix of constraints to innovation in Colombia**. For instance, the design of instruments to increase firms' technology absorption capacity and promote labor market insertion and linkages with the *diaspora* would conform to a number of international best practices identified during preparation. Project design includes a combination of complementary tools to: (i) improve the capacity of the agency implementing STI policy; (ii) strengthen the supply side through investments in labor market insertion of advanced human capital and social diffusion of knowledge; (iii) build the demand side through investments in R&D and private sector innovation; and (iv) enhance linkages between supply and demand through the promotion of public-private and private-private collaboration. This comprehensive approach ensures long-term sustainability and conforms to international good practice and lessons learned from recent World Bank loans, both in the Latin American and Caribbean region – including *Mexico Innovation* (2005), *Chile Innovation* (2003) and *Uruguay Innovation and Competitiveness* (2007) – and in other regions – Croatia (2005), Turkey (1999) and Armenia (2001) – (see section II.E and Annex 2 for a description of these projects).

[21] See also Lederman and Maloney (2003) and Jones and Williams (1998) for more on social returns to R&D.

[22] In particular, input from the following Bank and external sources has been taken into consideration in project design: Aghion and Howitt (1992), Arbelaez and Parra-Torrado (2009), Benavente (2006, 2009) , Chaparro, F. (2008), Crepon et al. (1998), Douguet (2006), Echeverria et al. (2008) , Ferreira, et al. (2006), Goldberg et al. (2006), Griffith, et al. (2000), Griffith, et al. (2003), Griliches (1992), Grossman and Helpman (1991), Hanushek and Woessmann (2007), Hausmann, Hwang and Rodrik (2006), Hausmann and Klinger (2008), Hausmann and Rodrik (2003), Kuznetsov and Dahlman (2008), Jefferson et al. (2006), Jones and Williams (1999) , Lederman (2009), Lederman and Maloney (2003), van Leeuwen and Klomp (2006), Loof and Heshmati (2006), Lundvall and Johnson (1994), Marotta et al. (2007), Masso and Vahter (2008), Mercer-Blackman (2008), Racine et al. (unpublished), Romer (1990), Solow (1956), Segerstrom (1991), Vestergaard (2005), Zachariadis (2003).

C. Fiduciary

89. **Administration of procurement, financial management, and disbursement activities would be conducted directly by COLCIENCIAS**.

Procurement

90. The Bank conducted a procurement management assessment, which included ensuring that the Project design allows for an appropriate level of transparency to facilitate oversight and control while also supporting smooth implementation. Procurement for the proposed Project would be carried out in accordance with the World Bank's *Guidelines: Procurement under IBRD Loans and IDA Credits* dated May 2004 and revised October 2006 and May 2010; and *Guidelines: Selection and Employment of Consultants by World Bank Borrowers* dated May 2004 and revised October 2006 and May 2010, and the provisions stipulated in the Legal Agreement. For each contract to be financed by the Loan, the different procurement methods or consultant selection methods, the estimated costs, prior review requirements, and time frame have been agreed between the Borrower and the Bank in the Procurement Plan. The Procurement Plan would be updated at least annually, or as required, to reflect the actual project implementation needs and improvements in institutional capacity. In order to promote transparency and strengthen accountability, the Procurement Plan would be incorporated into SEPA. Much of the Project's procurement would take place under *grants* and other financial instruments for subprojects. These financial incentives would be awarded through open, transparent, and competitive processes. Subprojects would be financed through competitive grants and other financial instruments; procurement under these subprojects would be carried out by beneficiaries following commercial practices. The applicability of "Established Private or Commercial Practices" as a procurement method is allowed by virtue of the fact that all the funds under Component 3 would, in principle, flow through the Francisco José de Caldas fund. The fund is controlled and overseen by COLCIENCIAS, but operated under a trust fund (*fideicomiso)* managed by a private firm. (See Annex 8 for details).

Financial Management

91. Annex 7 documents the results of the Financial Management (FM) Assessment of the Project as conducted by Bank staff in accordance with Bank policy. The Project entails considerable complexity in terms of FM, mainly for the following reasons: (i) COLCIENCIAS has been transformed into an Administrative Department, which has increased the complexity of its operational and accounting procedures, (ii) the flow of funds for some of the project's components (disbursement categories 1, 2 and 3, as described in Annex 7) has additional non-standard features, like, in principle, the use of a financial institution for the distribution of Project funds, (iii) the *Programa Ondas* has different implementation arrangements than other Project components, including the transfer of resources to 32 different Departmental coordinating agencies. These factors make the FM risk, at inception, Substantial.

92. **Diverse mitigating controls are in place in COLCIENCIAS or are being proposed as a result of the FM assessment, resulting in a residual risk rating of Modest**. Among the more important mitigating controls are the following: (i) there is a well established framework of operational rules and procedures in place, creating an adequate internal control environment; (ii)

the entity is currently using the SIIF system for the accounting and budgeting of operations, which is online with the Ministry of Finance and acceptable to the Bank; (iii) COLCIENCIAS has considerable experience working with multilateral organizations, and the FM department is reasonably well-staffed; and (iv) the strengthening of some procedures is being proposed as a result of this analysis, mainly related to operational and financial control mechanisms of subprojects financed by COLCIENCIAS.

93. A Financial Management section will be included in the Project Operational Manual, which was provided to the Bank for review and approval prior to negotiations.

D. Social

94. **The operation triggers the Indigenous Peoples safeguard policy (OP/ BP 4.10)**. It does not trigger the Involuntary Resettlement safeguard policy (OP/ BP 4.12) because no constructions, land acquisitions, or restrictions of access to resources in protected areas are expected to take place. COLCIENCIAS undertakes that no physical or economic involuntary displacement of people (as interpreted in accordance with OP/BP 4.12) shall take place as a consequence of Project implementation.

Indigenous Peoples

95. **The operation triggers the Indigenous Peoples safeguard policy (OP/BP 4.10) as stipend recipients and researchers benefitting from the Project may be indigenous peoples or Afro-descendants**. During Project preparation, COLCIENCIAS and the World Bank reviewed the planned Project procedures and verified that current operational processes do not present, in any form, a systematic barrier for indigenous peoples or Afro-descendants to access COLCIENCIAS' instruments, typically awarded on a competitive and merit basis. In addition, academic experts, who are knowledgeable about the reality of indigenous students and researchers, were consulted on Program design on February 2, 2010. This was to complement regular consultations by COLCIENCIAS throughout the planning and implementation of its programs. An agreement was reached for COLCIENCIAS to continue to increase the access of information about product offerings by beneficiaries and knowledge institutions with a significant representation of indigenous peoples under the Project. The goal is to ensure that candidates that comply with the merit requirements necessary to either successfully pursue advanced tertiary education or undertake quality research activities can effectively access COLCIENCIAS' incentives. In addition, an Indigenous Peoples Planning Framework (IPPF) was prepared by COLCIENCIAS. It reviewed, among other things, the key steps in the competitive funding award process and established a process for screening funding proposals to be financed under competitive fund mechanisms (see Annex 10). The IPPF was published by COLCIENCIAS on April 15, 2010 and by Infoshop on April 22, 2010.

Participation and Consultations

96. **In 2009, the World Bank organized in Bogota the *International Forum on Human Capital and Science, Technology and Innovation***. Its purpose was to initiate consultations with a broad array of stakeholders from civil society, Government, private sector, and academia as a first step toward preparation of the proposed operation (see Annex 10 for more details). The

Bank also participated in the *Forum on Science, Technology and Innovation*, co-organized by the Ministry of Education and COLCIENCIAS, which gathered more than 1,000 participants involved in the Colombian STI sector. Consultations with stakeholders would continue throughout Project implementation.

E. Environment

97. **The Project is classified as Environmental Category B. It triggers the Environmental Safeguard Policy (OP/BP 4.01) as research and innovation projects in some of the targeted areas (i.e. biofuels, biodiversity, energy and water) could be based in rural areas and potentially have negative environmental impacts**. An Environmental Management Framework has been developed to address any potential risks and was published by COLCIENCIAS on April 9, 2010 and by Infoshop on April 22, 2010. A summary of this framework can be found in Annex 10. The framework reviews the Colombian legal and administrative framework for environmental protection, which is found to be, in general terms, sound and adequate. It also establishes procedures for screening research and innovation projects to ensure that negative environmental and social impacts are avoided or mitigated. It does this by building on and improving existing procedures through which COLCIENCIAS, in its call-for-proposals and in its selection procedures, requires each and every subproject to include both an environmental and bioethics declaration. Furthermore, funding award contracts with beneficiaries include the legal obligation to abide by Colombian environmental regulations and seek all necessary administrative environmental permits.

F. Safeguard policies

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment (OP/BP 4.01)	[X]	[ ]
Natural Habitats (OP/BP 4.04)	[ ]	[X]
Pest Management (OP 4.09)	[ ]	[X]
Indigenous Peoples (OP/BP 4.10)	[X]	[ ]
Physical Cultural Resources (OP/BP 4.11)	[ ]	[X]
Involuntary Resettlement (OP/BP 4.12)	[ ]	[X]
Forests (OP/BP 4.36)	[ ]	[X]
Safety of Dams (OP/BP 4.37)	[ ]	[X]
Projects on International Waterways (OP/BP 7.50)	[ ]	[X]
Projects in Disputed Areas (OP/BP 7.60)*	[ ]	[X]

G. Policy Exceptions and Readiness

98. This Project complies with all applicable Bank policies.

99. COLCIENCIAS is an existing agency with established procedures for *Convocatorias*, which have been carried out regularly by COLCIENCIAS for more than 20 years. These procedures,

* *By supporting the proposed project, the Bank does not intend to prejudice the final determination of the parties' claims on the disputed areas*

through which most of the Loan proceeds would be allocated, are ready and have proved to work in different contexts. The Project is therefore ready for immediate implementation.

100. The Project Leader has been appointed and the Project's organizational structure, including reporting lines have been established in the draft Project Operational Manual.

101. Draft template contracts and procedures for the *Convocatorias* have been established and documented in the draft Project Operational Manual.

102. Accounting and investment guidelines for the *Francisco José de Caldas* Fund have been reviewed and found acceptable to the Bank.

103. A draft version of the Project's Operational Manual was revised and agreed with the Bank prior to negotiations. A revised version of the Operational Manual is currently being finalized to reflect the changes deriving from negotiations. Formal approval by Colciencias' *Dirección General* of the Operational Manual is expected to be a mere procedural step and will be a condition of effectiveness.

Annex 1: Country and Program Background

Strengthening the National System of Science, Technology and Innovation

Science, Technology and Innovation Policy in Colombia

1. This annex outlines the policy and institutional framework underpinning Colombia's system of STI, focusing on ongoing reforms to consolidate this framework and thereby improve the results from public investments, promote private sector involvement, and accelerate knowledge-driven economic growth. These efforts are directed especially at strengthening COLCIENCIAS, the administrative department charged with STI policy, which will affect the incentives and interactions of public and private sector agents that finance and/or carry out STI activities. The institutional strengthening of COLCIENCIAS has several dimensions – enhanced political status, organizational restructuring, revamping of instruments used to promote research, innovation and human capital formation – which are described in detail.

Overview of Colombia's STI policy and institutional framework

2. Colombia's National System of Science, Technology and Innovation has developed into a diverse set of institutions over the past four decades. This development was characterized by significant policy milestones, some of which were well ahead of their time and led to the early creation of specialized policy-making capabilities and implementation of best-practice financing instruments. However, as macroeconomic conditions and overall economic policy objectives changed, there were surges and dips in public investment in STI and this instability in budgetary allocations led to uneven progress in achieving scientific excellence and translating knowledge into increased productivity. Also, as budgets went up and down, the agencies and ministries taking responsibility for promoting STI in specific sectors changed, which hindered continuity and a long-term vision.

3. The main milestones in the development of the STI policy and institutional framework are:

(a) The establishment in 1968 of COLCIENCIAS, the Colombian Fund for the Development of Science and Technology, which marked the beginning of a process of institutional strengthening and increased awareness in policy circles about the social and economic benefits from investing in advanced human resources and research and technological development. At this point, the Colombian Institute for the Promotion of Higher education was set up, increasing financing for graduate degrees (specifically Master's Programs) and a first credit with the Inter-American Development Bank in the Science, Technology and Innovation sector was executed.

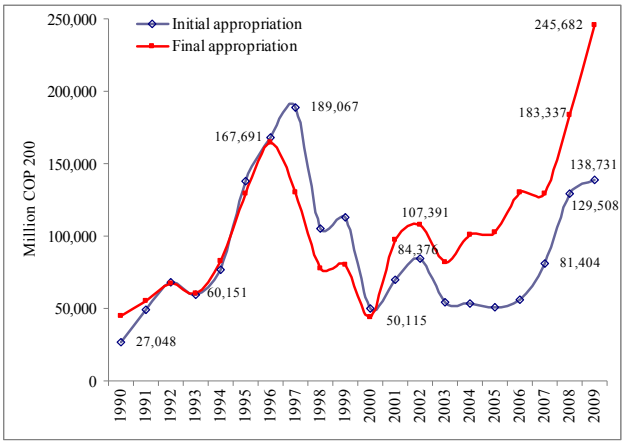
(b) From 1968 onward, there was progressive development of research capabilities with resources allocated in accordance with overarching industrial development objectives, namely, science and technology policy was guided by import substitution goals. Significant resources were allocated to R&D in protected industries that were promoted through industrial policy, using the national center for industrial development as a tool of centralized technology development. With liberalization and privatization processes in the 1990s, the State started to pull back investment resources, which ultimately led to the dismantling of important research groups.

(c) The enactment of Law 29 in 1990 accelerated the process of reform and decentralization of the existing system. COLCIENCIAS ceased to be a fund and became the Colombian Institute for the Development of Science and Technology, reporting to the National Planning Department. The National Science and Technology System (SNCTI) was formalized, specifically through the establishment of the national council for science and technology (CNCyT), which would coordinate and direct the SNCTI and act as advisor to the government in matters of STI.

(d) The enactment of Law 30 in 1992 made the promotion of graduate education a priority. The national science and technology programs were institutionalized in 1991. These 11 programs, steered by national program councils, strengthened planning in their respective scientific disciplines. Regions also became represented in this network of organizations, through regional commissions and program councils. A significant milestone following the enactment of Law 30 was the establishment of the first doctoral programs in Colombia in 2004.

(e) The two loans obtained from the Inter-American Development Bank in 1990 and 1994 enabled a huge ramp up in the investments channeled by COLCIENCIAS, which more than quadrupled between 1990 and 1997. However, as the external funds were exhausted and those from national sources did not increase, the level of investment once again returned to 1990 levels by 2000.

Figure A1C.1: COLCIENCIAS Budget[23]



(f) The first Uribe administration identified the promotion of national capabilities in STI as a key motor of economic development. Between 2000 and 2002, the National Council for Economic and Social Policy produced three documents pertaining to science and technology (CONPES 3080, 3179, 3201) which, respectively: defined the country's Science and Technology Policy for the period 2000-2002; guaranteed support to the

[23] Notes: (i) the 2009 budget corresponds to estimates based on MGMP (Medium Term Expenditure Framework); (ii) November's CPI was used for 2008; (iii) 2009 inflation target was used for 2009. Source: Colciencias, DANE (CPI). Calculations by DNP.

Scientific Community through the National Doctoral Programs;[24] and established support for Doctoral education between 2003 and 2008.[25] At this time, the Regional Agendas for Science and Technology were created; the ScienTI Platform was constituted; and resources for science and technology were included in the National Development Plan of 2003, through Law 344 of 1996.These various initiatives were followed-through with an increase in the budget of COLCIENCIAS.

Current STI policy directions

4. During the **period 2006-2009**, a series of documents and events have changed the landscape of the SNCTI and increased the importance of promoting STI activities to increase productivity and welfare. The beginning of the second Uribe administration was marked by the establishment of a long-term plan for social and economic policy in Colombia called **Vision 2019**. The purpose was to achieve a national long-term strategy that guided policy beyond electoral cycles. The document opened an inclusive national thought process to identify long-term sectoral plans to reach the broad goals set out in the Vision 2019 document of 2006. The outcome of the process was a series of discussion papers that have served as a basis for policy making during the second Uribe administration.

5. One of the broad objectives of Vision 2019 is to achieve an economy that guarantees a greater level of welfare for its citizens. **Productivity growth** through science, technology and innovation has been identified as a key strategy leading to this objective. Vision 2019 led to the establishment of specific goals and necessary investments related to increasing knowledge generation and absorption in Colombia. For instance, it established the goal of achieving an annual investment level in STI activities of 2 per cent of GDP by 2019. These goals are important in that they have kick-started the development of STI policy.

6. A second guiding document for STI policy in Colombia was prepared by the World Bank after the reelection of President Uribe for the period 2006-2010. This document set out specific policy recommendations around the following topics: (a) increase public spending in innovation, technology and R&D; (b) stimulate a cultural change within universities and firms towards public-private partnerships; (c) increase private sector capacity for innovation; (d) increase the importance of and coordination among innovation programs; and (e) increase the science and technology base to ensure sustainability. This document is highly relevant as a number of the guidelines and suggestions highlighted around each of these topics have been discussed and approved by Colombian policymakers.

[24] CONPES document 3,179 established funding of 10 student cohorts in two phases. In the first phase (2002-2005), yearly contributions by Colciencias, SENA, and ICFES, for a minimum value of US$6 million were considered, in addition to an external credit of US$5 million each year for 2003, 2004 and 2005. According to results obtained in the first phase, Colciencias, SENA, and ICFES would maintain their yearly contributions during the second phase (2006-2011); and a second external credit would be sought. Also, universities should secure matching funds for at least 25% of the funding received in condonable loans, infrastructure support, and mobility (DNP, 2002).

[25] This support consists of US$25 million for: student financing, program infrastructure, mobility of national and foreign researchers, and research projects (COLCIENCIAS, 2007).

7. After the launch of "Colombia: Vision 2019," a series of policy documents consistently placed the development of scientific and technological capabilities at the center of economic policy and gave shape to a coherent strategy embraced by a range of actors within the National Innovation System. This strategy consists not only of institutional reforms, but also of budgetary increases to the sector. The National Development Plan 2006-2010, the policy paper *Colombia construye y siembra future,* prepared by COLCIENCIAS, and the CONPES 3527 document on competitiveness and productivity all laid out similar approaches to science and technology policy and placed it at the forefront of national economic policy. These efforts led to the creation of a new CONPES 3582/2009 for STI policy in April 2009, which consolidated the recommendations of the previous documents around six main objectives, each with supporting strategies:

(a) ***Institutional consolidation of the SNCTI*** through six specific strategies: (i) to legally transform COLCIENCIAS into an administrative department that can fulfill its role as sector coordinator, to provide it with a financing scheme suitable for financing research and innovation through the pooling of private, public, national and foreign resources and to elaborate an agenda of coordinated action between the different entities that are part of the SNCTI; (ii) to increase and secure public funding for STI; (iii) to strengthen the National Programs for STI through long-term planning and a consultation process to ensure that they meet the needs of the private sector; (iv) to consolidate the market for scientific and technological services; (v) to strengthen research institutions and technology intermediaries; and (vi) to develop an integrated monitoring and evaluation system that ensures efficient and transparent use of public resources for STI.

(b) ***Strengthening human resources for research and innovation*** through the: (i) promotion of scientific competencies in basic and secondary education through teacher training, creation of new programs and didactic materials and the establishment of a monitoring and evaluation system that tracks the evolution of scientific and technological capabilities; (ii) establishment of policies that promote research in higher education institutions; (iii) strengthening of technical and technological education programs and its links to the labor market, with special attention to regional development of such programs; (iv) development of the national system of certification for all education levels and types; (v) increased funding for doctoral degrees in basic sciences and engineering, both in national and foreign institutions; (vi) promotion of researcher mobility and interactions between national and foreign knowledge institutions; (vii) promotion of the use of ICTs (information and communication technologies) in learning institutions; and (viii) promotion of university-industry linkages.

(c) ***Promote Innovation in the productive sector*** through: (i) the development of an incentive portfolio that matches the needs of private firms and addresses market failures present in the innovation process; (ii) the creation and strengthening of applied research units; (iii) the training of leaders for firm level innovation; (iv) the financing of business incubators, business plans for innovative and technology-based startups as well as of meetings between entrepreneurs and investors and entrepreneurial programs in universities; (v) the consolidation of the intellectual property rights system in line with CONPES 3533.

(d) ***Promote social appropriation of knowledge*** in specific audiences that can act as multipliers to increase social dialogue in scientific and technological issues. A key element is to create a culture of innovation through science and technology in society by increasing the presence of these issues in mass media and creating spaces such as interactive museums where science and technology is popularized.

(e) ***Focus public action in strategic areas*** in order to complement the national competitiveness policy through the following strategies: (i) the implementation of a process that periodically identifies and revises strategic knowledge areas to be developed (ii) the promotion and financing of high level research projects and programs in identified areas; (iii) financial support for the development of technology-intensive products; (iv) the identification of personnel needs in the national quality assurance system to support selected strategic areas; (v) the promotion of clusters or technology parks to facilitate private investments in R&D.

(f) ***Develop and strengthen STI capabilities regionally and promote internationalization of Colombian STI activities*** by: (i) improving the planning, coordination, execution and evaluation capabilities of SNCTI institutions at the regional level; (ii) supporting research in regional education institutions by funding the acquisition of research instruments; (iii) improving the diffusion of information about incentives for research and innovation at the regional level; (iv) funding the initiatives of national research centers or groups to access foreign knowledge or infrastructure.

8. The enactment of Law 1286 of 2009 (23 January 2009) consolidated the country's commitment to STI policy. This law transformed COLCIENCIAS into the Administrative Department of Science, Technology, and Innovation and created the National Fund for Science, Technology, and Innovation – the Francisco José de Caldas Fund, managed by COLCIENCIAS. COLCIENCIAS therefore became the rector of the National System of Science, Technology, and Innovation – SNCTI – and is now in charge of formulating, guiding, directing, coordinating, executing, and implementing national STI policy, in accordance with development plans and programs.

9. The creation of the **Francisco José de Caldas Fund** is expected to significantly increase the resources available for STI activities and to alleviate some of the budgetary restrictions previously faced by COLCIENCIAS. Resources are administered through an autonomous fund and governed by the rules of private contracting, subsidiary to those of science and technology. Funds are available through the following sources:

(a) Resources from the Nation's General Budget destined for the funding of activities in science, technology, and innovation and designated to be executed through the Fund.

(b) Resources that government entities assign to the Fund for financing activities in science, technology, and innovation.

(c) Resources from the private sector and from international cooperation, destined to support activities in science, technology, and innovation.

(d) Donations or legacies made by persons or legal entities, national or foreign, as well as by international organizations.

(e) The financial yields resulting from the investment of resources of the autonomous patrimony.

10. **Examples of recent positive steps** since the creation of the SNCTI include, among others: (i) the consolidation of research centers and groups inside and outside the universities; (ii) the creation of human capital through doctoral programs, young researcher programs and creation of science and technology museums among others; (iii) the creation of instruments to support private research and innovation, for instance, technology development centers, business incubators, regional productivity centers and financing instruments for innovation projects or research projects carried out by universities and firms; (iv) the development of information systems such as the national index of scientific publications (PUBLINDEX), CvLAC and GrupLAC which monitor the production and professional careers of researchers and research groups, respectively and (v) the establishment of seven centers of excellence since 2004 according to the following criteria: contribution to its scientific field, capacity to train researchers, and ability to apply the acquired knowledge to solving tangible problems.

11. **The recent policy developments** that place increasing importance on the development on science and technology to achieve innovation and productivity growth arise not only from external policy recommendations and economic theory but also from an internal learning process. In Colombia, the use of knowledge and technology has played an important role in the sustainability of the thousands of livelihoods that depend on two traditional export commodities: coffee and sugar cane. In both cases, associations of producers (small farmers in the case of coffee and mill owners in the case of sugar cane) jointly fund research aimed at improving the quality of products increasing yields, promoting sustainable farming and solving problems such as pests and plagues. Each association has thus a created a specialized research center: *Cenicafé* in the case of coffee and *Cenicaña* for sugar cane. The research agenda for these centers is set by the association of coffee growers or mill owners, which ensures that research is oriented to solving commercial problems and increasing productivity.

12. Both ***Cenicafé*** and ***Cenicaña*** are examples of success stories in integrating research and production to increase productivity. The instruments used by COLCIENCIAS aim to promote the same kinds of activities and cooperation – between the private sector, knowledge institutions, and –researchers – that gave rise to the success of *Cenicaña* and *Cenicafé*. These instruments are briefly described below.

Current COLCIENCIAS instruments to promote research and innovation

13. **Matching grants for basic research** (*Recuperación Contingente*): This instrument finances research or technology development projects undertaken by single researchers, research groups and research centers. Universities tend to provide in-kind counterpart funding for the subprojects. Subprojects must respond to a call-for-proposals issued by one of the National Science and Technology Programs (PNCyT). Furthermore, this instrument also finances pre-project phases (planning, idea consolidation) and post-project phases (impact evaluations). Only

in the event of commercial success will these grants have a repayment obligation toward COLCIENCIAS by the recipient.

14. **Matching grants for collaborative R&D and innovation** (*Cofinanciación*): this instrument is meant to finance programs or projects performed jointly by one or more firms and a research center, a university or a technological development center. Eligible projects are: technology development and innovation projects; technology upgrading projects; product, process and service development projects; technology training projects and energy efficiency projects. COLCIENCIAS finances a part or the total amount of the expenses incurred by the University or research center up to 75 per cent of the total value of the project for SMEs and up to 40 per cent for large firms. For projects carried out by one firm and research center only, the maximum amount is around US$250,000. For programs carried out by more than two firms and one research center or university, the maximum amount is around US$1,000,000.

15. **Long-term loans in partnership with financial intermediaries**: this instrument is intended to finance firms' innovation and technological development projects. The amount of project costs covered by the loan depends on the "innovation effort" of the project, its expected marketing possibilities in the export and national markets, and the size of the firm. The loan can cover up to 80 per cent of the investment up to around US$2.5 million, with a maximum maturity of 10 years. It can be denominated in Colombian pesos or US dollars. The type of projects eligible under this instrument are the same as with matching grants, except that firm-only projects are only eligible for loans and not matching grants.

16. **Guarantees for research and innovation projects**. This instrument is offered jointly by COLCIENCIAS and the National Guarantee Fund. It is meant to provide loan guarantees for SMEs that engage in research and innovation projects. The guarantee may cover up to 80 per cent of the value of the loan, up to US$500,000 depending on the type of guarantee.

17. **Shared technological risk**. This instrument is meant to finance high-risk research and innovation projects undertaken by SMEs. The resources put forward by COLCIENCIAS must be reimbursed in different degrees depending on the success or failure of the project.

18. **Firms-Researchers links**. In order to promote greater cooperation between firms and researchers, COLCIENCIAS subsidizes researchers' salaries up to 12 months if they become employed by a firm or a technology development center. The subsidy may cover up to 50 per cent of the salary for large firms and up to 70 per cent for SMEs. Eligible researchers need to have a Master's degree or PhD with at least two years of experience.

19. **Financing for patents and other protected technologies**. This instrument is directed to any person or firm in Colombia that wants to apply for a patent or other protected technology. COLCIENCIAS finances up to 80 per cent of the application costs (maximum US$25,000). The applicant must finance at least 20 per cent of the costs.

20. **Training programs for innovative managers and R&D personnel**. This instrument provides funding for short-term innovation and R&D management courses outside Colombia. COLCIENCIAS funds the fees for the course, a stipend and medical insurance. The host

institution and Academic and Professional Programs for the Americas (LASPAU) also participate in funding these programs.

21. **Fiscal incentives for R&D and innovation**. COLCIENCIAS processes applications for tax breaks for R&D and innovation activities. In Colombia, donations to or investments in subprojects are deductible by 125 per cent as long as the subproject belongs to one of the following areas: basic science, social sciences, humanities, industrial development, environment, natural habitats, education, health, agriculture, electronics, telecommunications, biotechnology, informatics, mining, or energy. COLCIENCIAS also processes applications for income tax exemptions arising from software and pharmaceuticals income and for VAT exemptions arising from research equipment.

COLCIENCIAS' historical instruments for human capital formation:

22. **National PhD Programs**. This program does not establish priorities by areas of study and funds three specific items: (i) infrastructure; (ii) mobility; and (iii) forgivable loans. Programs (i) and (ii) have already been discontinued due to the approval of *Generación del Bicentenario.*

23. **PhD Programs Abroad**. LASPAU and Fulbright, among others, have been COLCIENCIAS' partners for over a decade.

24. **Coordination with ICETEX**. Both national and international PhD programs are carried out in coordination with ICETEX.

25. **"Young Talent for Research and Innovation" Program**. This instrument is meant to promote on-the-job training and labor market absorption of young researchers and innovators. COLCIENCIAS finances up to 60 per cent of the internship in a technological development center, research center, firm, technological-business incubator, regional productivity center, public entity, or guild. Candidates must be nominated by a university, a research group, or a research center in order to be financed.

26. **Researchers' exchange program**. COLCIENCIAS finances stays of up to 6 months for foreign researchers in Colombia or for Colombian researchers abroad. These exchanges are meant to support activities that impact national PhD programs only. For instance, a visit by a foreign researcher to support a Colombian research project or to act as a jury in a PhD defense, or to teach a course in a PhD program. Eligible expenses are flights, lodging and medical insurance.

Annex 2: Major Related Projects Financed by the Bank and/or other Agencies

Strengthening the National System of Science, Technology and Innovation

1. The proposed Project design builds on recent experience with STI and tertiary education projects in Latin America and other Bank regions. Brief summaries of relevant World Bank projects in Colombia can be found below.

Colombia Higher Education - Improving Access Project- P074138 ICR Rating: Satisfactory (closed 12/31/2008)

2. The objective of the Project was to improve the quality and equity of the Borrower's Tertiary Education system and ultimately enhance Colombia's competitiveness in the global market by improving the tertiary education system's response to society's need for high-quality human capital. The Project aimed to make the Colombian tertiary education system more responsive to demand, and promote greater equity and quality in the preparation of tertiary education graduates

Colombia Second Rural Productive Partnerships Project- P104567; (Expected to close on 09/30/2013)

3. The Colombia Second Rural Productive Partnerships Project aims to increase rural competitiveness and build up rural entrepreneurship in poor rural communities in a sustainable manner through demand-driven partnership schemes with the commercial private sector. The project includes the following components: (a) partnership promotion and preparation – this includes the organization by the departmental agricultural secretariats of competitive processes amongst farmer organizations and the private sector to obtain project assistance, the preparation of pre-investment studies and the initial organization of the partnerships; (b) partnership implementation -- this includes the provision of (i) financial incentives to farmer organizations to enable farmers to adjust to the competitive conditions of national and international markets; and (ii) technical assistance to farmer organizations to achieve higher levels of productivity and entrepreneurship; and (c) management, monitoring and evaluation -- this includes the administrative project management costs such as salaries, consultant fees, monitoring and evaluation, audits and operational costs.

Colombia Agriculture Technology Development Project- P006880; ICR Rating: Satisfactory (closed 12/31/2003)

4. The development objective of the Project was to change the agricultural research culture of Colombia in accordance with Government policies on decentralization of technological development and privatization of Colombian agriculture with an emphasis on the transfer of agricultural technologies to small farmers. Research and technology transfer activities funded under the Project were expected to reduce rural poverty, increase rural employment, and improve the competitiveness of Colombia's agricultural producers. The specific objectives were to: (a) improve the quality and efficiency of agricultural research and technology transfer by introducing a demand-driven, competitive selection system that would be co-financed by private and public sector entities; (b) strengthen the institutional capacity of the agricultural sector in the development and testing of technical packages especially appropriate for small farmers; (c)

revitalize underused resources, both physical and human, that existed within Colombia's research and technology transfer system; (d) promote private sector participation in agricultural research and technology transfer; and (e) support decentralization by strengthening regional participation and identification of regional priorities and by supporting municipal extension services. The Project financed two main components: (1) technology development and adaptation, and (2) institutional development.

Colombia Scaling-Up Student Loans to Promote Equitable Access Project - P105164; (Expected to close on 12/31/2013)

5. The development objectives of the proposed Project are to: (a) improve coverage by increasing the enrollment and graduation rates of students in tertiary education; (b) improve equity by increasing enrollment and graduation rates of tertiary education students from economically disadvantaged backgrounds; and (c) increase and diversify the sources of alternative funding available to ICETEX in order to increase ICETEX's sustainability. The Project consists of two components: (a) providing student loans to talented but needy students; and (b) improving management practices to allow ICETEX to operate more efficiently and increase sustainability.

Projects financed by other agencies

6. IDB has been financing Science, Technology and Innovation programs and projects in Colombia since the 1980s. Three of these projects have been executed by COLCIENCIAS:

National Scientific and Technological Program – IADB CO0191; (Approved 12/20/1982, Completed)

7. This was the first multilateral loan executed by COLCIENCIAS and it primarily supported research projects in universities and other academic institutions to create and consolidate the institutional bases of scientific activity in the country. The Program was divided into two subprograms implemented by COLCIENCIAS and the Colombian Institute for the Promotion of Education (ICFES), respectively. COLCIENCIAS implemented the subprogram for the promotion of scientific and technological research. ICFES implemented the subprogram for training. The funding of research projects subject to peer review was implemented through this Program and it was instrumental in helping research groups to mature.

Science & Technology Research Promotion II –IADB CO-0048; (Approved 12/20/1989, Completed)

8. This Program was broader in scope and, in addition to providing financing for research in academic institutions, it included funding for projects in private enterprise, for educating researchers in doctoral programs and for launching a program to disseminate and popularize the sciences. This program launched an ambitious initiative to educate researchers through PhD scholarships and also financed 50 technology innovation projects presented by businesses, thereby establishing COLCIENCIAS' association with the productive sector. However, the research groups in universities did not develop ties with businesses.

Scientific and Technology Program III- IADB CO-0134; (Approved 08/09/1995, Completed 09/29/2003)

9. The Program's general objective was to strengthen the country's capacity in science and technology and to increase the competitiveness and productivity of business within a framework of sustainable development. To that end, the program was designed to develop a modern scientific and technological infrastructure. The program was organized into four subprograms: (a) innovation and development in the productive sector; (b) promotion of research at nonprofit centers and institutes; (c) training of human resources and strengthening of the scientific community; and (d) support for scientific and technological information and dissemination systems.

Annex 3: Results Framework and Monitoring

Strengthening the National System of Science, Technology and Innovation

Program (Phases I and II, CY 2010-2019) Objective	Program (Phases I and II) Outcome Indicators	Use of Program Outcome Information
Enhance Colombia's advanced human capital and its ability to generate, identify, disseminate, apply an integrate knowledge among its citizens to foster economic growth and diminish inequities.	*Human capital development* (PhDs per million population) *Generation of scientific and technical knowledge* (Number of journal articles by Colombian researchers in SCI expanded per million population) *Knowledge integration into production* (Patents granted yearly to Colombian residents, USPTO[26]	Monitor progress towards achieving the Program objective. These indicators give an overview of Colombia's progress in stimulating private investments in STI, increasing the stock of human capital necessary for knowledge generation and absorption and promoting the use of these skills to increase productivity.
Project Development Objective (PDO) (Phase I, CY 2010-2014)	**Project (Phase I) Outcome indicators**	**Use of Project Outcome Information**
(i) Strengthen COLCIENCIAS' capacity to promote human capital for the knowledge economy, R&D and innovation; (ii) raise awareness of science, technology and innovation in Colombian society.	*COLCIENCIAS' operational efficiency* (Percentage of COLCIENCIAS' annual investment budget committed by the end of the second quarter of the calendar year) *Instrument improvement* (Number of instruments[27] designed or redesigned[28] and approved by COLCIENCIAS' Board of Directors) *Lessons Learned* (Lessons learned summary completed based on the results of the evaluations) *Awareness* (Total grant applications for R&D and innovation subprojects received yearly by COLCIENCIAS)	Monitor the improvements in institutional capabilities and operational efficiency as well as the effectiveness of investment pilots. Measure increases in the relevance of Science and Technology among potential beneficiaries, expected to be brought about partly by the investments of Component 4.

[26] United States Patent and Trademark Office

[27] *Instruments* refers to the specific financing mechanisms to be used for the promotion of human capital, R&D and innovation. A specific *instrument* is defined by a set of eligibility criteria and financing terms and conditions.

[28] Instruments should be redesigned by incorporating the results of the technical assistance carried out for instrument revision.

Intermediate Outcomes/ Outputs	Intermediate Outcome/Output Indicators	Use of Intermediate Outcome/Output Monitoring
Component 1: Strengthening COLCIENCIAS' operational and policy-making capacity	Percentage of *staff trained* according to a revised competencies model Number of management units[29] using the *Balanced Scorecard* Revised COLCIENCIAS' *convocatoria* processes, from call-for-proposals to subproject monitoring, developed[30] and approved by COLCIENCIAS' Board of Directors Number of research papers completed by the *internal policy analysis unit*	Monitor project implementation and impact, adjust project design
Component 2: Strengthening COLCIENCIAS' capacity to promote human capital	Total number of students covered yearly by *Ondas* program[31] Monitoring and evaluation framework for *Ondas* established Number of doctoral graduates participating in the labor insertion programs financed by COLCIENCIAS under the Project Number of subprojects involving researchers residing abroad participating in collaborative research subprojects financed by the Project Number of evaluations[32] for the *convocatorias* corresponding to the labor insertion and diaspora pilots completed	Monitor project implementation and impact, adjust project design

[29] Colciencias is structured around 10 management units: 4 technical divisions, 4 support offices for the general director, the deputy director's office and the general director's office.

[30] The new process should be developed by incorporating the results from the technical assistance carried out for process revision

[31] Today, 280,000 students are covered annually by *Ondas*. This target is constructed taking into account World Bank, Colciencias and other expected counterpart resources that will finance *Ondas*.

[31] Possible examples include studies to analyze an increased regional focus for R&D instruments and improvements to the existing fiscal incentives instrument.

[31] Only concept notes submitted by research groups with the following characteristics are considered: the group must be recognized by an academic institution, it must have been in existence for at least one year, it must have published at least one scientific and two popularization articles and it must have at least one project under implementation.

[32] The demand study for the pilots will be undertaken by an independent consultant and will measure, *inter alia*: (a) effective demand for the revised instruments and processes; (b) applicant and beneficiary satisfaction with the revised call-for-proposals process and (c) the adequacy of pilot investments to recommendations arising from the priority areas' business plans

Component 3: Strengthening COLCIENCIAS' capacity to promote research and innovation.	Ratio of proposals for innovation-management capacity building subprojects received to proposals financed Number of research and innovation subprojects in priority areas for which Project resources have been committed.[33] Project resources[34] committed to finance R&D and innovation subprojects[35] in which there is at least one firm participating. Number of evaluations[36] for the calls-for-proposals corresponding to the R&D and innovation investment pilots[37] completed.	
Component 4: Promoting Social Dissemination of Science, Technology and Innovation	Monitoring and evaluation framework for social dissemination of STI established Number of citizens directly benefiting from COLCIENCIAS' citizen participation activities financed by the Project (excluding *Ondas* and mass media) Annual number of document downloads from COLCIENCIAS' Web page (not including documents related to calls for proposals)	Monitor project implementation and impact, adjust project design

[33] The goals for this indicator are constructed taking into account only the World Bank loan to Colciencias.
[34] Only World Bank loan resources are counted in the construction of the targets.
[35] This includes all subprojects belonging to any of the 3 investment pilots included under Component 3: (1) Matching grants for firms' innovation-management capacity building; (2) Matching grants to support the implementation of business plan recommendation through R&D and innovation subprojects in strategic priority areas; (3) Matching grants for R&D.

Arrangements for results monitoring

Program (Phase I and Phase II)

		Target Values									Data Collection and Reporting		
Program (CY 2010-2019) Outcome Indicators	**Baseline 2009**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**YR6**	**YR7**	**YR8**	**YR9**	**Frequency and Reports**	**Data Collection Instruments**	**Responsibility for Data Collection**
PhDs per million population (stock)	108.3 (2009)	----	----	---	----	-----	152.0	-----	----	173.0	Yearly	OCyT and DANE	COLCIENCIAS based on OCyT and DANE
Number of journal articles by Colombian researchers in SCI Expanded per million inhabitants	48.0 (2009)	----	----	---	-----	----	58.5	-----	-----	65.0	Yearly	SCI Expanded as reported by OCyT	COLCIENCIAS based on OCyT
Yearly patents granted to Colombian residents, USPTO	8.8 (Average 2003-2007)	----	----	---	-----	-----	9.6	-----	-----	10.5	Yearly	Knowledge Assessment Methodology (KAM) based on USPTO	COLCIENCIAS

Project (Phase I)

Project (CY 2010-2013) Outcome Indicators	Baseline 2009	2011	2012	2013	Frequency and Reports	Data Collection Instruments	Responsibility for Data Collection
Percentage of COLCIENCIAS' annual investment budget committed by the end of the second quarter of the calendar year	4.8%	20%	40%	60%	Yearly	COLCIENCIAS	COLCIENCIAS
Number of instruments designed or redesigned and approved by COLCIENCIAS' Board of Directors (cumulative)	0	1	2	3	Yearly	COLCIENCIAS	COLCIENCIAS
Lessons learned summary completed, including the results of the monitoring and evaluation of *Ondas* and activities promoting the social dissemination of knowledge	No	No	No	Yes	Yearly	COLCIENCIAS	COLCIENCIAS
Total grant applications for R&D and innovation subprojects received yearly by COLCIENCIAS (*anteproyectos* for *recuperación contingente*)	2009	2210	2431	2674	Yearly	COLCIENCIAS	COLCIENCIAS

Project Intermediate Outcome/ Output Indicators (CY 2010-2013)	Baseline 2009	2011	2012	2013	Frequency and Reports	Data Collection Instruments	Responsibility for Data Collection
Component 1							
Percentage of staff trained according to a revised competencies model	0	10%	30%	80%	Yearly	Reporting from COLCIENCIAS	COLCIENCIAS
Number of management units using the Balanced Scorecard	0	0	10	10	Yearly	Reporting from COLCIENCIAS	COLCIENCIAS
Revised COLCIENCIAS' *convocatoria* processes, from call-for-proposals to subproject monitoring, developed and approved by COLCIENCIAS' Board of Directors (cumulative)	0	1	1	1	Yearly	Reporting from COLCIENCIAS	COLCIENCIAS
Number of research papers completed by the *internal policy analysis unit* (Cumulative)	0	1	7	13	Yearly	Reporting from COLCIENCIAS	COLCIENCIAS
Component 2							
Total number of students covered yearly by *Ondas* (cumulative, from 2011 to 2013)	0	400,000	800,000	1,200,000	Yearly	Reporting from COLCIENCIAS	COLCIENCIAS
Monitoring and evaluation framework for *Ondas* designed	No	No	No	Yes	Yearly	Reporting from COLCIENCIAS	COLCIENCIAS
Number of doctoral graduates participating in the labor insertion programs financed by COLCIENCIAS under the Project (cumulative)	0	5	10	15	Yearly	Reporting from COLCIENCIAS	COLCIENCIAS
Number of subprojects involving researchers residing abroad participating in collaborative research projects (cumulative)	0	0	5	10	Yearly	Reporting from COLCIENCIAS	COLCIENCIAS
Number of evaluations for the *convocatorias* corresponding to the labor insertion and diaspora pilots completed.	0	0	0	2	Yearly	Reporting from COLCIENCIAS	COLCIENCIAS

Component 3							
Ratio of proposals for innovation-management capacity building subprojects received to proposals financed.	0	0	0	1.3	Yearly	Reporting from COLCIENCIAS	COLCIENCIAS
Number of R&D and innovation subprojects in priority areas for which Project resources have been committed. (cumulative)	0	0	5	10	Yearly	Reporting from COLCIENCIAS	COLCIENCIAS
Project resources committed to finance R&D and innovation subprojects in which there is at least one firm participating. (cumulative)	0	0	USD 1 Million	USD 4 Million	Yearly	Reporting from COLCIENCIAS	COLCIENCIAS
Number of evaluations for the calls-for-proposals corresponding to the R&D and innovation pilots completed.	0	0	0	3	Yearly	Reporting from COLCIENCIAS	COLCIENCIAS
Component 4							
Monitoring and evaluation framework for social dissemination of STI defined	No	No	No	Yes	Yearly	COLCIENCIAS	COLCIENCIAS
Number of citizens directly benefiting from citizen participation activities financed by the Project (excluding *Ondas* and mass media) (cumulative)	0	20,000	45,000	75,000	Yearly	COLCIENCIAS	COLCIENCIAS
Annual number of document downloads from COLCIENCIAS' Web page (not including documents related to calls for proposals)	18,000	22,000	29,000	39,500	Yearly	COLCIENCIAS	COLCIENCIAS

Annex 4: Detailed Project Description

Strengthening the National System of Science, Technology and Innovation

The Project (Phase I) would include four components:

Component 1: Strengthening COLCIENCIAS' operational and policy-making capacity; institutional strengthening of the Science, Technology and Innovation National System (Bank financing: US$5.8 million)

1. Strengthening of COLCIENCIAS' operational and policy-making capacity including : (a) the enhancement of its organization, human resource capabilities and business processes, through, *inter alia*, the provision of staff training, technical assistance and operating costs; (b) the improvement of its strategic and sector planning and policy-making, through, *inter alia*, the creation of a specialized internal policy analysis unit and the provision of goods, services, operating costs and technical assistance required therefore; and (c) the improvement of its capacity to monitor, evaluate and manage the Project, through, *inter alia*, the provision of goods, services, training, operating costs and technical assistance required therefore.

2. Improving COLCIENCIAS' organization, human resource capabilities, and internal processes would include, *inter alia*: (i) optimization of all phases of the proposal project cycle and other operational procedures within COLCIENCIAS, from issuance of calls-for-proposals and technical assessment to monitoring and evaluation; (ii) improving the existing database of project evaluators and reviewers; and (iii) supporting overall organizational development including the design of a competencies model, general human resource and managerial training and the design and implementation of a balanced scorecard system/process.

3. Strengthening COLCIENCIAS' capabilities in strategic and sector planning and policy definition would include financing the design and implementation of a plan to enhance policymaking capabilities within COLCIENCIAS by creating a specialized internal unit. The creation of this unit would include financing for, *inter alia*, (i) advanced and specialized human resources to lead and start up the unit, (ii) the acquisition of books and other forms of editorial content, including on-line content; (iii) the use of on-line platforms to support delivery of on-line content; (iv) conducting surveys to monitor perceptions of science, technology and innovation in society and perceptions of COLCIENCIAS; (v) developing policy publications; (vi) a yearly forum on STI policy; and (vii) the development of analytical tools for forecasting the impact of increased investments in STI on macro-variables, such as economic growth and productivity;

Component 2: Strengthening COLCIENCIAS' capacity to promote development of human capital for science and technology (Bank financing: US$7.2 million)

4. Strengthening of COLCIENCIAS' capacity to promote the development of human capital for the knowledge economy through:

(a) The financing of Investment Pilots to promote: (i) the labor market insertion of doctoral graduates by, *inter alia*, providing stipends to public and private knowledge institutions

and firms to hire doctoral graduates, including Colombian and non-Colombia researchers residing outside the Republic of Colombia; (ii) linkages between Colombian and non-Colombian scientists and the Colombian *diaspora* by, *inter alia*, (A) providing matching grants for collaborative subprojects, and (B) training, forums and seminars; and (iii) the provision of technical assistance to develop and implement plans and carry out evaluations therefore.

(b) (i) The financing of Investments to promote the development of scientific skills in basic and secondary education by, *inter alia*, providing grants for research activities of students and their teachers; and (ii) the provision of technical assistance to, *inter alia*, establish and implement a monitoring and evaluation framework therefore.

Activities to promote the development of scientific competencies in basic and secondary education:

5. The funding of these activities would occur under the existing COLCIENCIAS' *Ondas* Program. Under this component, a monitoring and evaluation framework for *Ondas* would be developed and used to ensure that COLCIENCIAS is able to measure the impact of the Program.

Activities to promote the labor market insertion of advanced human capital:

6. The *stipends* would cover part of the salary of the researcher in the university, research center or firm for 3 to 5 years. The amount of the stipend would decline over time, so that the institution would progressively finance a higher percentage of the beneficiary's salary. This instrument is designed to be a tool for the sustained insertion of PhD graduates into the labor market through the establishment of long-term contractual links prior to the expiration of the support. Component 2 would also finance consulting services to prepare a plan to finalize the design of the instrument as well as its *evaluation*. (See Table A4.2 for potential design characteristics of this pilot).

Activities to promote collaboration between Colombian firms and knowledge institutions and the Colombian diaspora:

7. Component 2 would also finance *matching grants* to implement Research and Innovation subprojects carried out collaboratively between firms and research centers inside the country and members of the *diaspora*. In addition, consulting services would be financed to prepare a *plan* to finalize the *design* of this investment pilot and its *evaluation*. Additional activities to support the creation of a diaspora network would include, *inter alia*, training, seminars and forums.

Component 3: Strengthening COLCIENCIAS' capacity to promote research and innovation; investment for research and innovation (Bank financing: US$8.5 million)

8. Strengthening of COLCIENCIAS' capacity to promote R&D and innovation through the financing, including matching grants, of Investment Pilots to promote and support: (a) the development of innovation-management capabilities in firms; (b) R&D and innovation subprojects in strategic knowledge areas; (c) subprojects under revisions of existing COLCIENCIAS' instruments for *recuperación contingente* and *cofinanciación*; and (d) the provision of technical assistance to develop and implement plans and carry out evaluations therefore.

Matching grants to support the development of innovation-management capabilities in firms*:*

9. This *investment pilot* would finance subprojects to develop innovation-management capabilities in firms to enable them to adopt existing technologies or develop R&D projects. This instrument could operate through two different calls-for-proposals, one for individual medium-sized or large firms and one for groups of about 5 to 8 small or micro enterprises (SMEs).

10. Subprojects would last 12 to 18 months and would seek to formalize the innovation process within the structure of firms so that firms are in a better position to: (a) identify opportunities for innovation; (b) organize a portfolio of subprojects, (c) select and design subprojects, (d) promote technology adoption and transfer, and (e) carry out monitoring and evaluation of subprojects.

11. Firms benefiting from these *matching grants* would be expected to develop a portfolio of subprojects to be potentially financed by COLCIENCIAS or other institutions. The type of interventions that could be financed would include: training courses and workshops, technological consulting by national or international experts, and technological missions. Furthermore, to support the implementation of this instrument, technology consulting firms could receive financing to enhance their own capacity to provide clients with services such as technology training workshops and proposal-drafting support.

Matching grants to support R&D and innovation subprojects in strategic knowledge areas:

12. This *investment pilot* would test the use of a selectivity approach in Colombia by financing matching grants supporting subprojects in any of the strategic priority sectors identified by the GoC and targeted with strategic business plans. Subprojects to be funded under this investment pilot could be carried out by researchers, research groups, firms, or any combination of these. Funds would be allocated through competitive processes under the two main matching grant instruments currently used by COLCIENCIAS: matching grants for financing R&D (*recuperación contigente*) and innovation (*cofinanciación*) (described in detail later in Annex 4). These two instruments and the respective funding award *processes* may be revised following the completion of technical assistance activities for instrument and process redesign to be carried out under Component 1 or completed by other donors. Revisions would be subject to approval by the Bank.

Matching grants promote the development of R&D subprojects through revisions of COLCIENCIAS' instruments:

13. This *investment pilot* would seek to test a revised version of the existing COLCIENCIAS R&D financing instrument (*recuperación contingente*) to improve public sector promotion of R&D.

Component 4: Promoting Social Dissemination of Science, Technology and Innovation and Institutional Communication (Bank financing: US$3.5 million)

14. Carrying out and financing of Investments to:

(a) Increase awareness and disseminate knowledge of science, technology and innovation among the Borrower's public and private sectors, including the provision of: (i) goods, including the rental, acquisition and operation of vehicles for mobile classrooms; (ii) training, forums and seminars, including training of mediators and facilitators; and (iii) technical assistance for, *inter alia*, the development and implementation of a monitoring and evaluation framework therefore; and

(b) Increase COLCIENCIAS' visibility in the Colombian society, including the preparation and carrying out of plans, seminars and mass media investments, and the provision of goods, services, operating costs, and technical assistance therefore.

Box A4.1: ***Description of complementary activities under IDB's operation***

The **IDB and the World Bank** are preparing to finance two independent operations in Colombia's STI sector under the umbrella of CONPES 3582. While the two operations are operationally and legally independent, a special effort has been made during Project preparation to ensure coordination. In particular, the IDB would finance activities in the areas of institutional strengthening, human capital, and research and innovation that would complement those financed by the World Bank under Components 1, 3 and 4 of the proposed Project (Phase I), respectively. However, these activities are not needed to achieve the project development objective of the bank-assisted project.

In the area of strengthening COLCIENCIAS' operational and policy-making capacity: The **IDB** would finance technical assistance and IT infrastructure to, *inter alia*: (i) design and implement information systems for COLCIENCIAS and the national STI system; (ii) enhance COLCIENCIAS' ability to collect information and conduct monitoring and evaluation of its policies; (iii) improve the governability of the national STI system and (iv) support the development of the new Francisco José Caldas Fund. Details about World Bank-supported institutional strengthening activities are included in the Component 1 description above.

In the area of strengthening COLCIENCIAS' capacity to promote research and innovation: both the IDB and the World Bank would finance technical assistance activities to support the development of business plans for strategic knowledge areas. The IDB would finance, in principle, the development of the *biofuels, energy, water,* and *forest resources* business plans, while the World Bank would finance, in principle, the business plans for *biodiversity, electronics, and materials.* The IDB would also finance technical assistance activities to help design the investment pilot supporting the development of in-house innovation-management capabilities in private sector firms. Both Banks would finance *investment pilots* to offer matching grants for R&D and innovation. Both Banks would also finance *evaluations* to analyze the preliminary results of these *investment pilots*.

In the area of social dissemination of STI and institutional communication, the IDB would finance, *inter alia,* grants for projects that promote the use of technology to solve social problems and communication strategies for technology transfer in society. It would also finance institutional communication activities such as Communication 2.0, public relations and events.

Table A4.1: WB assisted Project (Loan Amount) vs. IDB assisted Project (Loan amount), Million US$. (IDB amounts are preliminary and subject to change.)

Area of support	World Bank	IDB
Strengthening COLCIENCIAS' operational and policymaking capacity, project management and fees	5.8	
Strengthening COLCIENCIAS' capacity to promote human capital	7.2	
Strengthening COLCIENCIAS' capacity to promote research and innovation	8.5	
Promoting social dissemination of STI	3.5	
TOTAL World Bank	**25.0**	
Information systems for STI decision making		6.2
Governance of the National STI system		3.8
Improvement of the design, monitoring and evaluation of the STI policy system		4.1
Financial Management of the FJC fund		0.5
Competitive fund for research and innovation		8.9
Social dissemination of knowledge and communications		1.0
Project management		0.5
TOTAL IDB		**25.0**

Table A4.2: COLCIENCIAS' investment budget by policy initiative, 2004-2009
(Constant 2008 million Colombian Pesos)

STI Policy initiative	2004	2005	2006	2007	2008	2009
Strengthening of STI capacities (i.e. Financing of matching grants for research projects and excellence center support)	40,079	33,608	55,184	49,814	82,545	86,151
STI Training (i.e. financing of PhD Grants, Young Researchers Program and *Ondas*)	19,888	24,650	24,582	23,258	54,811	59,670
Productive transformation (i.e. Financing of matching grants for innovation projects undertaken by firms)	32,528	37,204	41,875	50,207	35,445	39,244
Consolidation of STI system	7,543	6,817	8,369	7,678	10,766	12,784
Social dissemination of STI	2,961	2,949	3,665	3,499	4,000	6,683
Regional and international dimension in STI	5,301	4,889	6,595	4,369	3,000	4,091

Source: Colombian Observatory of Science and Technology (OCyT), 2009

Description of COLCIENCIAS' current R&D and Innovation Competitive Fund processes:

15. Under COLCIENCIAS' current operational procedures, both R&D and Innovation *competitive funding* is allocated through a competitive six-step process. This general process would be followed for awarding funding through the Competitive Fund for R&D and Innovation

under the Project until a new process, currently under development, has been finalized by COLCIENCIAS and approved by the Bank.

16. The current operational process for selecting matching-grant beneficiaries in COLCIENCIAS is as follows:

a. *Short listing* (Only for R&D *matching grants*)
   i. When a concept note reaches COLCIENCIAS, technical staff verify that it fulfills the basic requirements of the call-for-proposals. The note is then classified according to subject and submitted to a Panel of Experts for review.
   ii. The Panel of Experts performs a technical evaluation of the concept notes and grades each on a scale of 1-100, according to the criteria in table A4.1. The Panel then submits the list of concept notes with assigned grades to the relevant Program Council.
   iii. Based on the technical evaluations of the Panel of Experts and on an evaluation of relevance, each Program Council shortlists a number of concept notes, which will be invited to participate in the calls for proposals for the following year. Short-listed applicants are invited to present full proposals.

b. Evaluation
   i. Selection of peer reviewers: when a full proposal reaches COLCIENCIAS, technical staff review it and verify that it fulfills all requirements. Staff then assign the proposal to two peer reviewers, selected according to their expertise in the topic. COLCIENCIAS has access to a national database of peer-reviewers, including national and international experts. International experts are included in the review panel to avoid potential conflicts of interest in specific disciplines that may have a small researcher community. COLCIENCIAS also relies on foreign experts to review a proposal when no national experts can be found or when the proposal requires a specific expertise not readily available nationally.
   ii. Each peer reviewer rates the proposal according to the criteria in table A4.1 and decides whether to recommend the proposal. If peer reviewers disagree in their recommendation, the proposal is sent to a third reviewer for evaluation. In many cases, the third peer reviewer will be international.
   iii. Comments from the peer reviewers are sent to the applicants who may be required to make clarifications or slight modifications to their proposals to be eligible to reach the decision stage.
   iv. The final assessment of the proposal by the two or three peer reviewers is sent back to the respective Program Council for decision.

c. Decision
   i. Each Program Council jointly reviews all proposals and makes a final recommendation to COLCIENCIAS' Director, ranking all proposals eligible for funding
   ii. According to funding availability per National Program, COLCIENCIAS' Director makes the final financing decision by establishing a cut-off proposal based on the proposed ranking. Historically, almost no Program Council recommendations have been overridden by COLCIENCIAS' Director.

d. *Contracting*: A legally binding agreement is then signed between the institution sponsoring the applicant (i.e. university or research group) and COLCIENCIAS. The steps are as follows, although this process is currently under revision:
    i. Publication of results on COLCIENCIAS' Web site
    ii. Notification of approval and request for financial documents
    iii. Contract preparation and delivery to beneficiary for signing
    iv. Receipt and authentication of signed contract
    v. Programming of disbursements
    vi. Disbursement of resources according to plan
e. *Monitoring*: Subprojects are monitored throughout their life cycle. In particular, the following elements are included in the process:
    i. Immediate technical supervision of project according to contract
    ii. Immediate financial supervision, if needed
    iii. Contract revision is required in the following cases:
        1. Changes in expense categories
        2. Request for additional funds
        3. Contract extension
f. *Liquidation*: Contracts are liquidated in the following three-step processes:
    i. Final technical evaluation
    ii. Final financial evaluation
    iii. Contract liquidation

17. The Bank's review of current processes revealed that matching grants are allocated through an open and transparent process. Pre-established criteria with different weights are applied and typically include: (i) relevance; (ii) quality; and (iii) contribution to technology. Knowledge centers and firms receiving the matching grants are required to make substantial in-kind and/or cash commitments to support the cooperative activities. Beneficiaries must present periodic progress reports with evidence of subproject results. Contracts establish actions to be taken in the event of underperformance and detail potential repayment schedules for commercially successful projects, when appropriate.

18. A detailed description of existing COLCIENCIAS instruments can be found below. A number of these instruments are currently under revision and further revisions may be undertaken under Component 1 of the proposed Project (Phase I) with the support of World Bank Loan proceeds. Once completed, the revised versions of those instruments would be presented to the Bank for no objection. In particular, a revision of the existing matching grant for R&D (*recuperación contingente)* is planned. This revision aims to, *inter alia*: (i) provide incentives for universities to increase their counterpart funding by giving higher odds of approval to proposals with higher levels of counterpart funding; (ii) establish differentiated overhead amounts for public and private universities; (iii) explore options to include a regional dimension in funding awards.

Table A4.3 Description of existing matching-grant instruments for financing R&D and Innovation

Instrument	**Matching grants for research (*Recuperación Contingente)***	**Matching grants for innovation (*Cofinanciación)***
Definition	A contractual modality to be entered into between the Borrower, through COLCIENCIAS and/or the Financial Institution and a Beneficiary pursuant to the financial terms detailed in Article 8(d) of the Borrower's Decree Law No. 591, dated February 26, 1991, as amended to the date of this Agreement.	"*Cofinanciación*" means a cofinancing mechanism to be used by the Borrower, through COLCIENCIAS and/or the Financial Institution for the provision of a Grant to a Beneficiary, with the collaboration of public and private entities as providers of funds.
Beneficiaries	Research groups registered in the Colombian research system , GrupLAC	One or more firms in collaboration with a university research group or a technology development center.
Estimated average grant amount	US$77,000	US$60,000
Eligible projects	Research projects in one of 11 programmatic areas	Collaborative projects with commercial purposes in the following areas: • Applied research • Technology transfer • Product/process development The project is carried out by the research or technology development center on behalf of the firm. This instrument can also be used to finance strategic programs that benefit two or more firms. A strategic program is a group of research projects articulated around a common theme.
Selection Criteria	Concept notes are rated by the Panel of Experts according to the following criteria: 40% Scientific rigor 20% Originality 20% Value added to the knowledge stock, technological development and/or solution to specific national problems 10% Budgetary coherence 10% Adequacy of researcher's capabilities to the project.	Proposals are rated by two peer reviewers on a 1 to 5 point scale for each of the following criteria: Project quality Relevance Expected Results Expected long-term impact International impact Economic and Financial Firm's experience
Matching requirements and maximum financing amounts	COLCIENCIAS will finance up to 60% of the project costs, up to US$100,000	The percentage of project funds financed by COLCIENCIAS depends on the size of the firm. COLCIENCIAS finances up to: 75% for micro enterprises 65% for SME's 40% for large firms The matching contribution of firms can be cash or in-kind for micro firms and SMEs. In the case of large firms, only 50% of their contribution can be in-kind.

		The maximum amounts financed by COLCIENCIAS are approximately US$375,000 for projects and 1,500,000 US$ for strategic programs.
Maximum financing period	36 months	36 months for projects and 48 months for strategic programs.

Table A4.4 Description of possible design options for the new instrument to promote labor market insertion of PhD graduates in knowledge institutions and firms.

Subprogram	**Insertion of recently graduated PhDs in R&D centers and universities**. This subprogram provides support to R&D centers, including universities, for hiring recently graduated PhDs in the form of a grant that lasts for 3 years.	**Insertion of PhDs in R&D centers and Universities**. This subprogram provides support to R&D centers, including universities, for hiring PhDs in the form of a grant that lasts for 5 years and that must be gradually matched by the hiring center.	**Insertion of university and PhD graduates in public and private R&D centers**. This subprogram provides support to public and private entities that perform R&D activities and technological consulting services, for hiring university and PhD graduates, in the form of a matching grant that lasts for 3 years.
Entities eligible for support	Non-profit R&D centers, including those housed by universities.	Non-profit R&D centers, including those housed by universities.	Public and private R&D and technological development centers, firms, and industry associations that perform R&D and technology consulting services.
Duration and amount of the support	3 years, The R&D center receives the full amount of the PhD graduate's annual salary, hiring costs and the Center's contribution to social security.	5 years, The first year the R&D center receives the full amount of the researcher's salary, this decreases by 10% every year; the center must increase its contribution to the researcher's salary and social security to ensure the minimum annual salary required by the program.	3 years, The percentage of the researcher's salary to be financed depends on the type of entity, its size and the type of Project they incorporate to. Grants for small enterprises vary between 45% and 75% of the researcher's salary, for medium-sized firms between 35% and 75%, and for large firms, industry association and technological development centers between 25% and 65%. Projects that may receive the largest percentage of funding are viability studies for industrial research projects; the percentage financed decreases gradually for

			industrial research projects, viability studies for technological development projects and technological development projects, in that order.
Eligible Expenses	Partial or full amount of gross income, including the center's contribution to social security and hiring costs.	Partial or full amount of gross income, including the center's contribution to social security and hiring costs.	Partial amount of gross income, including the hiring entity's contribution to social security and hiring costs.
Eligibility requirements for supported personnel	1. Candidates must have obtained a PhD no earlier than 4 years before the call-for-proposals or be in the final months of completing the PhD thesis. 2. Mobility requirements: -Researchers that have studied abroad can be absorbed by any R&D center. -Researchers obtaining their PhD diploma during the 18 months prior to the closing date of the call-for-proposals must be absorbed by an R&D center different from the one where they wrote their PhD thesis. -Researchers obtaining their PhD diploma before the 18 months prior to the closing date of the call-for-proposals must fulfill the following requirements: a) If they want to be absorbed by an R&D center, they must have been working for a different R&D center for at least 12 months. b) If they want to be absorbed by the specific R&D center where they wrote their PhD thesis, they must have been working for a different R&D center for at least 24 months.	1. Candidates must have obtained a PhD diploma no earlier than 10 years before the closing date of the call-for-proposals. 2. Mobility requirements: -Researchers must have worked in R&D centers different from the one they will be absorbed by for at least 24 months.	University graduates must have at least 4 months of experience working in R&D. Applicants cannot have previously worked for the entity by which they would be absorbed. Applicants cannot be shareholders of the entity by which they would be absorbed (some exceptions apply).
Timeframe to apply	4 weeks	4 weeks	From mid-January to end-April and from beginning of May to end-September.
Time from	6 months	6 months	6 months

application deadline to decision			
Evaluation criteria	1. Scientific and technical contribution of the researcher to the research area. 2. Scientific and technical profile of the research group the researcher would be joining. Adequacy of the candidate to perform the tasks contained in the job description.	1. Scientific and technical contribution of the researcher to the research area. 2. Scientific and technical profile of the research group the researcher would be joining Adequacy of the candidate to perform the tasks contained in the job description.	1. Quality and technical viability of the Project 2. Applicant's CV and his/her adequacy to the task to be performed. 3. Potential impact of the support on the entity's R&D capacity.

Annex 5: Project Costs

Strengthening the National System of Science, Technology and Innovation

Project Costs By Component and/or Activity	World Bank US$ million	Counterpart[38] US$ million	Total US$ million
1. Strengthening COLCIENCIAS' operational and policy-making capabilities	**5.8**		**5.8**
2. Strengthening COLCIENCIAS' ability to promote human capital	**7.2**	7.4	**14.6**
3. Strengthening COLCIENCIAS' ability to promote research and innovation	**8.5**	9.1	**17.6**
4. Promoting Social Dissemination of STI	**3.5**		**3.5**
Total Project Costs	**25.0**	**16.5**	**41.5**
Total Financing Required	**25.0**		

[38]Includes funding for subprojects from universities, firms and other private entities. It does not include any fiscal resources.

Annex 6: Implementation Arrangements

Strengthening the National System of Science, Technology and Innovation

1. **Implementation period**: The Program would be implemented over approximately a 9-year period (CY 2010-2019) and would consist of two phases. Phase I would amount to US$25 million for the period 2010 to 2013. Phase II would amount to an additional US$225 million for the period 2014 to 2019. The expected effectiveness date for Phase I is October 1, 2010 and the expected closing date is December 31, 2013.

2. **Executing agency and Borrower**. The *Departamento Administrativo de Ciencia, Tecnología e Innovación* (COLCIENCIAS) would implement the Project. COLCIENCIAS would have primary responsibility for implementing the operation, including procurement and financial management. COLCIENCIAS would execute all four Project components. The Borrower would be the Republic of Colombia.

3. **PCU/PIU. In order to utilize and strengthen COLCIENCIAS' existing organizational capacity, no project coordination unit (PCU) would be established**. A full-time Project Leader with qualifications and experience and terms of reference satisfactory to the Bank would be retained and maintained for the duration of the Project. The Project Leader would report directly to COLCIENCIAS' Director and link to a larger team including staff from the different divisions within COLCIENCIAS' current organizational structure (i.e. General Secretariat, Planning Office, Resource Management and Logistics Directorate, Knowledge Networks Directorate, Technological Development and Innovation Directorate, Research and Development Directorate, Institutional Communications Area). Members of this larger team would have a double reporting line, reporting to the heads of their divisions and to the Project Leader. In many cases, they would have prior experience in operations with multilateral banks, including the World Bank. The Project Leader will be responsible to coordinate the day-to-day management of the Project, including the (a) effective implementation of procurement; (b) financial management; (c) audit; (d) monitoring and evaluation activities pursuant to the provisions of this Agreement and the Project Operational Manual; and (e) preparation and submission to the Bank, for its review and approval of Project Annual Operating plans and related budgets. On December 9, 2009, the Borrower, through COCIENCIAS, appointed a Project Leader whose qualifications and experience and terms of reference were reviewed and found acceptable by the Bank.

4. ***Departamento Nacional de Planeación*** **(DNP)** would ensure activities undertaken under the Project are aligned with the CONPES 3582/2009 policy document and with any future policy or legal developments. The DNP would also participate in the overall monitoring of the Project's results framework and targets. A team of STI specialists from the DNP's Business Development Directorate and its Credit Sub-Directorate supported COLCIENCIAS and the Bank during project preparation.

5. The **IDB and the World Bank** would finance two independent operations in Colombia's STI sector, under the umbrella of CONPES 3582. While the two operations are independent, a special effort was made during Project preparation to ensure coordination. In particular, the IDB would finance activities in the areas of institutional strengthening, human capital and social diffusion of knowledge, and R&D and innovation that would complement those financed by the

World Bank under Components 1, 3 and 4 of the proposed Project, respectively. Nevertheless, the PDOs of the Bank-financed Project could be achieved independently of the IDB-financed operation. The two projects are independent of each other, and there is no co-financing.

(a) **In the area of strengthening COLCIENCIAS' general operational and policy-making capabilities**, the IDB would finance: (i) the design and implementation of information systems for COLCIENCIAS and the national STI system; (ii) consulting services to enhance COLCIENCIAS' ability to collect information and conduct monitoring and evaluation of its policies; and (iii) consulting services to improve the governability of the national STI system.

(b) **In the area of strengthening COLCIENCIAS' ability to promote research and innovation**, the IDB would finance the development of business plans for strategic knowledge areas, most likely including *biofuels, forestry, energy* and *water*, as well as a competitive fund to finance R&D and innovation. In addition, the IDB would finance consulting services to support the development of the new Francisco José Caldas Fund.

(c) **In the area of social dissemination of knowledge**, the IDB would finance grants for projects that promote the use of technology to solve social problems and communication strategies for technology transfer in society. It would also finance institutional communication activities such as Communication 2.0, public relations and events.

6. **Harmonization**: The IDB and the World Bank have also agreed to undertake the following joint activities in order to harmonize implementation efforts:

(a) To develop a common operating manual that acknowledges the particularities of the two independent operations

(b) To conduct joint financial management reports

(c) To conduct joint annual supervision missions, when appropriate.

7. **Operating manual**. The operating manual would include detailed guidelines for procurement and financial management procedures.

8. **Flow of funds: Funds to finance subprojects or stipends under components 2, 3 and 4 would, in principle,[39] flow through the Francisco José de Caldas Fund**. The fund was created by Law 1286 in 2009 with the goal of attracting public, international and private sector funds for the STI sector. The FJC fund is controlled and overseen by COLCIENCIAS, whose Director makes all strategic and operational decisions, but it is operated under a trust fund (*Contrato de Fiducia Mercantil*) with a private firm (currently *Sociedad Fiduciaria Bogota S.A.*) acting directly under the mandate of COLCIENCIAS' Director. The FJC trust fund was created in December 2009. There are three main reasons for the use of this Trust fund by COLCIENCIAS:

[39] This will be the flow of funds option selected in the Project Operational Manual at the beginning of Project implementation, but may be amended from time to time with prior agreement of the Bank.

(i) it allows for the multi-year execution of resources, (ii) it allows for the receipt of contributions from private entities, and (iii) it allows tax exemptions for donors to the fund.

9. **Alternatively, under Components 2, 3 and 4, subprojects or stipends could also be disbursed directly through COLCIENCIAS to the beneficiaries**. In the event that this disbursement method is utilized, it would follow the provisions established in the Project Operational Manual.

10. **Potential change of a Financial Intermediary**. The Borrower, through COLCIENCIAS, informed the Bank of its intention that, not later than December 1, 2011, and through COLCIENCIAS, it will:

(a) extend until the completion of the Project the *Contrato de Fiducia Mercantil* No. 623 to enable *Sociedad Fiduciaria Bogotá S.A.*, inter alia, to continue financing Sub-projects under Component 2 (except Component 2.1.(b)(i)), 3 and 4 of the Project, under terms and conditions approved by the Bank in the Project Operational Manual; or

(b) call for proposals (*licitación pública*), under terms and conditions to be agreed with the Bank, from other Financial Institutions established and operating in Colombia for purposes of selecting among them a Financial Institution to undertake, commencing on October 1, 2012 and through the completion of the Project, continue financing Sub-projects under Component 2 (except Component 2.1.(b)(i)), 3 and 4 of the Project.

11. **Terms and conditions of Grants:** The following provisions will be included in the Project Operational Manual as the agreed terms and conditions for making Grants to finance subprojects to Beneficiaries under Components 2, 3 and 4 of the Project, either directly by the Borrower, through COLCIENCIAS, or by a Financial Institution on behalf of the Borrower, through COLCIENCIAS:

(a) Subprojects shall be financed on a grant basis (the Grant) pursuant to separate Grant agreements (the Grant Agreement) to be entered into with each respective Beneficiary by the Borrower, through COLCIENCIAS.

(b) The Grant shall be denominated in Colombian Pesos.

(c) The Borrower, through COLCIENCIAS shall obtain rights adequate to protect its interests and those of the Borrower and the Bank, including the right to: (i) suspend or terminate the right of the Beneficiary to use the proceeds of the pertinent Grant, or obtain a refund of, as the case may be, all or any part of the amount of the Grant then withdrawn, upon the Beneficiary's failure to perform any of its obligations under the pertinent Financing Agreement; and (ii) require each Beneficiary to: (A) carry out its subproject with due diligence and efficiency and in accordance with sound technical, economic, financial, managerial, environmental, and social standards and practices satisfactory to the Bank, including in accordance with the provisions of the Anti-Corruption Guidelines applicable to recipients of Loan proceeds other than the Borrower, the Environmental Management Framework and the Indigenous Peoples Planning Framework, as the case may be, and as such terms have been defined in the Loan

Agreement; (B) provide, promptly as needed, the resources required for the purpose; (C) procure the goods, works and services to be financed out of the financing in accordance with the provisions of Loan Agreement; (D) maintain policies and procedures adequate to enable it to monitor and evaluate in accordance with indicators acceptable to the Bank, the progress of the subproject and the achievement of its objectives; (E) (1) maintain a financial management system and prepare financial statements in accordance with consistently applied accounting standards acceptable to the Bank, both in a manner adequate to reflect the operations, resources and expenditures related to the subproject; and (2) at the Bank's or the Borrower's request, have such financial statements audited by independent auditors acceptable to the Bank, in accordance with consistently applied auditing standards acceptable to the Bank, and promptly furnish the statements as so audited to the Bank and the Borrower; (F) enable the Bank and the Borrower to inspect the subproject, its operation and any relevant records and documents; and (G) prepare and furnish to the Bank and the Borrower all such information as the Bank and the Borrower shall reasonably request relating to the foregoing.

12. The Project Operational Manual shall include template grant agreements acceptable to the Bank.

13. **Anti-Corruption**. COLCIENCIAS shall ensure that the Project is carried out in accordance with the provisions of the Anti-Corruption Guidelines. In this regard, COLCIENCIAS shall, *inter alia*, ensure compliance with paragraph 9 (d) of the Anti-Corruption Guidelines by requiring *Sociedad Fiduciaria de Bogotá S.A* and any financial institution that may substitute it to:

(a) take appropriate measures to prevent, report, respond to and investigate corrupt, fraudulent, collusive, coercive and/or obstructive practices by its representatives in connection to the use of loan proceeds;

(b) allow the Bank to inspect accounts, records and other documents of the relating to the Project upon the Bank's request and in the company of the financial institution representatives;

(c) allow the Bank, at its request, to have such accounts, records and other documents audited by or on behalf of the Bank, using the Bank's terms of reference for such purpose, with the collaboration of the Borrower, through COLCIENCIAS;

(d) accept the Bank's right to apply any of the sanctions foreseen in Section 11 of the Anti-Corruption Guidelines if at any time the Bank determines that any of the financial institution representatives has have engaged in corrupt, fraudulent, collusive, coercive and/or obstructive practices in connection with the use of Bank proceeds; and

(e) restitute to the Borrower any amount of the loan with respect to which fraud and/or corruption has occurred.

14. ***Ondas***. Specifically, the ***Ondas Program*** under Component 2 (b) would, in principle,[40] be financed through the FJC fund and co-managed by COLCIENCIAS and 32 Departmental Coordination Units (i.e. in most cases, a local university). Agreements would be entered into between COLCIENCIAS, the FJC fund, each of the Departmental Coordination Units and the Department in the fourth quarter of the year prior to implementation. These agreements would be renewed annually, prior to the start of the annual implementation period. Based on the agreement, each Coordination Unit would present an annual action plan and budget, to be approved by COLCIENCIAS. The allocation of funds for subprojects under *Ondas*, which typically require amounts ranging from US$400 to US$800, would be competitive and based on calls-for-proposals launched at the Departmental level by the Coordinating Entity.

15. Proposals would be prepared by research groups formed by students and teacher(s). The selection process would be carried out by a Committee integrated by COLCIENCIAS, the Coordinating Entity, the Department, and, when relevant, other program donors (i.e. private sector entities). Once the selection process is completed and subprojects have been approved, COLCIENCIAS and the Coordinating Entity would assign a pedagogical advisor to each subproject that would provide support to the group to prepare a budget. Upon budget approval by the committee, COLCIENCIAS' Director would order the transfer of resources from the Francisco José Caldas Fund to the Departmental Coordinating Units. Financial monitoring would be carried out regularly by the advisor. The *Programa Ondas* must be implemented under the *Programa Ondas* operational manual.

16. **Semi-Annual Progress Report**. COLCIENCIAS would prepare a semi-annual report at the end of every calendar semester, presenting at minimum: (i) the status of the activities being implemented; (ii) the evolution of the indicators in the Results and Monitoring framework (Annex 3); (iii) implementation progress and problems during the preceding semester; (iv) a revised implementation plan for the following semester, setting out recommended measures to ensure efficient implementation of the project and the achievement of objectives during the following semester; and (v) a semi-annual interim unaudited financial report (SIUFR).

17. **Implementation Completion and Results Report**. Upon project completion, COLCIENCIAS would provide input to an Implementation Completion and Results Report in order for the report to be finalized no later than six months after the closing date of the loan. This report would summarize, among other things: (i) the Project (Phase I) activities in terms of inputs, process, outputs and impact indicators for all Project components; (ii) the Project (Phase I) financial status; and (iii) implementation issues and lessons learned.

[40] Preferred flow of funds option that may be amended from time to time in the Project Operational Manual prior agreement of the Bank.

Annex 7: Financial Management and Disbursement Arrangements

Strengthening the National System of Science, Technology and Innovation

1. **Introduction**. This annex documents the results of the Financial Management (FM) Assessment of Colombia's Administrative Department of Science, Technology and Innovation (COLCIENCIAS), which would be the implementing entity for the Colombia – Science, Technology and Innovation Project (the Project). The assessment was conducted by Bank staff in accordance with OP/BP 10.02 and the Guidelines for Assessment of Financial Management Arrangements in World Bank-Financed Projects.

2. **Summary**. The Project would entail considerable complexity in terms of FM, for the following reasons:

(a) COLCIENCIAS is facing a restructuring process as a result of the enactment of Law 1286 of 2009, which mandated its transformation into an Administrative Department reporting to the President. This process has implications for budget management as well as accounting processes carried out by COLCIENCIAS, and will complicate some of COLCIENCIAS' operational procedures.

(b) The Project would involve a variety of expense categories with different implementation arrangements. Approximately 70 per cent of the Project funds (under disbursement categories 1, 2 and 3) would be distributed through a number of grants or stipends targeted to a wide range of beneficiaries (e.g. individuals, firms, research institutes and universities). In principle, the proceeds of the loan would first be transferred from COLCIENCIAS to a Financial institution (named Francisco José de Caldas – FJC), which would in turn transfer resources to the beneficiaries, as explained in the flow of funds section of this Annex. Alternatively, funds for Components 2, 3 and 4, for subprojects or stipends could also be disbursed directly through COLCIENCIAS to the beneficiaries.

(c) The *Programa Ondas* would have different implementation arrangements from other components of the Project, including the transfer of resources from the FJC to 32 different departmental coordinating units.

3. The inherent FM risk is deemed Substantial because of the aforementioned factors; the residual FM risk, i.e. the inherent risk as mitigated by existing controls, described in detail in this Annex, is Modest. The main control factors applicable to this project are described below:

- The country's public financial management arrangements are generally strong and would apply to the program, which is integrated into the national budget;

- COLCIENCIAS operates under an acceptable framework of internal controls, including: (i) a well defined set of operating rules which are documented in manuals of policies and procedures, and (ii) suitable information technology (IT) support to prepare financial information;

- COLCIENCIAS' staff has considerable experience in the implementation of projects financed by multilateral organizations, including the Bank. The administrative department of COLCIENCIAS is reasonably well staffed and is familiar with the Bank's FM policies.

- In addition to reviews by an independent external auditor and by the internal control unit, the National Auditor's Office (CGR) regularly conducts performance, financial and compliance audits of COLCIENCIAS.

4. The Bank's supervision strategy for this project would include: (i) at least two full FM supervision missions in the first year, and this will be adjusted each year in accordance with the results of supervision missions and the assessed risk for the project accordingly. The objective of the supervision will be to examine the operation of the control systems and arrangements described in this annex, (ii) Desk reviews of semi-annual Interim Financial Reports IFRs and annual audit reports.

5. At this stage, the action plan consists of the elaboration of a Project FM Manual, which must be provided to the Bank for review and no objection. Specific conditions and covenants related to disbursements have been included in the relevant section of this document (III.F. Loan/ Credit covenants and conditions).

Description and Assessment of Project FM arrangements

6. **Country issues relevant to the Project**. The Bank accepts the use of the GoC's financial management systems for its projects and programs, including reliance on Colombia's Supreme Audit Institution (SAI and CGR by its name in Spanish) and sub-national SAIs for external audits of Bank-financed projects. A Public Financial Management and Procurement Performance Assessment Report concluded that PFM systems, institutions, and processes at the central level show advanced levels of performance which are equal or close to best international practices.

7. The Bank has been engaged with the GOC to enhance project financial management across the portfolio. The most important actions on this regard are the following: a) Since June 2006, project interim financial reports (IFRs) have been generated in the nation's integrated financial information system (SIIF); b) a Memorandum of Understanding (MOU) and Terms of Reference (TORs) for project audits were agreed between the Ministry of Finance (MHCP), the National Auditor's Office (CGR) and the Bank;[41] c) a MOU was signed by the MHCP, the Department of National Planning (DNP) and the Bank, to establish that executing entities will be directly responsible for project management. Therefore, this project's FM arrangements rely largely on COLCIENCIAS' institutional capacity and procedures.

8. **Implementing entity.** COLCIENCIAS' main responsibility is the implementation of public policies in order to promote activities related to science and technology in Colombia. It is an administrative department of the Central Executive Power, created in 1969.

[41] The MOU was signed on March 1, 2007.

9. COLCIENCIAS has considerable experience working with multilateral institutions, having received funds from both the World Bank and the IDB. COLCIENCIAS was the co-implementing agency for a US$200 million Bank Project called *Colombia: Higher Education-Improving Access* (LN 7155), approved in December 2002. COLCIENCIAS was responsible for implementing a US$25 million component under that Project. COLCIENCIAS has also implemented the following IDB projects:

Project number	Name	Approved amount US$ million	Year of approval
875/OC-CO	Science and Technology Program	$100	1995
109/IC-CO	Scientific and Technology Development Program	$50	1982
588/OC-CO	Project Science & Technology Research Promotion II	$40	1989

10. **Organization/FM Staffing**. The Directorate of Resource Management and Logistics (FM Department) is in charge of FM matters within COLCIENCIAS. It is subdivided into 2 departments whose responsibilities are described in the table below:

Department name	Main responsibilities
Financial Resources	• Responsible for ensuring the fulfillment of financial conditions for funds granted to the beneficiaries of the Science and Technology Programs funded by COLCIENCIAS. • Responsible for preparing withdrawal applications and records receipts made into the Central Bank's Designated Account (DA) for Loan funds granted by multilaterals in the past
Finance	• **Accounting**. Prepares the accounting records of COLCIENCIAS as well as its financial statements in accordance with local legislation and specific instructions received from MHCP. • **Budgeting**. Forecasts and follows up the annual budget of the entity. • **Treasury**. Responsible for instructing the National Treasury for making all payments on behalf of COLCIENCIAS.

It is worth mentioning that most of the staff of the FM department has experience working with projects financed by the World Bank and/or the IDB. At this stage, no additional staff would be required to strengthen COLCIENCIAS' FM capabilities.

11. **Budgeting arrangements**. The budget approval process begins in March of each year with the preparation of a proposal by the FM Department of COLCIENCIAS. The proposal is sent to the MHCP and DNP, which in turn are responsible for reviewing, consolidating and sending the proposal to Congress in July for further review and discussion. Congressional approval normally occurs between the months of October and November.

12. Several factors are taken into account in preparing the budget proposal, including national Science and Technology goals, the expected performance of key macro-economic

indicators, and projected operating expenses for the period. The funds approved in the budget are loaded and monitored through the SIIF.

13. It has come to our attention that the budget for the Calendar Year 2010 was approved without factoring in the resources that would result from the Bank's loan. However, COLCIENCIAS is currently in discussions with the MHCP and DNP in order to identify mechanisms that might enable them to include a certain amount in the CY 2010 budget, so the loan may start disbursing this year.

14. **Accounting systems**. COLCIENCIAS is subject to the accounting rules issued by the National Auditor's Office (CGR) under Resolution 555 of December 2006 and Resolution 357 of September 2007. In addition COLCIENCIAS has developed an internal accounting manual, which reflects the accounting rules and procedures specific to this entity.

15. In order to prepare its accounting records COLCIENCIAS uses the SAFI system (*Sistema Administrativo y Financier*o), which is capable of maintaining records and accounts adequate to reflect, in accordance with accounting practices compatible with International Accounting Standards and in compliance with local requirements, its operations and financial condition, including records and separate accounts for the proposed Project. Administrative procedures are in place to ensure that financial transactions are made with consideration to safeguarding Project assets and ensuring proper entry in the accounting and monitoring systems.

16. As a result of the enactment of Law 1286 of 2009, which mandated COLCIENCIAS' transformation into an independent Administrative Department, COLCIENCIAS has been using the SIIF system for accounting and budgeting purposes since January 2010. As of now, both systems (SAFI and SIIF) are being used in parallel, given the fact that SAFI has some features (payroll, asset inventories), which are not in the SIIF system. In order to mitigate the risks that arise from the use of two different systems for the same process, the FM Department carries out daily reconciliations of the information. We were informed that this will be resolved with the second version of the SIIF, which is under development and expected to be rolled out by the beginning of 2011.

17. **Internal control**. Internal auditing is carried out by COLCIENCIAS' Internal Control Unit which reports to the General Director of the entity. This unit coordinates its work program with the CGR and functions as a link and central point of contact when the CGR conducts audits of COLCIENCIAS.

18. **Control framework applicable to the supervision of grants (disbursement category 1)**. COLCIENCIAS' FM Department has the following policies and procedures for the supervision of funds provided to grant beneficiaries: (i) the signing of contracts between COLCIENCIAS and grant beneficiaries establishing policies for the use of funds, including a clause which states that funds must be returned to COLCIENCIAS if they are not used for the intended purposes; (ii) the requirement of periodic interim financial reports reflecting the sources and use of funds; (iii) the requirement to conduct periodic random audits conducted by the financial staff of COLCIENCIAS.

19. It is important to mention that COLCIENCIAS has an automated system (*Sistema de Gestión*, in Spanish) to control, manage and track financial information related to science and technology research grant funds (grants under disbursement category 1). However, the financial module of this system is not adequately designed and as a result is not properly used or populated with the information on the subprojects. One of the components of the IDB loan designed to strengthen this system and ensure it is adequate in terms of financial features and ready for use. This would be included as a dated covenant in the Loan Agreement signed between COLCIENCIAS and the World Bank (see Loan/credit conditions and covenants section).

20. **General flow of funds**. The Bank would advance the proceeds of the loan in US$ (United States Dollars) into a subaccount of the Treasury Single Account (TSA) in Colombia's Central Bank (*Banco de la República,* BdR).

21. **Disbursement categories 1 and 3**. The grants under Category 1, which range from US$80,000 to US$500,000 depending on the type of subproject, would have the following characteristics:

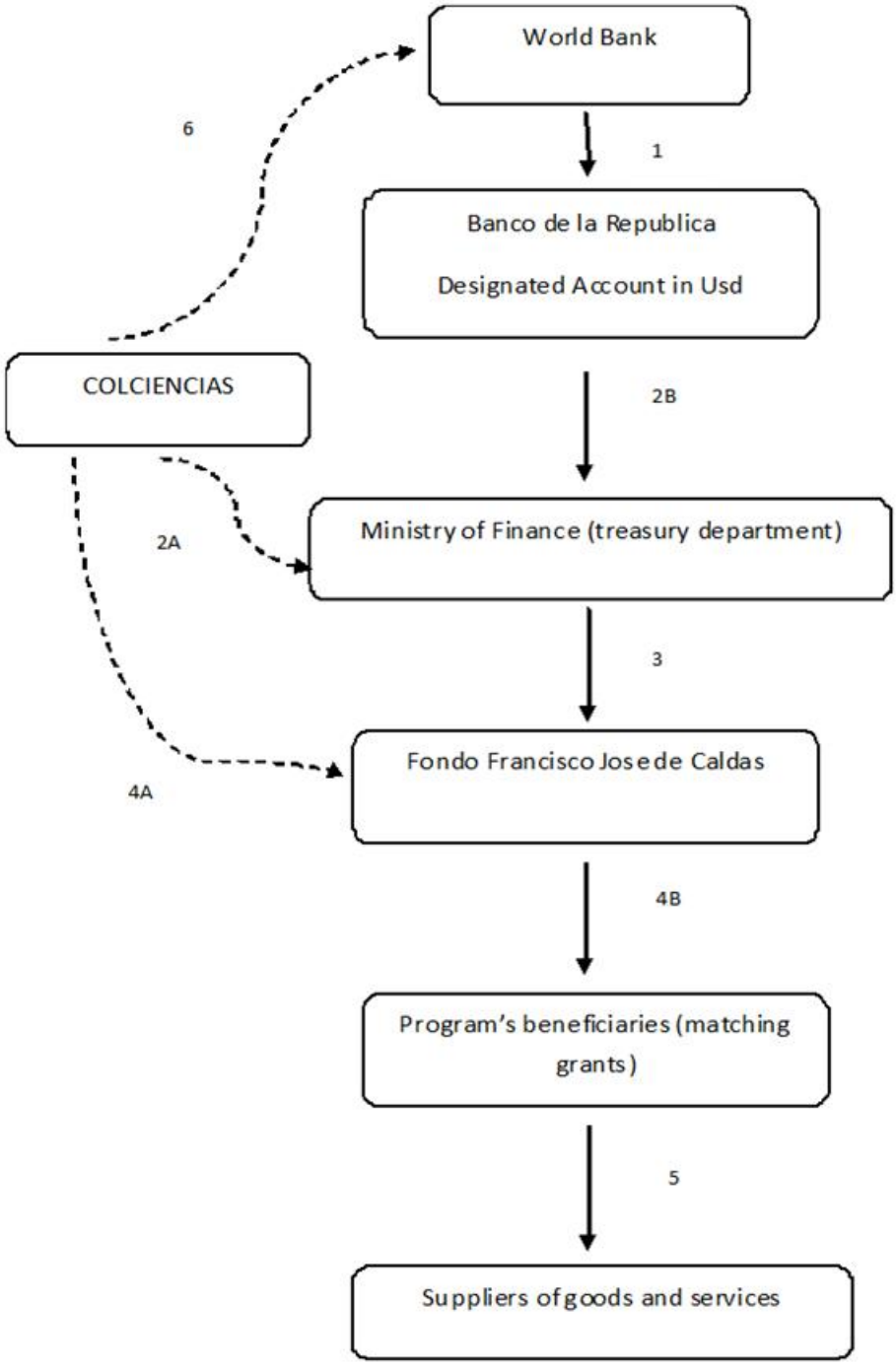
- Expenditures would be recognized on the basis of actual costs (i.e. expenditures incurred by the beneficiaries of subprojects). For expenditures to be deemed eligible, they would have to be delivered on or before the closing date of the loan.

- The disbursement process from COLCIENCIAS to the beneficiaries would be as follows: An up-front advance of 50% would be provided at the signing of the contract between the FJC and the beneficiaries. The remainder of the funds may be provided to the beneficiaries by COLCIENCIAS up to the total accumulated amount of expenditures incurred by the beneficiaries, maintaining at all times a maximum outstanding advance of 50%.

22. In order to implement the aforementioned mechanism, COLCIENCIAS must amend some arrangements currently established for subprojects, including some clauses of the legal agreements, the content of financial reports, etc. The adequate implementation of these amendments would be reflected in the template contracts, which must be acceptable to the Bank. The template contracts would have to be approved by the Bank and must be included in the Project Operational Manual (Condition of Effectiveness).

23. Expenditures related to Category 3 would finance *investment pilots* to promote the labor market insertion of doctoral graduates, *inter alia*, by providing stipends to public and private knowledge institutions and firms to hire doctoral graduates, including Colombian and foreign researchers residing outside the Republic of Colombia.

24. The general process of flow of funds is illustrated in the chart below; this flow of funds will be applicable when COLCIENCIAS uses a financial institution:


World Bank
6
1
Banco de la Republica
Designated Account in Usd
COLCIENCIAS
2B
2A
Ministry of Finance (treasury department)
3
Fondo Francisco Jose de Caldas
4A
4B
Program's beneficiaries (matching grants)
5
Suppliers of goods and services

- (1) The World Bank would advance loan proceeds in US$ into the TSA to finance eligible expenditures.

- (2A and B) Using the SIIF system, COLCIENCIAS would instruct the Treasury Department of the MHCP (treasury) to transfer resources from the Central Bank to the FJC fund. The Treasury would request funds from the Central Bank according to COLCIENCIAS' instructions, and make the currency conversions from US$ to Colombian Pesos.

- (3) The Treasury would transfer the resources to the FJC fund as per COLCIENCIAS' instructions.

- (4A) COLCIENCIAS would instruct the FJC fund to transfer the resources to the program's beneficiaries, in accordance with the contracts signed. (4B) The FJC would transfer the resources.

- (5) Grant/subproject beneficiaries would make direct payments to suppliers of goods and services, according to the specifications of each subproject. Beneficiaries would present COLCIENCIAS with financial reports reflecting expenditures incurred during the period.

- (6) COLCIENCIAS would periodically report to the Bank actual expenditures incurred through the use of Statements of Expenditures (SOEs), and would request the reimbursement of funds to the Designated Account.

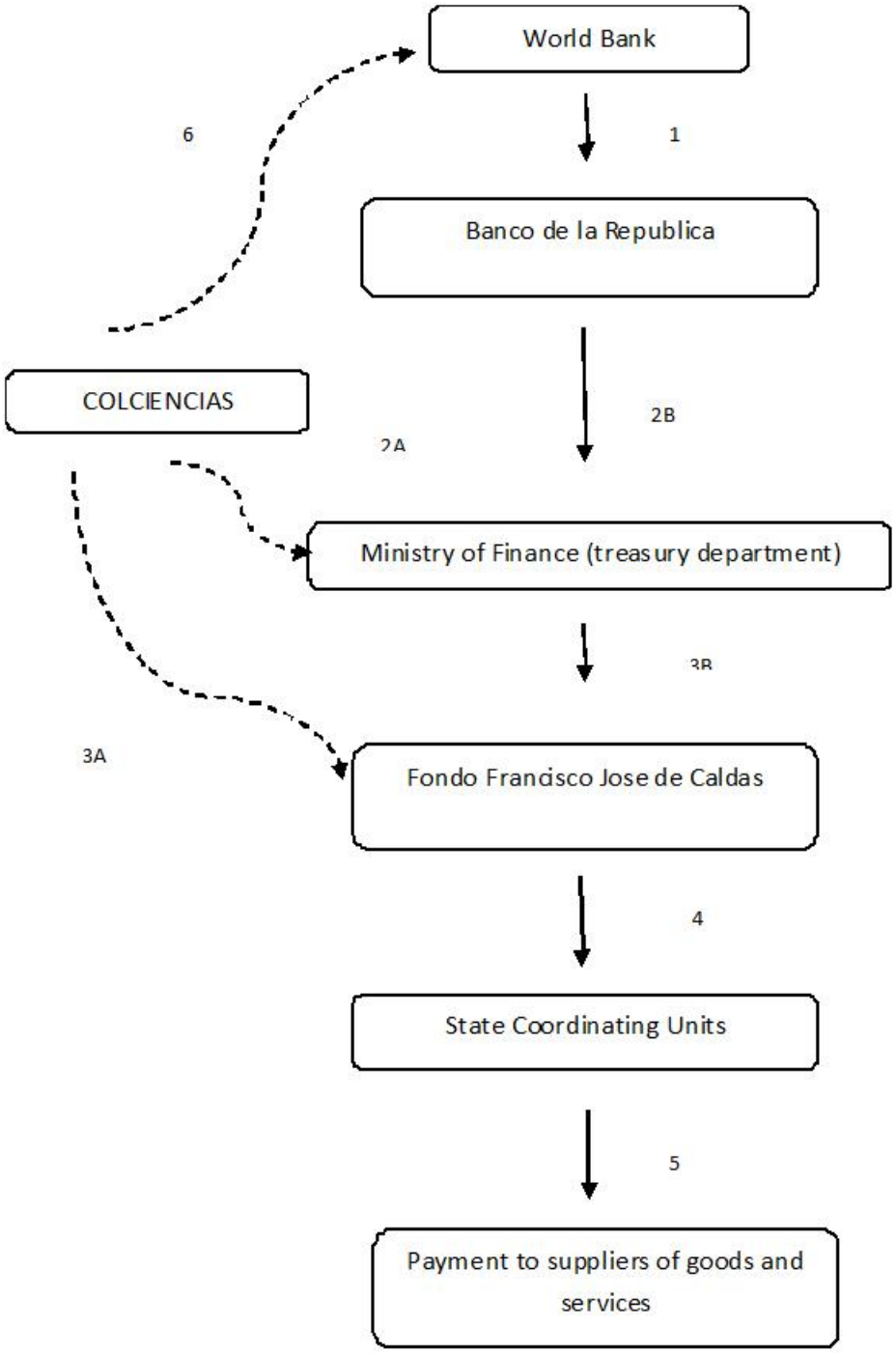
25. When the FJC fund was created by Law in 2009, it was established as a private financial institution with budget autonomy. The main reasons for the use of the fund are: (i) it allows for the multi-year execution of resources; (ii) it enables COLCIENCIAS to receive funds from third parties (e.g. private entities); and (iii) it allows COLCIENCIAS to provide tax exemptions to the donors of the fund.

26. The Bank signed an MOU with the GOC in August 2007 establishing certain requirements for the use of financial institutions in Bank--financed projects[42] which, among others aspects, included the elaboration of an investment and accounting policy manual of the FJC fund, which was sent to the Bank for review prior to negotiations.

27. **Disbursement Category 2**. *Ondas,* a program that finances research activities undertaken by basic and secondary education students and their teachers, has different implementation arrangements than other components of the Project. The amounts of *Ondas* subprojects range from US$600 to US$800, depending on the type of subproject, and resources are allocated through a selection process carried out by a Council formed by COLCIENCIAS, the Departmental Governments and other donors of the program (for example, private

[42] The MOU's requirements are: (i) the institution must be highly specialized in the funds management business, and must be regulated by the financial authorities; (ii) the institution must open separate banking accounts, and specific accounting records for the project; (iii) it must be able to provide financial information with regards to the project; (iv) the institution must permit the review from third parties (auditors and the Bank) of the records of the project.

companies). Resources are controlled by this Council, as well as the schools, the students and their parents. The flow of funds is illustrated below:



- (1) The World Bank would advance loan proceeds in US$ into the TSA to finance eligible expenditures.

- (2A and B) Using the SIIF system, COLCIENCIAS would instruct the Treasury Department of the MHCP (treasury) to transfer resources from the BdR to the FJC. The Treasury would request funds from the Central Bank according to COLCIENCIAS' instructions, and make the currency conversions from US$ to Colombian Pesos.

- (3) The Treasury would transfer the resources to the FJC fund as per COLCIENCIAS' instructions.

- (4) The FJC fund would transfer the resources to the Departmental Coordinating Units according to COLCIENCIAS' instructions. Each Department in Colombia has created a Coordinating Unit for the operation of the *Programa Ondas*, which is normally staffed with a coordinator and a financial administrator.

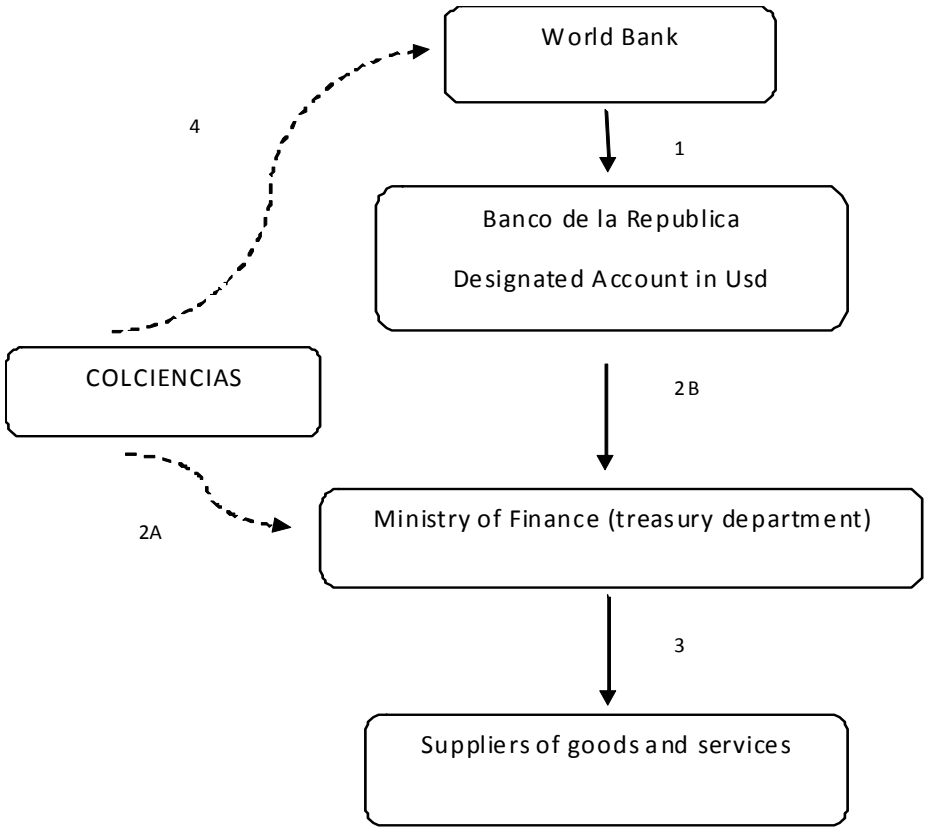
- (5) Each Coordinating Unit is responsible for the distribution of subproject funds to the students' groups.

28. **Alternatively, funds for Components 2, 3 and 4, for subprojects or stipends could also be disbursed directly through COLCIENCIAS to the beneficiaries**. In the event that this disbursement method would be utilized, it would have to follow the provision described in the Operational Manual. The only difference with regard to the flow of funds described above would be that the step involving the FJC fund would be eliminated.

29. For the supervision of the *Ondas* funds, COLCIENCIAS applies the same controls used for the supervision of grants previously described in this Annex. However, there is currently no process in place to assess the financial capabilities of the Coordinating Units in order to ensure they have adequate administrative capacity to manage the resources they receive from COLCIENCIAS. Therefore, the Bank has asked COLCIENCIAS to define a methodology for this purpose, which will be included in the Project Operational Manual (OM).[43]

30. **Disbursement Category 4**. Expenditures in this category would be disbursed and paid directly by the Treasury of the Ministry of Finance to the suppliers of goods and services as per COLCIENCIAS' instructions, as illustrated in the diagram below:

[43] The OM has been included as an effectiveness condition in the Article V of the loan agreement.



- (1) The WB would advance loan proceeds into a designated account held in US$ in Colombia's Central Bank (*Banco de la República*, BdR).

- 2A) Using the SIIF system, COLCIENCIAS would instruct the Treasury to make the payments to suppliers of goods and services. 2B) The Treasury would request funds from the Central Bank in accordance with COLCIENCIAS' instructions.

- (3) The Treasury would receive US$ from the Designated Account, make the currency conversions from US$ to Colombian Pesos, and make the payments to the suppliers of goods and services.

- (4) COLCIENCIAS would periodically report to the Bank actual expenditures incurred through the use of Statement of Expenditures (SOEs), and would request the reimbursement of funds to the Designated Account.

31. **Disbursement arrangements**. The loan disbursement arrangements[44] are summarized below:

Disbursement method	This project would primarily use the advance method to a Designated Account (within the Treasury Single Account) opened in US$ by COLCIENCIAS in the Central Bank.
Other procedures	The direct payment method may be used, as well as the reimbursement method.
Supporting documentation	SOEs[45] and/or records, according to the thresholds indicated in the Disbursement Letter.
Limits	A ceiling of USD 5 million has been established for the Designated Account, and reflected in the disbursement letter.
Retroactive expenditures	Eligible payments: That do not exceed 20 per cent of the loan amount. Made by the borrower after December 1st, 2009. Retroactive expenditures would be subject to the same systems, controls and eligibility filters described above in this Annex. Retroactive expenditures would also be subject to the regular project external audit (see below).

[44] For details, please see the Disbursement Letter.

[45] All SOE supporting documentation will be available for review by external auditors and Bank staff at all times during Project implementation, until at least the later of: (i) one year after the Bank has received the audited Financial Statements covering the period during which the last withdrawal from the Loan Account was made; and (ii) two years after the Closing Date. The Borrower and the Project Implementing Entity shall enable the Bank's representatives to examine such records.

32. **Disbursement Table**

Category	Amount of the Loan Allocated (expressed in USD)	Percentage of Expenditures to be financed (inclusive Taxes)	Recognition of expenditures
(1) Grants under Sub-projects under Components 2 (except 2(b)(i)), 3 and 4 of the Project	9,026,250	100%	Payment to suppliers of goods and services
(2) Grants under Sub-projects under Component 2(b)(i) of the Project	2,080,650	100%	Transfer from the Departmental Coordinating Units to student units
(3) Stipends under Component 2(a)(i) of the Project	2,080,650	100%	Payment of stipends to public and private knowledge institutions and firms
(4) Goods, services, training, operating costs and consultants' services under Components 1, 2, 3(d), 4 of the Project	11,812,450	100%	Payment to suppliers of goods and services
TOTAL AMOUNT	25,000,000		

33. **Financial reporting**. COLCIENCIAS would use the SIIF system as described earlier to prepare semi-annual Project unaudited Interim Financial Reports (IFRs) and annual audited Project financial statements, covering all project expenditures. These would be prepared on a cash basis using standard formats agreed with the GOC, which would be customized to fit the specific characteristics of this project, using a format that was agreed with COLCIENCIAS during negotiations.

34. After loan effectiveness, the financial reports would be presented by COLCIENCIAS to the Bank, as follows:

Report	Due date
Semi-annual unaudited project IFRs	Within 45 days after the end of each calendar semester.
Annual audit report on project financial statements and eligibility of expenditures	Within six months after the end of each calendar year of loan disbursements (or other period agreed with the Bank).

35. **Internal and External audit**. Annual audits of Project financial statements and eligibility of expenditures would be performed in accordance with Bank policy, as reflected in the Memorandum of Understanding (MOU) and Terms of Reference (TORs) for project audits

agreed between the Ministry of Finance (MHCP), the National Auditor's Office (CGR) and the Bank.

36. It is worth mentioning that the National Auditor's Office (CGR) regularly executes a number of performance, financial and compliance audits on all activities carried out by COLCIENCIAS, including funds transferred to the FJC, and by the *Programa Ondas*, as they remain under the audit scope of the CGR.

37. **Written Procedures**. Project financial procedures would be described in the Operational Manual, which would define the roles and responsibilities of the Project FM team. The draft OM would be submitted to the Bank before negotiations and would include, among other financial procedures, the: (a) accounting policies and procedures including accounting basis; (b) cash flow charts with detailed processes; (c) reporting requirements based on the agreements reached between the Ministry of Finance and the Bank in September 2006; (d) internal control procedures including criteria and procedures for processing payments; (e) records management, and (f) audit arrangements and TORs.

38. **Risk assessment**. On the basis of the Bank's Project FM assessment, the overall FM residual risk is considered modest, as explained in the following table:

Risk type[46]	Risk Rating	Comments / Risk mitigating measures incorporated into project design	Residual Risk Rating
Inherent risk	**S**		**M**
Country level	M	The Bank is engaged with the GOC to enhance Project FM across the portfolio and foster the use of country FM systems on the basis of institutional capacity building.	M
Entity	M	COLCIENCIAS has considerable experience working the World Bank and IDB financed projects.	L
Project	S	The project entails considerable risk in terms of FM as some of its expenditures would be targeted to a wide range of beneficiaries, with different implementation arrangements, including the *Programa Ondas*. In this case, the FM risk is mitigated primarily by the strong institutional control systems already in place and some specific mitigating measures proposed as a result of the FMA,	M
Control risk	**S**		**M**
Budgeting	S	The budget for the year 2010 was approved without factoring in the resources that would result from the Bank's loan.	S
Accounting	S	Since its transformation into an Administrative Department, COLCIENCIAS is using the SIIF system to prepare its accounting and budgeting records. This system is acceptable to the Bank	M
Internal Control	S	COLCIENCIAS already operates with different policies and procedures manuals which contain the internal control framework of the entity. In addition, a Project operational manual would be prepared and would be ready prior to Board submission.	M
Funds Flow	S	The flow of funds process, especially for disbursement categories 1 and 2, is quite complex as it involves the use of non-standard mechanisms, including a financial institution. The use of funds would be monitored through the financial reports presented by the beneficiaries of subprojects.	S
Financial Reporting	M	COLCIENCIAS would submit semi-annual unaudited Project Interim Financial Reports (IFRs) and annual audited financial statements.	M
Auditing	M	The audit of the Project would be conducted by the CGR.	M
Overall risk	**S**		**M**
Residual risk			**M**

H – High; S – Substantial; M – Modest; L - Low

[46] The **FM inherent risk** is that which arises from the environment in which the project is situated. The **FM control risk** is the risk that the project's FM system is inadequate to ensure project funds are used economically and efficiently and for the purpose intended. The **overall FM risk** is the combination of the inherent and control risks as mitigated by the client control frameworks. The **residual FM risk** is the overall FM risk as mitigated by the Bank supervision effort.

39. The Bank FM supervision strategy would include 2 full FM supervision missions in the first year, and this will be adjusted each year in accordance with the results of supervision missions and the assessed risk for the project accordingly. The objective of the FM supervision will be to examine the operation of the control systems and arrangements described in this annex, including but not limited to the beneficiary payments system, the reconciliation process, and the eligibility filters. Desk reviews of IFRs and audit reports would also take place.

Annex 8: Procurement Arrangements

Strengthening the National System of Science, Technology and Innovation

A. General

1. Procurement for the Project would be carried out in accordance with the World Bank's "Guidelines: Procurement under IBRD Loans and IDA Credits" dated May 2004, revised October 2006 and May 2010; and in accordance with "Guidelines: Selection and Employment of Consultants by World Bank Borrowers" dated May 2004, revised October 2006 and May 2010, and in accordance with the provisions stipulated in the Legal Agreement. The various items under different expenditure categories are described in general below. For each contract to be financed by the Loan, the different procurement methods or consultant selection methods, the need for prequalification, estimated costs, prior review requirements, and time frame are agreed between the Borrower and the Bank in the Procurement Plan. The Procurement Plan would be updated at least annually, or as required, to reflect the actual project implementation needs and improvements in institutional capacity.

2. Procurement Implementation. Procurement actions for institutional strengthening (Component 1) and strengthening human capital and promoting social diffusion of knowledge (Component 2, except for *Ondas* and for the matching grants for collaborative subprojects with the *diaspora*) and awareness and institutional communication (Component 4) would be carried out by COLCIENCIAS. At the subproject level, the procurement under Component 3 and under *Ondas* and the matching grants for collaborative subprojects with the *diaspora* would be carried out by the beneficiaries of grants and other instruments selected under transparent, competitive and publicly advertised procedures. Beneficiaries may be universities, research centers or private sector firms.

3. Procurement of Works. No civil works are expected under the Project.

4. Procurement of Goods and non-consultant services. Goods procured under Component 1 of the Project would include the equipment and goods necessary for strengthening COLCIENCIAS in strategic and operational areas such as computers, office equipment, software and peripherals. Procurement under subprojects of Component 3 would include, *inter alia*, equipment and a variety of inputs for research of not very large amounts. However, major equipment might be included in special cases in order to promote innovation in priority areas. Procurement would be done using the Harmonized SBD for International Competitive Bidding (ICB) (not expected) and National Competitive Bidding (NCB) processes. For smaller goods purchases, a model of Invitation to quote under shopping procedures would be agreed upon with the Bank, and commercial practices would be applied by beneficiaries of Component 3. Non-consultant services would include, *inter alia*, workshops, seminars, forums and other events to promote linkages with the *diaspora* and increase awareness and diffusion of knowledge under Components 2 and 4; it is expected that non-consultant services would include the diffusion of science through mass media and virtual spaces. Under Component 4, it is also expected that the Project would finance, *inter alia*, vehicles and equipment for Mobile Classrooms and editorial collections related to science popularization.

5. Selection of Consultants. The Project would require consulting services under the four Components as well as studies, evaluations and other types of technical assistance for: strategic and sector planning, policy definition, instrument design, managerial and organizational development, and monitoring and evaluation. Under Components 2 and 3, the development of instruments to promote the strengthening of human capital and research and innovation would include technical assistance. In many cases these activities may be carried out by individual consultants. Short lists of consultants for services estimated to cost less than $350,000 equivalent per contract may be composed entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines. The participation of universities, government research institutions, public training institutions and NGOs in some specialized fields of expertise is expected.

6. Firms. Most contracts for firms are expected to be procured using Quality and Cost Based Selection Method (QCBS). Consultant assignments of specific types as agreed previously with the Bank in the Procurement Plan may be procured with the use of the following selection methods: (i) Quality Based Selection (QBS); (ii) Selection under a Fixed Budget (SFB); (iii) Least Cost Selection (LCS); (iv) Selection Based on Consultants' Qualifications (CQS), and, exceptionally (v) Single Source Selection (SSS), under the circumstances explained in paragraph 3.9 of the Consultants' Guidelines. The harmonized request for payment (RFP) must be used.

7. Individuals. Individual consultants hired to provide technical advisory and project support services would be selected in accordance with Section V of the Guidelines.

8. Operating Costs. Operating costs are reasonable expenditures directly related to the Project incurred by the Borrower, through COLCIENCIAS, (which expenditures would not have been incurred absent the Project), including the costs of consumable materials and supplies, communications and translations, mass media and printing services, rental of vehicles, warehouse space, and facilities, operation and maintenance, charges for the opening and operation of bank accounts required for the Project, postage and handling, and travel, lodging and per-diems, but excluding salaries of officials of the Borrower's civil service.

9. Others. Grants for subprojects would be financed through competitive grants and other financial instruments; procurement under these subprojects would be carried out by beneficiaries following commercial practices according to the established thresholds in the table under #15. The applicability of "Established Private or Commercial Practices" as a procurement method is allowed by virtue of the fact that all the funds under Component 3 would, in principle, flow through the Francisco José de Caldas fund. The fund is controlled and overseen by COLCIENCIAS, but operated under a trust fund (*fideicomiso)* with a private firm. Commercial practices have been found acceptable by the Bank. Under subprojects, beneficiaries would decide what investments to make in accordance with their business plans and competitively selected proposals. In the grant application, beneficiaries must list goods, services and cost estimates as part of a business plan required in lieu of an individual procurement plan. The hiring of consultant firms and highly specialized individual consultants not initially listed in the application for the grant or subproject shall be hired in accordance with the procedures for hiring firms and individuals in the Table below. No procurement actions were identified under Component 2, where funds are allocated to increase the stock of advanced human capital and promote its insertion in research institutions and the private sector.

10. The procurement procedures and SBDs to be used for each procurement method, as well as model contracts for works and goods procured, are presented in the Operational Manual.

B. Assessment of the agencies' capacity to implement procurement

11. Procurement activities and all Project technical management would be carried out by COLCIENCIAS and grant beneficiaries as stated above in paragraph 2. The analysis of the procurement capacity indicates that COLCIENCIAS has previous experience in dealing with projects funded by the Bank and other multilateral and bilateral institutions. The implementation entity must be staffed by personnel or consultants knowledgeable in Bank procurement Guidelines or at minimum with training in their application. Procurement supervision must be conducted by COLCIENCIAS, to avoid mistakes that could lead to misprocurement during project implementation.

12. An assessment of the capacity of COLCIENCIAS to implement procurement actions for the project was conducted by the Procurement Accredited Specialist (PAS) in January 2010. It was found that COLCIENCIAS has a specialized staff that can deal with procurement activities. However, COLCIENCIAS' team should be strengthened before project implementation. COLCIENCIAS should guarantee during Project implementation that procurement supervision would be carried out by its own specialized staff or by consultants with significant experience in Bank-funded procurement.

13. The key issues and risks concerning procurement for implementation of the Project have been identified, and include: (i) need to strengthen COLCIENCIAS' team; and (ii) need to establish a regulatory and supervision mechanism for COLCIENCIAS to guide grant beneficiaries in Bank procurement procedures.

14. The corrective measures recommended in order to minimize procurement-related risks are:

(a) Prior review of procurement of all goods above US$500,000;

(b) In addition to mandatory advertisement as stated in the Guidelines, Project activities should include the mandatory publication of procurement notices and results for all contracts in national media (such as the GoC's government contracts portal – *Portal Único de Contrataciones*) and the Web page of COLCIENCIAS;

(c) The agreements signed between COLCIENCIAS and each of the *grant* recipients under the competitive fund in Component 3 must include a statement in which the beneficiaries agree to apply, in all procurement for the subproject, procedures acceptable to the Bank and to the principles of economy, efficiency, equal opportunity and transparency.

(d) Public universities and research centers would be eligible for commercial practices if they meet one of the following conditions:

i. Their proposal is submitted jointly with a private firm;
ii. They are legally and financially autonomous, operate under commercial law and are not dependant agencies of the borrower or;

iii. Their institutional procurement guidelines are satisfactory to the Bank.

(e) COLCIENCIAS must regularly supervise procurement by the beneficiaries of subprojects. Periodic and specialized procurement reviews by independent procurement reviewers or specialized COLCIENCIAS' staff should be carried out annually and should include visits to the subprojects and reporting of procurement regulations until procurement under subprojects financed by the loan is completed. No fewer than 1 in 10 subprojects should have their procurement processes reviewed annually.

(f) A consistent program of procurement training for COLCIENCIAS' staff expected to be directly involved in Project procurement implementation.

(g) At least one procurement specialist with experience in Bank-funded procurement should be assigned to COLCIENCIAS' *General Secretariat*. The Terms of Reference and selection of this consultant must be subject to Bank's prior review.

15. The overall project risk for procurement is MODERATE (January 2010). This risk rating should be reviewed after the first year of implementation of the Project. The following thresholds are recommended and were taken in account in the design of the procurement plan, and are included in the procurement plan pursuant to the loan agreement:

Category	**Contract value (thresholds US$)**	**Procurement Method**	**Prior review**
Good to be procured by COLCIENCIAS	>1,000,000 >500,000 ≤50,000	ICB NCB Shopping Direct contracting	All (not expected) All First one All
Good to be procured by subprojects	>1,000,000 >250,000 ≤150,000 >10,000* ≤10,000*	ICB NCB Commercial practices Direct contracting Direct contracting	All (not expected) First one No All No
Consultants' services	≥100,000 <100,000	QCBS,QBS FBS,LCS, CQS SSS	All First one All
Consultants' services (individuals)	>100,000 or sole source <100,000	In accordance with Section V of Guidelines.	All First one

*Threshold only for review (prior or post)

Note: Procurement methods: International Competitive Bidding (ICB), National Competitive Bidding (NCB), Quality and Cost Based Selection Method (QCBS), Quality Based Selection (QBS); Selection under a Fixed Budget (SFB); Least Cost Selection (LCS); Selection Based on Consultants' Qualifications (CQS), and Single Source Selection (SSS)

C. Procurement Plan

16. The Borrower, at Appraisal, developed a procurement plan for project implementation which provides the basis for the procurement methods. This plan was agreed upon between the Borrower and the Bank on May 21, 2010 and would be available in the Procurement Plan Execution System, SEPA. The plan would also be available in the Project's database and on the Bank's external Web site. The procurement plan would be updated in agreement with the Bank annually, or as required, to reflect actual project implementation needs and improvements in institutional capacity.

D. Frequency of Procurement Supervision

17. In addition to the prior review supervision to be carried out from Bank offices, the current capacity assessment recommends two missions during the first year of project life, based on good procurement performance.

E. Details of the Procurement Arrangements Involving International Competition

18. Goods, and Non-Consulting Services – Not expected.

(a) List of contract packages to be procured following International Competitive Bidding (ICB) and direct contracting: Not expected.

19. Consulting Services

(a) List of consulting assignments with short-list of international firms: No contracts for Consulting Services that exceed the US$ 350,000 threshold have been identified.

E. Appendix: Additional provisions related to Procurement

National Competitive Bidding

Goods estimated to cost less than $1,000,000 equivalent per contract may be procured under contracts awarded on the basis of National Competitive Bidding, subject to the following additional provisions:

(a) Before issuing any invitation to bid, the Borrower shall use, or cause to be used, standard bidding documents, as approved by the Bank for bidding under the Project and incorporated in the Operational Manual (the "Standard Bidding Documents"). Any change or departure from the Standard Bidding Document approved by the Bank shall require its prior approval.

(b) All bidders, irrespective of whether they are foreigners or citizens of the Borrower's territory, will be treated equally and, particularly, no preference will be granted to any bidder or group of bidders for bid evaluation purposes. Bidders shall be allowed to submit their bids by hand or through the post office or private mailing services. There

shall not be any requirement for any bidder to show evidence of the bidder's registration in any public registry, chamber of commerce or similar entity, whether in the Borrower's territory or elsewhere, or to appoint a representative domiciled in Borrower's territory, unless and until such bidder is awarded the corresponding contract.

(c) Bids shall be opened in a public meeting to which bidders and their representatives shall be allowed to attend if they so wish. Date, time and place for the opening meeting shall be set forth in the bidding documents. Bid opening shall coincide with, or take place promptly after, the final date and time of the period for bid submission stipulated in the bidding documents.

(d) Each bid shall be evaluated and the corresponding contract awarded to the responsive bidder who meets appropriate technical and financial standards of capability and whose bid has been determined to be the lowest evaluated bid. Such determination shall be made exclusively on the basis of the specifications, conditions and evaluation criteria stipulated in the bidding documents. If any factor additional to the amount or amounts of each bid is to be considered in bid evaluation, such factor or factors and the quantified manner on which they will be applied for purposes of determining the lowest evaluated bid shall be precisely stipulated in the bidding documents. For purposes of bid evaluation and comparison, the only bid amount or amounts to be used as a factor shall be the bid amount or amounts as quoted in the corresponding bid, including correction of arithmetic errors.

(e) The provisions of paragraph 2.46 of the Guidelines shall fully apply and, more specifically, bids shall not be disclosed to persons other than the persons officially charged with the task of comparing and/or evaluating the bids while they are performing their official duties, without the corresponding bidder's written authorization. Moreover, bidders shall not be required to provide such authorization as a condition to be entitled to bid. This confidentiality requirement shall apply until the award of contract is notified to the successful bidder. Thereafter, confidentiality of the bids shall be limited to those bid portions for which confidentiality has been specifically requested by the bidder in question.

Annex 9: Economic and Financial Analysis

Strengthening the National System of Science, Technology and Innovation

1. This annex focuses on the economic rationale behind this Project's support for STI in Colombia. It first considers the value of STI for productivity and economic growth. It then turns to the links between innovation and productivity at the micro level in Colombia. Next, it summarizes the rationale for public interventions in STI. Finally, it provides a calculation of the public and private investment necessary to reach a ratio of STI investment to GDP of 2 per cent by 2019.

The value of investing in science, technology and innovation for economic growth

2. A society's capability to produce and commercialize scientific and technological knowledge is critical for gains in productivity and global competitiveness. Emerging countries that invested in human capital, technology and R&D early on—and where other conditions such as market incentives and strong institutions were present—now have economies with a strong capacity to innovate and turn knowledge into business. A number of studies have attempted to quantify the effect of investments in R&D on total factor productivity (TFP). Table A9.1 presents the findings arising from several key studies. Although the range of estimates for the elasticity of TFP to investments in R&D is very broad, all of these studies find the effect to be positive and statistically significant.

Table A9.1: Selected Estimates of the Elasticity of TFP with respect to R&D investments

Study	Elasticity	Independent variable	Dependent variable	Sample
Coe and Helpman (1995)	0.08 (Non G7) 0.23 (G7)	R&D stock	TFP	21 OECD +Israel 1971-1990
Xu and Wang (1999)	0.104-0.149	R&D stock	TFP	21 OECD 1983-1990
Frantzen (2000)	.077-0.091	R&D	TFP	21 OECD 1965-1991
Guellec and van Pottelsberghe de la Potterie (2004)	0.13 0.17	Business R&D Public R&D	TFP	16 OECD Countries panel 1980-1998
Australian Industry Commission (1995)	0.02 0.14	Private R&D stock	TFP Output	Australia 1975-1991
Bronzini and Piselli (2009)	0.006-0.077	R&D stock	TFP	Italian regions (19) 1985-2001
Teixeira and Fortuna (2010)	0.238-0.795	R&D stock	TFP	Portugal 1960-2001

Note: These studies apply the perpetual inventory method to R&D investment data, which means that the stock of R&D is measured as the accumulated expenditures on R&D, which are depreciated over time.

3. The relationship between investments in science, technology and innovation and economic growth also holds for economies that have relied on their natural resource endowments. In fact, productivity growth in agriculture and other natural resource-based activities has outpaced that of manufacturing in both developed and developing countries. Many countries have experienced high rates of growth for long periods thanks to their natural resource

endowments; for example, Australia, Finland, United States, Sweden, and, more recently, Chile. The recurrent lesson of the successful natural resource developers is that sustaining growth requires a high level of human capital and a capacity for national learning and innovation.

4. To achieve innovation, new knowledge is required, be it self-generated or acquired from external sources. Given the size of Colombia's economy, both avenues are important: domestic R&D to generate new knowledge and technology transfer from abroad. Evidence shows that even for countries that rely heavily on the transfer of technology generated abroad, domestic expenditures on R&D for new products and processes are crucial for adapting imported technologies to the specific characteristics of domestic industries and consumers.[47] This Project aims to strengthen indigenous R&D and knowledge absorptive capabilities so that Colombia can generate innovations and be in a better position to take advantage of the global stock of knowledge.

The link between innovation and productivity at the micro level

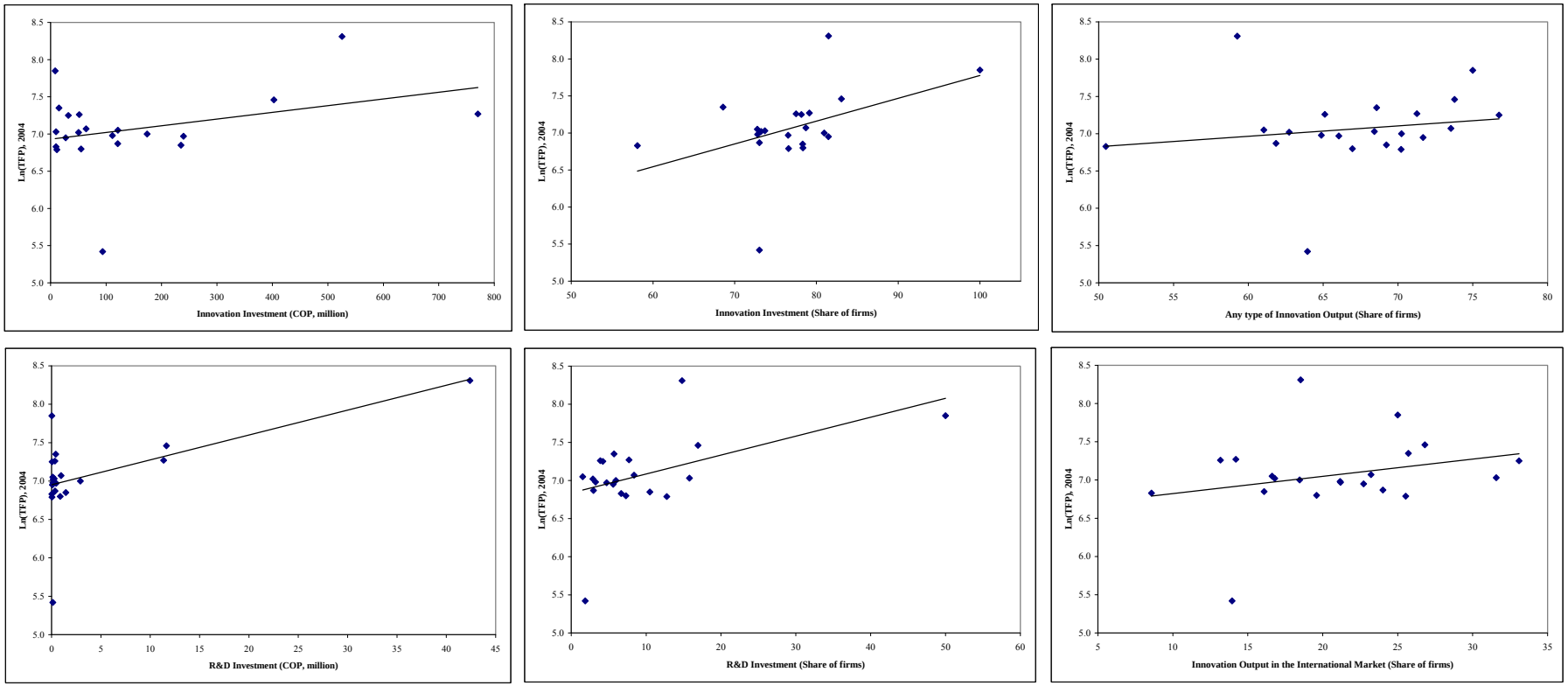
5. Innovation and productivity are closely linked. The link between innovation and productivity has been widely studied in the literature, first in the developed world and more recently in developing economies.[48] For the Colombian case, Arbeláez and Parra Torrado (2009) estimate a four-stage model and find that R&D and, more broadly, innovation have a positive impact on firms' performance. In Figure A9.1 below, some simple scatter graphs illustrate the positive relationship between R&D, innovation and productivity. In the y-axis, firms' TFP, averaged at the sector level, is depicted; in the x-axis, different measures of innovation intensity and output are used. With few exceptions, the sectors having experienced more investment in R&D or innovation are also more productive. This exercise[49] corroborates the strong, possibly endogenous, relationship between these variables, albeit it does not establish the direction of causality.

6. An analysis of firm-level data from Colombia identifies several factors that positively impact the probability that a firm will successfully innovate (see Table A9.2). In the first place, *ceteris paribus*, having an R&D department within the firm can increase the probability of the firm innovating in product, processes and Intellectual Property Rights (IPR)[50] by 18, 27 and 40 per cent respectively. Also, a higher share of employees with tertiary education can increase the probability of product and process innovation within a firm by 35 and 21 per cent, respectively. Collaborating with universities and research centers is also found to be an important determinant of successful innovation. Keeping all other explanatory variables in the model constant, collaborating with research centers increases the probability of innovating in products, processes

[47] The Balanced Scorecard is a strategic planning and management system that is used extensively in business and industry, government, and nonprofit organizations worldwide to align business activities to the vision and strategy of the organization, improve internal and external communications, and monitor organization performance against strategic goals.
[48] The new process should be developed by incorporating the results from the technical assistance carried out for process revision.
[49] Including, *inter alia*, all plans and evaluations.
[50] Goldberg, 2006
[50] See also Lederman and Maloney (2003) and Jones and Williams (1998)

and IPRs by 58, 41 and 57 per cent, respectively. Finally, according to the results of this study, investing in training on topics related to innovation and development can also increase the probability of successful product, process and IPR innovation.

Figure A9.1: Productivity and Innovation by Economic Sectors, 2004



Source: Parra Torrado et al. (2010) based on EDIT II

7. In spite of their potential to increase a firm's productivity, innovation-related activities are not commonplace in Colombia's industrial landscape. In fact, the last innovation survey of the manufacturing sector (EDIT II) reveals that most firms do not invest in those activities that are most relevant to increasing innovation outputs. The issues highlighted in Table A9.2 appear again very clearly in the results of this survey. For instance, only 6 per cent of manufacturing firms invested in R&D and only 1 per cent of the workforce is employed in R&D units. In general, Colombian manufacturing firms do not have adequately-trained personnel to perform research: only 0.06 per cent of the workforce holds a PhD, lower than in comparator countries in Latin America, and significantly lower than in middle-income countries in other regions. When asked about the main obstacles to achieving innovation, around 40 per cent of firms mentioned the lack of a corporate culture that values innovation, while 34 per cent mentioned lack of training.

Table A9.2: Marginal effect of company characteristics on innovation, Colombia

	Product innovation	Process innovation	IPR
Firm Characteristics			
Firm size (in #employees)	**0.08**	**0.17**	**0.06**
Capital location	**0.06**	0.02	0.01
R&D department	**0.18**	**0.27**	**0.40**
Human capital			
Share of employee with tertiary	**0.35**	**0.21**	0.08
Share of employee with secondary	**0.14**	0.07	0.07
Collaboration with			
Universities	**0.44**	0.17	**0.51**
Research Centers (private & public)	**0.58**	**0.41**	**0.57**
Suppliers	**0.50**	**0.69**	0.23
Internal	0.39	0.30	0.40
Other firms	0.20	0.09	0.12
Training and Re-education			
Innovation and development	**0.48**	**0.55**	**0.14**
Organizational	**0.26**	**0.22**	0.13
Management	-0.07	***-0.13***	-0.04
Observations	6212	6212	6212

Note: Bold denotes significance at a 5% level. Bold + Italic denotes significance at a 10% level. The table is an extraction from the full models counting 25 explanatory variables including controls for economic sectors.
Source: Marotta et al. (2007)

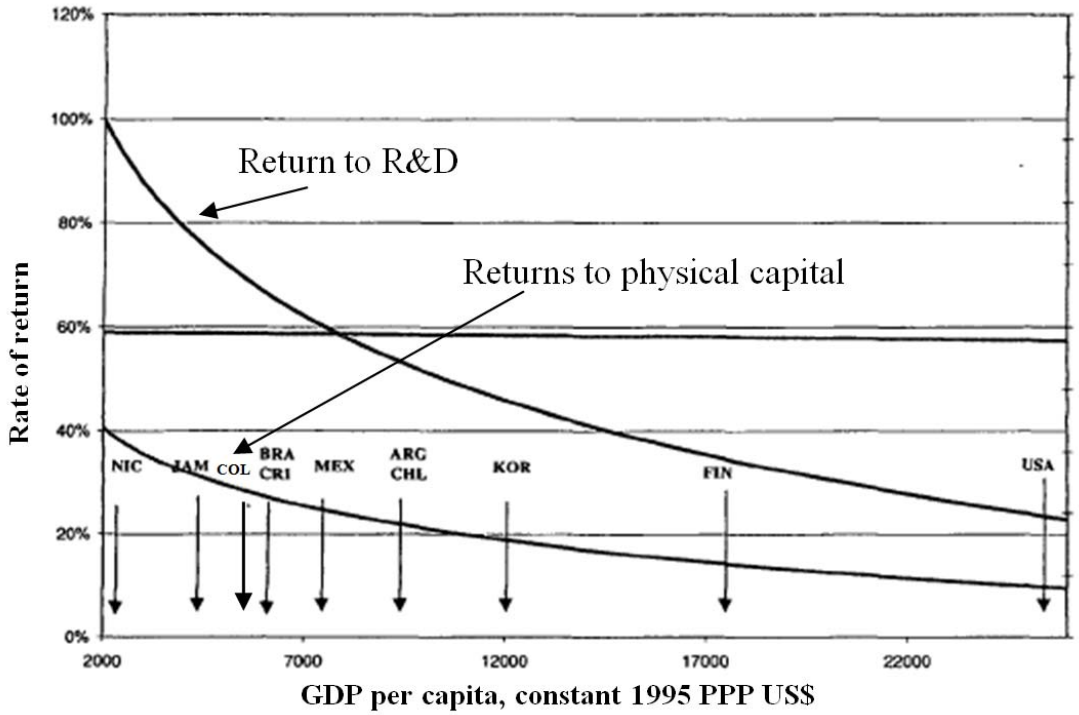
8. The proposed Project seeks to develop and implement public instruments that increase incentives for firms to invest in the four key areas highlighted above. Specifically, each of the investment pilots to be financed under Components 2 and 3 have been designed to address these issues. The matching grants for firms' technological and innovation capacity-building (Component 2.d) will promote the development of capabilities to carry out R&D and innovation within the firm, both through assistance in specific projects, consulting services to implement an innovation management system or through specialized training. The matching grants for labor-market insertion of advanced human capital (Component 2) seek to increase the share of employees with tertiary education in the private sector. Matching grants for innovation in priority sectors (Component 3) will be channeled through the instrument currently used by

COLCIENCIAS or modifications thereof. This instrument actively promotes collaboration between firms and knowledge institutions (universities and research centers) in the development of commercially-oriented research and innovation projects, as all subprojects must be a joint initiative between the two types of institution.

Rationale for public policy intervention

9. Lederman and Maloney (2003) suggest that social rates of return for investments in R&D are higher for developing countries and that there is a generalized underinvestment in R&D in relation to its potential benefit. They estimate the return of R&D investments for a panel of countries controlling for a series of factors including GDP per capita, labor and capital growth, tertiary education, and natural resource abundance. Simulations suggest that the returns on R&D for OECD countries are in the 20-40 per cent range. For medium income levels, such as that of Colombia, the average return is around 60 per cent, and for relatively poor countries such as Nicaragua, the average return is closer to 100 per cent (Figure A9.2). Depending on the assumptions about the cost of investment resources, Lederman and Maloney suggest that investment in R&D should be between 2 and 10 times its current value to be in line with social returns.

Figure A9.2: Returns to R&D and level of development



Source: Lederman and Maloney (2003).

10. Several failures in the market for knowledge and technology lead to the significant underinvestment in R&D and other innovation-related activities. The following paragraphs review these market failures.

11. **Knowledge is not appropriable**. As a result, firms that invest in knowledge generation cannot privately absorb all the benefits resulting from their activities, and they tend to invest less than what would be socially optimal. This reasoning applies not only to the generation of knowledge that is new from a global perspective, but also to the first introduction of foreign ideas in a country where they have not been tested on a commercial basis. In particular, Hausmann and Rodrik (2003) point to the fact that while in the case of new products, patents may allow for the realization of private benefits, such protection mechanisms do not exist for the case when an existing product is first produced in a country. Thus, the full cost of failure is assumed by the innovative entrepreneur but, if successful, the company is forced to share the benefits with imitators. This reduces the incentive to invest both in the development of new products and processes, as well as in the search for technologies in which a country might have an untested comparative advantage.

12. **Knowledge and innovation generate significant positive externalities and spillovers**. As suggested by Griliches (1992) and others, the social rate of return on R&D expenditures is often three times as large as the private rate of return. In other words, the return to R&D for the individual firm may be less than the return that firm's R&D provides to the overall economy through knowledge spillovers. Thus by investing in R&D, a firm may help improve competitors' products and processes. This suggests that there is significant scope for public interventions to align social and private returns.

13. **There are indivisibilities in innovation expenditures**. Many technology services follow the rules of economies of scale, therefore making in-house provision of R&D (which can be very expensive) prohibitive for all but large firms. At the same time, to be effective, resources need to be concentrated in a manner beyond the capacity of the individual firm, thus creating the need for coordination.

14. **Investments in R&D are long term and risky**. Less developed financial markets seldom provide adequate instruments and term structures for financing R&D expenditures. For this reason, companies tend to underinvest in R&D.

15. **Need for collaboration among institutions and firms for innovation diffusion and application**. Although innovation can sometimes come from an individual firm, it is more often the outcome of a process of collaboration. The cost of bringing and coordinating the various agents and institutions involved in the production of knowledge is relatively high and often no single agent has the incentives to bear those costs, since the benefits of such coordination are not appropriable.

16. **Tacit Knowledge**. Many types of knowledge are not easily codifiable and hence can only be transmitted through interactions between individuals. This characteristic of knowledge provides the rationale for the facilitation of interactions among researchers and users. Public intervention is justified in this case given that no single firm has the incentive to bear the costs of

generating such interactions (conferences, agglomeration of firms, technology parks, etc.), which creates a free rider problem.

17. These market failures imply that an unregulated and purely privately funded market for knowledge produces sub-optimal outcomes. To counter this, governments intervene in various ways in the market for knowledge, for example by establishing intellectual property rights systems. But regulations alone do not align private returns to knowledge creation with social returns, which is why many governments in developed nations invest close to 1 per cent of GDP in science, technology and innovation. These funds finance universities, technology transfer centers, metrology institutions, venture capital funds, private sector R&D, and knowledge sharing activities.

Scenarios for increasing STI investment in Colombia

18. For the past 6 years, Colombia's investment in STI activities has fluctuated at around 0.4 per cent of GDP. Table A9.3 shows the required yearly growth in STI investment in order to reach the government's goal of 2 per cent of GDP in 2019, for different yearly GDP growth rates

Table A9.3: Required annual growth in STI investments to achieve 2% of GDP in 2019

GDP growth	STI growth
2%	20%
4%	23%
6%	25%
8%	27%

Source: Authors' calculations based on OCyT and DANE

19. Another important development for Colombia would be to achieve a mix of STI investments where private investments exceed those of the public sector. Countries that have experienced high knowledge-driven increases in productivity growth have achieved a private share of STI investments of 60 per cent or more. Table A9.4 shows the required yearly growth in public and private STI investment for the period 2010-2019 for different public-private splits in 2019.

Table A9.4: Required annual growth of public and private STI investments to reach 2% of GDP in 2019

Public-Private mix in 2019	Growth of Public STI**	Growth of Private STI**
52.4-45.3*	23%	25%
48-50	22%	26%
45-55	20%	27%
38-60	19%	28%

*Average split for the period 2004-2009; International Resources amounted to 2.3%
**The initial amounts used to calculate this growth rates are the 2008 contributions of the public and private sector respectively
Note: for a yearly GDP growth of 5% in the period 2010-2019
Source: OCyT and authors' calculations

20. For the period 2004-2009, the ratio of private to public resources spent on STI activities was around 0.86, that is, for every peso of public resources spent in STI activities, the private sector invested 0.86 pesos. Assuming that public and private investments in STI would grow smoothly at the yearly rate necessary to reach a 38-60 split in 2019, as in the last row of Table A9.4, the ratio of total private investments to total public investments in the period as a whole should be approximately 1.23.

21. Table A9.5 compares two scenarios, both with a 5 per cent yearly GDP growth: (a) a "current path" scenario in which the pattern and amount of STI investment continues to follow the current pattern of 0.4 per cent of GDP; and (b) an "STI path" scenario that follows the investment pattern necessary to reach 2 per cent of GDP in 2019 with a 38-60 split of public-private resources. The necessary investments in the STI path are 2.4 and 3.6 greater than in the current path for the public and private sector respectively. Furthermore, a multilateral loan of US$500 million (the amount that would be jointly financed by the IDB and WB over a 9 year period) represents 5.7 per cent of the necessary increase in public investment in STI.

Table A9.5: Two scenarios for STI investment

	Total public investments in STI 2010-2019*	Total private investments in STI 2010-2019*	Total investments in STI 2010-2019*	Ratio Private/Public Investments
Current path**	13,633,618	11,089,401	24,723,019	0.8
STI path***	30,868,642	39,459,910	70,328,552	1.3
Difference	17,235,024	28,370,510	45,605,534	1.6
Ratio STI path/ current path	2.3	3.6	2.8	
Multilateral loan	994,500			
Loan/Difference	5.7%			
Loan/Total	3.2%			

*Million Colombian Pesos
** Scenario of 5% yearly GDP growth, 0.4% STI/GDP ratio and 52-45 split in 2019
*** Scenario of 5% yearly GDP growth, 2% STI/GDP ratio and 48-60 split in 2019
Source: OCyT and authors' calculations

22. Two factors will be crucial in achieving the goals set out by the government. First, the extent to which Colombia is able to make the budgetary effort necessary to increase public investment in STI activities, and second the amount of private resources that each dollar of public resources is able to leverage. As shown above, program resources would represent 5.7 per cent of the additional budgetary effort necessary to reach the 2 per cent goal. The Program aims to kick-start a learning process within the public institutions in charge of promoting innovation and, through demonstration effects, increase the leverage achieved by public resources invested in STI in general. Therefore, even though the resources injected by the Program would be small in comparison to the total effort that needs to be exerted, the Program aims to have a catalytic effect of improving the leverage of public resources in general.

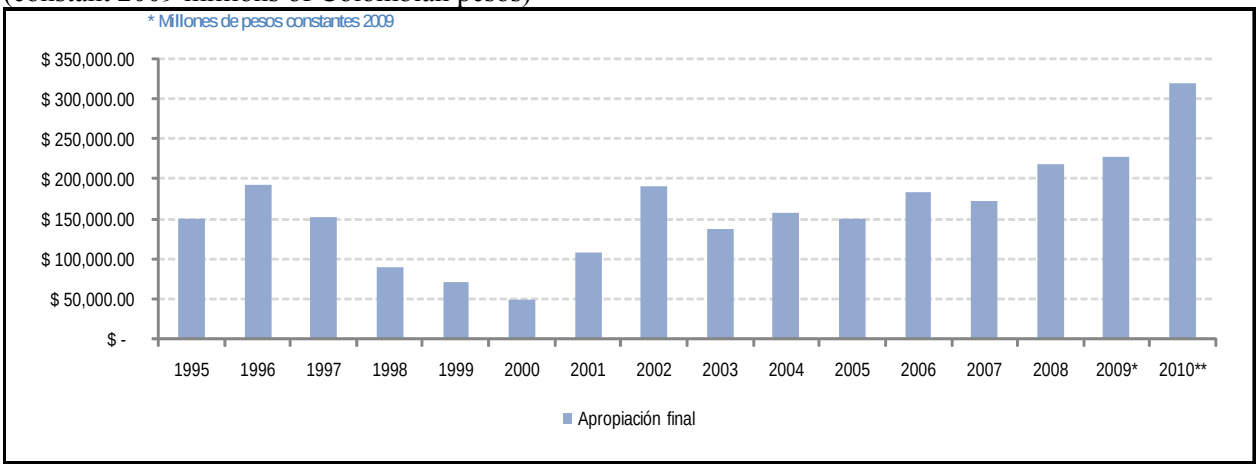
23. On average during 2009, a peso channeled by COLCIENCIAS to R&D and innovation projects through matching grants directly mobilized an additional 1.5 pesos invested by the beneficiaries (firms, universities and research centers) of the projects. It is expected that, as

COLCIENCIAS improves its internal and policy-making capacity and instruments, it will be able to increase the leverage impact its own resources have on the STI investments by the private sector and other public institutions. If COLCIENCIAS manages to leverage at least 1.5 pesos for every peso provided by the multilateral loan, the sum of these resources will represent approximately 5.4 per cent of the additional combined public-private effort necessary to reach the 2 per cent goal by 2019.

How large is COLCIENCIAS' share of total public resources invested in STI activities?

24. In 2008, COLCIENCIAS received nearly a 40 per cent budget increase, making it responsible for 21.5 per cent of public resources channeled to STI activities (see Figure A9.3 and Table A9.6). Furthermore, in the 2004-08 period, the resources invested in STI activities by central government entities grew by 26 per cent while COLCIENCIAS' investment budget increased by 79 per cent in the same period. This budget increase occurred even before the legal developments that established COLCIENCIAS as an Administrative Department and sector coordinator. It is therefore reasonable to expect that its budget will remain above previous levels, that multilateral resources will further boost the budget and that COLCIENCIAS will have a growing influence on how other entities use STI resources. The growing importance of COLCIENCIAS as a sector coordinator and budget executor justifies a large investment in its institutional capacity and the improvement of the instruments it uses to promote research and innovation.

Figure A9.3: Changes in COLCIENCIAS budget, 2004-2009*
(constant 2009 millions of Colombian pesos)



Source: COLCIENCIAS, 2009
* 2004-2008 values are executed budget, the values for 2009 and 2010 are initial budget.

Table A9.6: COLCIENCIAS resources as a share of public investment in STI, 2008

Resources	% of total STI investment	% of public STI investment
Public resources	51%	100%
COLCIENCIAS investment	10%	20.6%
COLCIENCIAS operating	0.4%	0.8%
COLCIENCIAS total	11%	21.5%

Source: OCyT 2009 and authors' calculations

Annex 10: Safeguard Policy Issues

Strengthening the National System of Science, Technology and Innovation

1. The proposed Project is classified as category B. It triggers the Environmental Assessment safeguard policy (OP/BP 4.01) as subprojects in some of the targeted areas (i.e. biofuels, biodiversity, energy and water) for R&D and innovation could be based in rural areas and could potentially have negative environmental impacts . It also triggers the Indigenous Peoples and Afro-descendants safeguard (OP/BP 4.10) as (i) scholarship recipients and researchers benefitting from the Project may come from these population groups, and (ii) R&D subprojects financed by the Project could potentially negatively affect these groups. The Project does not trigger the Involuntary Resettlement safeguard (OP/BP 4.12). During preparation, the World Bank team confirmed that the implementation of the Project components is not expected to require land acquisition or restrict access to resources in protected areas. Finally, consultations were carried out during Project preparation and will continue to be carried out during implementation.

A. Environmental Safeguards

2. This Project falls under Category B as it would finance research and innovation activities in sectors where there could potentially be negative environmental impacts, such as biodiversity, water, bio-fuels, materials and energy. Therefore, it triggers the Environmental Assessment safeguard policy (OP/BP 4.01).

3. An Environmental Management Framework has been developed to address any potential risks. A summary of this framework can be found below. The framework establishes the procedures for screening research and innovation projects to ensure that environmental and social impacts are avoided or mitigated by building on and improving existing procedures. Current procedures require that any subprojects financed by COLCIENCIAS include both an environmental and bioethics declaration. Furthermore, each subproject is subject to an evaluation of environmental impacts. The Environmental Management Framework was published by COLCIENCIAS on April 9, 2010 and by Infoshop on April 22, 2010.

4. In particular, the Environmental Management Framework concluded that the Colombian legal system for environmental protection is robust and has established a number of legal instruments to protect the biodiversity and the environment, including the need to request mandatory governmental permits to carry out a number of specific activities potentially affecting the environment. In addition, COLCIENCIAS operational processes take into consideration the environmental dimension from the call-for-proposals stage to the supervision stage. An environmental assessment of subprojects is part of COLCIENCIAS' operations. Subproject application templates include an environmental plan. Subsequently, the different review and approval instances prior to funding approval, including external expert panels and national and international peer review, take into consideration the soundness of the environmental plan included in the subproject proposals when evaluating subprojects and issue, when appropriate, recommendations for subproject redesign. Finally, once a funding decision has been reached, the contracts signed between COLCIENCIAS and the beneficiaries clearly establish the latter's obligation to follow the Colombian regulation and require the mandatory permits in the implementation of subprojects. Finally, regular subproject monitoring and on-site and field visits

carried out by COLCIENCIAS include a review of environmental aspects and there is a comprehensive, integral audit system that reviews ex-post and selectively specific subprojects, including compliance with the environmental plan.

B. Indigenous Peoples

5. The operation triggers the Indigenous Peoples safeguard policy (OP/BP 4.10) as scholarship recipients and researchers benefitting from the Project may be indigenous peoples or Afro-descendants. Nearly 1.4 million Colombians self-identify as indigenous peoples, representing approximately 3 per cent of the population. Well over half of these indigenous peoples live in *resguardos*, typically rural indigenous areas, and they are disproportionately represented among the poor.

6. During Project preparation, COLCIENCIAS and the World Bank reviewed the planned Project procedures and verified that current operational processes do not present, in any form, a systematic barrier for indigenous peoples or Afro-descendants to access COLCIENCIAS' instruments, which are typically awarded on a competitive and merit basis. In addition, academic experts, who are knowledgeable about the reality of indigenous students and researchers, were consulted on Program design on February 2, 2010. This was to complement regular consultation processes by COLCIENCIAS throughout the planning and implementation of its programs. An agreement was reached for COLCIENCIAS to continue to increase the access of information about COLCIENCIAS' product offerings by beneficiaries and knowledge institutions with a significant representation of indigenous peoples under the Project. The goal would be to ensure that candidates that comply with the merit requirements necessary to either successfully pursue advanced tertiary education or undertake quality research activities can effectively access COLCIENCIAS' Project incentives. In addition, an Indigenous Peoples Planning Framework (IPPF) was prepared by COLCIENCIAS. It reviewed, among other things, the key steps in the competitive funding award process and established the process for screening funding proposals received to be financed under competitive fund mechanisms (see Annex 10). The IPPF was published by COLCIENCIAS on April 15, 2010 and by Infoshop on April 22, 2010.

B.1. Ethnographic Profile of Colombia

B.1.1 Indigenous Peoples

7. According to the population census conducted by the National Statistics Department (DANE), Colombia had a total population of 42.8 million inhabitants in 2005. 14.1 per cent of the total population self-identified as belonging to an ethnic group; 10.6 per cent or 4.3 million identified themselves as Afro-descendants (Afro-Colombians, *Raizales* and *Palenqueros*); 3.4 per cent or 1.39 million identified themselves as indigenous peoples belonging to 87 groups and speaking 67 languages in 30 departments of the country; and 4,858 identified themselves as Roma peoples of itinerant tradition (nomads). The 16 largest indigenous groups, each with more than 10,000 people, add up to 87.3 per cent of the total indigenous population, and of those, the three largest groups (Wayúu, Nasa (Paez) and Pasto) account for 45.5 per cent of the indigenous population. In total, there are 36 groups with more than 2,000 people and 51 distinctive groups with fewer than 2,000 people. The detail of this distribution is shown in Table A10.1 below. The Colombian Constitution (1991) recognizes the pluri-ethnic and multi-cultural nature of its population, and the equal rights to education of vulnerable groups.

8. Indigenous peoples hold title to a substantial portion of Colombian territory, primarily in the form of 722 reserves, o*r resguardos,* which account for 29.8 per cent of the territory of Colombia. They are located in 228 municipalities and 27 departments*. Resguardos* are home to 800,270 indigenous people (67,500 families) and are geographically distributed as follows: 88 in the Amazon Region (5,619 families), 104 in the Central Region (5,224 families), 31 in the North (25,299 families), and 238 on the Pacific Coast (22,948 families). Table A10.2 below provides the distribution of indigenous population by region. The departments with the largest indigenous population are: Vaupés (67 per cent), Guainía (65 per cent), Guajira (45 per cent), Vichada (44 per cent) and Amazonas (43 per cent). About 66 per cent of the indigenous live in the departments of La Guajira, Cauca, Nariño, Córdoba and Sucre. Only a minority of the indigenous population live in municipal capitals and urban centers. It is calculated that some 592,000 indigenous peoples do not live i*n resguardos*.

Table A10.1 Ethnic Groups, Location, Population and Native Language/linguistic family (2001)

	Major Ethnic Groups	Location	Population	%	L1 (linguistic family)
1	Wayuu	Dept. Guajira. Plus displaced in Sta Marta, Barranquilla	149,827	19.0	Wayu (Arawak)
2	Nasa (Paez)	Depts Tolima, Huila, Cauca. Plus Displaced in Putumayo, Caqueta, Meta	138,501	17.6	Paez
3	Pasto	Dept Nariño (Southern Andes)	69,789	8.8	Spanish
4	Emberá	Dept Chocó, Cauca, Valle del Cauca, Nariño, Caldas, Risaralda, Antioquia. Plus displaced in Bolívar, Caquetá, Córdoba, Putumayo, Bocayá.	49,686	6.3	Emberá Chamí, Eyábida, Dóbida,
5	Señú	Dept Córdoba, Antioquia, Sucre, Chocó	34,566	4.4	Spanish
6	Emberá Katío	Dept Antioquia, Cordoba, Chocó	32,899	4.1	Katio
7	Mokaná	Dept Atlántico	27,973	3.4	Spanish
8	Cañamomo	Dept Caldas	26,083	3.3	Spanish
9	Pijao	Dept Tolima, Huila, Cauca.	24,633	3.1	Spanish
10	Guambiano	Dept Cauca, Huila.	23,462	2.9	n/a
11	Sikuani	Dep. Vichada, Meta, Arauca, Casanare, Guaviare.	23,066	2.9	Guahibo
12	Yanacona	Dep. Meta	21,457	2.7	Spanish
13	Inga	Dep. Putumayo, Nariño. Migrants to Dept. Cauca y ciudades Cali, Bogotá, Cúcuta, Arauca, Medellín.	19,079	2.4	Quechua
14	Awá	Dept Nariño, Putumayo	15,364	1.9	n/a
15	Kankuamo	Dep. Cesar y Dep. Magdalena	15,000	1.9	Spanish
16	Ijka or Arhuaco	Dep. Cesar, Magdalena, Guajira.	14,799	1.9	Ika or Arhuaca (Chibcha)
17	Kogui	Guajira, Magdalena, César	9,911	1.2	(Chibcha)
18	Wounan	Chocó, Valle, Nariño	8,177	1.0	Wounan
19	Kurripako	Dept Vichada, Guainia, Vaupes, Guaviare	7,827	0.9	Arawak
20	Uitoto	Dep. Amazonas, Dep. Caquetá, Putumayo	7,343	0.9	(Uitoto)
21	U'wa O	Dept Boyacá, Santander, Casanare, Arauca	7,231	0.9	U'wa (Chibcha)

	Major Ethnic Groups	Location	Population	%	L1 (linguistic family)
	Tunebo				
22	Tikuna	Dep. Amazonas	7,102	0.9	n/a
23	Tukano	Dept. Vaupes. Displaced in Dept Guainía, Guaviare	6,996	0.8	Tukano Oriental
24	Coconuco	Dept Cauca	6,767	0.8	Spanish
25	Kubeo	Dep. Amazonas, Dept. Vaupes. Displaced in Guainía, Guaviare	6,647	0.8	Tukano Medio
26	Puinave	Depts Guaviare, Guainia	6,694	0.8	Maku-Puinave
27	Embera Chamí	Dept Risaralda, Valle, Antioquia	5,511	0.7	Emberá
28	Piapoko	Dep. Vichada, Guainía. Orinoco	4,926	0.6	Arawak
29	Kamëntsa	Dpt Putumayo	4,773	0.6	n/a
30	Totoroe	Dept Cauca	4,130	0.5	(Chibcha)

Source: DANE, post-census 2001 in *Los Pueblos Indígenas de Colombia*. 2004

Table A10. 2: Location of Indigenous Peoples by Region and Department

Region	Departments	Indigenous Population
TOTAL		**1,392,623**
Amazonia	Amazonas, Caquetá, Guainía, Guaviare, Vaupés, Putumayo	86,417
Orinoquia	Arauca, Casanare, Meta, Vichada	33,349
Pacific/ Central	Antioquia, Cauca, Nariño, Quindío, Risaralda, Valle, Chocó, Caldas	574,759
Caribe-Atlantic	César, Magdalena, Atlántico, La Guajira, Santander, Sucre, Córdova	596,476
Central	Boyacá, Cundinamarca, North Santander, Tolima, Huila.	86,589
Bogotá D.C.		15,033

Source: ONIC (regions), DANE 2005 (population)

B.1.2. Afro-descendant Population

9. The Afro-descendant population in Colombia amounts to 4,311,757 inhabitants, approximately 10.6 per cent of the total population. They are self-identified as members of three groups: Afro-Colombians (4,277,848), *Raizales* (30,377) and *Palenqueros* (3,532). The *Afro-Colombians* are spread all over the country but concentrated in the departments of Antioquia, and the Pacific and Atlantic Coasts. As can be observed in table A10.3, the majority of the Afro-descendant population lives in urban areas (73 per cent) and is mostly concentrated in 5 cities: Bogotá, Cali, Medellin, Barranquilla and Cartagena.

Table A10.3: Afro-Colombian Peoples concentrate in four urban centers

City	Population	%	Urban Center	Other
Bogota – Soacha	535,381	16.08	533,739	1,642
Cali and South of Valley	967,917	29.08	901,027	66,890
Medellin and Aburra Valley	534,097	16.04	505,795	28,302
Barranquilla metropolitan area	506,265	15.20	494,257	12,008
Cartagena and North of Bolivar	785,050	23.60	607,521	177,529
Total	**3,328,710**	**100**	**3,042,339**	**286,371**

10. Around 27 per cent of the Afro-descendant population lives in rural areas identified as areas of extreme poverty and experience a lower level of education and health coverage and a higher level of unemployment (Table A10.4). On the Pacific coast, they are concentrated in collective lands called *Tierras de Comunidades Negras* (Collective Territories of Black Communities, *TCCN*) (Law 70, 1993, INCODER) particularly in watersheds on the Pacific coasts. They live in 1,219 communities spread along 132 TCCNs occupying 4.7 million ha. or 4.13 per cent of the country's territory. Some 57.3 per cent of the Afro-Colombian peoples are concentrated in the Valle del Cauca (25 per cent), Antioquia (15 percent), Bolívar (11.6 per cent) and Chocó (6.6 per cent). The *Raizal* live in the departments of San Andres and Providencia and speak creole and patua - Anglo-Caribbean languages). The *Palenqueros* live mainly in San Basilio, Cartagena, Barranquilla, and Maicao.

Table A10.4: Comparison of Quality of Life Indicators. Afro-Colombian and the rest of population

Variable	Afro-Colombian	Rest of population
Population 2003	3,448,389	40,269,190
% population in SISBEN 1 & 2	72	54
% of population in income quintiles 1 & 2	49	40
% of unemployment	14	11
% assistance ICBF	26	15
% coverage of primary education	86	87
% coverage of secondary education	62	75
% coverage of tertiary education	14	26
% population without health insurance	51	35
% population receiving subsidies	21	23
% population paying taxes	25	36
% population are home-owners	62	55

Source: DANE, ECV 2003
SISBEN: National system of identification of potential beneficiaries of social programs
ICBF: Colombian Institute for Family Wellbeing

B.2. Legal framework

- National Constitution, Art. 357, establishes rules for the distribution of social spending to departments and municipalities. It establishes that 60 percent of spending be distributed in direct proportion to the number of people with unsatisfied basic needs (NBI Index).
- Law 60 (1993), Art. 30 defines targeting and provides formulas for distribution of resources for social spending in territorial entities to be applied since 1994.
- Law 715 (2001), Art. 94 defines general elements for targeting of social spending and provides recommendations to review targeting criteria every three years. Also, it mandates municipalities to allocate resources for updating of the system of identification of potential beneficiaries of social programs, SISBEN.
- In 1991, Colombia ratified the International Labor organization (ILO) Convention 169 on Indigenous Peoples and Tribal groups, law 21, Part I, Art 2,3; and Part VI, Art 26 to 30 refers to education among ethnic groups.
- Decree 1122 (1998) refers to the development of the Afro-descendant Studies.

B.3 Summary of COLCIENCIAS' Indigenous People's Planning Framework

11. During Project preparation, the COLCIENCIAS and World Bank team reviewed the planned Project procedures and verified that current operational processes do not present, in any form, a systematic barrier for indigenous peoples or Afro-descendants to access COLCIENCIAS' instruments, which are awarded on a competitive and merit basis. In addition, academic experts, who are knowledgeable about the reality of indigenous students and researchers, were consulted on Program design on February 2, 2010. This was to complement regular consultation processes that COLCIENCIAS regularly carries out in the planning and implementation of its programs. An agreement was reached with COLCIENCIAS to ensure that information about COLCIENCIAS' product offerings are adequately communicated and reach potential beneficiaries and knowledge institutions with a significant representation of indigenous peoples, to ensure that candidates that comply with the merit requirements necessary to either successfully pursue advanced tertiary education or undertake quality research activities, can effectively access COLCIENCIAS' services. In addition COLCIENCIAS prepared an Indigenous Peoples Planning Framework (IPPF) that reviewed key steps in the competitive funding award process and identified those where attention to Afro-descendant access should be increased. The IPPF was published by COLCIENCIAS on April 15, 2010.

C. Involuntary Resettlement

12. During preparation, the World Bank team confirmed that the implementation of the Project components is not expected to require land acquisition or restrict access to resources in protected areas and that the Involuntary Resettlement safeguard (OP/ BP 4.12), therefore is not triggered. COLCIENCIAS undertakes that no physical or economic involuntary displacement of people (as interpreted with OP/BP 4.12) shall take place as a consequence of Project implementation.

D. Participation and Consultation Activities

13. The World Bank-organized **International Forum on Human Capital and Science, Technology and Innovation** held in Bogota on **April 28, 2009** in collaboration with the Ministry of Education, the *Departamento Administrativo de Ciencia, Tecnología e Innovación "Francisco José de Caldas"* (*COLCIENCIAS)* and the *Departamento Nacional de Planeación* (National Planning Department), became an important meeting point for international and national experts to discuss key sector issues and develop a list of actionable recommendations for the country**.** Participating entities included representatives from civil society, government, academia and the private sector. The Forum's conclusions became relevant input to the preparation of the proposed operation. Table A10.5 below provides a complete list of participating entities.

Table A10.5: Participants of the International Forum on Human Capital and Science, Technology and Innovation

Acción Social	Instituto Tecnológico de Educación Superior de
Agencia de Desarrollo Económico Local (ADEL	Comfacauca
METROPOLITANA)	Instituto Tecnológico de Soledad Atlántico ITSA)
Alianza Manufacturera de los Santanderes	Instituto Tecnológico del Putumayo
Alianza Team	International Finance Corporation (IFC)
ALPINA	Inversiones ManuelitaIncubadora de Empresas de Base
ANDI	Tecnológica de Antioquia
Artesanías de Colombia	Independence Drilling
Banco Mundial	Institución Universitaria Antonio José Camacho
Bancolombia	Institución Universitaria de Envigado
British Petroleum	Instituto Colombiano de Bienestar Familiar (ICBF)
CAFAM - Caja de Compensación Familiar	Instituto de Educación Técnica Profesional de
Cámara de Comercio de Bogotá	Roldanillo
Carvajal	Ladrillera Santa Fe
CEMEX	Maloka
CENDEX - Centro de Proyectos para el Desarrollo	MAVDT-Ministerio de Ambiente, Vivienda y
Centro de Diagnostico Urológico Travel Medic	Desarrollo Territorial
Centro de Liderazgo y Gestión	McKinsey
Chaid Neme Hermanos S.A.	Merck Sharp & Dohme
CINDE-Centro Internacional de Educación y Desarrollo	Microsoft
Humano	Ministerio de Agricultura y Desarrollo Rural
COLCIENCIAS	Ministerio de Comercio, Industria y Turismo
Colegio Integrado Nacional Oriente de Caldas	Ministerio de Comunicaciones
Colegio Mayor de Nuestra Señora del Rosario	Ministerio de Educación Nacional
Colombit	Ministerio de Hacienda y Crédito Púbico
Comité Universidad Empresa Antioquia	Ministerio de Industria, Comercio y Turismo
Comité Universidad Empresa Bogotá	Nacional de Chocolates
Comité Universidad Empresa Caribe	Observatorio Colombiano de Ciencia y Tecnología
Comité Universidad Empresa Cauca-Nariño	Oportunidad Estratégica
Comité Universidad Empresa Eje Cafetero	Organización Corona
Comité Universidad Empresa Santander	Promigas
Comité Universidad Empresa Tolima-Huila	Red Assist
Comité Universidad Empresa Valle	Revista Dinero
CONALGODÓN	SAC
Conconcreto	Secretaría de Educación de Risaralda
Confecámaras	Securitec
Consejo Privado de Competitividad	Servicio Nacional de Aprendizaje (SENA)
Convenio Andrés Bello	Smurfit Kappa Carton de Colombia
Corporación Financiera Internacional	Sociedades Bolivar
Departamento Nacional de Planeación (DNP)	Suramericana
Escuela Colombiana de Ingeniería "Julio Garavito"	UCC
Escuela Naval de Suboficiales ARC Barranquilla	UMB-ITAE
Experto Sectorial - Universidad de los Andes	Uniminuto Corporación Universitaria Minuto de Dios
FD Gravitas	Universidad Javeriana de Cali
Fedegan	Universidad Autonoma de Bucaramanga (UNAB)
FEDEPALMA	Universidad Autonoma de Occidente
Federación Nacional de Cafeteros	Universidad de Antioquia
FEDESARROLLO	Universidad de Caldas
Fondo de Fomento a la educación media (FEM)	Universidad de Cartagena
Fundación Corona	Universidad de EAFIT
Fundación Dis	Universidad de la Sabana
Fundación Empresarios por la Educación	Universidad de la Salle
Fundación Escuela Nueva Volvamos a la Gente	Universidad de los Andes
Fundación Manuel Mejía - Federación Nacional de	Universidad de los Llanos

Cafeteros	Universidad del Rosario
Fundación Sociedad Portuaria Regional de Buenaventura	Universidad del Tolima
Fundación Universidad del Norte	Universidad del Tolima
Fundación Universitaria CAFAM	Universidad del Valle
Fundación Universitaria Católica del Norte	Universidad Externado de Colombia
Fundación Universitaria de San Gil	Universidad Francisco de Paula Santander (UFPS)
Fundación Universitaria Panamericana	Universidad Industrial de Santander
Fundación UniversitariaTecnológico Comfenalco	Universidad Javeriana
Grupo Argos	Universidad Manuela Beltrán, Seccional Bucaramanga
Grupo Sanford	Universidad Minuto de Dios
Harinera del Valle	Universidad Nacional Abierta y a Distancia (UNAD)
ICESI	Universidad Nacional de Colombia
ICETEX	Universidad Pontificia Bolivariana
ICFES	Universidad Santo Tomás Tunja
(INTEP)	Universidad Tecnológica de Pereira
Inversiones Mundial	UPME-Unidad de Planeación Minero Energética
Kpmg	USAID-MIDAS

D.2 Participation in the Forum on Science, Technology and Innovation organized by the Ministry of Education

14. On June 2 and 3, 2009 representatives from the World Bank participated as discussants in the International Forum on Science, Technology and Innovation organized by the Ministry of Education and COLCIENCIAS. Presentations were delivered on "*World Class Universities*" and "*Recent International Experiences in STI funding.*" The Forum gathered more than 20 international experts and over 1,000 Colombian participants, including representatives from academia, research centers and the private sector, and was an opportunity to engage in discussions about the challenges that the new law for Science, Technology and Innovation brings about for Colombia, in particular in relation to COLCIENCIAS' institutional transformation into an Administrative Department and the launch of the new STI fund Francisco José de Caldas. Over the course of the seminar, COLCIENCIAS announced the upcoming launch of its new postgraduate scholarship *Bicentenario* program.

Annex 11: Project Preparation and Supervision
Strengthening the National System of Science, Technology and Innovation

	Planned	Actual
PCN review	12/02/2009	12/04/2009
Initial PID to PIC	1/2/2010	01/19/2010
Initial ISDS to PIC	1/2/2010	01/21/2010
Appraisal	2/15/2010	04/23/2010
Negotiations	04/05/2010	06/01/2010
Board/RVP approval	07/13/2010	
Planned date of effectiveness	10/01/2010	
Planned date of mid-term review	06/30/2012	
Planned closing date	12/31/2013	

Key institutions responsible for preparation of the project: *Departamento Administrativo de Ciencia, Tecnología e Innovación* (COLCIENCIAS)

Bank staff and consultants who worked on the project included:

Name	Title	Unit
Alejandro Caballero	Task Team Leader	LCSHE
Thomas Haven	Private Sector Development Specialist	LCSPF
John Gabriel Goddard	Economist	ECSF1
Maria Retana de la Peza	Economist (JPA)	LCSHE
Juan Carlos Serrano-Machorro	Financial Management Specialist	LCSFM
Gabriel Penaloza	Procurement Specialist	LCSPT
Tatiana Proskuryajova	Senior Operations Officer	LCSHE
Reynaldo Pastor/Carlos Escudero/Teresa Genta-Fonz	Country Lawyer	LEGLA
Jose C. Janeiro	Sr. Finance Officer	CTRFC
Kristine Ivarsdotter	Sr. Social Specialist	LCSSO
Carlos Vargas	Environ mental Specialist (Consultant)	LCSEN
Monica L. Parra	Consultant	LCSHE
Rachel Sorey	Consultant	LCSHE
Juan Julio Gutierrez	Consultant	LCSHE
Marcela Cardenas	Consultant	LCSHE
María Colchao	Senior Program Assistant	LCSHE
Antonella Novali	Program Assistant	LCSHE
Elsa Coy	Program Assistant	LCCCO

Bank funds expended to date on project preparation: US$ 409,654
Estimated Approval and Supervision costs:
Remaining costs to approval: US$5, 630
Estimated annual supervision costs: US$100,000

Annex 12: Documents in the Project File

Strengthening the National System of Science, Technology and Innovation

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Annex 13: Statement of Loans and Credits

Strengthening the National System of Science, Technology and Innovation

			Original Amount in US$ Millions						Difference between expected and actual disbursements	
Project ID	FY	Purpose	IBRD	IDA	SF	GEF	Cancel.	Undisb.	Orig.	Frm. Rev'd
P106708	2010	CO Social DPL	500.00	0.00	0.00	0.00	0.00	500.00	0.00	0.00
P106628	2010	CO Consolidation of Nat. Publ Mgmt Inf.	25.00	0.00	0.00	0.00	0.00	22.41	-2.59	0.00
P101279	2010	CO Solid Waste Management Program Projec	20.00	0.00	0.00	0.00	0.00	18.00	-1.00	0.00
P083904	2010	CO - Justice Services Strenghtening	20.00	0.00	0.00	0.00	0.00	20.00	0.00	0.00
P099139	2009	CO Strength. Public Info, M&E for RMgmt.	8.50	0.00	0.00	0.00	0.00	6.63	0.50	0.00
P113084	2009	CO Disaster Risk Mgmt CAT DDO	150.00	0.00	0.00	0.00	0.00	150.00	0.00	0.00
P101211	2009	CO Second Social Safety Net Project	636.50	0.00	0.00	0.00	0.00	257.80	185.37	0.00
P082908	2008	CO (APL2) Rural Education APL II	40.00	0.00	0.00	0.00	0.00	37.00	11.98	0.00
P104567	2008	CO-Second Rural Productive Partnerships	30.00	0.00	0.00	0.00	0.00	19.09	-2.75	0.00
P105164	2008	CO-(APL)Second Student Loan Support Proj	300.00	0.00	0.00	0.00	0.00	168.06	68.06	0.00
P052608	2008	CO- Antioquia Secondary Education Projec	20.00	0.00	0.00	0.00	0.00	17.53	4.13	0.00
P096965	2007	CO (APL1) La Guajira Water and Sanit.	90.00	0.00	0.00	0.00	0.00	90.00	58.33	0.00
P082520	2006	CO Sustainable Development Inv Project	7.00	0.00	0.00	0.00	0.00	0.54	0.54	0.00
P085727	2006	CO-(APL2) Disaster Vulnerability Reduct.	80.00	0.00	0.00	0.00	2.45	71.47	73.41	73.41
P082429	2005	CO-(APL1)Disaster VulnerabilityReduction	260.00	0.00	0.00	0.00	150.00	29.02	12.05	0.00
P082167	2005	CO Agricultural Transition Project	30.00	0.00	0.00	0.00	0.00	0.92	-0.28	0.00
P082466	2004	CO Integrated Mass Transit Systems	757.00	0.00	0.00	0.00	0.06	89.04	-417.91	0.00
P051306	2004	CO 1st APL PEACE AND DEV	37.81	0.00	0.00	0.00	0.00	7.81	0.00	0.00
P074726	2003	CO Bogota Urban Services Project	130.00	0.00	0.00	0.00	0.00	33.48	3.48	23.14
		Total:	3,141.81	0.00	0.00	0.00	152.51	1,538.80	- 6.68	96.55

COLOMBIA
STATEMENT OF IFC's
Held and Disbursed Portfolio
In Millions of US Dollars

		Committed				Disbursed			
		IFC				IFC			
FY Approval	Company	Loan	Equity	Quasi	Partic.	Loan	Equity	Quasi	Partic.
2003	AAA	18.24	0.00	0.00	0.00	18.24	0.00	0.00	0.00
2002	BCSC	0.00	7.00	0.00	0.00	0.00	7.00	0.00	0.00
2006	BCSC	0.00	12.78	0.00	0.00	0.00	12.78	0.00	0.00
2001	CHMC	23.92	10.09	0.91	0.00	4.05	5.27	0.91	0.00
2004	Cartones America	19.86	0.00	0.00	0.00	19.86	0.00	0.00	0.00
2004	Carvajal S.A.	35.00	0.00	35.00	0.00	15.00	0.00	26.73	0.00
2006	Carvajal S.A.	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2001	Cementos Caribe	2.02	0.00	0.00	2.59	2.02	0.00	0.00	2.59
2003	DAVIVIENDA I	19.27	10.00	0.00	0.00	19.27	8.80	0.00	0.00
2006	DAVIVIENDA I	0.00	15.00	35.00	0.00	0.00	13.20	0.00	0.00
2006	Fundacion Soc...	0.00	0.00	50.00	0.00	0.00	0.00	0.00	0.00
2006	Interbolsa	14.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2002	Inversura	0.00	15.00	0.00	0.00	0.00	15.00	0.00	0.00
2002	Omimex Oil	0.00	0.00	5.00	0.00	0.00	0.00	5.00	0.00
2006	Petrotesting	0.00	15.00	0.00	0.00	0.00	9.00	0.00	0.00
2006	Promigas	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2002	Proteccion	0.00	10.00	0.00	0.00	0.00	10.00	0.00	0.00
	SIE	0.00	0.20	0.00	0.00	0.00	0.20	0.00	0.00
2002	SIG	42.00	0.00	0.00	0.00	42.00	0.00	0.00	0.00
	WWB Cali	8.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	WWB Popayan	5.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total portfolio:	288.35	95.07	125.91	2.59	120.44	81.25	32.64	2.59

		Approvals Pending Commitment			
FY Approval	Company	Loan	Equity	Quasi	Partic.
2001	CHMC	0.00	0.02	0.00	0.00
2004	Bancafe	0.00	0.02	0.00	0.00
2006	Interbolsa	0.00	0.01	0.00	0.00
2006	Petrotesting	0.02	0.00	0.00	0.00
2006	Promigas Corp	0.00	0.00	0.00	0.04
2006	WWB Facility COL	0.02	0.00	0.00	0.00
	Total pending commitment:	0.04	0.05	0.00	0.04

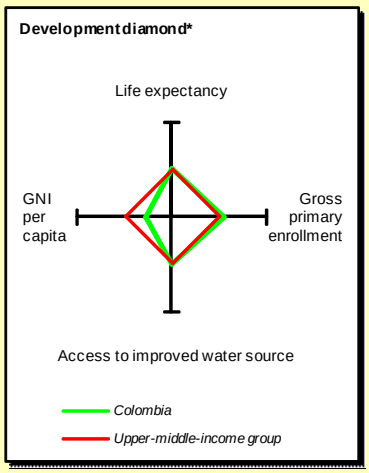
Annex 14: Country at a Glance

Strengthening the National System of Science, Technology and Innovation

Colombia at a glance

12/9/09

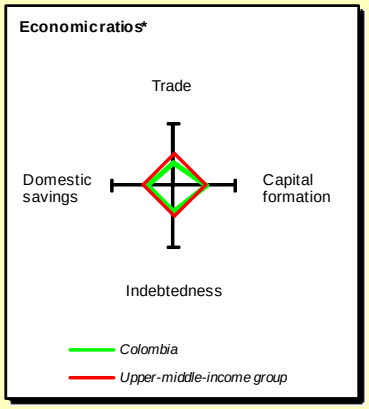
POVERTY and SOCIAL	Colombia	Latin America & Carib.	Upper-middle-income
2008			
Population, mid-year *(millions)*	45.0	565	949
GNI per capita *(Atlas method, US$)*	4,620	6,781	7,878
GNI *(Atlas method, US$ billions)*	207.9	3,833	7,472
Average annual growth, 2002-08			
Population *(%)*	1.5	1.2	0.8
Labor force *(%)*	2.6	2.2	1.7
Most recent estimate (latest year available, 2002-08)			
Poverty *(% of population below national poverty line)*	..	..	..
Urban population *(% of total population)*	74	79	75
Life expectancy at birth *(years)*	73	73	71
Infant mortality *(per 1,000 live births)*	16	22	21
Child malnutrition *(% of children under 5)*	5	5	..
Access to an improved water source *(% of population)*	93	91	94
Literacy *(% of population age 15+)*	93	91	94
Gross primary enrollment *(% of school-age population)*	120	117	110
Male	120	119	112
Female	120	115	108



KEY ECONOMIC RATIOS and LONG-TERM TRENDS

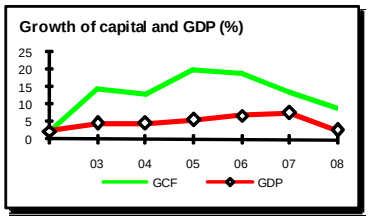
	1988	1998	2007	2008
GDP *(US$ billions)*	39.2	98.5	207.8	243.8
Gross capital formation/GDP	20.6	19.7	24.3	24.7
Exports of goods and services/GDP	16.3	15.0	16.9	18.2
Gross domestic savings/GDP	23.1	13.8	20.2	21.2
Gross national savings/GDP	21.5	12.8	18.9	19.2
Current account balance/GDP	-0.5	-4.9	-2.8	-2.8
Interest payments/GDP	3.9	2.0	1.4	1.3
Total debt/GDP	43.4	33.6	21.2	19.2
Total debt service/exports	44.2	31.0	21.3	17.2
Present value of debt/GDP	..	..	22.1	18.2
Present value of debt/exports	..	..	113.2	96.1

	1988-98	1998-08	2007	2008	2008-12
(average annual growth)					
GDP	3.8	4.1	7.5	2.5	2.1
GDP per capita	1.9	2.4	6.0	1.0	-0.3
Exports of goods and services	6.7	5.1	11.4	7.0	6.1

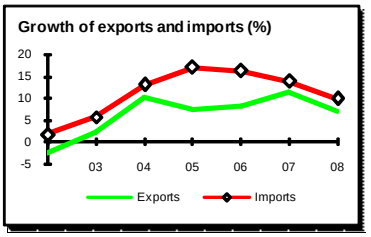


STRUCTURE of the ECONOMY

	1988	1998	2007	2008
(% of GDP)				
Agriculture	17.4	14.3	8.9	8.6
Industry	37.6	28.4	35.5	36.5
Manufacturing	21.9	15.1	17.6	16.0
Services	45.0	57.4	55.6	54.9
Household final consumption expenditure	68.3	65.3	63.3	62.5
General gov't final consumption expenditure	8.6	20.8	16.6	16.3
Imports of goods and services	13.9	20.9	21.0	21.7



	1988-98	1998-08	2007	2008
(average annual growth)				
Agriculture	-1.8	2.2	3.9	2.7
Industry	3.0	3.1	8.1	0.7
Manufacturing	-1.3	4.1	9.5	-1.8
Services	4.4	4.7	7.3	3.3
Household final consumption expenditure	0.2	4.5	7.6	2.3
General gov't final consumption expenditure	9.8	3.8	4.5	1.3
Gross capital formation	7.3	9.4	13.7	8.8
Imports of goods and services	15.0	8.2	13.9	9.8



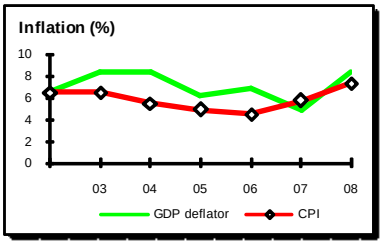
Note: 2008 data are preliminary estimates.

This table was produced from the Development Economics LDB database.

* 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.

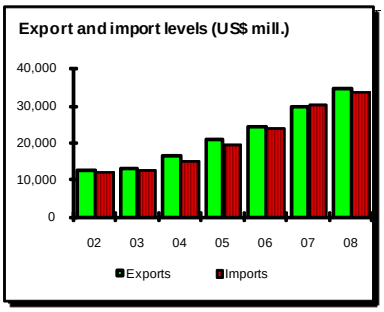
PRICES and GOVERNMENT FINANCE

	1988	1998	2007	2008
Domestic prices				
(% change)				
Consumer prices	28.1	16.7	5.7	7.3
Implicit GDP deflator	27.8	14.8	4.8	8.3
Government finance				
(% of GDP, includes current grants)				
Current revenue	21.8	27.7	25.7	25.3
Current budget balance	4.7	4.3	4.1	3.5
Overall surplus/deficit	-2.2	-4.0	-0.8	-0.3



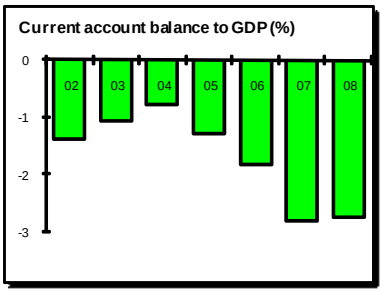
TRADE

	1988	1998	2007	2008
(US$ millions)				
Total exports (fob)	5,439	10,866	29,381	34,402
Coffee	1,641	1,893	1,714	..
Petroleum products	987	2,329	7,318	..
Manufactures	1,134	4,100	11,955	13,317
Total imports (cif)	5,005	14,633	30,100	33,894
Food	246	1,693	2,819	..
Fuel and energy	178	305	908	..
Capital goods	1,744	5,575	9,134	10,363
Export price index *(2000=100)*	..	..	147	160
Import price index *(2000=100)*	..	..	114	125
Terms of trade *(2000=100)*	..	..	129	129



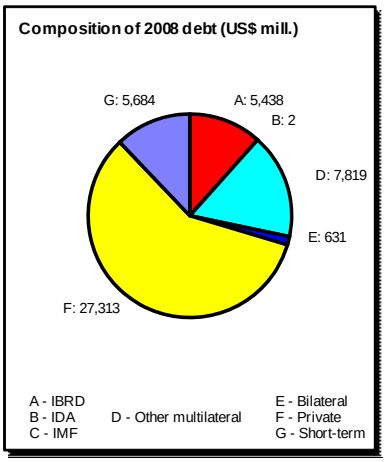
BALANCE of PAYMENTS

	1988	1998	2007	2008
(US$ millions)				
Exports of goods and services	6,761	12,885	34,213	42,579
Imports of goods and services	6,364	17,033	37,416	44,743
Resource balance	397	-4,148	-3,203	-2,165
Net income	-1,576	-1,682	-7,847	-10,063
Net current transfers	964	589	5,231	5,514
Current account balance	-215	-4,858	-5,819	-6,713
Financing items (net)	-144	6,248	1,105	4,075
Changes in net reserves	359	-1,390	4,714	2,638
Memo:				
Reserves including gold *(US$ millions)*	..	8,740	20,952	24,794
Conversion rate *(DEC, local/US$)*	299.2	1,426.0	2,078.3	1,967.7



EXTERNAL DEBT and RESOURCE FLOWS

	1988	1998	2007	2008
(US$ millions)				
Total debt outstanding and disbursed	17,016	33,085	43,956	46,887
IBRD	3,898	1,740	4,756	5,438
IDA	16	9	2	2
Total debt service	3,298	4,528	8,647	7,941
IBRD	665	347	688	399
IDA	1	1	1	1
Composition of net resource flows				
Official grants	36	64	521	733
Official creditors	334	178	220	1,833
Private creditors	292	175	2,999	532
Foreign direct investment (net inflows)	203	2,829	9,049	10,600
Portfolio equity (net inflows)	0	47	790	-86
World Bank program				
Commitments	315	227	632	2,074
Disbursements	485	184	564	847
Principal repayments	339	233	432	159
Net flows	146	-48	132	688
Interest payments	326	115	256	241
Net transfers	-181	-164	-124	448



Note: This table was produced from the Development Economics LDB database. 12/9/09

Annex 15: Map IBRD 33388

Strengthening the National System of Science, Technology and Innovation