

A dark blue silhouette of the state of São Paulo, Brazil, is centered on the page. The text is overlaid on this map.

SCIENCE, TECHNOLOGY &
INNOVATION INDICATORS
IN THE STATE OF SÃO PAULO/
B R A Z I L – 2 0 1 0

VOLUME 1



São Paulo, Brazil – 2011



**SCIENCE, TECHNOLOGY &
INNOVATION INDICATORS
IN THE STATE OF SÃO PAULO/
B R A Z I L – 2 0 1 0**

(In 2010)

Governor of São Paulo State

José Serra (until April 2, 2010)
Alberto Goldman (beginning April 2, 2010)

Secretary of Higher Education

Carlos Vogt

São Paulo Research Foundation (FAPESP)

President

Celso Lafer

Vice-President

José Arana Varela (until July 23, 2010)
Eduardo Moacyr Krieger (beginning November 30, 2010)

Board of Trustees

Celso Lafer
Eduardo Moacyr Krieger
Herman Jacobus Cornelis Voorwald
Horacio Lafer Piva
José Arana Varela (until July 23, 2010)
José de Souza Martins
José Tadeu Jorge
Luiz Gonzaga Belluzzo
Maria José Soares Mendes Giannini (beginning July 23, 2010)
Sedi Hirano
Suely Vilela Sampaio
Vahan Agopyan
Yoshiaki Nakano

Executive Board

Chief Executive Officer

Ricardo Renzo Brentani

Scientific Director

Carlos Henrique de Brito Cruz

Administrative Director

Joaquim José de Camargo Engler



**SCIENCE, TECHNOLOGY &
INNOVATION INDICATORS
IN THE STATE OF SÃO PAULO/
B R A Z I L – 2 0 1 0**

(In 2011)

Governor of São Paulo State
Geraldo Alckmin

Secretary of Economic Development, Science & Technology

Guilherme Afif Domingos (until April 26, 2011)

Paulo Alexandre Barbosa (beginning May 2, 2011)

São Paulo Research Foundation (FAPESP)

President

Celso Lafer

Vice-President

Eduardo Moacyr Krieger

Board of Trustees

Celso Lafer

Eduardo Moacyr Krieger

Herman Jacobus Cornelis Voorwald

Horacio Lafer Piva

José de Souza Martins

José Tadeu Jorge

Luiz Gonzaga Belluzzo

Maria José Soares Mendes Giannini

Sedi Hirano

Suely Vilela Sampaio

Vahan Agopyan

Yoshiaki Nakano

Executive Board

Chief Executive Officer

Ricardo Renzo Brentani

Scientific Director

Carlos Henrique de Brito Cruz

Administrative Director

Joaquim José de Camargo Engler

Indicators of Science, Technology & Innovation in São Paulo 2010

Editorial Production

Coordination

Carlos Henrique de Brito Cruz

Executive Production

Maria da Graça Mascarenhas

Production Assistance

José Tadeu Arantes

Copy Editing & Technical Revision

Flávia Gouveia

Milena Yumi Ramos

Oficina Editorial

Translation

Kevin Mundy

Proofreading

Kendra Johnson

Maya Johnson

Graphic Design, Layout & Final Artwork

2 estúdio gráfico

Figures

Arthur Kenji

Maps

Sírio J. B. Cansado

Cataloging-in-publication by FAPESP Documentation
and Information Center

Science, technology & innovation indicators in the State of São Paulo/ Brazil - 2010 / [general coordination Ricardo Renzo Brentani; Carlos Henrique de Brito Cruz ; executive coordination Wilson Suzigan, João Eduardo de Moraes Pinto Furtado, Renato de Castro Garcia] - São Paulo : FAPESP, 2011.

Translation from: Indicadores de ciência, tecnologia e inovação em São Paulo 2010

Translated by: Kevin Mundy

Reviewed by: Kendra Johnson, Maya Johnson

Mode of access: World Wide Web

ISBN

1. São Paulo Research Foundation. 2. Research and development - São Paulo. 3. Science. 4. Technology. 5. Technological innovation. I. Brentani, Ricardo Renzo. II. Cruz, Carlos Henrique de Brito.

01/12

CDD 507.208161

Legal deposit at National Library, Brazil, according to Law n.º 10,994, December 14, 2004.



SCIENCE, TECHNOLOGY & INNOVATION INDICATORS IN THE STATE OF SÃO PAULO/ B R A Z I L – 2 0 1 0

General Coordination

Ricardo Renzo Brentani (from 2007 until December 2009)

Carlos Henrique de Brito Cruz (beginning January 2010)

Executive Coordination

Wilson Suzigan

João Eduardo de Moraes Pinto Furtado

Renato de Castro Garcia

Technical Staff

Milena Yumi Ramos

Technical Support

Flávia Gouveia

Chapter 1 – Basic education

Coordinator: Vera Lúcia Cabral Costa

Researchers: Maria Cândida Raizer Cardinalli Perez, Mônica Maia Bonel Maluf

Chapter 2 – Profile of higher education: academic and technological undergraduate studies, postgraduate studies

Coordinator: Eunice Ribeiro Durham

Researchers: Adilson Simonis

Research assistants: Flávio Sant'Ana Daher, Lucas Petri Daniari, Iara Nascimento Moreira

Chapter 3 – Financial and human resources in research and development

Coordinators: Carlos Henrique de Brito Cruz, José Roberto Rodrigues Afonso,
Sinésio Pires Ferreira

Researchers: Vagner de Carvalho Bessa, Sílvia Maria Caldeira Paiva

Research assistants: Kleber Pacheco de Castro, Beatriz Barbosa Meirelles, Camilla Jorge Farah

Chapter 4 – Analysis of scientific production based on publications in specialized journals

Coordinator: Leandro Innocentini Lopes de Faria

Researchers: José Ângelo Rodrigues Gregolin, Wanda Aparecida Machado Hoffmann,
Luc Quoniam

Collaborators: Carlos Afonso Nobre, Carlos Lenz César, Fernando Galembeck, Gláucia Mendes
Souza, Maria Ester Soares dal Poz

Research assistants: Gerson Azzi Cesar, Iandra Maria Carlos Cartaxo

Chapter 5 – Patenting activity in Brazil and abroad

Coordinator: Eduardo da Motta e Albuquerque

Researchers: Adriano Ricardo Baessa, Leandro Alves Silva, Leonardo Costa Ribeiro

Research assistants: Caroline Ubaldo Gomes da Silva, Juliana Rodrigues Vieira,
Stefania Listgarten, Luiza Teixeira de Melo Franco

Chapter 6 – Technology balance of payments: a renewed perspective

Coordinator: João Eduardo de Morais Pinto Furtado

Researchers: João Alberto de Negri, Vanderléia Radaelli, Wellington da Silva Pereira

Chapter 7 – Technological innovation by business in São Paulo State: an analysis based on the findings of the PINTEC survey

Coordinator: André Tosi Furtado

Researcher: Ruy de Quadros Carvalho

Research assistant: André Tortato Rauen

Chapter 8 – The regional dimension of ST&I activities in São Paulo State

Coordinator: Renato de Castro Garcia

Researchers: Conceição Fátima da Silva, Hérica de Morais Righi

Chapter 9 – Information & Communication Technology (ICT) in São Paulo State: characterization and diffusion indicators

Coordinator: José Eduardo de Salles Roselino Júnior

Researcher: Antônio Carlos Diegues Júnior

Research assistant: Murilo Damiano Carolo

Chapter 10 – ST&I and the agricultural sector in São Paulo State

Coordinator: Sergio Salles-Filho

Researchers: Ana Maria Carneiro, Maria Beatriz M. Bonacelli, Marcos Paulo Fuck,
José Roberto Vicente, Antônio Flávio Dias Ávila, Paule Jeanne Vieira Mendes

Research assistants: Carolina Thaís Rio, Ana Serino de Rezende, Luiz Fernando Rigacci Vazzóler

Chapter 11 – ST&I Indicators in health in São Paulo State

Executive coordination

Researchers: Eduardo Muniz Pereira Urias, Thays Murakami

Chapter 12 – Public perceptions of science and technology in São Paulo State

Coordinator: Carlos Vogt

Researchers: Marcelo Knobel, Rafael de Almeida Evangelista, Simone Pallone de Figueiredo,
Yurij Castelfranchi, Sabine Righetti

Research assistant: Giovana Martineli

Peer reviewers

Cibele Yahn de Andrade (chapter 02)

Clélio Campolina Diniz (chapter 08)

Cristina de Albuquerque Possas (chapter 11)

João Alberto de Negri (chapter 07)

Jorge Nagle (chapter 01)

Marcelo Silva Pinho (chapter 06)

Maria Tereza Leopardi Mello (chapter 05)

Mariano de Matos Macedo (chapter 03)

Orlando Martinelli Júnior (chapter 10)

Paulo Bastos Tigre (chapter 09)

Rachel Meneghelo (chapter 12)

Regina Célia Figueiredo Castro (chapter 04)

Chapter 1 – Basic Education

Vera Lúcia Cabral Costa

Graduated in economics from the University of São Paulo (USP, 1987). Master's in economic theory from USP (1993). PhD student in social and labor economics at the State State University of Campinas (Unicamp). Formerly technical director for social policy at the São Paulo State Government Foundation for Administrative Development (Fundap). Currently director of the São Paulo State Department of Education's Teacher Training School.

Maria Cândida Raizer Cardinalli Perez

Consultant specializing in themes related to the evaluation of social projects and the development of information systems for the public sector, third sector and international agencies.

Mônica Maia Bonel Maluf

Advisor to the Executive Board of the São Paulo State Government Foundation for Administrative Development (Fundap).

Chapter 2 – Profile of higher education: academic and technological undergraduate studies, postgraduate studies

Eunice Ribeiro Durham

Graduated in social sciences from the University of São Paulo (USP, 1954). Master's in social anthropology from USP (1964). PhD in social anthropology from USP (1967). Currently Full Professor at USP.

Adilson Simonis

Graduated in statistics from the Federal University of Rio Grande do Sul (UFRGS, 1982). Master's in probability from the University of São Paulo (USP, 1988). PhD in probability from USP (1995). Postdoctoral studies at the University of Rome Tor Vergata (1996-1998). Currently Associate Professor at USP.

Flávio Sant'Ana Daher

Undergraduate student in applied and computational mathematics at the University of São Paulo (USP).

Lucas Petri Damiani

Undergraduate student in statistics at the University of São Paulo (USP).

Iara Nascimento Moreira

Undergraduate student in statistics at the University of São Paulo (USP).

Chapter 3 – Financial and human resources in research and development

Carlos Henrique de Brito Cruz

Graduated in electronic engineering from the Aeronautics Technology Institute (ITA, 1978). Master's in science (1980). PhD in science (1983) from Gleb Wataghin Institute of Physics at the State State University of Campinas (Unicamp). Visiting researcher at the Italo-Latin American Institute of Università degli Studi (Rome). Resident visitor at Bell Labs (Holmdel, NJ). Visiting professor at Pierre & Marie Curie University (Paris). Director, Gleb Wataghin Institute of Physics (1991-94 and 1998-2002). Pro-Rector for Research, Unicamp (1994-98). Rector, Unicamp (April 2002-April 2005). President of FAPESP (1996-2002). Currently professor at Gleb Wataghin Institute of Physics, Unicamp; member of the Brazilian Academy of Sciences (since 2000); and FAPESP's Scientific Director (since April 2005).

José Roberto Rodrigues Afonso

Graduated in economics and accounting. Master's in economics of industry and technology from the Federal University of Rio de Janeiro (UFRJ, 1989). PhD in social and labor economics from the State State University of Campinas (Unicamp, 2010). Currently an economist with BNDES, the national development bank (since August 1984). Seconded to the Federal Senate as technical advisor (since July 2007). Formerly head of fiscal and employment affairs at BNDES, where he led the technical team responsible for drafting the Fiscal Responsibility Law.

Sinésio Pires Ferreira

Graduated in economic sciences from the State State University of Campinas (Unicamp, 1980). Master's in economics of industry and technology from the Federal University of Rio de Janeiro (UFRJ, 1986). Currently assistant director of the São Paulo State Data Analysis System Foundation (Seade).

Vagner de Carvalho Bessa

Graduated in geography from the University of São Paulo (USP, 1990). Master's in geography from USP (1994). PhD student at the Institute of Economics, State State University of Campinas (Unicamp). Currently head of the Economic Analysis Division, São Paulo State Data Analysis System Foundation (Seade).

Sílvia Maria Caldeira Paiva

Graduated in economics from the University of Brasília (UnB). Master's in industrial economics from the Federal University of Rio de Janeiro (UFRJ, 1991). Former general coordinator, Office of Education & Training in Information Technology, Department of Science & Technology, now the Ministry of Science & Technology (MCT); advisor to the Department of the National Treasury (STN); consultant to the Federal Senate's Budget Office; and advisor to the Ministry of Planning, Budget & Administration (MPOG). Currently a legislative consultant to the Federal Senate.

Kleber Pacheco de Castro

Graduated in economics. Master's in economics from the Federal University of Rio de Janeiro State (UFF). PhD student in economics at UFF.

Beatriz Barbosa Meirelles

Graduated in economic sciences from the Federal University of Rio de Janeiro (UFRJ, 1998). Master's in economics of industry and technology from UFRJ (2005). Currently an economist with BNDES, the national development bank.

Camilla Jorge Farah

Graduated in economics from the Federal University of Rio de Janeiro State (UFF, 2010). Currently taking an MBA at Ibmecc. Former intern at the Ministry of Finance and the Social Security & Welfare Foundation (FAPES) of BNDES, the national development bank. Former administration analyst with Saint-Gobain. Currently a market analyst with AkzoNobel.

Chapter 4 – Analysis of scientific production based on publications in specialized journals

Leandro Innocentini Lopes de Faria

Assistant Professor, Department of Information Science, Federal University of São Carlos (UFSCar). Professor, Postgraduate Program in Science, Technology & Society, UFSCar. Researcher, Materials Technology Information Unit (NIT/Materiais), UFSCar.

José Ângelo Rodrigues Gregolin

Associate Professor, Department of Materials Engineering, Federal University of São Carlos (UFSCar). Coordinator, Postgraduate Program in Science, Technology & Society,

UFSCar. Professor, Postgraduate Program in Science & Materials Engineering, UFSCar. Researcher, Materials Technology Information Unit (NIT/Materiais), UFSCar.

Wanda Aparecida Machado Hoffmann

Head, Department of Information Science, Federal University of São Carlos (UFSCar). Professor, Postgraduate Program in Science, Technology & Society, UFSCar. Researcher, Materials Technology Information Unit (NIT/Materiais), UFSCar.

Luc Quoniam

Full Professor, University of the South Toulon-Var (Toulon, France). Professor, Postgraduate Program in Science, Technology & Society, Federal University of São Carlos (UFSCar).

Carlos Afonso Nobre (collaborator)

Graduated in electronic engineering from the Aeronautics Technology Institute (ITA). PhD in meteorology from the Massachusetts Institute of Technology (MIT, Cambridge, MA). Tenured researcher at INPE, the national space research institute. Chair, Scientific Committee, International Geosphere-Biosphere Program (IGBP). Coordinator, Center for Terrestrial System Science, INPE. One of the authors of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). Executive Secretary, Brazilian Climate Change Network (Rede Clima). Former coordinator of FAPESP's Global Climate Change Research Program (PFPMCG). Currently Secretary of Research & Development Policies & Programs, Ministry of Science & Technology (MCT).

Carlos Lenz César (collaborator)

Graduated from the Federal University of Ceará (UFC, 1977). Master's and PhD in physics (1979, 1985) from the State State University of Campinas (Unicamp). Currently Full Professor, Department of Quantum Electronics, Gleb Wataghin Institute of Physics, Unicamp.

Fernando Galembeck (collaborator)

Graduated in chemistry from the University of São Paulo (USP, 1964). PhD in chemistry from USP (1970). Postdoctoral studies at the University of Colorado (Boulder, CO, 1972-3) and the University of California (Davis, CA, 1974). Full Professor, State State University of Campinas (Unicamp). Has held leadership positions at Unicamp, the Ministry of Science & Technology (MCT), the National Council for Scientific & Technological Development (CNPq), the Brazilian Academy of Sciences (ABC), the Brazilian Chemistry Society (SBQ), the Brazilian Association for the Advancement of Science (SBPC) and the Brazilian Microscopy & Microanalysis Society (SBMM). Has worked as an advisor and planner at FAPESP, MCT, CNPq and the Office for Higher Education Personnel Improvement (CAPES), and as a consultant to several companies.

Glaucia Mendes Souza (collaborator)

Graduated in biology from the Biosciences Institute at the University of São Paulo (USP). PhD in biochemistry from the Chemistry Institute at USP (1993). Postdoctoral studies in glycobiology at Sanford-Burnham Institute (La Jolla, CA, 1994-96) and molecular genetics at Baylor College of Medicine (Houston, TX, 1996-97). Earned her Habilitation (*livre-docência*) at the Department of Biochemistry, USP (2004). Leader, Signal Transduction Laboratory, Chemistry Institute, USP. Coordinator of several sugarcane genomics initiatives, including Projects SUCEST and SUCEST-FUN. Coordinator of FAPESP's Bioenergy Research Program (BIOEN). Member, Biology Committee, International Society of Cane Technologists. Associate Editor, *International Journal of Plant Genomics*.

Maria Ester Soares dal Poz (collaborator)

PhD in science and technology policy from the State University of Campinas (Unicamp, 2006). Postdoctoral studies at the Center for Health Technology Development (CDTS), Fundação Oswaldo Cruz (Fiocruz, 2007 and 2009). Lecturer at the School of Applied Sciences (FCA) and researcher at the Economics Institute's Agricultural Economics Unit, Unicamp.

Gerson Azzi Cesar

Researcher, Materials Technology Information Unit (NIT/Materiais), UFSCar.

Iandra Maria Carlos Cartaxo

Undergraduate student in library and information sciences at the Federal University of São Carlos (UFSCar).

Chapter 5 – Patenting activity in Brazil and abroad

Eduardo da Motta e Albuquerque

Associate Professor, School of Economic Sciences (FACE), and Center for Development & Regional Planning (Cedeplar), Federal University of Minas Gerais (UFMG).

Adriano Ricardo Baessa

Economist. Researcher, Minas Gerais Center for Nuclear Technology Development (CDTN-MG).

Leandro Alves Silva

Economist, Euvando Lodi Institute, Minas Gerais State Federation of Industry (FIEMG). PhD student in economics, Center for Development & Regional Planning (Cedeplar), Federal University of Minas Gerais (UFMG).

Leonardo Costa Ribeiro

PhD in physics. Postdoctoral studies at the Center for Development & Regional Planning (Cedeplar), Federal University of Minas Gerais (UFMG). Researcher, National Institute of Metrology, Standardisation & Industrial Quality (Inmetro).

Caroline Ubaldo Gomes da Silva

Undergraduate student in economics, School of Economic Sciences (FACE), Federal University of Minas Gerais (UFMG). Scientific initiation grantee, Center for Development & Regional Planning (Cedeplar), Federal University of Minas Gerais (UFMG).

Juliana Rodrigues Vieira

Undergraduate student in economics, School of Economic Sciences (FACE), Federal University of Minas Gerais (UFMG). Scientific initiation grantee, Center for Development & Regional Planning (Cedeplar), Federal University of Minas Gerais (UFMG).

Stefania Listgarten

Undergraduate student in economics, School of Economic Sciences (FACE), Federal University of Minas Gerais (UFMG). Scientific initiation grantee, Center for Development & Regional Planning (Cedeplar), Federal University of Minas Gerais (UFMG).

Luiza Teixeira de Melo Franco

Undergraduate student in economics, School of Economic Sciences (FACE), Federal University of Minas Gerais (UFMG). Scientific initiation grantee, Center for Development & Regional Planning (Cedeplar), Federal University of Minas Gerais (UFMG).

Chapter 6 – Technology balance of payments: a renewed perspective

João Eduardo de Moraes Pinto Furtado

Graduated in economic science from the State University of Campinas (Unicamp, 1981). Master's in economics from Unicamp (1984). PhD in economics from the University of Paris XIII (1997). Specialization in industrial and technological strategies and policies at the UN Economic Commission for Latin America (ECLAC, Santiago, Chile, 1991). Formerly advisor to the Brazilian Innovation Agency (FINEP, 1999-2002) and BNDES, the national development bank (2005-07). Founder and former executive editor of *Revista Brasileira de Inovação*. Assistant professor at the Polytechnic School of the University of São Paulo (USP). Board member, São Paulo State Federation of Industry (FIESP) and São Paulo School of Sociology & Politics (FESP-SP). Member of FAPESP's Research Area Panels.

João Alberto de Negri

Master's in economics from the Federal University of Minas Gerais (UFMG, 1996). PhD in economics from the University of Brasília (UnB, 2003). Researcher, Institute of Applied Economics (IPEA, since 1996). Former General Coordinator, Department of Foreign Trade (SECEX), Ministry of Development, Industry & Trade (MDIC, 1999). Director and Vice-President, IPEA, 2005-07.

Vanderléia Radaelli

Graduated in economics from São Paulo State University (Unesp, 2003). Master's in science and technology policy from the State State University of Campinas (Unicamp). PhD student in science and technology policy at Unicamp. Former head of technological innovation at the São Paulo State Federation of Industry (FIESP). Specialist in science, technology and innovation at the Inter-American Development Bank (IADB). Associate Researcher, Industrial Economics Research Group (GEEIN), Unesp.

Wellington da Silva Pereira

Graduated in economics from São Paulo State University (Unesp, 2003). Master's in economic development from the Federal University of Paraná (UFPR). Assistant Professor, UFPR. Economist, Planning, Regional Bank for Development of the Far South (BRDE). Associate Researcher, Industrial Economics Research Group (GEEIN), Unesp, and Elabora Consulting and Training.

Chapter 7 – Technological innovation by business in São Paulo State: an analysis based on the findings of the PINTEC survey

André Tosi Furtado

Economist with PhD from the University of Paris I. Full Professor, Department of Science & Technology Policy, State State University of Campinas (Unicamp).

Ruy de Quadros Carvalho

Graduated in business administration. PhD in development economics from the University of Sussex, Brighton, U.K.. Currently Associate Professor, Department of Science & Technology Policy, State State University of Campinas (Unicamp).

André Tortato Rauen

Economist with master's in science and technology policy. PhD student in the same discipline at the State State University of Campinas (Unicamp).

Chapter 8 – The regional dimension of ST&I activities in São Paulo State

Renato de Castro Garcia

Professor of economics at the Production Engineering Department of the Polytechnic School, University of São Paulo (USP).

Conceição Fátima da Silva

Professor at the University Center of the School of Industrial Engineering (FEI) of the State State University of Campinas (Unicamp). PhD student in science and technology policy at the Geosciences Institute of the State State University of Campinas (Unicamp).

Hérica de Moraes Righi

Master's degree in science and technology policy at the Geosciences Institute of the State State University of Campinas (Unicamp). PhD student in the same subject, Unicamp.

Chapter 9 – Information & Communication Technology (ICT) in São Paulo State: characterization and diffusion indicators

José Eduardo de Salles Roselino Júnior

Graduated in economic sciences from São Paulo State University (Unesp, 1993). Master's (1998) and PhD (2006) in economic sciences from the State State University of Campinas (Unicamp). Currently a researcher and lecturer (undergraduate and master's) at the São Paulo Salesian University Center (UNISAL) and Campinas Colleges (Facamp), and affiliated with the Industrial Economics Research Group (GEEIN), Unesp.

Antonio Carlos Diegues Júnior

Graduated in economics from the State State University of Campinas (Unicamp, 2004). Master's (2007) and PhD (2010) in the same subject from Unicamp. Currently a lecturer in economic sciences at the Federal University of São Carlos (UFSCar) and a researcher in economics of industry, technology and innovation

Murilo Damião Carolo

Graduated in economics from the State State University of Campinas (Unicamp, 2008). Intern at the University of São Paulo (USP).

Chapter 10 – ST&I and the agricultural sector in São Paulo State

Sergio Salles-Filho

Graduated in agronomy from the Federal Rural University of Rio de Janeiro (UFRRJ, 1980). Master's in agrarian sciences from São Paulo State University (Unesp Botucatu, 1985). PhD in economics from the State State University of Campinas (Unicamp, 1993). Full Professor, Department of Science & Technology Policy (DPCT), Unicamp, having twice been department head. Co-founder of Group for Studies on the Organization of Research & Innovation (GEOPI), Unicamp (1995). Former Head of the Brazilian Innovation Agency (FINEP, 2001-03). Has twice won Unicamp's Zeferino Vaz Award for academic performance (1998 and 2001). Winner of the Air Force's Santos Dumont Medal (2005) for coordination and development of the Aerospace Technical Center (CTA). Currently FAPESP's Program Evaluation Coordinator.

Ana Maria Carneiro

Graduated in social sciences from the Federal University of Goiás (UFG, 1997). Master's in sociology from the State State University of Campinas (Unicamp, 2000). PhD in science and technology policy from Unicamp (2007). Formerly Research Manager, SOFTEX Digital Observatory, Association for the Promotion of Brazilian Software Excellence (SOFTEX). Currently a researcher with Unicamp's Public Policy Research Unit (NEPP) and Coordinator of the same university's Group for Studies on the Organization of Research & Innovation (GEOPI).

Maria Beatriz M. Bonacelli

Graduated in economic sciences from the State State University of Campinas (Unicamp, 1985). Specialization in agrifood economics at the Viterbo Chamber of Commerce's Center for Training & Development (CeFAS), Viterbo, Italy (1988). Master's in science and technology policy from Unicamp (1992). PhD in economic sciences from the University of Toulouse, France (1996). Professor and Head, Department of Science & Technology Policy (DPCT), Unicamp. Coordinator, Group for Studies on the Organization of Research & Innovation (GEOPI), Unicamp.

Marcos Paulo Fuck

Graduated in economic sciences from the Federal University of Paraná (UFPR, 2001). Master's (2005) and PhD (2009) in science and technology policy from the State State University of Campinas (Unicamp), with sandwich PhD in S&T policy and management from the University of Buenos Aires, Argentina (2006), and the Federal Technology University of Paraná (UTFPR, 2009). Senior Lecturer, Federal University of the ABC (UFABC). Researcher, Group for Studies on the Organization of Research & Innovation (GEOPI), Unicamp. Participant, National S&T Institute (INCT), public policy, strategies and development.

José Roberto Vicente

Graduated in agronomy from the University of São Paulo (USP, 1976). Master's in applied economics from USP (1989). PhD in economics from USP (1997). Currently a scientific researcher at the Agricultural Economics Institute (IEA-APTA).

Antônio Flávio Dias Ávila

Graduated in agronomy from the Federal University of Santa Maria (UFSM, 1971). Master's in applied economics from the Federal University of Viçosa (UFV, 1973). PhD in rural economics from the University of Montpellier, France (1981). Postdoctoral studies at the Economic Growth Center of Yale University (New Haven, CT, 1993-94 and 2002-03). Researcher with Embrapa since January 1974. Coordinator, Evaluation of Institutional Performance, Department of Management & Strategy, Embrapa. Member, Standing Panel on Impact Assessment, Science Council, Consultative Group on International Agricultural Research (CGIAR).

Paule Jeanne Vieira Mendes

Graduated in mathematics from the Federal University of Mato Grosso do Sul (UFMS, 1991). Master's in mechanical engineering from the State State University of Campinas (Unicamp, 2002). PhD in science and technology policy from Unicamp (2009). Has worked for Embrapa since 1987, as analyst in the Department of Strategic Management and, since February 2010, Head of the Office of Strategic Planning. Researcher, Group for Studies on the Organization of Research & Innovation (GEOPI), Unicamp.

Carolina Thaís Rio

Graduated in geography from the State State University of Campinas (Unicamp, 2006). Master's and PhD in science and technology policy from Unicamp. Affiliated with Group for Studies on the Organization of Research & Innovation (GEOPI), Unicamp.

Ana Serino de Rezende

Graduated in food engineering from the State State University of Campinas (Unicamp, 2005). Researcher, Group for Studies on the Organization of Research & Innovation (GEOPI), Unicamp. Staff member, Department of Technological Innovation, Sadia.

Luiz Fernando Rigacci Vazzóler

Undergraduate student in geography at the State State University of Campinas (Unicamp, 2007). Research assistant, Researcher, Group for Studies on the Organization of Research & Innovation (GEOPI), Unicamp.

Chapter 11 – ST&I Indicators in health in São Paulo State

Eduardo Muniz Pereira Urias

Graduated in economic sciences from São Paulo State University (Unesp, 2006). Master's in science and technology policy from the State State University of Campinas (Unicamp). PhD student, Program in Economics & Policy Studies of Technical Change, UN University, in collaboration with Maastricht University (UNU-Merit). Research collaborator, Group for Studies on the Organization of Research & Innovation (GEOPI), Unicamp.

Thays Murakami

Graduated in economics from São Paulo State University (Unesp). Master's in science and technology policy from the State State University of Campinas (Unicamp). PhD student in economics at Unicamp. Associate consultant, Elabora Consulting and Training.

Chapter 12 – Public perceptions of science and technology in São Paulo State

Carlos Vogt

Postgraduate studies in literary theory and comparative literature at the University of São Paulo (USP). Master's in Letters from USP. Master's in general linguistics and French stylistics from the University of Besançon, France. PhD in science from the State State University of Campinas (Unicamp). Rector of Unicamp (1990-94). Vice-president of the Brazilian Association for the Advancement of Science (SBPC, 2001-05). President of FAPESP (2002-07). São Paulo State Secretary for Higher Education (2007-10). Formerly Editor in Chief, *Ciência e Cultura* (SBPC) and *Inovação*. Currently Editor Director, *ComCiência*.

Marcelo Knobel

Physicist with a PhD in science from the State State University of Campinas (Unicamp). Postdoctoral studies in Italy and Spain. Coordinator, Creativity Development Unit (NUDECRI), Unicamp (2003-06). Executive Director, Science Exploration Museum, Unicamp (2006-08). Full Professor, Gleb Wataghin Institute of Physics (IFGW), Unicamp. Researcher, Laboratory of Advanced Studies in Journalism (Labjor), Unicamp (since 2000). Editor in Chief, *Ciência e Cultura* (SBPC). Coordinator, Master's Program in Scientific & Cultural Dissemination, Language Studies Institute (IEL)/Labjor, Unicamp.

Rafael de Almeida Evangelista

Graduated in social sciences from the State State University of Campinas (Unicamp). Master's in linguistics and PhD in social anthropology from Unicamp. Researcher, Laboratory of Advanced Studies in Journalism (Labjor), Unicamp (since 1999). Former Editor in Chief, *ComCiência* (2002-07) and *Patrimônio* (2005-07).

Simone Pallone de Figueiredo

Journalist with master's and PhD in science and technology policy from the State State University of Campinas (Unicamp). Former Editor of *ComCiência* (2002-07) and *Inovação* (2005-07). Researcher, Laboratory of Advanced Studies in Journalism (Labjor), Unicamp. Currently Editor of *Conhecimento & Inovação* (Labjor/Inova Unicamp).

Yurij Castelfranchi

Graduated in physics from the Sapienza University of Rome. Master's in science communication from the International School for Advanced Studies (SISSA), Trieste. PhD in sociology from the State University of Campinas (Unicamp). Formerly a researcher and lecturer in scientific journalism at the Laboratory of Advanced Studies in Journalism (Labjor), Unicamp; Vice-Director of *Journal of Science Communication*; and collaborator with the Organization of Ibero-American States for Education, Science & Cultura (OEI). Currently Senior Lecturer, Department of Sociology & Anthropology, School of Philosophy & Human Sciences (Fafich), Federal University of Minas Gerais (UFMG).

Sabine Righetti

Graduated in journalism from São Paulo State University (Unesp). Specialization in scientific journalism from the Laboratory of Advanced Studies in Journalism (Labjor), Unicamp. Master's in science and technology policy from Unicamp. Researcher with Labjor (since 2003) and Group for Studies of Business & Innovation (GEMPI), Unicamp (since 2005).

Giovana Martineli

Graduated in statistics from the Mathematics, Statistics & Science Computing Institute (IMECC) at the State University of Campinas (Unicamp). Participates in the public of perception of science research group at the Laboratory of Advanced Studies in Journalism (Labjor), Unicamp.

Peer reviewers

Cibele Yahn de Andrade

Sociologist with PhD in public-sector economics. President, Public Policy Research Unit (NEPP), State University of Campinas (Unicamp).

Clélio Campolina Diniz

Graduated in operations engineering from the Catholic University of Minas Gerais (PUC-MG, 1967). Graduated in mechanical engineering from PUC-MG (1970). Specialization in development and planning from the Latin American & Caribbean Institute for Economic & Social Planning (ILPES), Santiago, Chile (1971). Master's in economic sciences from the State University of Campinas (Unicamp, 1978). PhD in economic sciences from Unicamp (1987). Postdoctoral studies at the Rutgers New Brunswick, NJ (1991). Former Director, School of Economic Sciences, Federal University of Minas Gerais (UFMG). Former CEO, Belo Horizonte Technology Park (BHTec). Full Professor, Department of Economics, School of Economic Sciences (FACE), UFMG.

Cristina de Albuquerque Possas

Graduated in psychology from the Catholic University of Rio de Janeiro (PUC-RJ). Master's in social sciences and social anthropology from the State University of Campinas (Unicamp). PhD in public health from the Sergio Arouca National School of Public Health (ENSP) at the Oswaldo Cruz Foundation (Fiocruz). Postdoctoral studies in population and international health at the Harvard University School of Public Health (Boston, MA). Former Executive Secretary, National Biosafety Technical Commission (CTNBio), Ministry of Science & Technology (MCT). Tenured researcher, lecturer, coordinator of postgraduate studies and advisor to the Presidency at Fiocruz. Head, Research & Development, Department of STDs, AIDS & Viral Hepatitis, Ministry of Health.

João Alberto de Negri

Master's in economics from the Federal University of Minas Gerais (UFMG, 1996). PhD in economics from the University of Brasília (UnB, 2003). Researcher, Institute of Applied Economics (IPEA, since 1996). Former General Coordinator, Department of Foreign Trade (SECEX), Ministry of Development, Industry & Trade (MDIC, 1999). Director and Vice-President, IPEA, 2005-07.

Jorge Nagle

Graduated in education from São Paulo State University (Unesp). PhD in education from the University of São Paulo (USP). Rector of Unesp (1985-88). Former São Paulo State Secretary of Science & Technology.

Marcelo Silva Pinho

Graduated in economic sciences from the Catholic University of Rio de Janeiro (PUC-RJ, 1986). Master's and PhD in economics from the State University of Campinas (Unicamp, 1993 and 2001). Associate Professor, Department of Production Engineering, Federal University of São Carlos (UFSCar). Collaborator, Master's Program in Economics, São Paulo State University (Unesp).

Maria Tereza Leopardi Mello

Graduated in law from the Catholic State University of Campinas (Puccamp, 1984). PhD in economics from the State University of Campinas (Unicamp, 1995). Currently Senior Lecturer, Federal University of Rio de Janeiro (UFRJ).

Mariano de Matos Macedo

Graduated in economic sciences from the State University of Campinas (Unicamp, 1981). Master's in economics from the University of São Paulo (USP, 1987). PhD in economic sciences from Unicamp (1997). Currently Full Professor, Federal University of Santa Maria (UFSM).

Orlando Martinelli Júnior

Graduated in economic sciences from the Federal University of Minas Gerais (UFMG, 1975). PhD in economic sciences from the State University of Campinas (Unicamp, 1994). Currently on the staff of the Paraná State Institute of Economic & Social Development (IPARDES).

Paulo Bastos Tigre

Graduated in economics from the Federal University of Rio de Janeiro (UFRJ, 1974). Master's in production engineering from UFRJ (1978). PhD in science and technology policy from the University of Sussex, Brighton, U.K. (1982). Full Professor and member of Innovation Economics Group, Economics Institute, UFRJ.

Rachel Meneguello

Professor (Habilitation), Department of Political Science, State University of Campinas (Unicamp). Director, Public Opinion Research Center (CESOP), Unicamp. Editor, *Opinião Pública*. Member, Planning Committee, The Comparative Study of Electoral Systems, University of Michigan, Ann Arbor, MI, and of the Advisory Board, Americas Barometer, Vanderbilt University (Nashville, TN).

Regina Célia Figueiredo Castro

Librarian with master's in information science from the Brazilian Institute of Science & Technology Information at the Federal University of Rio de Janeiro (UFRJ, 1978). PhD in public health from the School of Public Health, University of São Paulo (USP, 2002). Worked for many years at the Latin American & Caribbean Center for Health Science Information (BIREME). Currently editor of *Revista Panamericana de Salud Pública / Pan American Journal of Public Health*, published by the Pan American Health organization (PAHO/WHO), in Washington DC.

Acknowledgements

- Adi Balbinoti Júnior, Office for the Improvement of Higher Education Personnel (CAPES)
- Alexandre Marafon, Office for the Improvement of Higher Education Personnel (CAPES)
- Ana Rosa Pais Ribeiro, Central Register of Business Organizations, Brazilian Institute of Geography & Statistics (IBGE)
- Anísio Teixeira National Institute for Educational Studies and Research (INEP)
- Antonio Carlos Lopes da Silva, Institution Planning, Federal University of São Carlos (UFSCar)
- Antônio Juliano Ayres, Citrus Defense Fund (Fundecitrus)
- Antonio Roque Dechen, Luiz de Queiroz School of Agriculture (ESALQ), University of São Paulo (USP)
- Applied Economics Research Institute (Ipea)
- Biominas Foundation
- Brazilian Agricultural Research Corporation (Embrapa)
- Brazilian Innovation Agency (FINEP)
- Brazilian Institute of Geography & Statistics (IBGE)
- Carlos Américo Pacheco, Economics Institute, State University of Campinas (Unicamp)
- Central Bank of Brazil (BACEN)
- Citrus Defense Fund (Fundecitrus)
- Clélio Campolina Diniz, Federal University of Minas Gerais (UFMG)
- Denis Miguel Roston, School of Agricultural Engineering, State University of Campinas (Unicamp)
- Edson Ramos de Siqueira, School of Veterinary Medicine & Animal Science, University of São Paulo (USP)
- Eduardo Emrich Soares, Biominas Foundation
- Eletrobrás
- Fabício Brollo Dunham, Brazilian Innovation Agency (FINEP)
- Federal University of São Carlos (UFSCar), Agrarian Science Center
- Federal University of São Carlos (UFSCar), Office of Institutional Planning
- Gerson Leão Passos, Events, Anísio Teixeira National Institute for Educational Studies and Research (INEP)
- Hérica Morais Righi, Geosciences Institute, State University of Campinas (Unicamp); Dom Cabral Foundation
- Holmer Savastano Júnior, School of Animal Science & Food Engineering, University of São Paulo (USP)
- Instituto de Pesquisas Tecnológicas do Estado de São Paulo S.A. (IPT)
- José Antonio Visintin, School of Veterinary Medicine & Animal Science, University of São Paulo (USP)
- José Maria Ferreira Jardim da Silveira, Economics Institute, State University of Campinas (Unicamp)
- Leonardo Theodoro Büll, School of Agronomy, São Paulo State University (Unesp Botucatu)
- Lídia Ferraz, Integrated Education Information System, Anísio Teixeira National Institute for Educational Studies and Research (INEP)
- Lívia Amaral, Office for the Improvement of Higher Education Personnel (CAPES)
- Luiz Carlos de Souza Vieira, National Industrial Apprenticeship Service (SENAI-SP)
- Marcelo Ferreira Ferraz, São Paulo State Department of Finance
- Marco Antônio de Araújo Lima, National Industrial Property Institute (INPI)
- Marco Antonio Zabotto, Institutional Planning, Federal University of São Carlos (UFSCar)
- Maria das Dores Pereira Rosa, Integrated Education Information System, Anísio Teixeira National Institute for Educational Studies and Research (INEP)
- Marta Elias Ribeiro de Oliveira, Office for the Improvement of Higher Education Personnel (CAPES)
- Ministry of Development, Industry & Trade (MDIC), Department of Foreign Trade (SECEX)
- Ministry of Labor & Employment (MTE)
- Ministry of Science & Technology (MCT), Department of Indicators (CGI)
- National Council for Scientific & Technological Development (CNPq)
- National Industrial Apprenticeship Service (SENAI)

National Industrial Property Institute (INPI)

National Space Research Institute (INPE)

National Synchrotron Light Laboratory (LNLS)

Nayara Lopes Gomes, Applied Economics Research Institute (Ipea)

Norberto Antonio Lavorenti, Agrarian Science Center, Federal University of São Carlos (UFSCar)

Nuclear Energy Research Institute (IPEN)

Office for the Improvement of Higher Education Personnel (CAPES)

Paulo Rogério Borges, National Industrial Apprenticeship Service (SENAI-SP)

Pedro Felício Estrada Bernabé, School of Dentistry (FOA), São Paulo State University (Unesp Araçatuba)

Petrobras

Project to Develop Ibero-American Indicators of Social Perception, Scientific Culture & Civic Participation in S&T

Public Opinion, Statistics & Quality Institute (IOPEQ)

Raul José Silva Gírio, School of Agrarian & Veterinary Sciences, São Paulo State University (Unesp Jaboticabal)

Raul Suster, Head, Dissemination, Documentation & Technological Information Center (CEDIN), National Industrial Property Institute (INPI)

Renata Silveira Corrêa, São Paulo State Government Administrative Development Foundation (Fundap)

Renato Archer Information Technology Center (CTI-CenPRA)

Renato Baumgratz Viotti, Ministry of Science & Technology (MCT)

Roberta Busse, Brazilian Institute of Geography & Statistics (IBGE)

Rogério Buccelli, Planning & Budget, São Paulo State University (Unesp)

Ruy Gonçalves Silva, Office for the Improvement of Higher Education Personnel (CAPES)

São Paulo State Agribusiness Technology Agency (APTA)

São Paulo State Department of Education (SEESP)

São Paulo State Department of Finance (Sefaz)

São Paulo State Department of the Environment (SMASP)

São Paulo State Government Administrative Development Foundation (Fundap)

São Paulo State University (Unesp Araçatuba), School of Dentistry (FOA)

São Paulo State University (Unesp Botucatu), School of Agronomy (FCA)

São Paulo State University (Unesp Ilha Solteira), Ilha Solteira School of Engineering (Feis)

São Paulo State University (Unesp Jaboticabal), School of Agrarian & Veterinary Sciences (FCAV)

São Paulo State University (Unesp Dean's office), Office of Planning & Budget (APLO)

Sérgio Oswaldo de Carvalho Avelar, Office for the Improvement of Higher Education Personnel (CAPES)

Sidney Sanches, São Paulo State Agribusiness Technology Agency (APTA)

Silvana Pagotto, School of Animal Science & Food Engineering, University of São Paulo (USP)

Thiago Rocha, Polytechnic School, University of São Paulo (USP)

State University of Campinas (Unicamp), Economics Institute (IE)

State University of Campinas (Unicamp), School of Agricultural Engineering (Feagri)

University of São Paulo (USP), Luiz de Queiroz School of Agriculture (ESALQ)

University of São Paulo (USP), School of Animal Science & Food Engineering (FZEA)

University of São Paulo (USP), School of Veterinary Medicine & Animal Science (FMVZ)

Vahan Agopyan, Office of the Provost for Postgraduate Studies, University of São Paulo (USP)

Valdinei Costa Souza, Office for the Improvement of Higher Education Personnel (CAPES)

Vale S.A.

Vera Bonomi, São Paulo State Department of the Environment

Vera Marli Caro, Luiz de Queiroz School of Architecture (ESALQ), University of São Paulo (USP)

Virgínia Duarte, SOFTEX Observatory, Association for the Promotion of Brazilian Software Excellence (SOFTEX)

Wilson Manzoli Júnior, Ilha Solteira School of Engineering, São Paulo State University (Unesp)

Table of Contents

VOLUME 1

Foreword	XIX
Chapter 1	
Basic Education	
1. Introduction	1-5
2. The educational context in Brazil and São Paulo State	1-5
3. Learning outcomes in basic education	1-11
3.1 Domestic indicators	1-12
3.1.1 The Basic Education Development Index (IDEB)	1-14
3.1.2 The São Paulo State Educational Development Index (IDESP)	1-17
3.2 International comparisons	1-18
Age/grade lag	1-20
Public versus private schools	1-21
4. Evolution of policies for basic education and the legal framework in the post-2000 period	1-23
Organization of basic education	1-23
Funding	1-24
5. Final considerations	1-25
References	1-28
Chapter 2	
Profile of higher education: academic and technological undergraduate studies & post-graduate studies	
1. Introduction	2-9
2. Institutional organization of the higher education system in São Paulo State	2-9
3. Undergraduate education	2-12
3.1 Social inclusion in higher education: enrollment ratios	2-12
3.2 Growth of enrollment ratios in higher education in São Paulo State and Brazil: comparison with other countries	2-14
3.3 Recent progress of enrollment ratios in higher education	2-17
3.4 Structural barriers to expansion of access to higher education: relationship between primary and higher education	2-17
3.4.1 Socioeconomic inequality	2-23
3.4.2 The quality of primary education	2-26
3.5 Evolution in the number of graduates	2-28
3.5.1 Graduating students according to the day or evening period of the classes	2-30
3.5.2 Graduating students in relation to the population: international comparison	2-31
3.6 Undergraduate education: public and private systems	2-33
3.6.1 Expansion in undergraduate education	2-33
3.6.2 Relationship between the public and private sectors	2-34
3.6.3 The new private education	2-40
3.7 Educational institutions	2-41
3.8 Distribution of enrollment by knowledge area	2-44
3.9 Internalization of higher education	2-52

3.10 Evening courses	2-56
3.11 The quality of higher education	2-58
3.11.1 Degrees held by faculty	2-59
3.11.2 Faculty work regimes	2-62
3.12 Technology education	2-66
3.13 Distance education	2-77
4. Graduate education	2-78
4.1 Graduate education in São Paulo State: the importance of state universities	2-80
4.2 The quality of the graduate system	2-85
4.3 Professional master's programs	2-85
4.4 Distribution of enrollment by knowledge area	2-87
4.5 Fellowships and grants	2-91
4.5.1 Trajectory of FAPESP fellows	2-94
4.6 Graduate degrees awarded	2-95
4.6.1 Graduate degrees awarded: main institutions	2-96
4.6.2 Doctorate degrees awarded: international comparison	2-98
5. Summary and Conclusions	2-99
References	2-102
Online data sources	2-103

Chapter 3

R&D Expenditures and Human Resources

Part A

Research and development (R&D) in São Paulo State

1. Introduction	3A-11
2. Definitions and methodology	3A-12
2.1 The categories R&D and S&T	3A-13
2.2 Some characteristics of the data sources used by MCT for its S&T indicators	3A-14
3. R&D expenditure in São Paulo State	3A-20
3.1 R&D expenditure in São Paulo State by research funding agencies	3A-20
3.1.1 R&D expenditure in São Paulo State by federal research funding agencies	3A-20
3.1.2 R&D expenditure in São Paulo State by state research funding agencies	3A-20
3.2 R&D expenditure in São Paulo State by higher education institutions	3A-22
3.2.1 Analysis of methodological alternatives for estimating the share of HEI budgets allocated to R&D	3A-22
3.2.2 Statistical counts of HEI academic staff	3A-23
3.2.3 Estimating the fraction of time devoted to R&D by full-time academics with PhDs	3A-24
3.2.4 R&D expenditure by HEIs in São Paulo State	3A-25
3.3 R&D expenditure in São Paulo State by R&D institutions	3A-27
3.3.1 R&D expenditure by state research institutions	3A-27
3.3.2 R&D expenditure by federal research institutions	3A-28
3.4 Business expenditure on R&D (BERD) in São Paulo State	3A-29
3.4.1 Limitations to estimates of BERD due to the regionalization system used by PINTEC	3A-29
3.4.2 Estimating BERD for the service sector	3A-30
3.4.3 Using gross fixed capital formation (GFCF) to estimate BERD over the long term	3A-31
4. Consolidated results for R&D expenditure in São Paulo State	3A-35

4.1	Consolidated results for national R&D expenditure calculated by method based on full-time academics with PhDs and BERD estimated based on GFCF	3A-40
4.2	Difference between values of state R&D expenditure estimated by the methodology used in this study and MCT indicators	3A-43
5.	Analysis	3A-44
5.1	Federal, state and private shares of R&D expenditure in São Paulo State	3A-44
5.1.1	Federal and state expenditure on R&D in public HEIs	3A-46
5.1.2	R&D expenditure by research funding agencies	3A-51
5.1.3	Business expenditure on R&D in São Paulo	3A-54
5.2	Heterogeneity of the national S&T system: an analysis of R&D expenditure in São Paulo, Brazil, and Brazil excluding São Paulo	3A-55
5.2.1	R&D intensity in São Paulo, Brazil and Brazil excluding São Paulo	3A-58
5.2.2	Composition of total R&D expenditure	3A-58
5.2.3	Composition of public R&D expenditure	3A-59
5.2.4	Business share of R&D expenditure	3A-60
5.2.5	Per capita R&D expenditure	3A-61
6.	Some salient features of R&D	3A-62
7.	International overview	3A-69
8.	Closing remarks	3A-75
	References	3A-76

Part B

Human resources in scientific and technological activities in São Paulo State

1.	Introduction	3B-5
2.	Personnel devoted to R&D activities	3B-5
2.1	General methodological procedures	3B-7
2.2	Estimating the number of researchers per sector	3B-10
2.2.1	Research institutions	3B-10
2.2.2	Higher education institutions	3B-10
2.2.3	Business	3B-11
2.3	Evolution of number of researchers in São Paulo	3B-16
2.4	Comparative analysis	3B-16
2.5	Closing remarks	3B-18
3.	Human resources in science and technology (HRST)	3B-19
3.1	Methodological procedures	3B-19
3.2	Results and analysis	3B-20
3.3	Closing remarks	3B-29
	References	3B-29

Chapter 4

Analysis of scientific production based on publications in specialized journals

1.	Introduction	4-7
2.	World scientific production	4-11
3.	Brazilian scientific production	4-16
3.1	Brazil's contribution to world scientific production	4-16
3.2	Contributions by regions and states to Brazilian scientific production	4-17
3.3	Breakdown of Brazilian scientific production by knowledge area	4-19
3.4	Contributions of institutions to Brazilian scientific production	4-24
4.	São Paulo State's scientific production	4-25

4.1	Contributions of São Paulo State, São Paulo City and other cities in the state to scientific production	4-25
4.2	Contributions of universities and research institutions to scientific production in São Paulo State	4-27
4.3	Breakdown of scientific production in São Paulo State by knowledge area	4-32
5.	International and national scientific collaboration	4-36
5.1	Scientific collaboration by Brazil and São Paulo State with other countries	4-36
5.2	Scientific collaboration by São Paulo with other Brazilian states	4-42
5.3	Scientific collaboration by institutions in São Paulo	4-45
6.	Citations of scientific articles published by selected countries	4-56
7.	Using additional databases to analyze scientific production	4-62
8.	Conclusions	4-66
	References	4-69

Chapter 5

Patenting activity in Brazil and abroad

1.	Introduction	5-5
2.	Brazil in the world context	5-5
2.1	Brazil – relative technological stagnation in global terms?	5-5
2.2	Changes in the world's leading technology subdomains	5-10
2.3	S&T interaction matrices	5-14
2.3.1	Preparation of the matrices	5-14
2.3.2	World matrices: growing interaction	5-14
2.3.3	Brazil's intermediate position	5-16
2.3.4	The biotechnology subdomain as an example	5-17
2.3.5	The role of the national science base	5-18
2.4	Leading subdomains in Brazil	5-18
2.5	Contrast between resident and non-resident patent filings: weaknesses and technological hurdles	5-27
3.	Long-term assessment of INPI resident patent filings	5-29
3.1	Geographic distribution	5-29
3.2	Resident patents: leading companies and institutions	5-30
3.3	Patenting by residents: economic sectors and branches of industry	5-37
4.	Non-resident patents	5-42
5.	Patenting by universities and research institutions	5-49
6.	Conclusions	5-52
	References	5-53

Chapter 6

Technology balance of payments: a renewed perspective

1.	Introduction	6-5
2.	The TBP concept and some of its difficulties	6-6
3.	Problems in defining high, medium and low technology in the TBP	6-8
3.1	Embodied technology intensity	6-8
3.2	Electronics	6-9
3.3	Implications of the internationalized production system	6-10
3.4	United States: leadership in science, industrial deficiencies, trade fragilities	6-10
3.5	The electronics industry in Brazil and its fragilities	6-11
3.6	Oil & gas	6-12
3.7	Technology intensity of an economy, a sector, a company	6-12

3.8 Technology efforts in Brazil	6-13
4. Trade in goods with embodied technology: concept and measurement	6-14
5. Overview of international trade in goods with embodied technology	6-15
6. Patterns of trade in goods with embodied technology by Brazil and São Paulo State	6-21
7. Evolution of Brazil's & São Paulo's trade flows: classification by level of technology content & partner country development	6-27
7.1 Exports	6-27
7.2 Imports	6-30
7.3 Balance	6-30
8. Technological services	6-32
8.1 International context	6-32
8.2 Brazilian context	6-38
9. Final considerations	6-43
References	6-44

Methodological annexes

Table of Contents: Methodological Annexes — Volume 1	A-1
---	-----

Annex – Chapter 4

Analysis of scientific production based on publications in specialized journals	A-3
1. Conceptualization of quantitative indicators for the analysis of science	A-3
2. Characteristics of SCIE, SSCI and A&HCI databases	A-3
3. Characteristics of Scopus, SciELO and selected specialized databases	A-4
4. Complexity of using science citation indicators	A-6
5. Methodology of boxes on research networks (section 5)	A-6
5.1 Box 4.2: Nanotechnology research networks	A-6
5.2 Box 4.4: Sugarcane genomics and breeding scientific cooperation network	A-7
5.3 Box 4.5: Networks: Theoretical and conceptual aspects	A-7
5.3.1 Algebraic indicators	A-8
5.3.2 Network density	A-9
5.3.3 Connectivity	A-9
5.3.4 Geodesic distance	A-9
5.3.5 Centrality of actors	A-10
5.4 Box 4.6: Biophotonics research networks	A-10

Annex – Chapter 5

Patenting activity in Brazil and abroad	A-15
1. Data furnished by IPEA and INPI	A-15
2. Treatment of data furnished by INPI	A-16

Annex – Chapter 6

Technology balance of payments: a renewed perspective	A-18
--	------

Acronyms	A-21
-----------------	------

VOLUME 2

Chapter 7

Technological innovation by business in São Paulo State: an analysis based on the findings of the PINTEC survey

1. Introduction	7-5
2. PINTEC, IBGE's innovation survey: methodology and evolution	7-6
3. Innovative firms in industry and knowledge-intensive services	7-9
Patents and other innovation protection methods	7-22
4. Sources of innovation and technological cooperation	7-26
4.1 Cooperation for innovation	7-29
5. Innovation activities and R&D spending by innovative firms	7-32
5.1 Intensity of internal R&D	7-35
5.2 Intensity of external R&D	7-37
5.3 Structure of internal R&D	7-40
5.4 Funding of internal and external R&D	7-42
6. Economic impact of product innovation	7-44
7. Conclusions	7-48
References	7-49

Chapter 8

The regional dimension of ST&I activities in São Paulo State

1. Introduction	8-5
2. Regionalized quantitative indicators of ST&I activities	8-6
2.1. Profile and geographical distribution of skilled labor	8-6
2.2. Innovative firms	8-14
2.3. Patenting	8-15
2.4. Scientific articles	8-23
2.5. University-business interaction	8-26
3. Institutional structure supporting technological and innovation activities in firms	8-35
3.1. Business support institutions (education and research)	8-35
3.2. Vocational and technical-scientific education institutions	8-38
3.3. Technology centers, test laboratories and R&D institutions	8-42
4. The configuration of local innovation systems in São Paulo State	8-44
4.1. Metropolitan São Paulo	8-45
4.2. Campinas region	8-46
4.3. São José dos Campos region	8-47
4.4. São Carlos region	8-48
4.5. Ribeirão Preto region	8-49
5. Conclusions	8-50
References	8-50

Chapter 9

Information & Communication Technology (ICT) in São Paulo State: characterization and diffusion indicators

1. Introduction	9-7
2. The ICT industry in Brazil and São Paulo State: definition of scope and general characterization	9-8
3. Participation in international trade by the ICT industry in São Paulo State	9-17
4. The secondary dimension of ICT firms' software activities and related services in	

São Paulo	9-25
5. Indicators of ICT diffusion for Brazil and São Paulo State based on the National Household Sample Survey (PNAD)	9-38
6. Innovation by São Paulo's ICT firms: an analysis based on PINTEC data	9-42
7. Conclusions	9-52
References	9-53

Chapter 10

ST&I and the agricultural sector in São Paulo State

1. Introduction	10-7
2. Characterization and recent evolution of the São Paulo State Agricultural ST&I System (SPInA)	10-11
2.1 Public agricultural research organizations in São Paulo State	10-13
2.2 Private agricultural research organizations in São Paulo State	10-16
2.3 Educational institutions conducting agricultural research in São Paulo State	10-18
3. ST&I expenditure and human resources (inputs: expenditure & HR)	10-21
3.1 Public expenditure	10-24
3.2 Private expenditure on agricultural R&D	10-34
3.3 Formation of human resources for agricultural and agribusiness S&T	10-38
4. Results and impacts of SPInA	10-43
4.1 Economic impacts of agricultural R&D	10-43
4.2 Patenting in agriculture	10-45
4.3 Plant variety protection	10-52
4.4 Scientific production	10-56
4.5 Competencies	10-60
5. Outlook for SPInA	10-63
Glossary	10-65
References	10-66

Chapter 11

ST&I Indicators in Health in São Paulo State

1. Introduction	11-7
2. Indicators of ST&I inputs, outputs and outcomes in health in São Paulo State	11-9
2.1 Input indicators	11-10
2.1.1 FAPESP's role in promoting ST&I in health in São Paulo State	11-19
2.2 Output indicators	11-24
2.2.1 Overview of scientific production in health in Brazil and São Paulo State	11-24
2.2.2 Brazilian scientific production on selected diseases and the share of institutions in São Paulo State	11-34
2.2.3 Overview of technological production in Brazil and São Paulo State	11-37
2.3 Outcome indicators	11-52
3. Indicators of ST&I/H human resources in São Paulo State	11-55
3.1 Human resources in postgraduate programs	11-55
3.2 Human resources in the health industrial complex	11-60
4. Final considerations	11-64
References	11-65

Chapter 12

Public understanding of science and technology in São Paulo State

1. Introduction	12-7
2. Interest in measuring public understanding of science	12-8
2.1 International and domestic context	12-8
2.2 In search of a standard for Ibero-America	12-9
2.3 Questionnaire construction methodology	12-9
2.4 Questionnaire application methodology	12-10
3. Data analysis and discussion	12-10
3.1 Interest in S&T	12-10
3.1.1 Who is “interested” in S&T?	12-13
3.2 Information about S&T	12-20
3.2.1 Scientific Information Consumption Indicator	12-21
3.3 Perceptions, values and attitudes to S&T	12-24
3.3.1 Perceptions of Brazil’s performance	12-26
3.3.2 Risks and benefits	12-26
3.3.3 Consumption of information	12-29
3.4 Individual and social appropriation of S&T	12-32
3.4.1 Appropriation x interest in S&T	12-32
3.4.2 Appropriation x information about S&T	12-36
3.4.3 Faith and science, faith in science	12-37
3.4.4 Can science solve any problem?	12-38
3.4.5 Faith and science: two valued spheres	12-39
3.5 Comparisons within the Ibero-American Project and other international comparisons	12-41
4. Final considerations	12-47
References	12-49

Methodological annexes

Table of Contents: Methodological Annexes — Volume 2	A-1
--	-----

Annex – Chapter 7

Technological innovation by business in São Paulo State: an analysis based on the findings of the PINTEC survey	A-5
---	-----

Annex – Chapter 9

Information & Communication Technology (ICT) in São Paulo State: characterization and diffusion indicators	A-8
1. Indicators of geographical concentration and economic specialization	A-8
2. Discrimination of ICT products by segment	A-8

Annex – Chapter 10

ST&I and the agricultural sector in São Paulo State	A-34
A.1 Values of IPCA (IBGE) for 1995- 2007	A-34
A.2 Calculating expenditure on S&T and R&D in agriculture	A-34
A.3 Data on MCT agreements in the agricultural area	A-35
A.4 Primary survey of agricultural research budgets in higher education	A-36
A.5 Courses selected for calculating CAPES grants in São Paulo	A-37
A.6 Fisher index and Törnqvist index	A-38
A.7 USPTO and INPI patent search strategy	A-39

A.8 Decision codes for applications, patents and certificates of addition	A-40
A.9 Scientific article search strategy	A-41

Annex – Chapter 11

ST&I Indicators in Health in São Paulo State	A-42
Lattes Platform	A-42
Health industrial complex	A-44
ISI database	A-45
FAPESP's annual reports	A-47
Description of IPC Class A61 (Medical or Veterinary Science; Hygiene) and its subclasses	A-48
Description of selected knowledge areas according to CAPES	A-49

Annex – Chapter 12

Public perceptions of science and technology in São Paulo State	A-51
1. Questionnaire development and application	A-51
2. Survey sample	A-52
3. Data analysis	A-54
3.1 Construction of ICIC	A-55
4. The questionnaire	A-56

Acronyms	A-71
-----------------	------

Statistical conventions adopted in this publication

- Zero (exact value, not rounded)
- .. Numerical data not applicable
- ... Numerical data not available
- x Numerical data omitted to avoid individualizing information
- 0.0 Zero resulting from rounding
- * Missing data

Foreword

Celso Lafer

President of FAPESP

São Paulo was the first Brazilian state to recognize the vital role of science and technological research as a matter of public policy. In Article 123 of the State Constitution, the 1947 State Constituent Assembly established that a foundation would be created to pursue this mission and that it was to be funded by “not less than half of one per cent of the state’s total ordinary revenue”. Federal agencies with a similar mission were not to be set up until the 1950s.

Thus in the words of Miguel Reale “scientific research became a *primordial duty of the state* [original emphasis], whose effective performance was immediately assured by the laudable idea of setting up a foundation endowed with the necessary autonomy, starting with the appropriation of adequate funds.”

São Paulo has remained conscious of the importance of science and technological research to society – an importance that only increased throughout the second half of the twentieth century, so much so that the 1989 State Constituent Assembly augmented FAPESP’s funding from half of one per cent of ordinary revenue to a full one per cent, explicitly including technology in the foundation’s remit.

Article 1.VI of FAPESP’s charter, approved in 1962, states that the core activities to be performed by the foundation in order to achieve its objectives include “periodically carrying out surveys of the overall status of research in São Paulo and Brazil, and identifying the fields to be prioritized in terms of funding”.

This is the context for the publication of these Indicators, which constitute a highly valuable input for the formulation of public policy relating to science and technological research. Previous editions were published in 2002 and 2004.

The conceptual framework for the Indicators includes a selection component. From an economic standpoint it is possible to distinguish between inputs and outputs. Chapters 1, 2 and 3 deal with inputs. The first two chapters focus on the formation of human resources in São Paulo State through both basic education and higher education (undergraduate university and technology courses, as well as postgraduate courses). The third presents data and analysis on research and development (R&D) expenditure in São Paulo,

whether public (federal and state) or private, as well as useful comparisons with the rest of Brazil and selected countries worldwide.

The other chapters of this important book address what may be called the “outputs” of science and technological research in São Paulo State today. Chapter 4 analyzes scientific production in terms of articles and papers published by journals at home and abroad. São Paulo and Brazil are again compared with the rest of the world, and emphasis is placed on national and international scientific collaboration, which globalization is increasingly making a priority. Chapter 5 deals with patenting both in Brazil and abroad.

Assessment of the impact of S&T activities on the production chain, among other dimensions, begins in this edition with Chapter 6, which focuses on the technology balance of payments. The chapter opens with a fundamental discussion of the TBP concept and its difficulties, proceeding with an analysis of trade in goods with embodied technology by São Paulo State and Brazil.

Chapter 7 analyzes technological innovation by business in São Paulo State based on the findings of a survey of innovation conducted nationwide by the government (IBGE’s PINTEC). This matches the technology dimension included in FAPESP’s remit by the new State Constitution.

Chapter 8 highlights the regional dimension of ST&I efforts in São Paulo, while Chapter 9 focuses on information and communications technology (ICT).

The impact of ST&I on agriculture and agribusiness is the theme of Chapter 10. Chapter 11 analyzes ST&I in health, one of the sectors most benefited by research funding from FAPESP in São Paulo State.

Finally, Chapter 12 presents an interesting survey of public perception of S&T in São Paulo State. To some extent this is the culmination of all the work done by FAPESP, since society is its essential audience, as intended by the drafters of the 1947 and 1989 constitutions, which guarantee the material conditions for it to function.

We hope the efforts of the researchers who have contributed to this comprehensive and impressively detailed publication are useful to the entire São Paulo community.

