



Babbage Seminar

Institute for Manufacturing, Charles Babbage Road, Cambridge

13 December 2012

Industrial and innovation policies in Brazil: recent paths and main challenges

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Industrial and Innovation Policies in Brazil: recent paths and main challenges

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Cambridge, Babbage Seminar, 13 December 2012

Agenda

1) The context

- ✓ Brazil in a nutshell
- ✓ History matters...

2) PITCE – Política Industrial, Tecnológica e de Comércio Exterior, 2003

3) PDP – Plano de Desenvolvimento Produtivo, 2008

4) PBM – Plano Brasil Maior, 2011

5) Main challenges for the future



Facts and figures

- Borders with 10 countries
 - 50% of South America's surface
More than 8 million sq. km
 - 50% of the South American Population
190 million inhabitants
 - 55% of South American GDP
US\$ 1.9 billion
8th world's largest economy
- * VENEZUELA:
full MERCOSUR member,
in process of adhesion

There is a Brazil that many people know

Amazon forest

Soccer

Carnival

Coffee



It keeps being successful, but there is still more to know

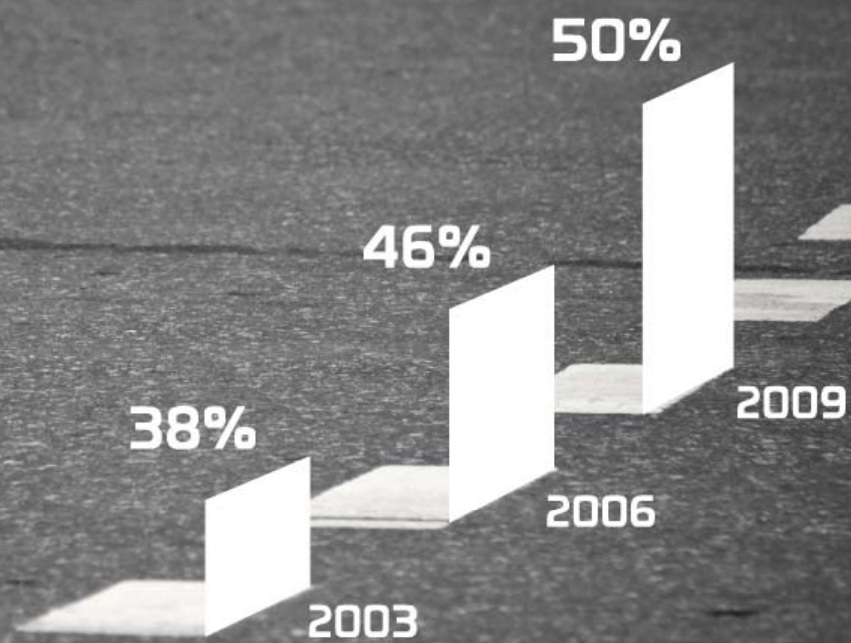
The Brazil that you must know



Innovation, technology, competitiveness and productivity

MIDDLE CLASS GROWTH

% of total population



Source: FGV and IBGE

BRAZILIAN CONSUMPTION...

**Computers:
5th
World Market**



Source: IDE



BRAZILIAN CONSUMPTION...

Cosmetics:
3rd
World Market



Source: INSTITUTO EUROMONITOR

BRAZILIAN CONSUMPTION...

Mobile Phones:
5th
World Market



Source: RC CONSULTORES

BRAZILIAN CONSUMPTION...

Cars:
5th
World Market



Source: GUIDO VILDOSO



BRAZILIAN GROWTH

2018 GDP

- 1º USA
- 2º China
- 3º Japan
- 4º India
- 5º Germany
- 6º BRA**
- 7º Russia
- 8º UK
- 9º France

2026 GDP

- 1º China
- 2º USA
- 3º Japan
- 4º India
- 5º BRA**
- 6º Germany
- 7º Russia
- 8º UK
- 9º France

Source: Economist Intelligence Unit (USA)



121,000 NEW GRADUATES
A YEAR IN
SCIENCE & TECHNOLOGY AREA

source: MCT

161



TECH TRANSFER

OFFICES **IMPLEMENTED**

source: ANPROTEC

SO FAR...



400

TECHNICAL INCUBATORS

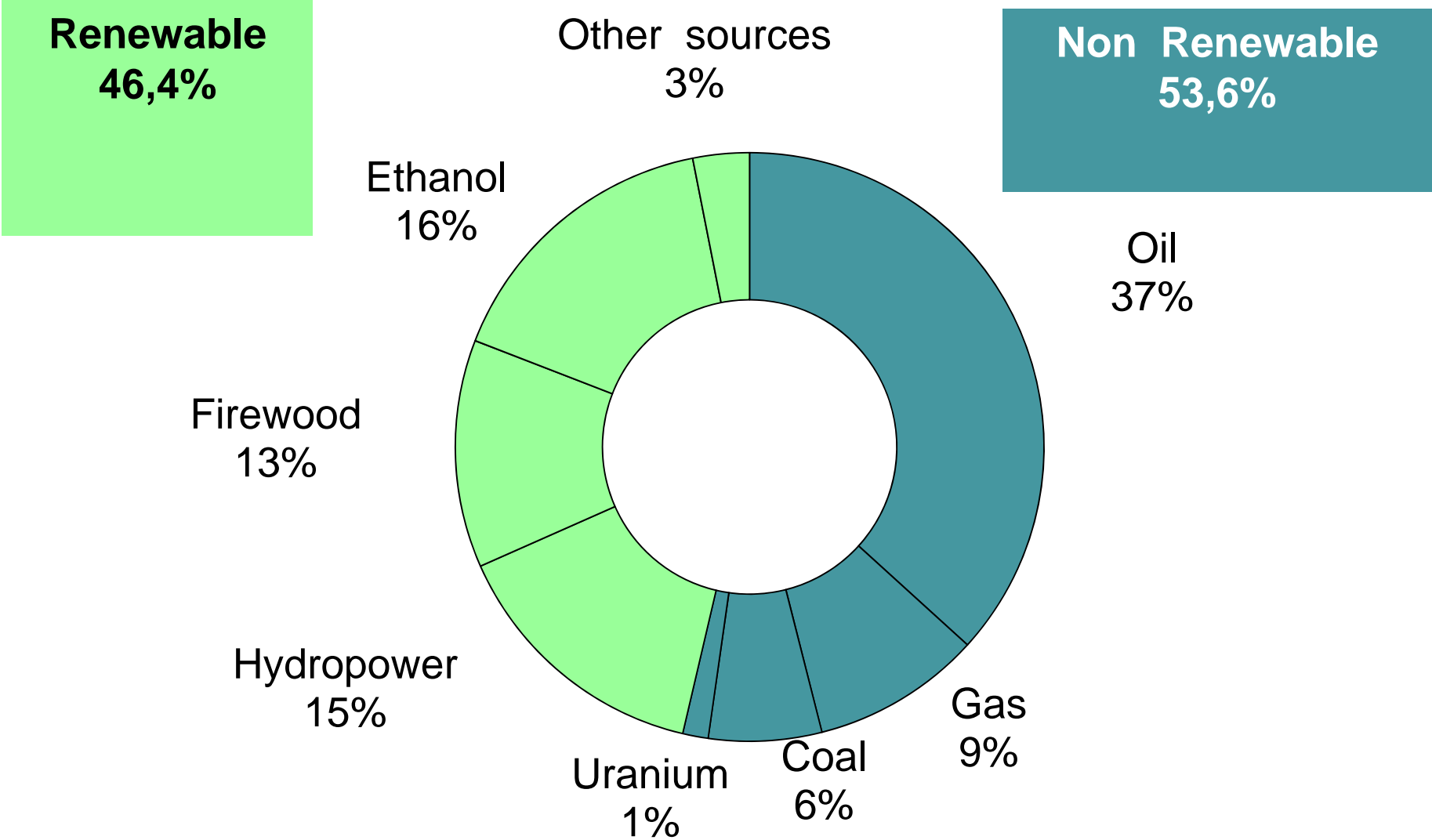
INVOLVING

6,000

INNOVATIVE
BUSINESSES

source: ANPROTEC

Brazil – energy matrix



Brazilian companies go global

AMBEV/INBEVI

THE
WORLD'S
LARGEST BREWER

JBS-FRIBOI

1st
COMPANY IN
ANIMAL PROTEIN
PRODUCTION

VALE

2nd
COMPANY IN
MINING PRODUCTION
IN THE WORLD

EMBRAER

3rd
LARGEST
AIRCRAFT COMPANY
IN THE WORLD

MARCOPOLO

7%
GLOBAL PRODUCTION
OF BUS BODIES AND
PARTS

TOTVS

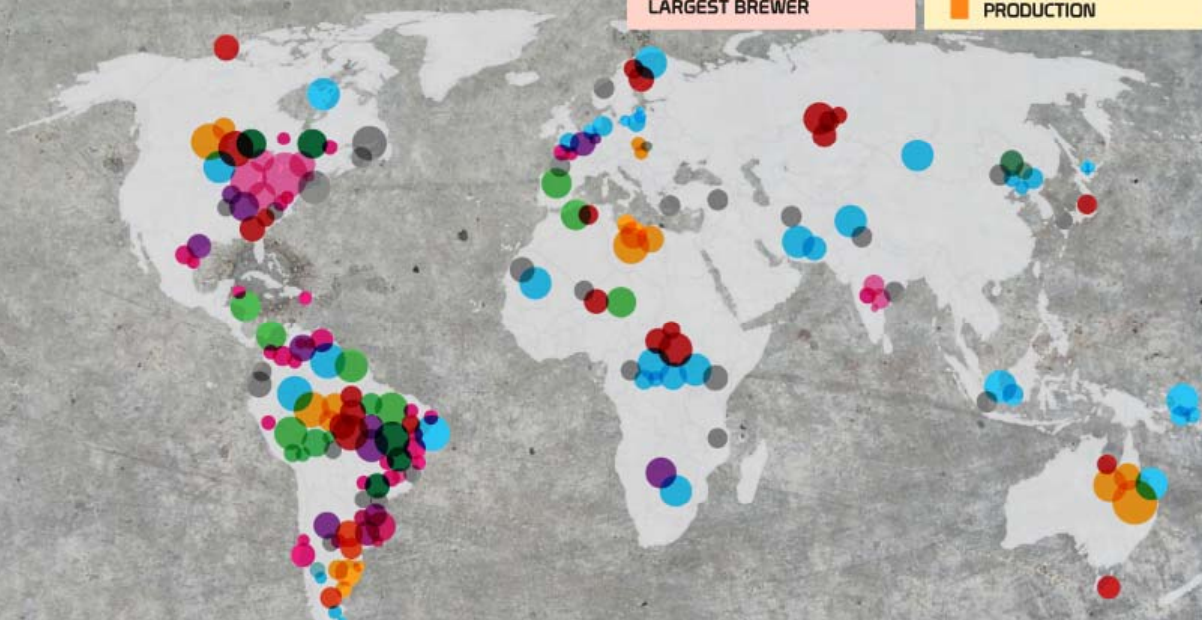
8th
WORLD BIGGEST
BUSINESS SOFTWARE
COMPANY

GERDAU

8th
COMPANY IN
STEEL PRODUCTION
IN THE WORLD

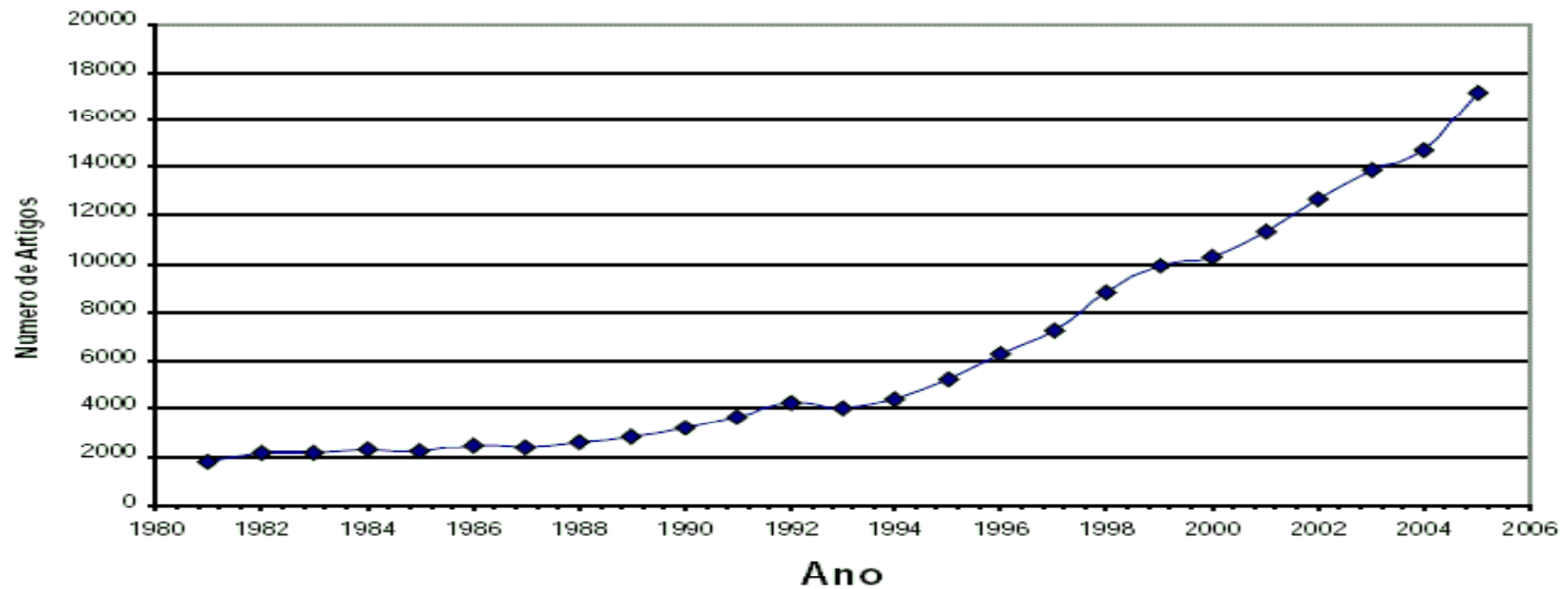
PETROBRAS

8th
LARGEST
COMPANY IN
IN THE WORLD



2- Artigos científicos do Brasil indexados no ISI

Artigos Publicados Indexados (ISI)
(Brasil)

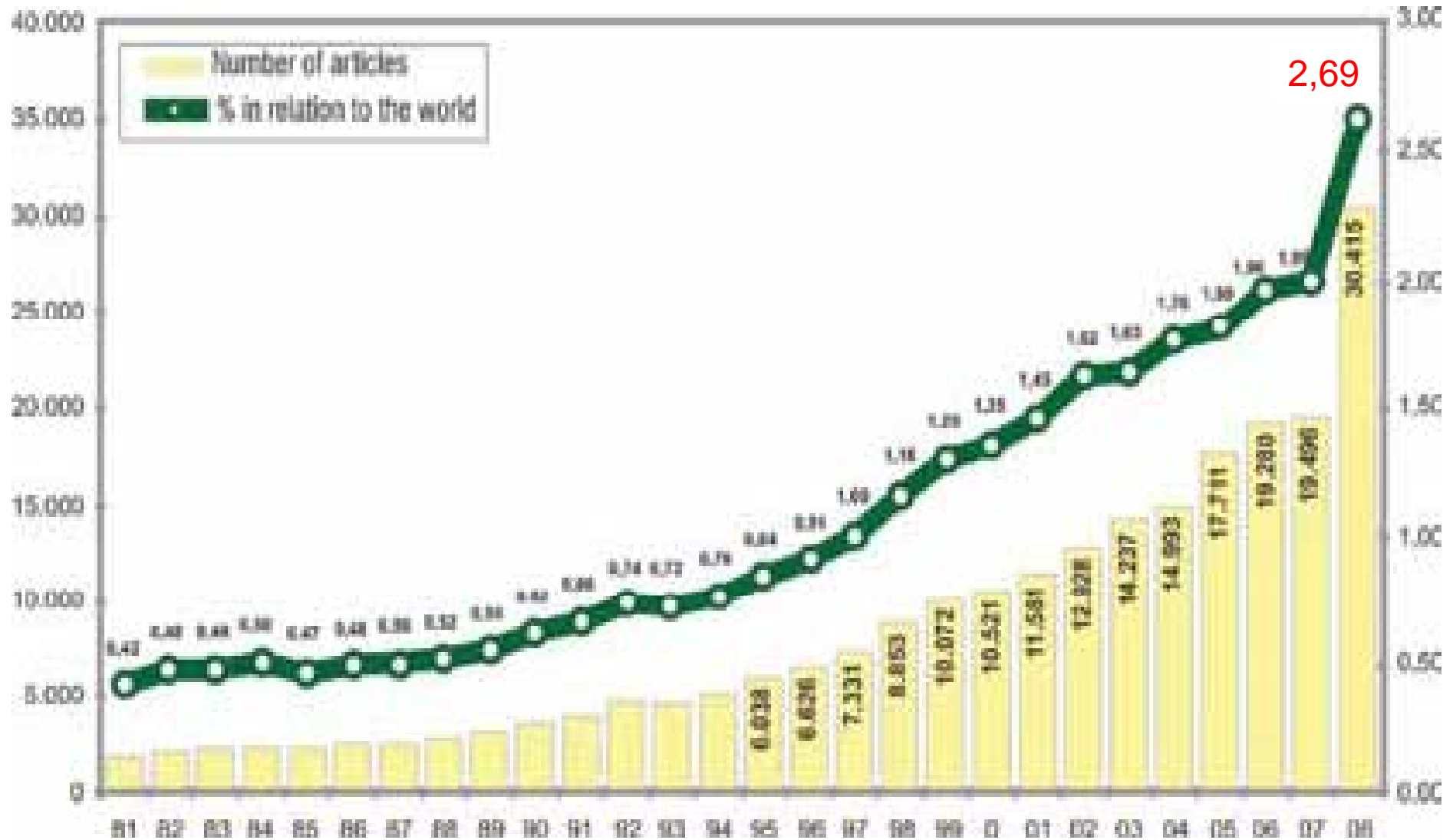


2002: 12.681

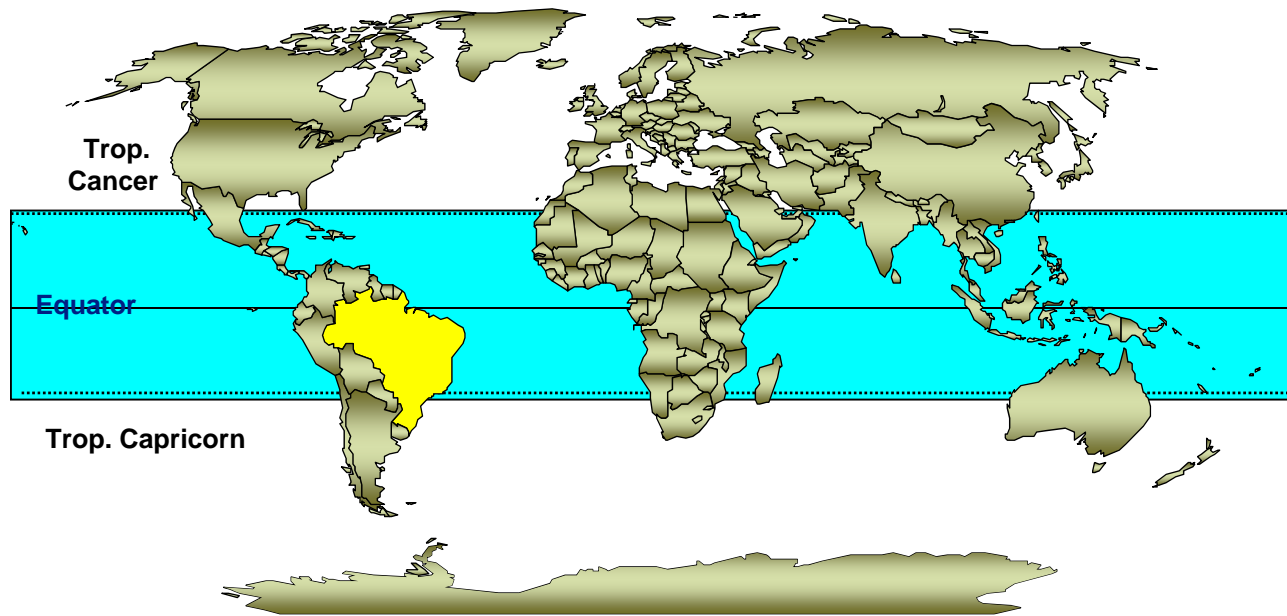
2005: 17.155 (+35%)



Brazilian scientific articles indexed in the Institute for Scientific Information (ISI)



S&T in Brazil: a partner for innovative tropical agriculture



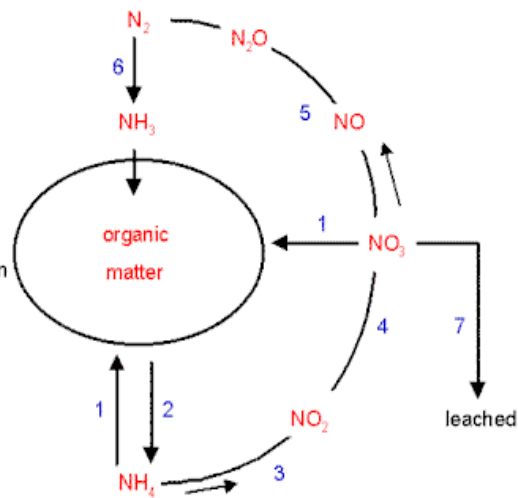
Natural resources ; Genetic resources;
Cereals; Vegetables; Animal breeding;
Raw materials; Agroforestry / forestry production;
Family farming; Post-harvest/Agribusiness;
Environmental protection; Farming automation;
Rural and regional development; Fruits



Biological nitrogen fixation and the soybean industry



1. Uptake of NH_4 or NO_3 by organisms
2. Release of NH_4 by decomposition
- 3,4. Microbial oxidation of NH_4 (yields energy in aerobic conditions)
5. Denitrification (NO_3 respiration) by microbes in anaerobic conditions (NO_3 is used instead of O_2 as the terminal electron acceptor during decomposition of organic matter)
6. Nitrogen fixation
7. Nitrate leaching from soil



After early failures (since 1909), research (in biological nitrogen fixation, soil, ...) made soy one of the most important crops (planted area, production and exports) in Brazil.

Soy contributes around 6 % of the Brazilian gross national product (GNP)
 Around 1 million people are employed in the soy sector in Brazil.

Renewable Energy: Bio-fuels



Brazil is the world leader in developing bio-fuels and their use in automobiles

“Brazil represents a great success story, as the country’s National Alcohol Program dates back to 1975, when the Brazilian government first introduced the policy as a measure to reduce its dependence on petrol imports and enable the country to produce renewable and environmentally friendly energy.

From 1985 to 1990, around 90% of all automobiles manufactured in Brazil were powered by ethanol.

To date, more than 6 million ethanol and flexible fuel vehicles have been manufactured in Brazil”

Ford Motor Company, USA, May 10, 2005
(http://media.ford.com/print_doc.cfm?article_id=20825)

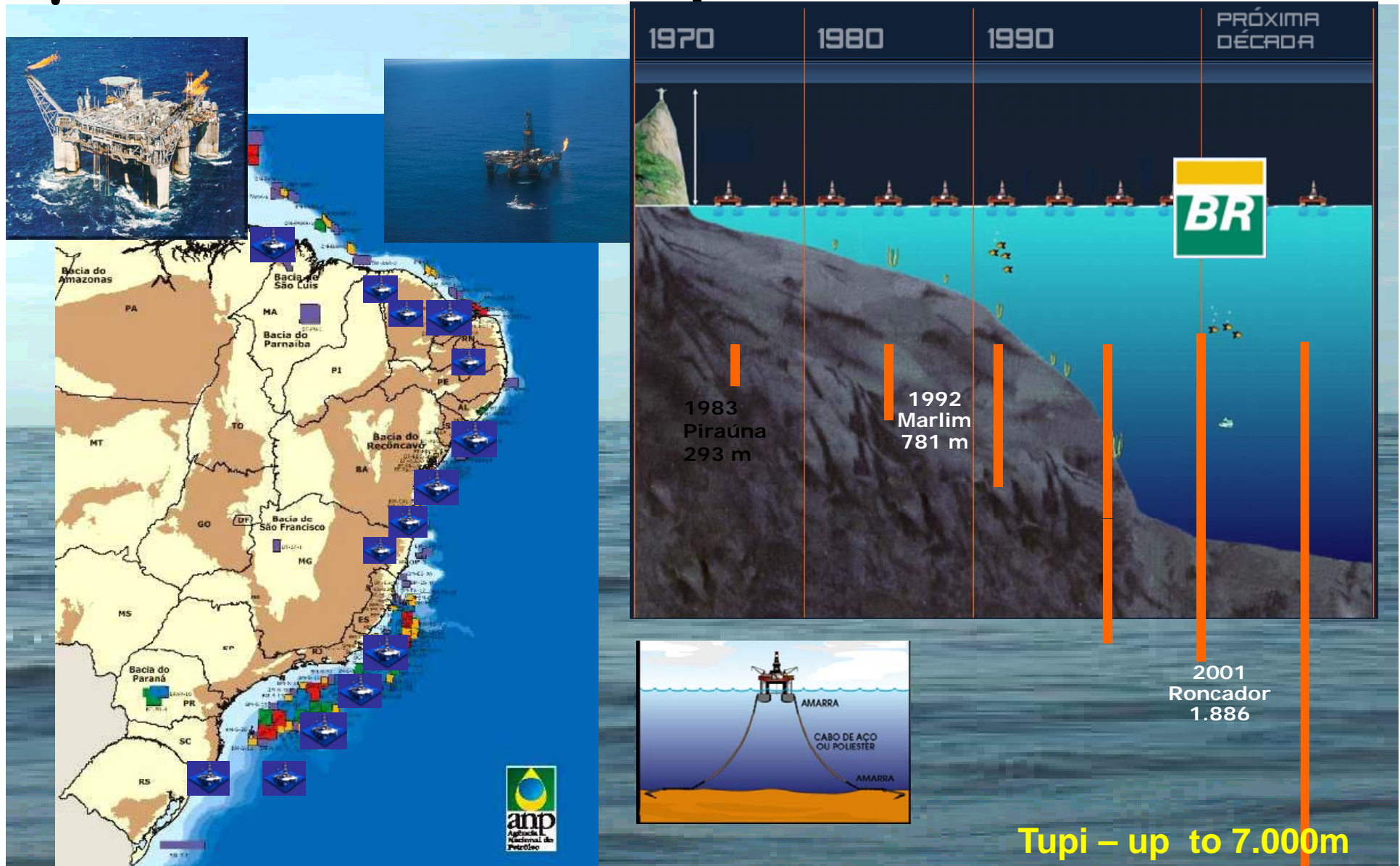
Building Resources for Molecular Breeding of Eucalyptus

The Genolyptus Project

Example of pre-competitive cooperation between Universities and Companies, involves 13 enterprises, 7 universities and 3 research centers from National Research Institute for Agriculture (Embrapa): a suite of genomic, field and information resources to discover, sequence, map, validate and understand the underlying variation of genes and genomic regions of economic importance in Eucalyptus with a focus on wood and disease resistance.



Petrobras: world's top producer of oil in deep waters

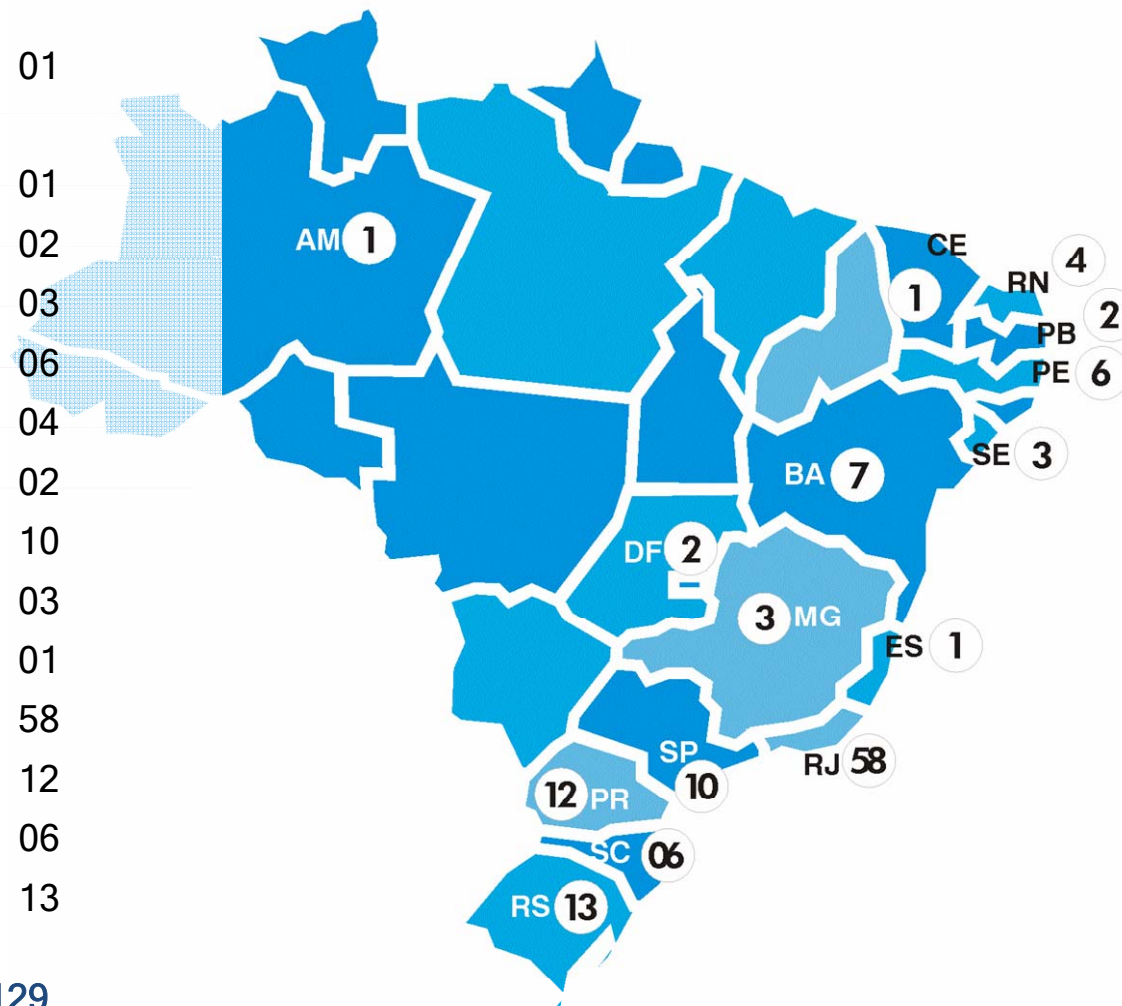


Cooperation Petrobras / Universities in Brazil



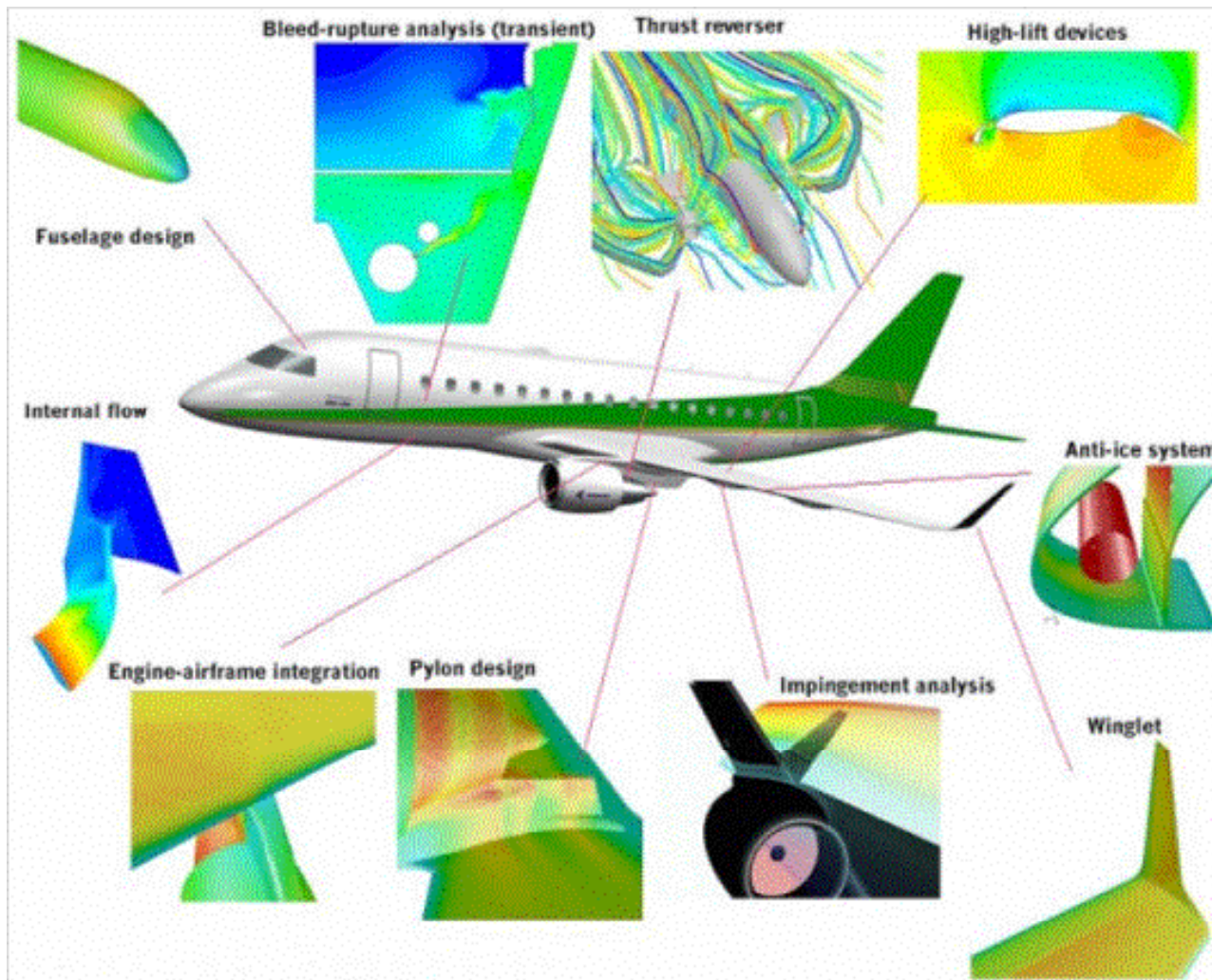
Region State Research Groups

North	Amazonas	01
Northeast	Bahia	07
	Ceará	01
	Paraíba	02
	Sergipe	03
	Pernambuco	06
	Rio Grande do Norte	04
	Centre West	Distrito Federal
Southeast	São Paulo	10
	Minas Gerais	03
	Espírito Santo	01
	Rio de Janeiro	58
	South	Paraná
	Santa Catarina	06
	Rio Grande do Sul	13
Total Research Groups		129



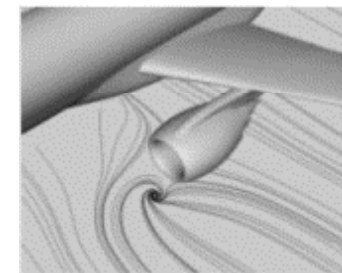


Computational Fluid Dynamics (CFD)

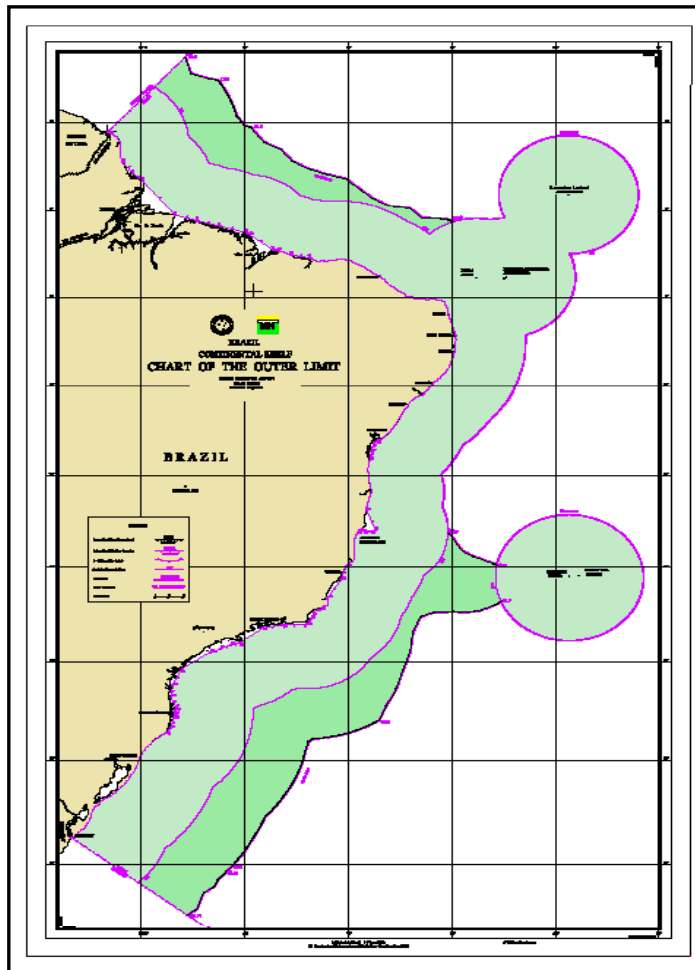


Prize CNI 2005

- 8 Institutions: Embraer, CTA, USP – Poli & São Carlos, UNICAMP, UFSC, UFU, PUC-Rio
- 3 enterprises: ESSS, CITS & DELTACORE.
- 100 specialists.



Sustainable use of the marine environment



United Nations Convention of the Law of the Sea (UNCLOS) granted the right to exclusive use of marine resources within 200 nm economic zone.

REVIZEE program:

- Inventory of living resources and environmental features of ZEE ;
- Determination of their biomass;
- Establishment of sustainable capture potentials;
- People employment and means.

REVIZEE



Living Resources in the Exclusive Economic Zone

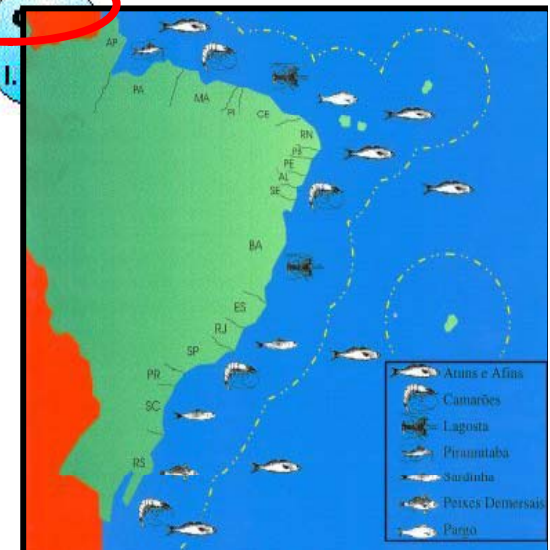
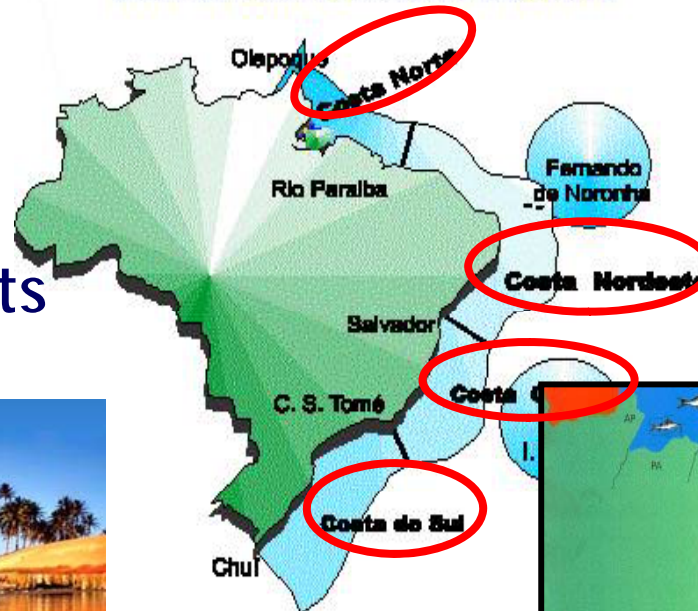
Avaliação do Potencial Sustentável dos Recursos Vivos na Zona Econômica Exclusiva

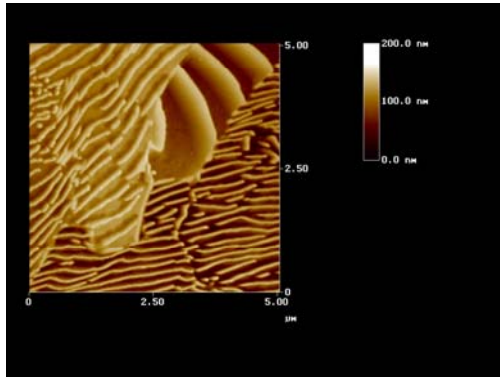
Research Network:

10 Ministries & Agencies

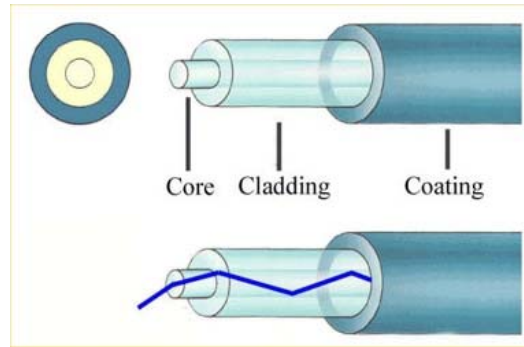
42 Research Institutions

> 100 research vessels/boats

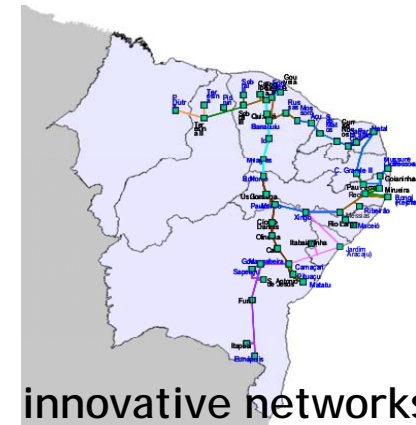




nanotech applications



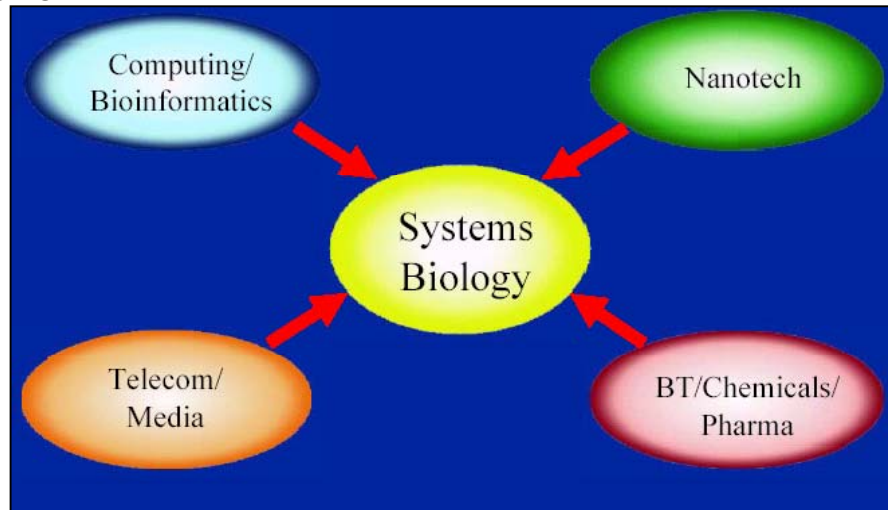
optical fiber



innovative networks (clusters)



automation

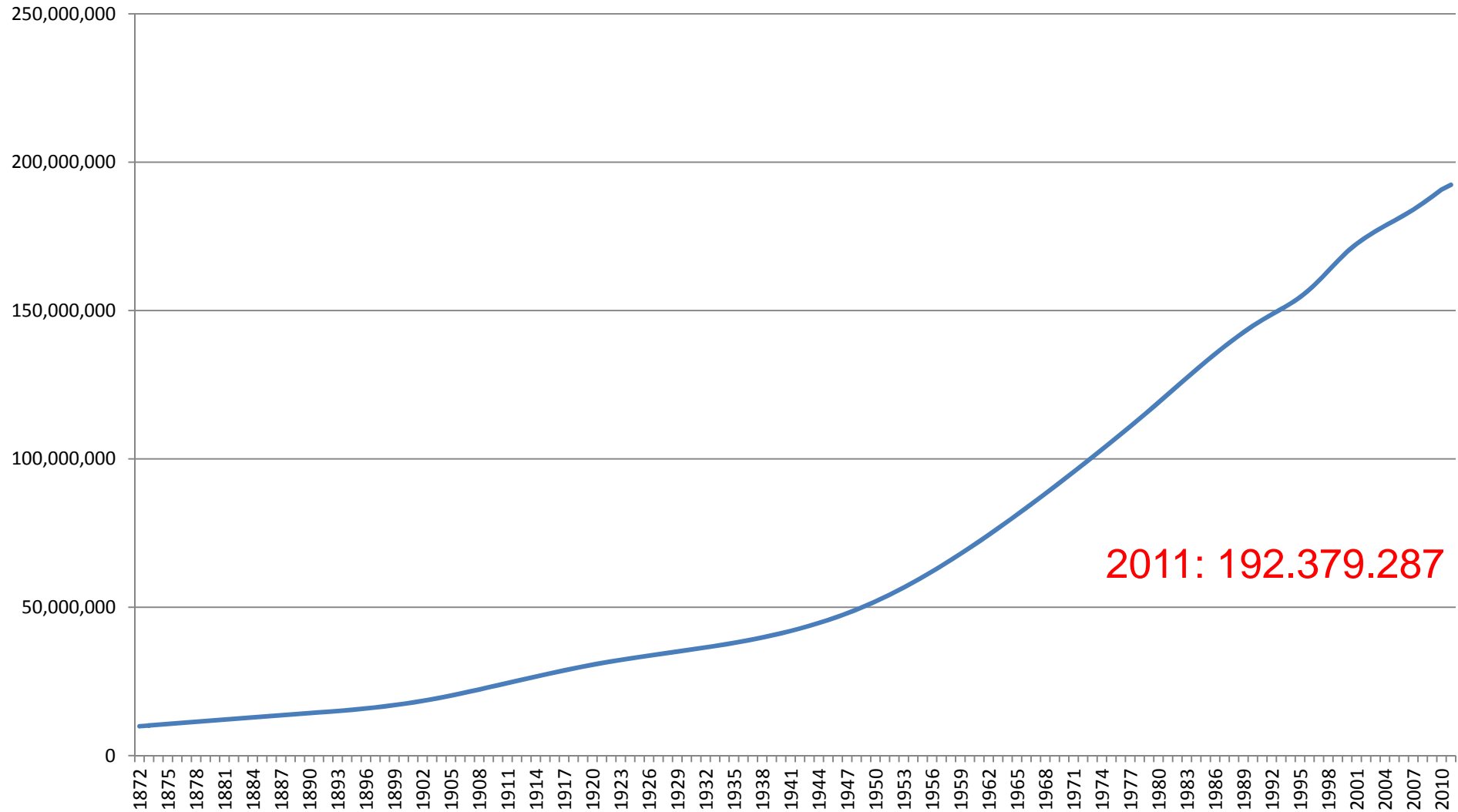


new materials

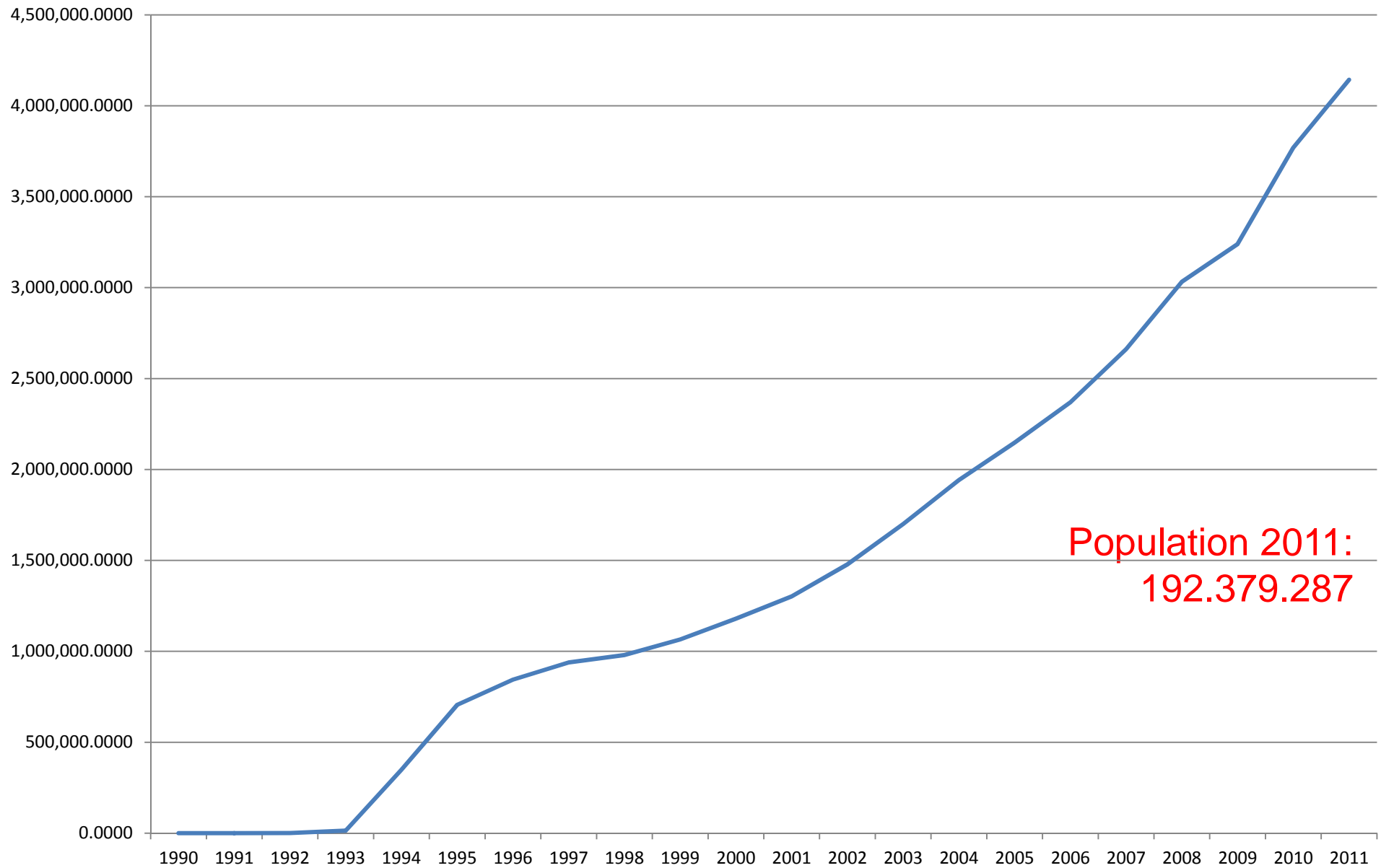


cheese rolls

Populational Growth

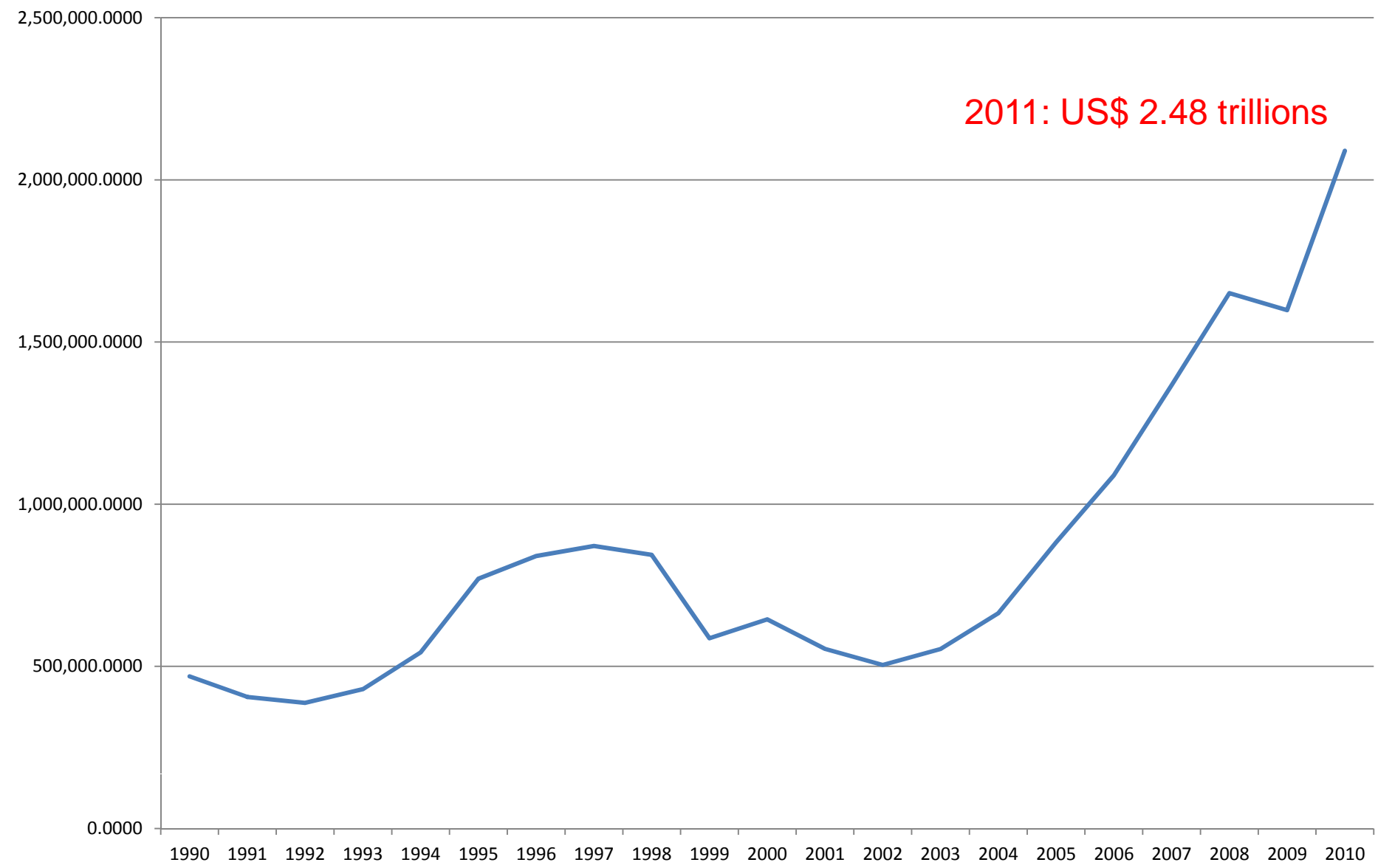


GDP

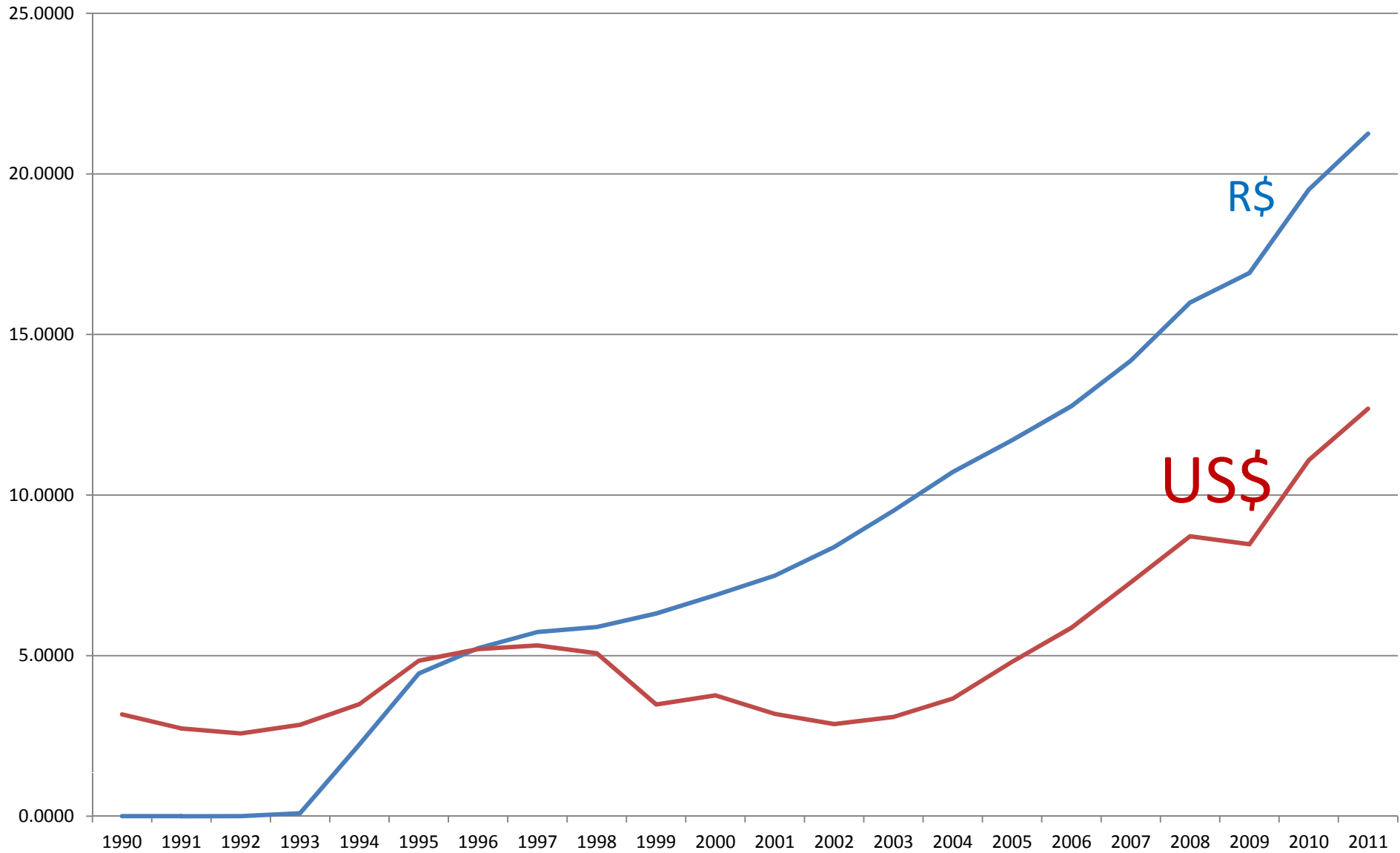


Population 2011:
192.379.287

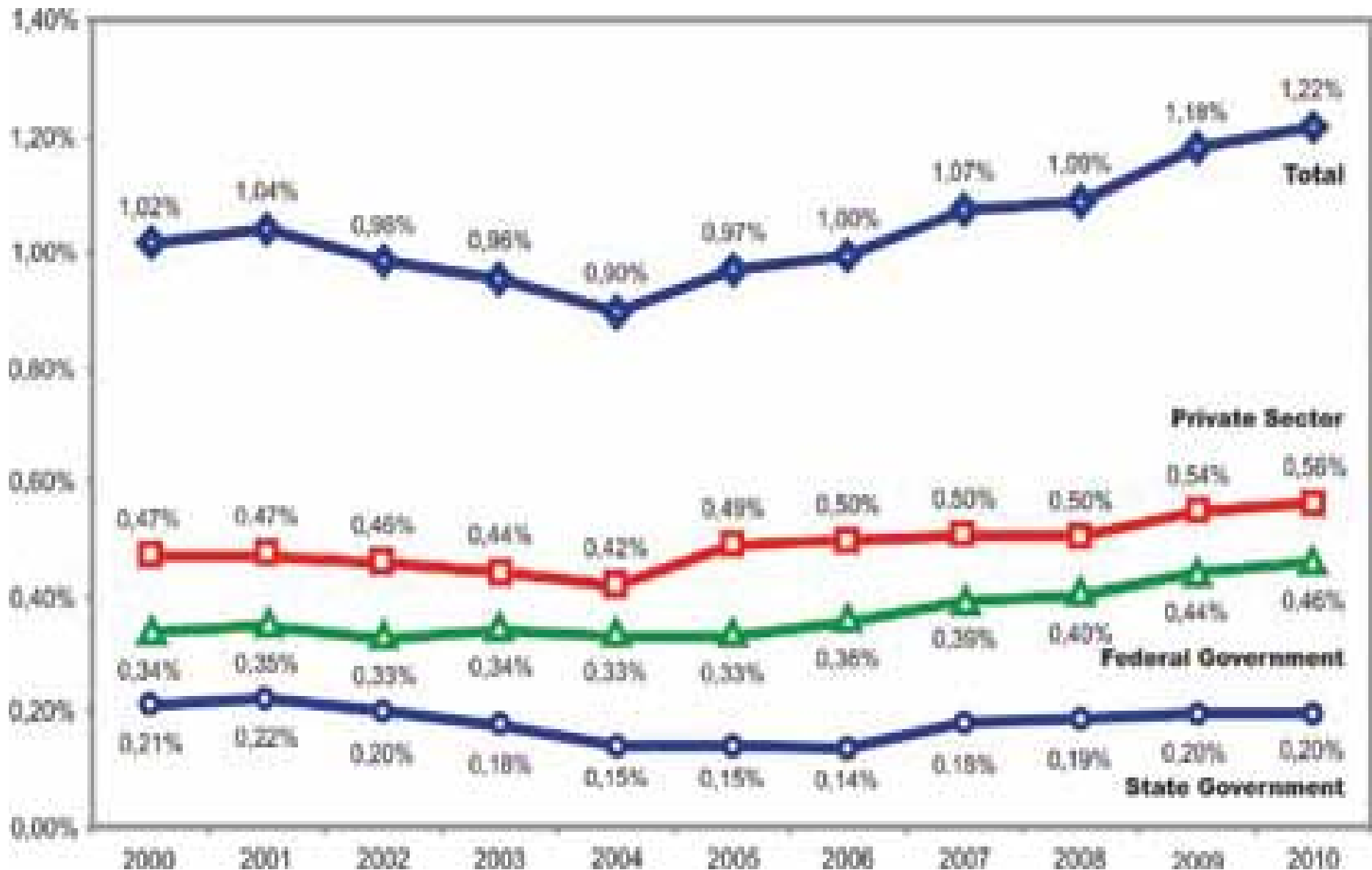
GDP – US\$ dollars



GDP per capita



R&D/GDP



A bit of history

The building of the Brazilian Production System

- Late industrialisation
 - ✦ Industries were forbidden until April 1, 1808
 - ✦ Only sugar mills, for export
- Most of the main value chains / networks governed by TNCs
 - ✦ 5 out of 10 / 8 out of 20 largest companies are TNCs, the others were created by the State
 - ✦ Exceptions: Braskem, Ipiranga
- Productive chains / networks based on eletromechanicals
 - ✦ Gaps in (micro)electronics, fine chemicals

A bit of history

The building of the Brazilian Production System

Origin of Capital – 10 largest companies by sector

SETOR	ESTRAN- GEIRO	BRASI- LEIRO	OBS
Automobilístico	10	0	
Bens de Capital	4	6	Não há brasileiras integradoras
Bens de Consumo	6	4	
Eletroeletrônica	9	1	Brasileira é montadora na Zona franca de Manaus, operando com tecnologia e produtos com marca japonesa
Farmacêutica	7	3	Apenas 1 empresa brasileira com molécula própria (MeToo*, não molécula radicalmente inovadora)
Indústria Digital	9	1	A brasileira é o Serpro, de serviços para o Estado Federal
Papel/Celulose	5	5	Setor baseado em recursos naturais
Química/Petroquímica	7	3	Brasileiras em petroquímica e fertilizantes (<i>commodities</i>)
Telecomunicações	7	3	
Têxtil	10	0	Houve troca de comando em pelo menos 1 empresa após o levantamento
Varejo	5	5	

R&D, engineering design & manufacturing



- Many researches have demonstrated the crucial role of location
 - Location of R&D and product engineering activities have a close link with location of physical production
 - The concept of Design Headquarters (Salerno et al, 2009)
 - Controlling engineering specifications
 - Efforts for innovation → internal R&D expenditures / income
 - Brazilian Cos. have efforts 81% higher than foreigners Cos. (probabilistic model by Araújo, 2005)

Industrial polices since 1950s (1)

- Getulio Vargas (1940s)
 - State-owned heavy industries (steel, basic chemicals, oil - Petrobras)
- Juscelino (JK) government – “Plano de Metas” 1950s
 - “50 years in 5”, but no exigency of design activities
 - Attraction of foreign industries to produce for the internal market
 - Ex.: Auto assemblers for foreigners; the policy killed the Brazilian industry at the time
 - Import substitution: closed market (for TNCs...)
- The hegemony of foreign capital in industry may explains the differences of the Brazilian import substitution policy from those of Japan and Korea

Industrial polices since 1950s (2)

- Military dictatorship (1960s -70s)
 - Nationalistic view of production, not of engineering and product design
 - Heavy investments to fulfil gaps in industrial chains (petrochemicals, machinery etc.), external debt
 - Mid70s
 - Brazil as the fast growing economy of XX century
 - Imports accounted for only 6% of its GDP
- Oil crisis / debt crisis and political fights against dictatorship have dismantled the model
 - Crisis - the “lost decade” (80s) with high inflation and low growth

FHC: 1995 – 2002

- FHC: “The best industrial policy is not to have one”, by Pedro Malan, Ministry of Economy
 - Focus on stabilizing the economy (Plano Real)
 - Fixed parity real – US\$ dollar, industrial regression
 - Privatizations, financed by BNDS
 - Some programs based on “total quality”
 - Automotive regime to cope with investments being deviated to Argentina
 - New funds aiming at regaining historical levels of public investments in scientific research

Lula's Government: PITCE 2003

- First explicit industrial policy in many decades
- Focus 1: technology and innovation
 - Innovation law
 - Tax incentive law, inducing R&D employment
- Focus 2: exports
 - Credit, Apex, procedures simplification, monitoring
- Focus 3: institutional
 - ABDI – Brazilian Agency for Industrial Development
 - CNDI – The National Council of Industrial Development
 - BNDES: back to the finance of new facilities



The Building of PITCE 2003

● Mandate

- Building the mandate
- Consolidating it
 - Research, studies, data and analysis for Ministers and public
- Reforming it (“MRO”)

● Process

- CPE
- GE-PITCE

● Institutional building

- New laws
- ABDI – Brazilian Agency for Industrial Development
- CNDI – The National Council of Industrial Development

● Coordination

- The formal document has helped a lot
- ABDI



Lula's Government: PDP 2008

Production Development Plan

- Focus: to sustain growth
- A consolidation of a myriad of instruments measures etc., focusing on the increase of the investments
 - Official presentation had 240 slides...
 - To increase offer
 - To preserve balance of payments
 - To increase innovation
 - To strength production chains
- In practice, the main measures were linked to the strengthening of medium-large Brazilian groups
 - They suffered a lot during the debt crisis
 - They suffered a lot during Plano Real (R\$1 = US\$1)
- 2008 crisis slowed down PDP



Objetivo Central

DAR SUSTENTABILIDADE AO ATUAL CICLO DE EXPANSÃO

Desafios

Ampliar capacidade de oferta

Preservar robustez do Balanço de Pagamentos

Elevar capacidade de inovação

Fortalecer MPES

Metas

Macrometas 2010

Metas por programas específicos

Políticas em 3 níveis

Ações Sistêmicas: focadas em fatores geradores de externalidades positivas para o conjunto da estrutura produtiva

Programas Estruturantes para sistemas produtivos: orientados por objetivos estratégicos tendo por referência a diversidade da estrutura produtiva doméstica

Destaques Estratégicos: temas de política pública escolhidos deliberadamente em razão da sua importância para o desenvolvimento produtivo do País no longo prazo

Dilmas's Government: PBM 2011

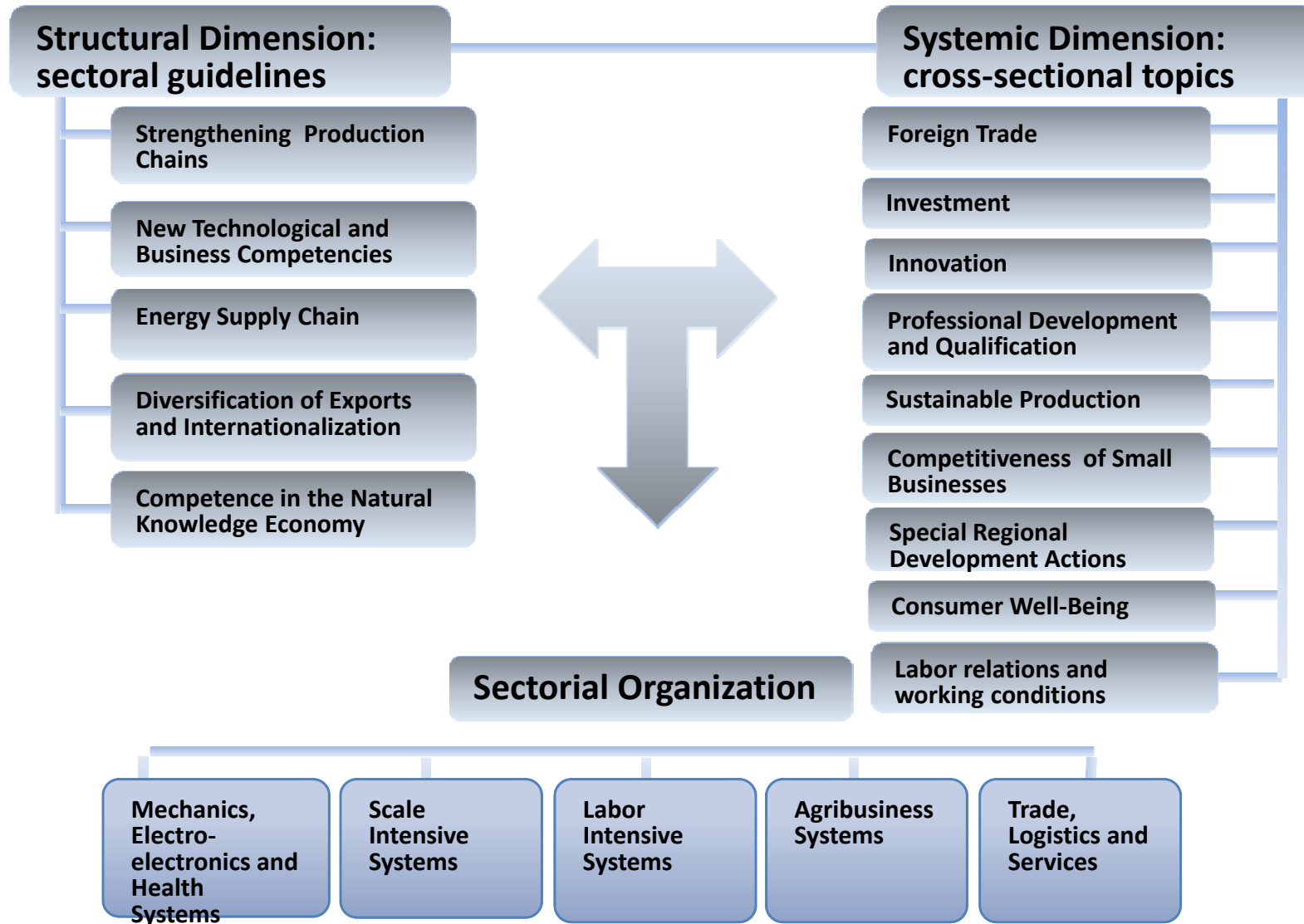


Plano Brasil Maior

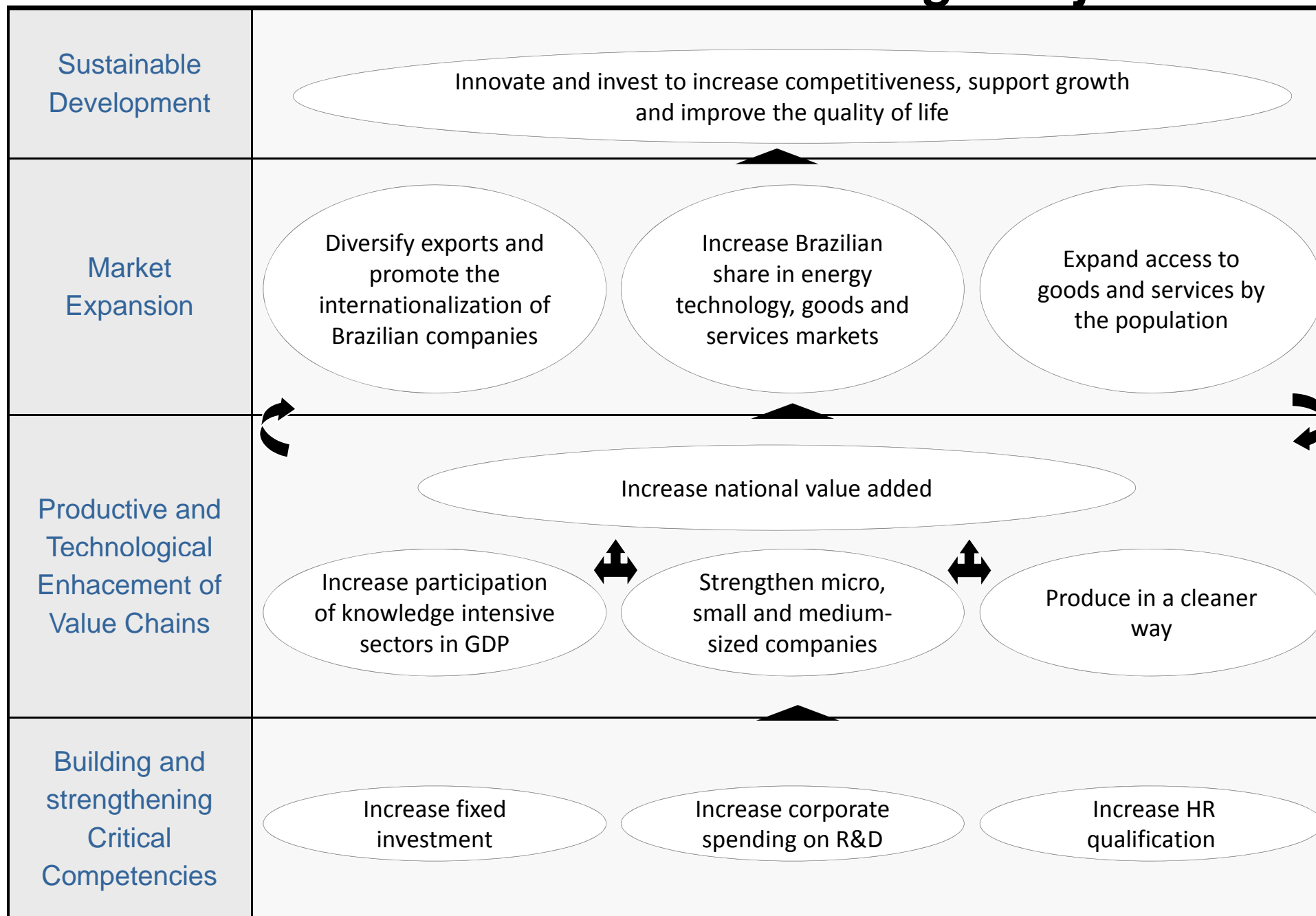
- Focus: innovation & tech developpt.
- Priorities
 - To build and strengthen critical competencies
 - To enhance productivity and technological density within value chains
 - To expand the domestic and external markets of Brazilian Cos
 - To ensure socially domestic and environmentally sustainable growth



Plano Brasil Maior: three main dimensions



PBM 2011 Plano Brasil Maior Strategic Objectives



What have happened after all these plans?



- Some Brazilian companies are stronger now
- More Brazilian multinationals
 - ✦ Important due to intra-company external trade
- Inequality reduction and income increase have created a whole new market (~30 million people)
 - ✦ Companies have focused on the Brazilian market
 - ✦ Foreign companies too → imports were rising due to lack of competitiveness
- Education improvement is finally highlighted

The relationship engineering – industrial policies my own experience

- Most of the daily life of public agencies are fulfilled with economic issues
- A generic approach is a necessary but not sufficient condition for a successful history
- It is easier to discuss productive issues with entrepreneurs if one knows the logics of production systems
 - Implicit association engineers – production – product
 - Engineering is associated with efficiency, innovation, product development, value creation

Before the end...

What are we doing at the University? USP

Innovation Management Lab

- Focus: innovation systems for companies
- Unity of actuation: companies, firms
- Disciplines/ courses on innovation management: under graduated, post-graduation, extension (modular)
- Projects
 - Models for organization and management of innovation in companies
 - Innovation programs
 - Initial planning for start ups

The Observatory of Innovation and Competitiveness

- Focus: public policies on innovation
- Interdisciplinarity: engineers, sociologists, economists, lawyers, doctors
- Periodic seminars transmitted live on the web
- Projects:
 - Modelling of technological demonstrators platforms;
 - Scorecard of countries' competitiveness (with CoC-USA and GFCC)
 - EngenhariaData – website on informations and analysis on engineering in Brazil

Observatório da Inovação e Competitividade

www.observatoriousp.pro.br

Histórico

- ❑ **Criado** em 2007 - iniciativa dos Profs. Glauco Arbix (FFLCH-USP) e Mario Sergio Salerno (POLI-USP)

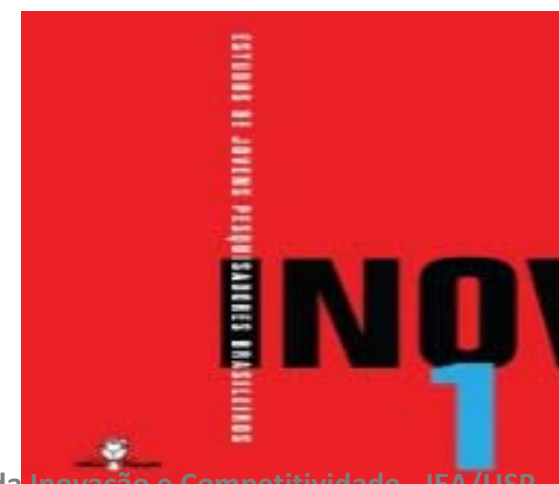


- ❑ **Articulado** com diversas instituições externas
- ❑ **Sediado** no Instituto de Estudos Avançados da Universidade de São Paulo (IEA-USP)

Objetivos

- ❑ **Foco**
 - Inovação, Competitividade e Desenvolvimento na sociedade do conhecimento
- ❑ **Objetivos**
 - Geração de conhecimento;
 - Discussão de políticas públicas e de estratégias empresarias pró-inovação
 - Difusão

Algumas realizações

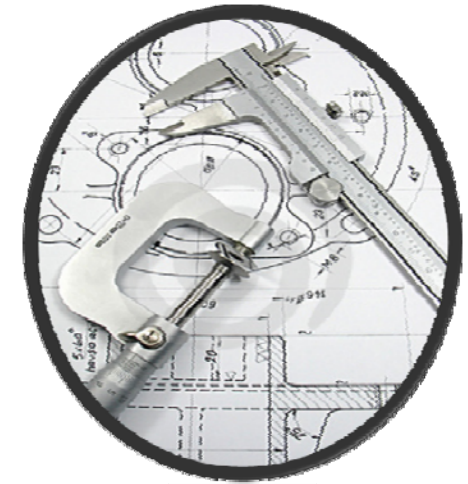


Projeto NAP/OIC

Lançado publicamente dia 9 de maio de 2011

DataEngenharia: Sistema de indicadores de Engenharia

Construção de um amplo e consistente sistema de indicadores que permita avaliar sistematicamente a situação das engenharias no Brasil, viabilizando análises regionais, setoriais e comparações internacionais.



Sistema de indicadores de Inovação

Construção de sistema de indicadores que possibilite recortes temáticos (inovação não tecnológica, patentes, educação, etc.) e regionais, para permitir discussões de desenvolvimento e de políticas de inovação (nacionais, regionais, setoriais,...)



Industrial and Innovation Policies in Brazil: recent paths and main challenges

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Cambridge, Babbage Seminar, 13 December 2012

Industrial and Innovation Policies in

THANK YOU!

recent paths and main challenges

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IPEA Research

- Based on national large databases
 - PIA (Annual Industrial Research), PINTEC (CIS3 like) / IBGE
 - External trade / SECEX-MDIC
 - RAIS (employment, wages, qualification, education & turn over) / MTE
 - Foreign capital census (BACEN)
 - Federal acquisitions database (MPOG)
- It concerns
 - 72.000 industrial companies
 - 5.000.000 workers
 - 90% of value added
 - 1996 – 2002
- Participation of main Brazilian academics + IPEA team
 - UFMG, UFRJ, UNb UNICAMP, USP
 - economics, engineering, regional development, sociology, statistics

Classification by Competitive Strategy and Performance

- A. Firms that have product differentiation and have launched a new product to the market
 - ✳ new product: PINTEC (similar to CIS3)
 - ✳ differentiation: 30% extra-price in exports regarding the average to the same product (Mercosul classification) weighted by market share
 - ✳ classification is based on product specification (tighter than sector)
- B. Firms specialized in standardised products (commodities)
 - ✳ exporters not included in A or not exporters but with equal or higher productivity than B exporters
- C. Firms without product differentiation and with lower productivity
 - ✳ not classified in A or B

Themes Analysed

(by category of firm)

- General overview of companies' strategy
- Firms internationalisation
- Work force and wages
- Technological spill over MNCs-nationals
- Regional issues
 - spatial distribution of firms
 - technology and innovation
- Determinants of firms' growth
- Sectorial analysis
- Innovation and technology in the agro-industry
- General overview of food industry
- “C” companies profile and competitive patterns
- Cooperation between firms and with other institutions
- Technological content of exports
- Cost and income structure
- Industrial concentration
- Governmental acquisitions
- Productivity
- Origin of capital
- International comparisons (with CIS3)

Some Initial Results

General overview (I)

Category	Total	Brazilian owned	Foreign capital	Mix
A) Innovate and differentiate product	1.199	742	394	63
B) Specialised in commodities	15.311	13.876	1.243	192
C) No differentiation / lower productivity	55.486	55.161	214	111
Total	71.996	69.779	1.851	366

Some Initial Results

Firms by competitive strategy and capital origin (I)

- Cat A: only 1% of firms
 - 39% of all A firms are foreign / mix capital
- 79% of MNCs are not A
 - Technological effort concentrated in headquarters
 - Brazilian subsidiaries established for the internal market
 - Established to explore natural resources/ low cost workforce
- Technological spill over from MNCs to Nationals
 - MNCs have a positive impact on the development of Brazilian companies innovative effort

Some Initial Results

Is innovation a good policy for Brazil?

- Technological innovation is one of the export determinants
 - Firms realizing technological innovation have 16% higher probability to be an exporter comparing to non innovative firms
- Wages
 - Average A= R\$1.255,00 / B=R\$749,00 / C= R\$431,00
 - But compares different conditions (income, sector, external trade etc)
 - Probabilistic model controlling 200 variables (income, sector, exports, qualification, school time, employment time, turn over, capital origin etc.)
 - A firms pay wages **23% higher** than C and 11% higher than B
 - Wage premium paid by firms that differentiate and innovate product
 - So, more A companies tend to have positive effects on general wages
- Innovative effort is greater in Brazilian-owned firms
 - The result is against the common sense largely diffused in Brazil
 - Probabilistic model controlling variables such as income, personnel, sector etc
 - Brazilian-owned (P&D internal expenditures / income) is **80,8% greater** than the MNCs ones

Some Initial Results

General overview (II)

Category	Number of Workers	Income R\$ 1.000,00	Value added R\$ 1.000,00	Scale efficiency (Indicator)
A) Innovate and differentiate product	545,9	135,5	51,1	0,77
B) Specialised in commodities	158,1	25,7	10,6	0,70
C) No differentiation / lower productivity	34,2	1,3	0,45	0,48

Some Initial Results

General overview - competitiveness indicators

Category	Productivity (R\$1.000/worker)	Technical efficiency	Market leadership	P&D expend. (% income)
A) Innovate and differentiate product	74,1	0,30	0,02	3,06
B) Specialised in commodities	44,3	0,18	0,004	0,99
C) No differentiation / lower productivity	10,0	0,11	0,00028	0,39
	Value added by worker	De Negri's indicator	(Firm income) / (CNAE sector income)	P&D expenditures / income

Some Initial Results

External Trade

- Firms realizing technological innovation have probability 16% higher to be exporters than non innovative firms
- Product innovation and product differentiation (extra-price) are highly correlated
- Product innovation has a strong association with medium tech intensity exports
- Process innovation is associated to high tech intensity exports
- Imports are very high for high tech exporters (trade imbalance)
- MNCs have higher propensity to export medium tech intensity products

Some Initial Results

Characteristics of Innovation Process

- Only 4,1% of the firms introduced a new product for the market (2,8% new process for the market)
- A firms
 - 71% are also process innovators
 - 35,6% introduced process innovation for the market
 - higher % of own process development
 - less dependent of other companies
- B&C pattern: innovation by technological diffusion
 - 26% of B firms introduced product innovation
36% of B firms introduced process innovation
 - 13% of C firms introduced product innovation
21% of C firms introduces process innovation
- 23% of A firms declared innovation as highly important to fit external market rules and standards / 13% of B firms

Some Initial Results

Finance Support for Innovation Process

- P&D expenditures: own resources is twice as important as public resources (finance, grants etc.)
 - 10% more of own \$ → 2,8% growth in the probability to accomplish a technological innovation
 - 10% more of public resources → 1,4%
- But this is a picture of the current situation
 - There is public funding for process innovation (mainly for machinery acquisition)
 - There is virtually no public funding/resources for product innovation
 - So, there is a necessity to introduce programs to

Political Implications

- Innovation is a good strategy for Brazilian industry
- Brazilian industry has enough scale to dispute but it should be improved
- The need to improve Brazilian firms to A category
- The need to improve MNCs technological activities locally
- New institutionalism to improve firms – universities & public research institutes cooperation
- Instruments to reduce innovation costs and risks
 - According to different types of firms
- Revision support laws

Is *Plano Brasil Maior* working?

Reduction of factors' costs & economy wide costs

- Relief of the tax burden over the payroll
- Welfare tax over the payroll (20%) was zeroed for different sectors
- Improved set of BNDES' long term funding mechanisms
- Taxes on capital goods were lowered
- The interest rate has been steadily reduced
- Tax regimes for businesses' incorporation were enlarged – Simples & MEI
- Measures to lower energy costs are being designed

Innovation and Technological Development

- Brazil's Innovation Agency (Finep) expenditure grew 24 x since 2002
- Finep's disbursement : ~R\$ 6.5 bi in 2011 → + R\$9 bi in 2012
- Science and Technology Development Fund grew +3 x since 2004 (R\$ 1.96 bi)
- New and/or improved BNDES financial lines to support innovation
- Innovation Law (Bayh-Dole Act like) – 2005
 - Amended in 2011 to support advanced procurement for innovation
- New legal mandate for the Brazilian Institute for Metrology, Quality and Technology
- Science Without Borders – 100,000 STEM students to be sent abroad
- Brazilian Industrial Innovation Corporation (Embrapi) set up in 2011 – 6 institutes
- Public procurement for innovation – preference margins mechanism set in 2012
- 9 PPPs in the health industry complex
- Number of companies using R&D incentives grew + 5x since 2006

Efficiency and Productivity

- National vocational and technical training program - Pronatec
- US\$ 2 bi for SENAI's new training centers
 - Funded by BNDES and the National Confederation of Industry
- New tax regimes for a selected set of industrial systems
 - Automotive, PADIS, REPUBLIC, RETID, PATVD, Reporto, Repetro etc.
 - Focus on supply chain development

The research

- We set a research to capture which kinds of innovation processes are relevant to configure managerial actions
 - Methodology similar to Clark & Wheelwright's, Clark & Fujimoto's, Cooper's, Hansen & Birkinshaw's etc.
 - Unity of research: innovation projects, not companies
 - * Different processes run in a same company
 - 131 innovation processes analyzed in 71 companies
 - * 68 Cos in Brazil, 2 in The Netherlands, 1 in France
 - * All sectors mixed, including some services
 - Hospitals, Engineering Service Providers, R&D services
 - Objective: to map the real process followed by each project and the contingencies that have shaped it
 - Financed by Fapesp (Foundation for Research Support of the São Paulo State, Brazil) and CNPq (The National Council of Research)

Concept, R&D, NPD

Traditional graphical representation of innovation process show a single flow
But ... it is useful to consider up to three flows (or subsystems or...
integrated with other corporate functions like marketing, finance etc.)

1. Concept flow: a process to define product concepts

- ➡ led hegemonically by marketing (Natura: “well being”)

2. R&D flow: a process to generate technologies, tech platforms

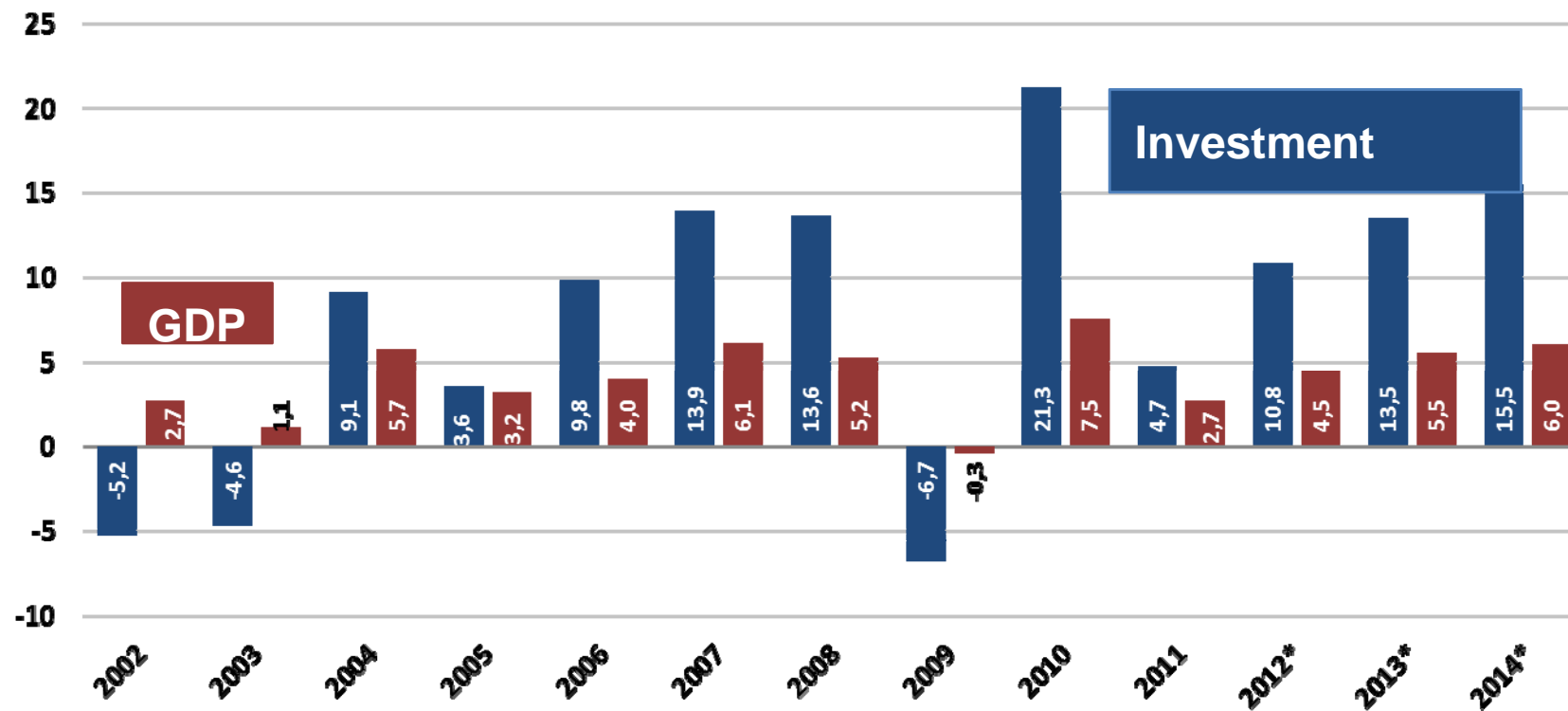
- ➡ Led by R&D departments or a dedicated team performing similar tasks

3. NPD flow

- ➡ Uses inputs from the other two, or from other sources

Since 2004 investment growth rates higher than GDP growth, except for 2009

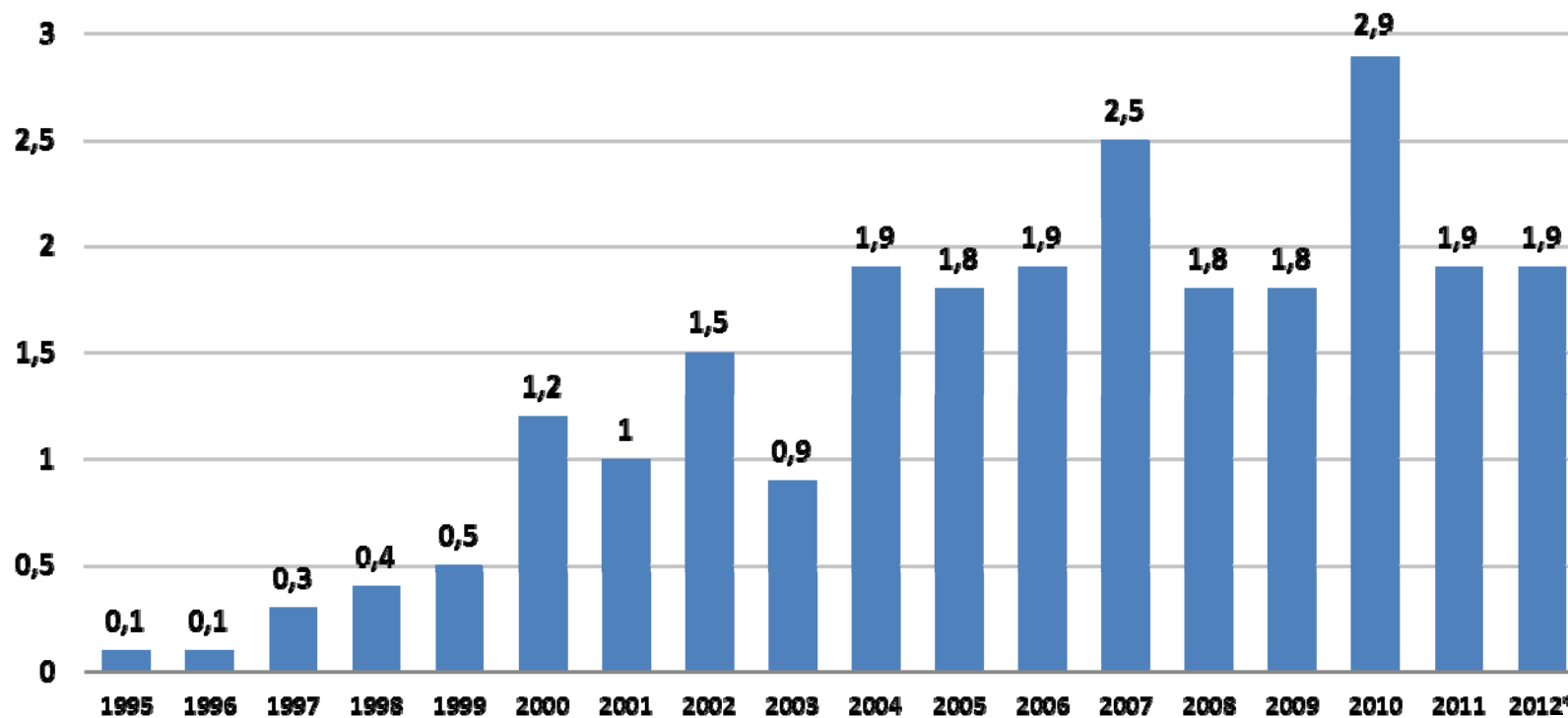
GDP and Investment – GFCF (% YoY)



* Estimated data

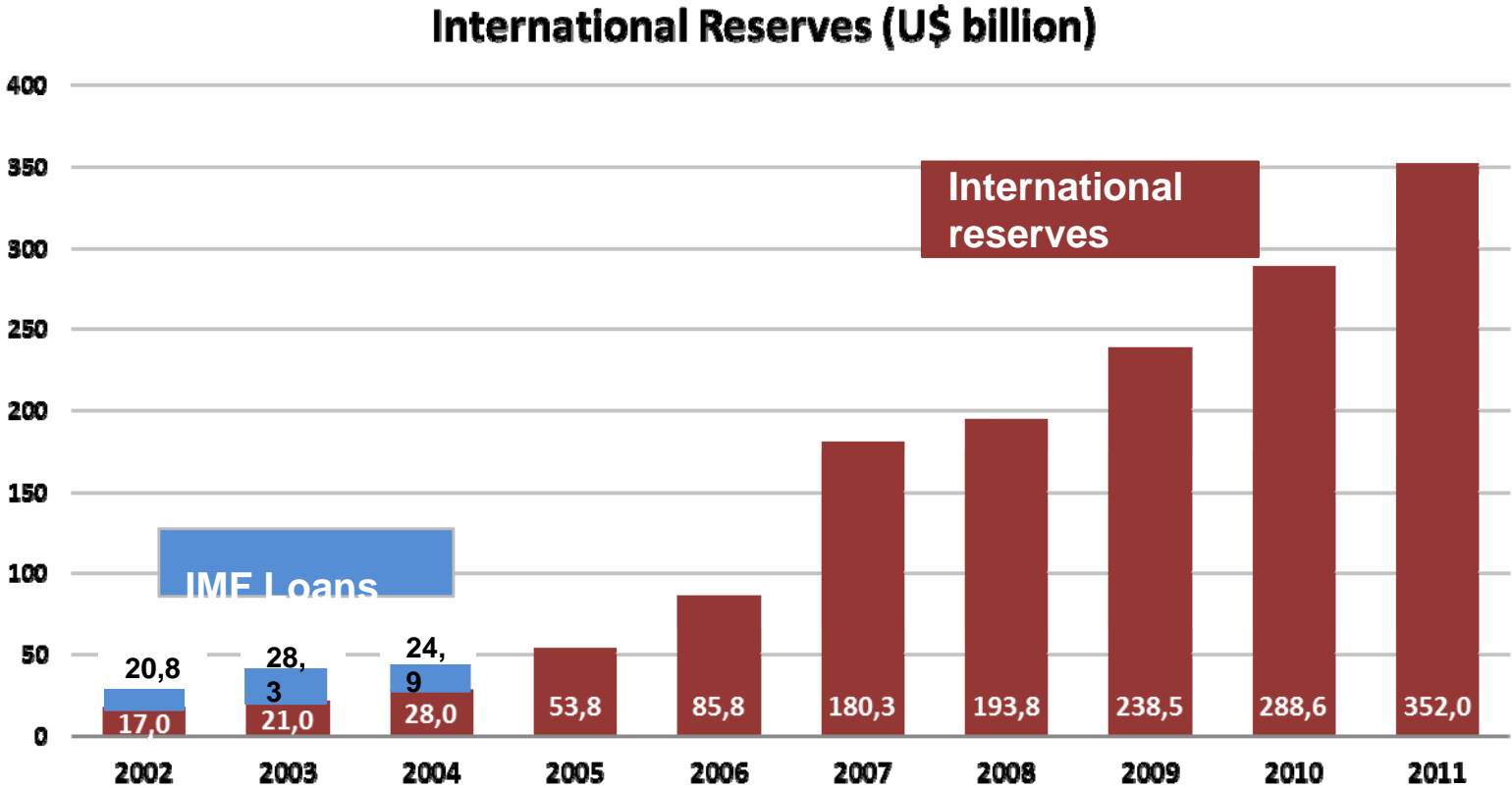
Source: IBGE and Ministry of Finance

Job Creation (millions)



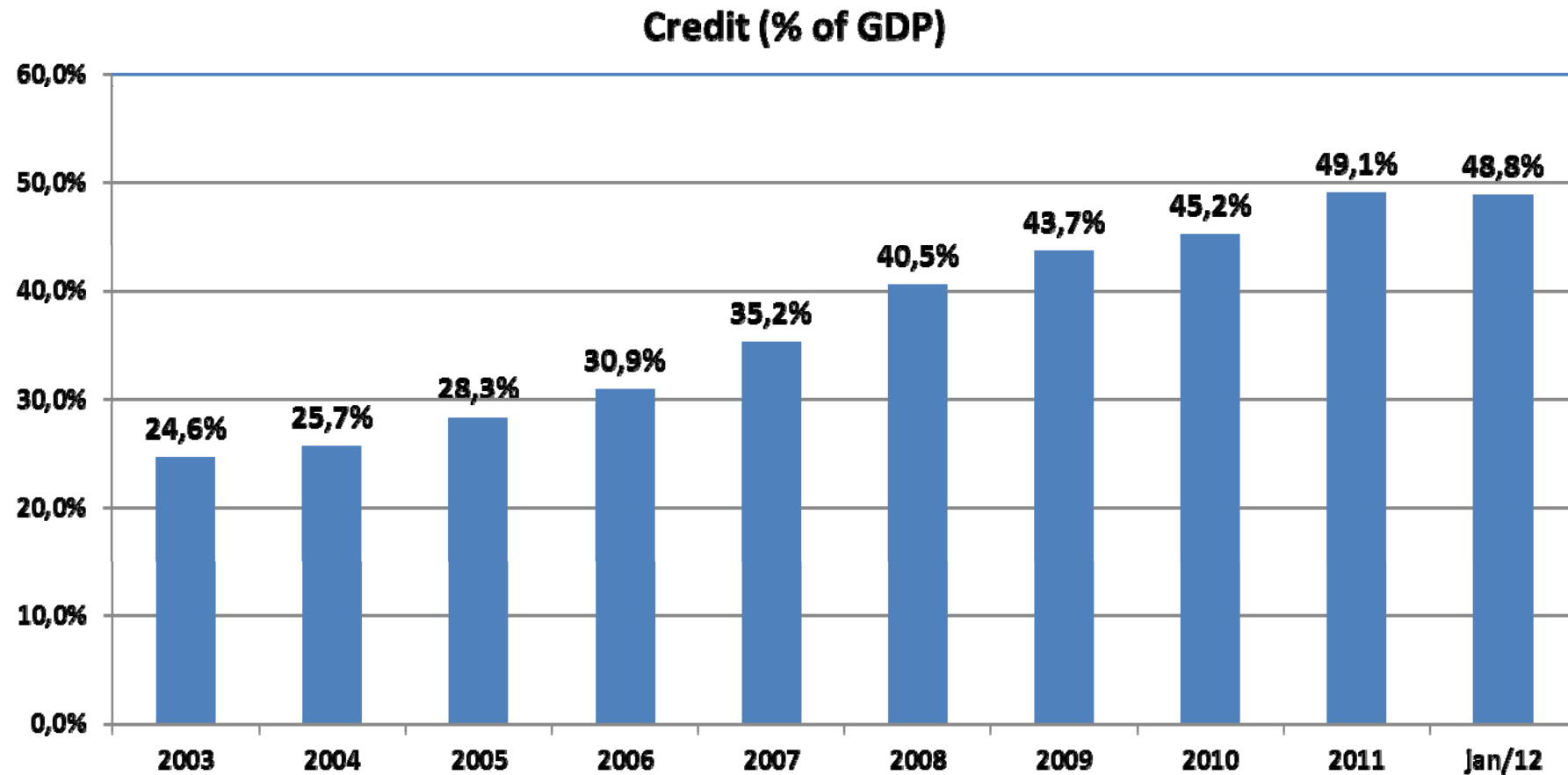
* Ministry of Finance forecast
Source: RAIS/Ministry of Labour
Elaboration: Ministry of Finance

International reserves have been rising steadily



Source: Central Bank of Brazil

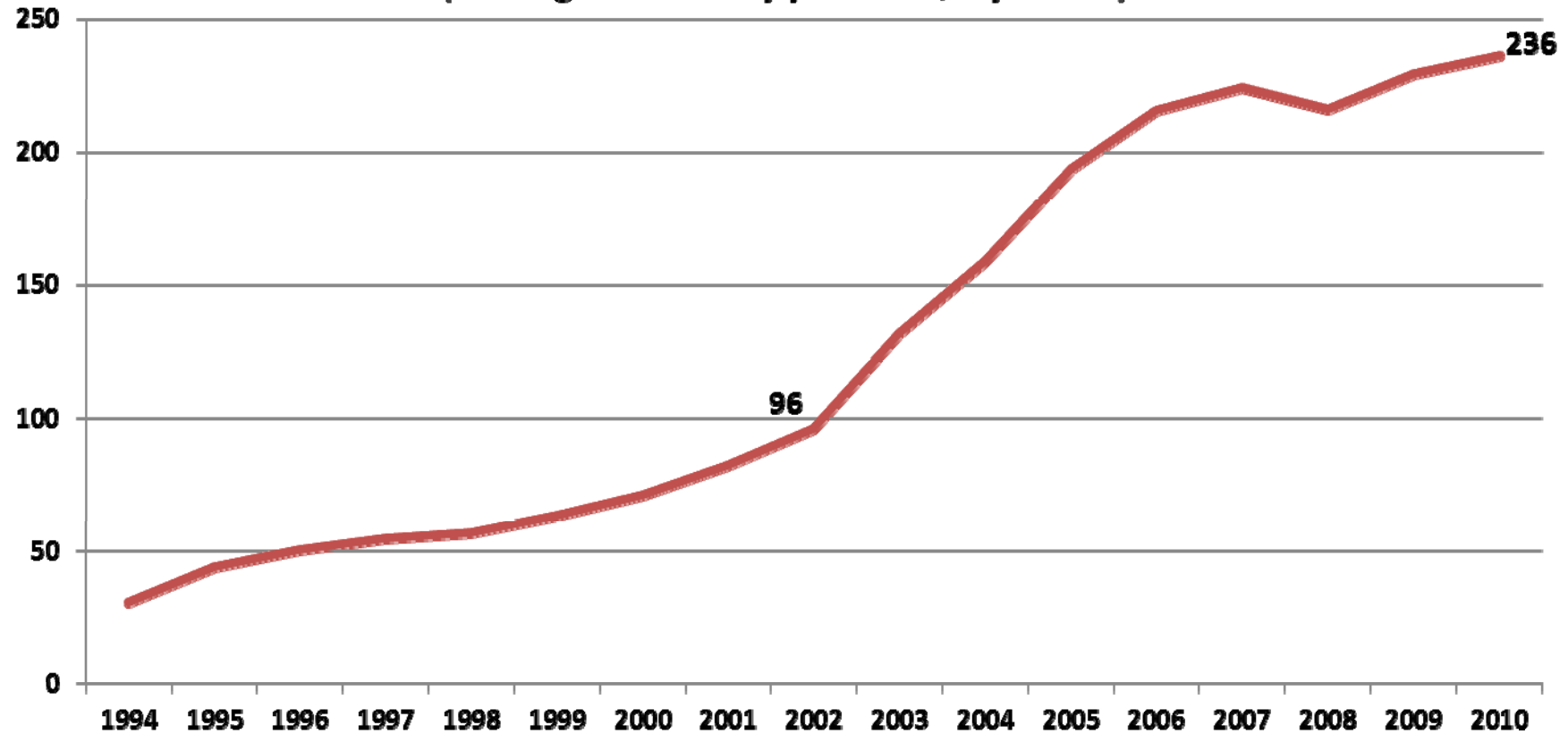
Credit supply in a steady growth



Source: Central Bank of Brazil

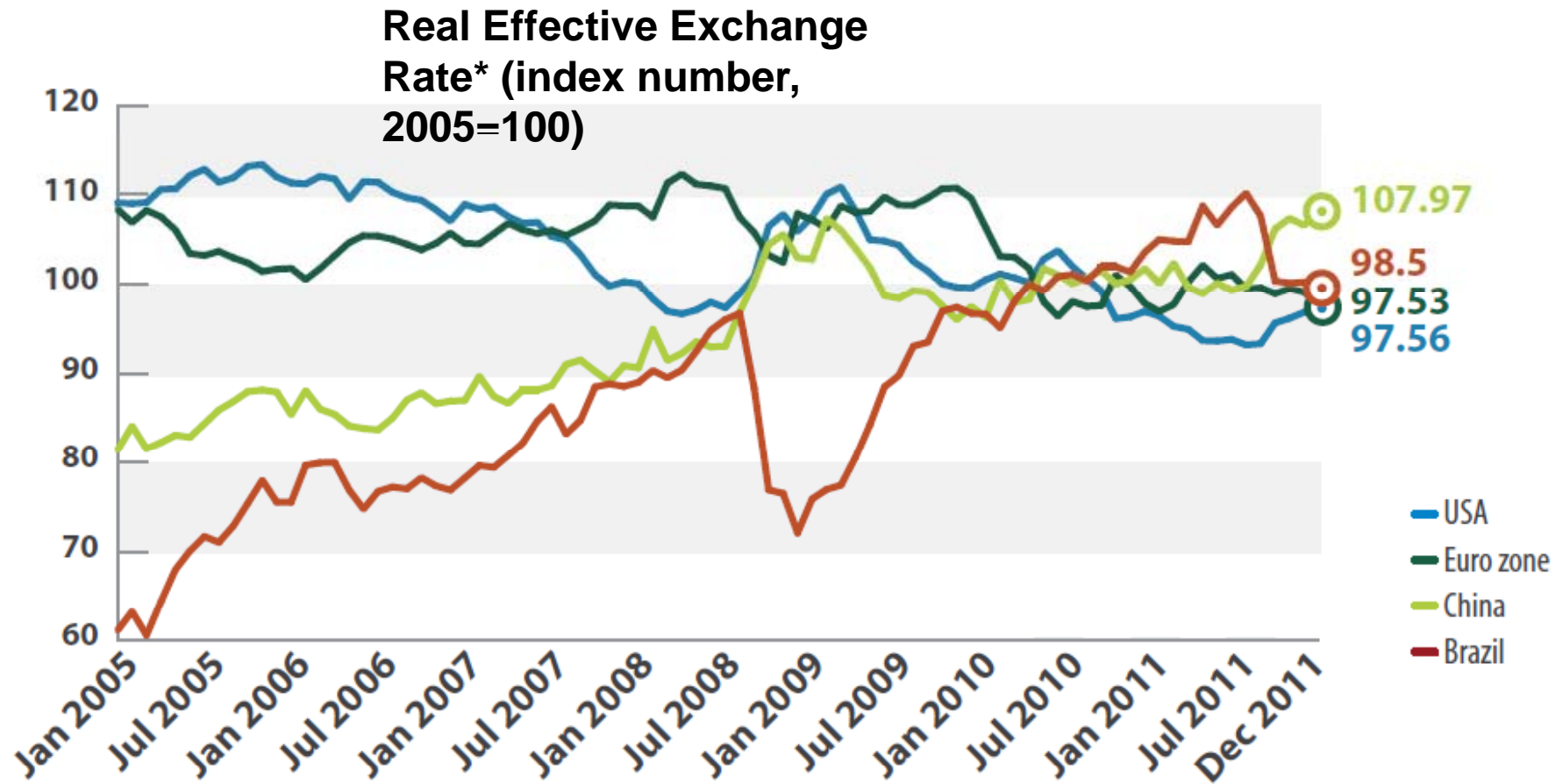
Energy costs have been increasing

Energy Price - Industry
(average electricity price - R\$ by MWh)



Source: Ipeadata

The exchange rate is the highest compared to China, Germany and US



* Deflator: Consumer Price Index from each country. A rise means exchange appreciation and a fall means depreciation
Source: BIS
Elaboration: Ministry of Finance