The Brazilian System of Innovation: old truths, new illusions and real challenges

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The Evolution of the Brazilian National Innovation System

- The Brazilian Innovation System from the 1950s to the late 1970s – partial successes in some sectoral innovation systems in a production-based development process

- The Brazilian NIS in the 1980s and 1990s – downgrading of most innovation systems in an exchange-based development process

Structural Changes and Industrialization - selected countries, 1965-1980

Countries	Index of Structural Change in Manufac. *	Average Growth Rate of Value Added in Manufac.
European NICs		
Spain	24.73	6.78
Yugoslavia	12.01	6.94
Portugal	21.61	7.18
Greece	13.56	7.00
Asian NICs		
India	20.89	2.59
South Korea	31.37	18.99
Hong Kong	9.87	6.05
Singapore	48.32	11.41
Next-tier NICs		
Philippines	10.95	5.45
Thailand	17.69	7.98
Malaysia	15.86	8.12
Colombia	10.90	6.36
Natural Resources NICs		
Brazil	30.03	9.50
Mexico	14.83	7.09
Argentina	15.90	3.12
Indonesia	19.52	10.20
Global Averages		
Developed Countries	10.90	4.66
Developing Countries	13.83	6.55
World	10.60	4.85

From a S&T&I point of view the model was based on a:

1. Rapidly upgrading of the scientific infrastructure
2. Massive (and disorganized) import of technology (and capital)
3. Attracting foreign capital was perceived as a quick and easier way to channel modern technology into the economy

There were, however, some remarkable exceptions, particularly in sectors where state control was considered necessary for strategic reasons: infrastructure, air space, oil, and energy.

- similar attempts were envisaged in other sectors like the car industry (Fábrica Nacional de Motores – was created in the late 1950s), but they were aborted in their initial stages as MNCs subsidiaries were preferred as major manufacturers.
- the modernization of agriculture was also emphasized and a state-controlled firm (EMBRAPA) aiming at developing novel agricultural technologies was created.

The Brazilian NIS in the 1980s and 1990s –

1 – the crisis - development process subjected to an exchange-based economic system
2 - downgrading of most innovation systems
3 – some remarking exceptions
    agro-industrial systems (the role of EMBRAPA)
    aircraft system (EMBRAER)
    oil extraction and refining (Petrobrás)
    other exceptions
4 – the evolution of infrastructure
5 – the policy environment

Selected developing countries: share in world exports and GDP growth, 1980-2000

Country	1980	1985	1990	1995	2000	GDP 1990-200((%yearly growth)
Developing countries	*29,1*	*25,2*	*23,0*	*25,3*	*29,5*	-
Asia	15,6	20,7	21,5	25,6	25,9	-
China	0,89	1,40	1,80	2,93	3,92	10,1
South Korea	0,86	1,55	1,89	2,46	2,71	6,2
Malaysia	0,64	0,79	0,85	1,46	1,54	7,0
Singapore	1,0	1,2	1,5	2,3	2,2	7,9
Thailand	0,3	0,4	0,7	1,1	1,1	4,4
India	0,4	0,5	0,5	0,6	0,7	5,4
Indonesia	1,1	1,0	0,7	0,9	1,0	4,2
Ireland	0,41	0,53	0,69	0,88	1,25	7,3
Brazil	0,99	1,31	0,91	0,92	0,87	2,7
Mexico	0,89	1,37	1,18	1,57	2,61	3,5

Fragility of the Brazilian NIS

- weak competitive performance with outstanding trade weakness in all sectors of high added value and high technological content
- widespread loss of national ownership in many sectors, weakness and reduced size of the remaining Brazilian business groups
- persistent financial vulnerability of Brazilian-owned businesses resulting from very high costs of capital and inexistence of long-term financing mechanisms.

S&T infrastructure in Brazil evolved positively in the 80s and 90s

- In 2001 , around 19 thousand people obtained their MSc and more than 5 thousand their PhD, twice as much as in 1991
- Research activities, that were restricted to a small number of groups in the early 1980s expanded significantly during this period: in 2002 there were 15,158 research groups with approximately 59 thousand researchers working in 268 research institutions (the vast majority public universities and research institutes).
- Brazilian scientific production has significantly augmented:.
  - in 1991, occupied the 28° position in terms of production of indexed scientific and technical articles, got the 17ª place 2000
  - The average of articles originated in Brazil published in 1988-92 (3,166 or 0.6% of world production) increased four-fold in1996-2000 (7,836 or 1.12% of world production).

However, instability in public support for the area

- Throughout the 1980s and during the 1990s, the fiscal crisis of the state and a lack of definition of what development strategy to pursue give contours to this pattern of instability
- Total expenditure of FUNTEC (the most important S&T fund) fell from US$ 1.2 billion (1970-1979) to US$ 754.32 million (1980-1989)
- After the stabilization program of 1994 public budgetary resources to S&T slightly increased in local currency (from R$ 3.1 billion to RS$ 3.3 billion in 1996), fell significantly till 2000 (when they amounted to R$ 2.8 billion), slightly recovering in 2001 (RS$ 3.9 billion) with the implementation of the new sectoral funds
- Government expenditure to R&D, however fell more dramatically from around R$ 2 billion in 1994 to R$ 1.58 billion in 1999

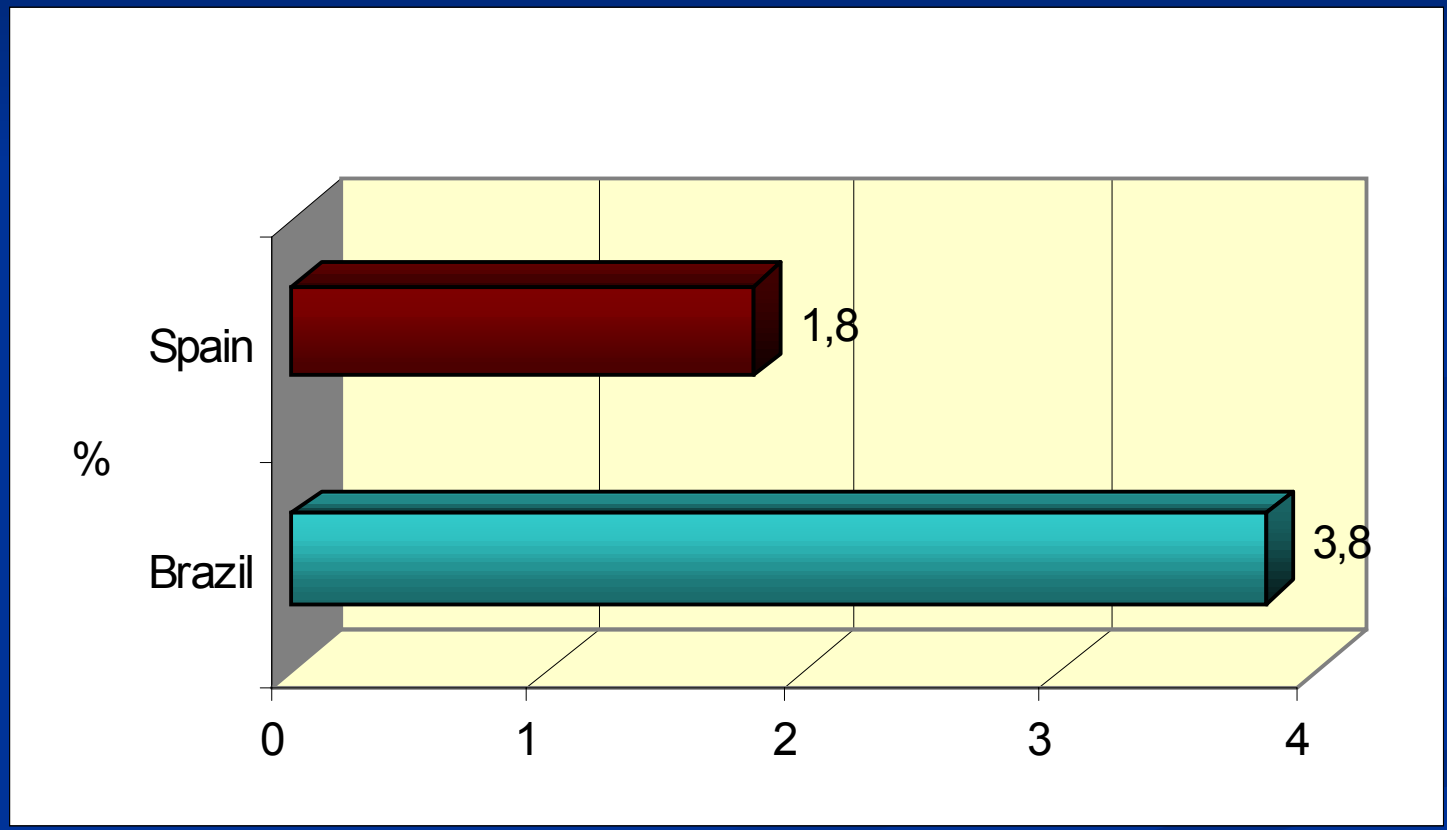
1 – Brazilian manufacturing firms are relatively less innovators than most countries

- The innovation rate (percentage of firms that introduced in the market new or improved products and/or processes in the 3 years prior to the survey) of Brazilian firms were 31% in 2000
- This compares to innovation rates above 60% in countries such as Sweden, Austria, Canada, Denmark, Switzerland, Ireland, Holand an Germany

2 –Innovation expenditures of Brazilian manufacturing firms are relatively high

- To this general pattern it is surprisingly associated a relatively high pattern of innovation expenditures.
- PINTEC's data suggest that Brazilian manufacturing firms spent in 2000 3.7% of sales in innovation.
- This is equivalent to the average of the European Union and higher than 11 OECD countries, including the U.K (3.2 %), Italy (2.6 %) and Australia (1.9%).

Percentage of Expenditures of Innovation Activities on Sales - 2000

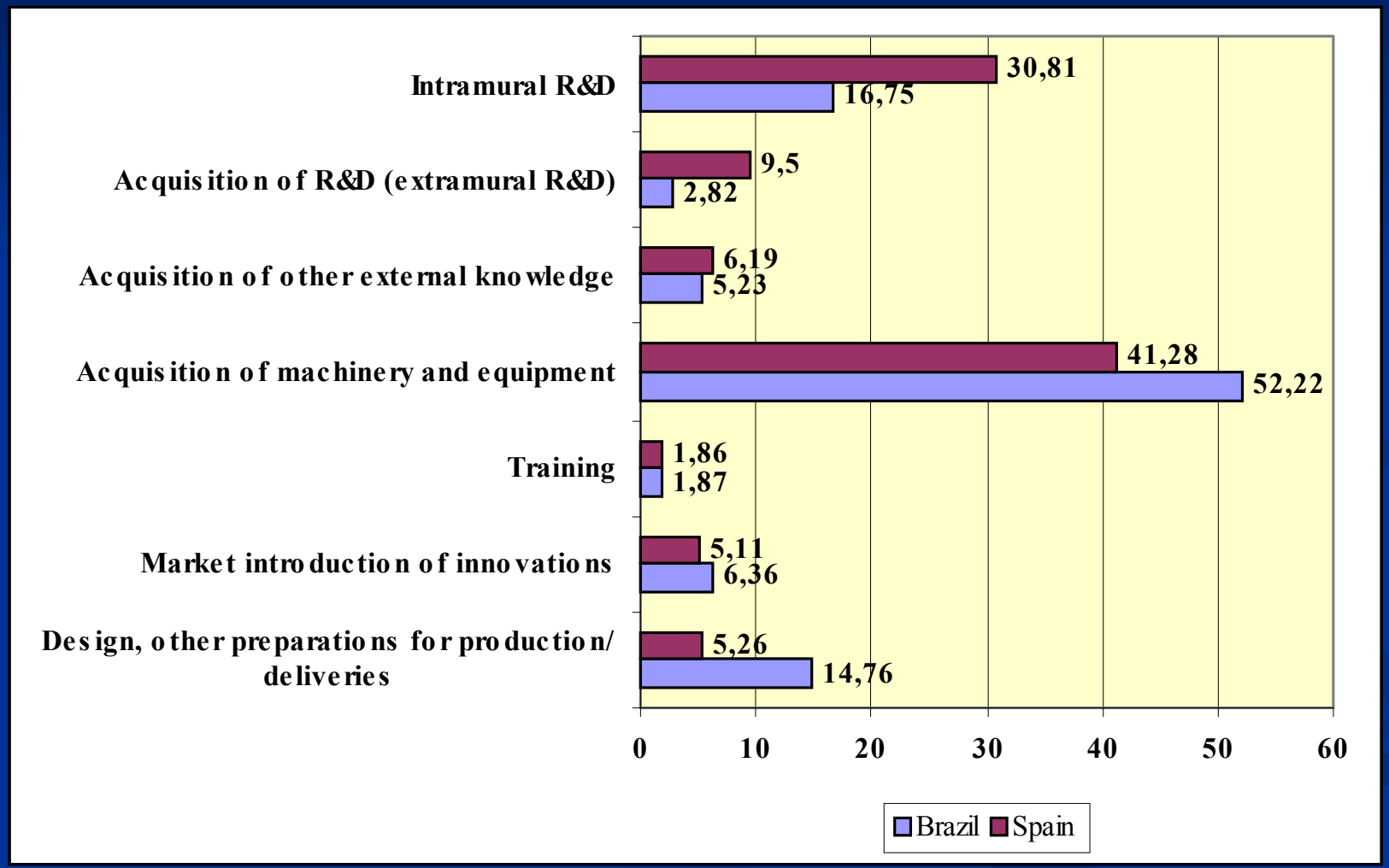


Fonte: EIT-2000, INE ES e PINTEC -2000, IBGE-BR

3 – Innovation expenditure of Brazilian manufacturing firms are concentrated on acquisition of capital goods while in most OECD countries expenditures are concentrated on R&D

- More than 50% of innovation expenditure of Brazilian manufacturing firms refer to the acquisition of tangibles (basically machinery).
- In most OECD countries this share is between 10 and 20% .
- In those countries internal R&D is responsible for the majority of innovation expenditures (30 to 60% of total innovation expenditures), while in Brazil this share is below 20%.

Expenditure Structure – 2000



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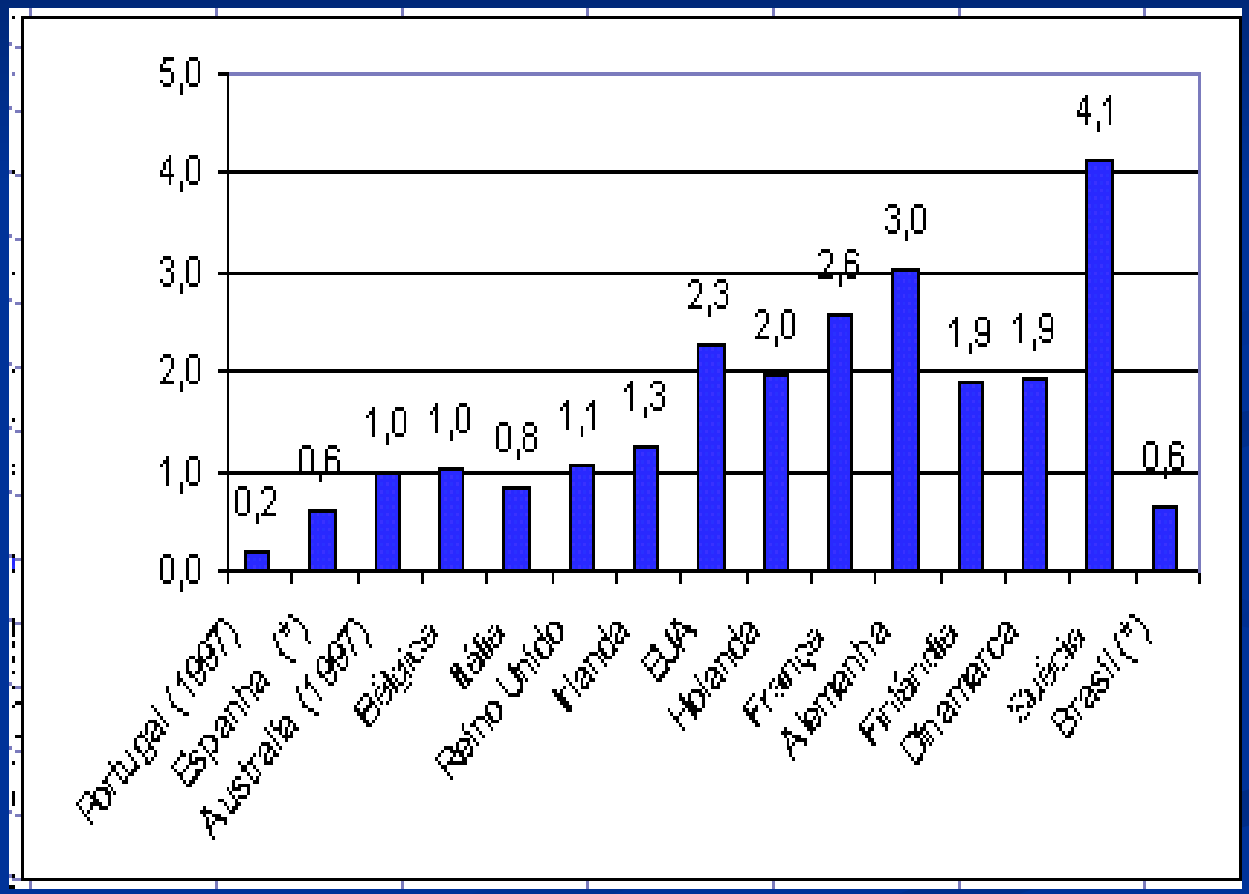
Share of R&D expenditure over sales, Brazil (2000) OECD (1996)



Old Questions

- Firms do not perform R&D
- Very few linkages between firms and R&D infrastructure

An old question – the role of TNC subsidiaries

- Although inflows of foreign capital in the 1990s are approximately **13 times** of what was observed during the 1970s, economic growth has been **50% lower** than the what was obtained in that period.
- FDI in the 1990s
  - directed to merger and acquisition of existing firms rather than *green field* investment.
  - market seeking forms
- These two features of foreign direct investment in Mercosur countries have had a critical impact on local innovation systems.
  - Several experiences in Brazil illustrate this (auto - Metal Leve, Freios Varga and Cofap – telecom, etc.)

The illusions of the 1990s – early 2000

- Attraction of MNCs
- The University as Innovator
- The IPR regime as the main organizer of NSI
- Horizontal policies (fiscal incentives !!!!)
- University/Industry collaboration policies

The Challenges

- Designing a S&T&I policy connected to a development policy and (education and industrial policies)
- Finding innovation policy mechanisms that really deal with issues of cost and risk
- Implementing a regional innovation policy