

# Science, Technology & Innovation Indicators in the State of São Paulo / Brazil 2010

## Highlights of Chapter 3 – Part B: Human resources in R&D in São Paulo State

### Researchers

- In 2008, São Paulo State had almost 63,000 researchers, or 66% more than the estimate for 1995. This statistic encompasses university professors employed full-time for teaching and research or on exclusive dedication contracts and holding doctoral degrees; professionals at public research institutions classified as career scientific researchers; doctoral and post-doctoral students with grants from CNPq, Capes or state research foundations; and graduates employed by business organisations in in-house R&D.

### Number of researchers (headcount) by type of institution and administrative jurisdiction – São Paulo State, 1995, 2001 & 2008

Sector & administrative jurisdiction	Number of researchers		
	1995	2001	2008
<b>Total</b>	<b>37,894</b>	<b>43,723</b>	<b>62,897</b>
<b>Higher Education Institutions</b>	<b>17,703</b>	<b>22,295</b>	<b>26,333</b>
State	10,870	10,030	10,740
Federal	1,280	1,268	1,872
Private & municipal	466	1,143	2,123
Post-doctoral grantees	443	1,035	2,386
Doctoral grantees	4,644	8,819	9,212
<b>Research Institutions</b>	<b>3,058</b>	<b>2,672</b>	<b>3,036</b>
State	2,122	1,750	1,710
Federal	786	772	898
Private nonprofit	150	150	428
<b>Business</b>	<b>17,133</b>	<b>18,756</b>	<b>33,528</b>

Sources: Inep, Higher Education Census; Capes; CNPq, Statistics and grant indicators, Research Group Directory; FAPESP; federal and state research institutions in São Paulo State (special tabulations supplied to FAPESP); IBGE, Pintec 2000, 2003 & 2005.

- Most of this contingent (42%) were employed by higher education institutions (HEIs), but the fastest growth in numbers (96%) was seen among R&D personnel employed by business organisations, whose share of the total rose from 45% in 1995 to 53% in 2008. The fact that firms are hiring more researchers is in itself an indicator of an important change in the behaviour of the business sector, which according to the evidence is starting to consider technological innovation a key component of competition and growth strategy.
- The number of researchers employed by public research institutions located in São Paulo State remained stagnant in the period, with some 3,000 professionals classified as career scientific researchers, so that their share of the total fell from 8% in 1995 to less than 5% in 2008.
- Most researchers (67% in 2008) are employed by HEIs in Brazil, although the proportion is falling (it was 70% in 1995), according to statistics published by the Ministry of Science & Technology (MCT), Capes and CNPq, adjusted using the methodology applied to the case of São Paulo State.
- The number of researchers employed by public research institutions has risen again more recently, from 5,095 in 2003 to 6,855 in 2008, for 34.5% growth in the period. Given the already noted stagnation in São Paulo State, it must be concluded that this growth was driven by institutions located in other states.
- The number of researchers employed by business organisations has risen significantly, doubling between 1995 and 2008. As a share of the total, however, in-house R&D personnel rose only 3 percentage points in the period (from 27% in 1995 to 30% in 2008).

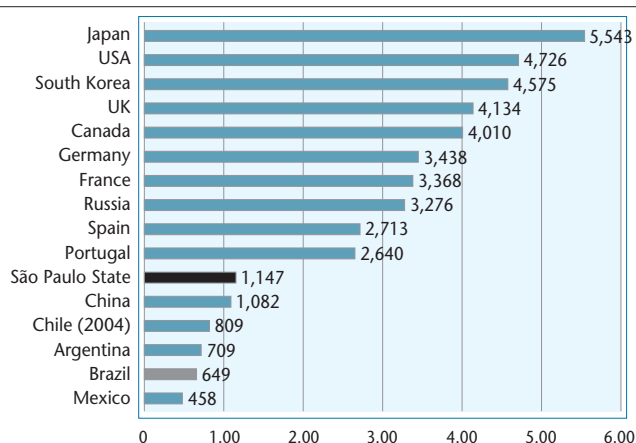
### Number of researchers (headcount) by type of institution and administrative jurisdiction – Brazil, 1995, 2001 & 2008

Sector & administrative jurisdiction	Number of researchers		
	1995	2001	2008
<b>Total</b>	<b>124,751</b>	<b>155,742</b>	<b>229,121</b>
<b>Higher Education Institutions</b>	<b>86,932</b>	<b>113,380</b>	<b>152,519</b>
State	25,932	34,618	44,870
Federal	44,486	51,765	66,122
Private & municipal	1,383	2,586	5,287
Post-doctoral grantees	2,992	3,597	6,704
Doctoral grantees	12,139	20,814	29,536
<b>Research Institutions</b>	<b>4,740</b>	<b>4,652</b>	<b>6,855</b>
<b>Business</b>	<b>33,079</b>	<b>37,710</b>	<b>69,747</b>

Sources: Inep, Higher Education Census; Capes; CNPq, Statistics and grant indicators, Research Group Directory; FAPESP; federal and state research institutions in São Paulo State (special tabulations supplied to FAPESP); IBGE, Pintec 2000, 2003 & 2005.

- Measured in terms of full-time equivalent (FTE) to avoid possible distortions due to different work regimes, the indicators show that:
  - In 2008 there were some 50,000 FTE researchers in activity in São Paulo, of whom 17,565 were in HEIs, 3,036 in public and private research institutions, and 29,943 in business organizations.
  - São Paulo's share of the national total changed very little in the period: it was 38% of all FTE researchers in Brazil in 1995 and 37% in 2008.
  - The number of FTE researchers employed by business organizations rose more in São Paulo (126%) than Brazil (111%) in the period, and 51% were estimated to be residents of São Paulo in 2008, compared with 47% in 1995.)

### Researchers (full-time equivalent) per million inhabitants – selected countries, 2007



Sources: São Paulo State and Brazil, data from this chapter; Argentina and Chile, RICYT (Tabla personal de ciencia y tecnología); other countries, OECD (2009).

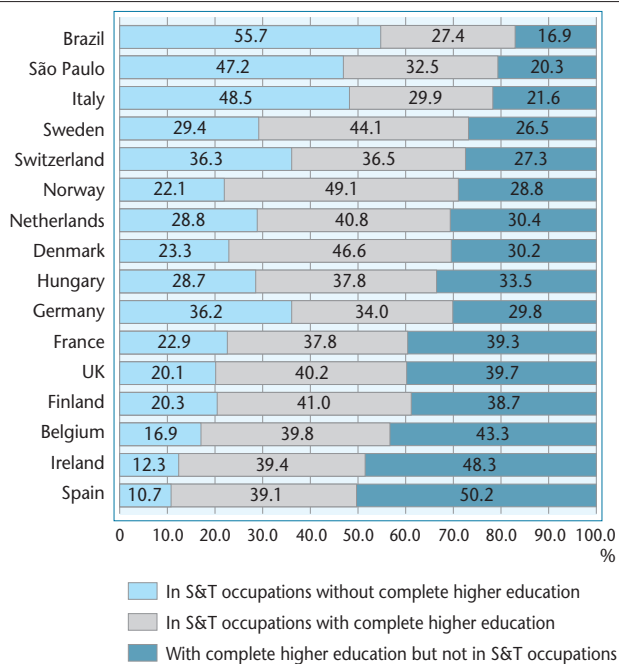
- Considering the number of FTE researchers per million inhabitants, São Paulo State is slightly ahead of China, Argentina, Chile, Mexico and the total for Brazil, but behind countries with which it competes in the international market. The disparity in this latter case is at least 2.3 times, showing the fundamental

importance of a strategy to foster strong growth in the number of researchers in São Paulo State in the coming years. In the case of Brazil, the challenge is even greater. The effort to increase the number of researchers must be waged on both the academic and business fronts.

### Human resources in science & technology (HRST)

- HRST can be divided into two main groups: higher education graduates with university degrees or the equivalent and thus qualified by formal education (HRST Education or HRSTe); and professionals who are employed in occupations that require a high level of qualification but may not have qualified formally via education (HRST Occupation, or HRSTo).
- The stock of HRST in Brazil is estimated to have totalled 21.4 million in 2006, of whom 6.0 million or 28% resided in São Paulo State. While the numbers are large, as will be seen from the international comparisons below, in proportion to the economically active population they are relatively small, corresponding to 20% for Brazil and 25% for São Paulo.
- These proportions are far lower than in such countries as Ireland (37.4%), Spain (37.6%), the U.K. (38.9%), Germany (40.7%) or Switzerland (47.1%), to cite only a few examples.
- On this criterion Brazil outperforms only Turkey (17.1%) and closely resembles Portugal and Romania (20.6% for both). São Paulo outperforms these countries but lags Bulgaria (28.9%).

### Human resources in science & technology (HRST) by Canberra Manual categories – Brazil, São Paulo State & selected European Union countries, 2006



Source: IBGE, PNAD (2002, 2006); Eurostat.

- The number of people with higher education working in occupations that require high levels of qualification was:
  - 5.8 million in Brazil (33% of HRSTo);
  - 1.9 million in São Paulo State (41% of HRSTo).
- It is worth noting that even in São Paulo 60% of the people working in occupations that require high levels of qualification did not have a complete higher education.
- In both Brazil and São Paulo, only 62% of HRSTe were in highly skilled jobs. A comparison with the member countries of the European Union shows only Italy with such a low proportion.
- HRSTe rose more than HRSTo in the period 2002-06, both for Brazil and for São Paulo alone.
- Another national peculiarity is the importance of higher education to employability. In São Paulo, the unemployment rate among HE graduates was 1.7% in 2006, slightly higher than the rate for Brazil (1.4%), compared with a general unemployment rate of about 10%. In no other country with unemployment rates at this level, and indeed in few countries with low unemployment rates, are graduates in such a favourable situation. Once again this reflects the shortage of professionals with university degrees in Brazil and São Paulo.
- From the gender standpoint, the situation in Brazil and São Paulo is similar to that found elsewhere: roughly half of all highly qualified human resources are women. It is also worth noting that women account for an even larger share of HRSTe, with 58% of university graduates in 2006.

### Breakdown of HRST gender, according to Canberra Manual category – Brazil & São Paulo State, 2002-2006

Canberra Manual categories	HRST percentage distribution by gender			
	Brazil		São Paulo State	
	Homens	Mulheres	Homens	Mulheres
<b>2006</b>				
Total HRST	48.9	51.1	49.3	50.7
In S&T occupations	50.7	49.3	51.0	49.0
In S&T occ. & complete HE	43.7	56.3	47.1	52.9
Complete HE	42.4	57.6	45.4	54.6
<b>2002</b>				
Total HRST	50.1	49.9	49.2	50.8
In S&T occupations	51.5	48.5	51.5	48.5
In S&T occ. & complete HE	45.8	54.2	47.4	52.6
Complete HE	44.4	55.6	44.3	55.7

Source: IBGE, PNAD, 2002 & 2006.

- A breakdown by age shows Brazil and São Paulo in a relatively balanced situation compared with the developed countries. More than half of HRST are aged 25-44, whereas those over 45 predominate in Germany, for example.