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# Statistics on R&D Budgetary Allocations in Russia

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# SCIENCE AND TECHNOLOGY STATISTICS IN THE PARTNERS IN TRANSITION COUNTRIES AND THE RUSSIAN FEDERATION

**ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT**

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## FOREWORD

The development of reliable and internationally comparable statistics which meet the needs of a market economy is a priority activity of the OECD Centre for Co-operation with the Economies in Transition (CCET). The Czech Republic (now a member of the OECD), the Partners in Transition (PIT) countries -- Hungary, Poland and the Slovak Republic -- and the Russian Federation have undertaken the transformation of their science and technology statistical systems, building on the work and experience of the OECD Group of National Experts on Science and Technology Indicators (NESTI).

This document presents a selection of papers which were prepared for the Workshop on the Implementation of OECD Methodologies for the Collection and Compilation of R&D/S&T Statistics in the Partners in Transition Countries and the Russian Federation held at the OECD, 4-5 December 1995. These papers aim at giving an overview of the situation in each of these countries. The first one presents methodological and statistical data collected by the OECD Secretariat. The subsequent papers are presentations by statisticians from the countries of efforts carried out to adopt OECD recommendations as described in the "Frascati family" of manuals and in particular efforts to launch new R&D and innovation surveys.

The workshop and the report were prepared by Laudeline Auriol (Directorate for Science, Technology and Industry) in the framework of the CCET work programme.

The report is published on the responsibility of the Secretary-General of the OECD.

Salvatore Zecchini
OECD Deputy Secretary-General
Director of the CCET

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# RESULTS OF THE OECD 1995 DATA COLLECTION IN THE PIT COUNTRIES AND THE RUSSIAN FEDERATION

## Introduction

This document presents the results of the methodological and statistical data collection conducted by the OECD Secretariat in the Partners in Transition countries (PIT) and the Russian Federation, which received the OECD R&D questionnaire at the end of 1993 and 1994. These countries were only able to partially complete the questionnaire, and data provided are not fully compatible with OECD standards. In order to increase their significance, the Secretariat made efforts to collect methodological information underlying the data.

The first part of the document provides a series of statistical tables, showing selected indicators, among those traditionally published in the OECD publication *Main Science and Technology Indicators*. The reader's attention should be drawn to the table notes and to the fact that data are not fully compatible with OECD standards and not fully comparable at the international level. The second part presents methodological information and is organised for each country according to the plan set for the collection of methodological notes in the questionnaire.

This document marks a transition stage, since the five participatory countries are in the process of launching new national questionnaires based on the Frascati Manual. Changes until now were only partial amendments to existing methodologies. New sets of data, based on the new questionnaires and more compatible with OECD standards, should be available to the OECD Secretariat in 1996.

## Statistical tables

**Table 1. Gross Domestic Expenditure on R&D - Million national currency [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | 12 415 | 15 211 | 14 499 | 12 320 | 12 983 |
| Hungary [3] | 33 340 | 26 731 | 30 988 | 34 686 | 38 852 |
| Poland [4] | | 8 510 | 9 557 | 12 954 | 17 720 |
| Slovak Republic [5] | 4 859 | 7 185 | 6 241 | 5 662 | 4 473 |
| | | | | | |
| Russian Federation | 13 078 | 19 991 | 140 591 | 1 313 557 | 5 146 102 |

1. Defence R&D not included.
2. Total expenditure of the R&D base, depreciation costs not excluded.
3. Until 1993, including purchase of licences, know-how etc.
4. Until 1993: capital expenditure in enterprises and the higher education sector not included, depreciation costs not excluded.
5. Until 1993, total expenditure of the R&D base; depreciation costs not excluded.

**Table 2. Gross Domestic Expenditure on R&D - Million current PPP $ [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | 1 901.4 | 1 574.3 | 1 173.3 | 1 148.9 |
| Hungary [3] | | 655.2 | 640.2 | 601.1 | 579.0 |
| Poland [4] | | 1 700.0 | 1 412.1 | 1 494.5 | 1 637.3 |
| Slovak Republic [5] | | 801.0 | 638.1 | 510.1 | 372.8 |
| | | | | | |
| Russian Federation | | | 9 569.9 | 6 412.4 | 5 992.2 |

1. Defence R&D not included.
2. Total expenditure of the R&D base, depreciation costs not excluded.
3. Until 1993, including purchase of licences, know-how etc.
4. Until 1993: capital expenditure in enterprises and the higher education sector not included, depreciation costs not excluded.
5. Until 1993, total expenditure of the R&D base; depreciation costs not excluded.

**Table 3. GERD - Annual growth rate (constant prices) [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | -16.8 | -19.2 | -26.9 | -5.1 |
| Hungary [3] | | | -4.7 | -7.8 | -6.3 |
| Poland [4] | | | -18.9 | 3.8 | |
| Slovak Republic [2] | | 10.0 | -22.2 | -21.2 | |
| | | | | | |
| Russian Federation | | -34.0 | -59.0 | -8.5 | -6.8 |

1. Defence R&D not included.
2. Total expenditure of the R&D base, depreciation costs not excluded.
3. Until 1993, including purchase of licences, know-how etc.
4. Until 1993: capital expenditure in enterprises and the higher education sector not included, depreciation costs not excluded.

*Source*: OECD.

**Table 4. GERD per capita population - Current PPP $ [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | 184.4 | 152.6 | 113.6 | 111.2 |
| Hungary [3] | | 63.3 | 61.9 | 58.3 | 56.3 |
| Poland [4] | | 44.4 | 36.8 | 38.9 | 42.4 |
| Slovak Republic [5] | | 151.6 | 120.3 | 95.8 | 69.7 |
| Russian Federation | | | 64.4 | 43.0 | 40.0 |

1. Defence R&D not included.
2. Total expenditure of the R&D base, depreciation costs not excluded.
3. Until 1993, including purchase of licences, know-how etc.
4. Until 1993: capital expenditure in enterprises and the higher education sector not included, depreciation costs not excluded.
5. Until 1993, total expenditure of the R&D base; depreciation costs not excluded.

**Table 5. Gross Domestic Expenditure on R&D as a percentage of GDP [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | 2.19 | 2.12 | 1.83 | 1.35 | 1.25 |
| Hungary [3] | 1.60 | 1.08 | 1.07 | 0.99 | 0.89 |
| Poland [4] | | 1.05 | 0.83 | 0.83 | 0.84 |
| Slovak Republic [5] | 1.99 | 2.57 | 2.03 | 1.66 | 1.12 |
| Russian Federation | 2.03 | 1.54 | 0.78 | 0.81 | 0.82 |

1. Defence R&D not included.
2. Total expenditure of the R&D base, depreciation costs not excluded.
3. Until 1993, including purchase of licences, know-how etc.; break in series in 1991 due to changing methodology for calculating GDP.
4. Until 1993: capital expenditure in enterprises and the higher education sector not included, depreciation costs not excluded.
5. Until 1993, total expenditure of the R&D base; depreciation costs not excluded.

**Table 6. Total R&D personnel [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | 107 828 | 81 895 | 60 292 | 40 793 | 37 779 |
| Hungary [3] | 36 384 | 29 397 | 24 192 | 22 609 | 22 008 |
| Poland [3] | | | | | 74 473 |
| Slovak Republic [4] | 51 641 | 40 085 | 30 284 | 25 094 | 17 256 |
| Russian Federation [5] | 1 943 400 | 1 677 800 | 1 532 600 | 1 315 000 | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time personnel in the R&D base.
3. In full-time equivalent (FTE).
4. Until 1993, average recalculated number of full-time personnel in the R&D base; in 1994, full-time equivalent (FTE).
5. In head counts; higher education teaching personnel working as part time researchers excluded.

*Source*: OECD.

**Table 7. Total R&D personnel - Annual growth rate [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | -24.1 | -26.4 | -32.3 | -7.4 |
| Hungary [3] | | -19.2 | -17.7 | -6.5 | -2.7 |
| Poland | | | | | |
| Slovak Republic [2] | | -22.4 | -24.5 | -17.1 | |
| Russian Federation [4] | | -13.7 | -8.7 | -14.2 | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time personnel in the R&D base.
3. In full-time equivalent (FTE).
4. In head counts; higher education teaching personnel working as part time researchers excluded.

**Table 8. Total R&D personnel per thousand labour force [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | 20.0 | 15.5 | 11.5 | 7.9 | 7.2 |
| Hungary [3] | 8.1 | 6.3 | 5.1 | 4.9 | 5.0 |
| Poland [3] | | | | | 4.2 |
| Slovak Republic [4] | 20.7 | 16.3 | 12.4 | 9.9 | 7.0 |
| Russian Federation [5] | | 19.3 | 17.7 | 18.6 | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time personnel in the R&D base.
3. In full-time equivalent (FTE).
4. Until 1993, average recalculated number of full-time personnel in the R&D base; in 1994, full-time equivalent (FTE).
5. In head counts; higher education teaching personnel working as part time researchers excluded.

**Table 9. Number of researchers, scientists and engineers [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | 63 231 | 44 223 | 33 456 | 23 641 | 23 096 |
| Hungary [3] | 17 550 | 14 471 | 12 311 | 11 818 | 11 752 |
| Poland [3] | | | 41 440 | 41 480 | 44 169 |
| Slovak Republic [4] | 15 550 | 12 576 | 10 681 | 8 927 | 10 249 |
| Russian Federation [5] | 992 571 | 878 482 | 804 043 | 644 834 | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time RSE and technicians;
3. In full-time equivalent (FTE).
4. Until 1993, average recalculated number of full-time RSE; in 1994, FTE;
5. In head counts; higher education teaching personnel working as part time researchers excluded.

*Source*: OECD.

**Table 10. Total number of RSE - Annual growth rate [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | -30.1 | -24.3 | -29.3 | -2.3 |
| Hungary [3] | | -17.5 | -14.9 | -4.0 | -0.6 |
| Poland [3] | | | | 0.1 | 6.5 |
| Slovak Republic [4] | | -19.1 | -15.1 | -16.4 | |
| Russian Federation [5] | | -11.5 | -8.5 | -19.8 | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time RSE and technicians.
3. In full-time equivalent (FTE).
4. Average recalculated number of full-time RSE.
5. In head counts; higher education teaching personnel working as part time researchers excluded.

**Table 11. Number of RSE per thousand labour force [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | 11.7 | 8.4 | 6.4 | 4.6 | 4.4 |
| Hungary [3] | 3.9 | 3.1 | 2.6 | 2.6 | 2.6 |
| Poland [3] | | | 2.4 | 2.3 | 2.5 |
| Slovak Republic [4] | 6.2 | 5.1 | 4.4 | 3.5 | 4.2 |
| Russian Federation [5] | | 10.1 | 9.3 | 9.1 | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time RSE and technicians.
3. In full-time equivalent (FTE).
4. Until 1993, average recalculated number of full-time RSE; in 1994, FTE.
5. In head counts; higher education teaching personnel working as part time researchers excluded.

**Table 12. Percentage of GERD financed by industry [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic | | | | | |
| Hungary [2] | 70.1 | 56.0 | 52.5 | 53.1 | 38.0 |
| Poland | | | | | |
| Slovak Republic [3] | 67.2 | 68.3 | 63.9 | 68.6 | 59.9 |
| Russian Federation | | | | | |

1. Defence R&D not included.
2. Underestimated; break in series in 1994.
3. Estimate by the Statistical Office.

*Source*: OECD.

**Table 13. Percentage of GERD financed by the government [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic | | 29.4 | 21.7 | 22.6 | 27.9 |
| Hungary [2] | 28.9 | 40.0 | 41.6 | 40.5 | 53.4 |
| Poland | | | | | |
| Slovak Republic | 32.8 | 31.7 | 36.1 | 31.4 | 38.6 |
| Russian Federation | | | | | |

1. Defence R&D not included.
2. Underestimated; break in series in 1994.

**Table 14. Percentage of GERD performed by business enterprise sector [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic | | 69.4 | 75.0 | 73.2 | 67.0 |
| Hungary [2] | 38.1 | 41.4 | 36.5 | 32.5 | 35.3 |
| Poland [3] | | | | 42.9 | |
| Slovak Republic [4] | 64.1 | 74.6 | 68.0 | 61.7 | 52.7 |
| Russian Federation | | | | | |

1. Defence R&D not included.
2. Underestimated.
3. Until 1993: capital expenditure in enterprises and the higher education sector not included.
4. Break in series in 1992 and 1994.

**Table 15. Percentage of GERD performed by the government sector [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic | | 29.0 | 24.0 | 23.6 | 28.5 |
| Hungary [2] | 19.5 | 24.5 | 25.3 | 25.7 | 27.2 |
| Poland [3] | | | | 36.5 | |
| Slovak Republic [4] | 31.5 | 21.5 | 26.9 | 25.6 | 42.4 |
| Russian Federation | | | | | |

1. Defence R&D not included.
2. Underestimated.
3. Estimate.
4. Break in series in 1992 and 1994.

*Source*: OECD.

**Table 16. Percentage of GERD performed by the higher education sector [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic | | 1.6 | 1.0 | 3.2 | 4.5 |
| Hungary [2] | 14.4 | 20.3 | 21.4 | 22.6 | 26.4 |
| Poland [3] | | | | 20.6 | |
| Slovak Republic | 4.4 | 3.9 | 4.2 | 2.6 | 4.9 |
| Russian Federation [2, 4] | 6.7 | 5.5 | 5.4 | 5.4 | 5.9 |

1. Defence R&D not included.
2. Underestimated.
3. Until 1993: capital expenditure in enterprises and the higher education sector not included.
4. Current expenditure.

**Table 17. Total business enterprise R&D personnel [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | 54 435 | 39 063 | 27 253 | 23 114 |
| Hungary [3] | 18 431 | 12 990 | 8 990 | 8 017 | 7 782 |
| Poland | | | | | |
| Slovak Republic [4] | 36 800 | 25 912 | 19 037 | 14 837 | 5 695 |
| Russian Federation | | | | | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time personnel in the R&D base.
3. In full-time equivalent (FTE).
4. Break in series in 1992; until 1993, average recalculated number of full-time personnel in the R&D base; in 1994, full-time equivalent (FTE);

**Table 18. Total business enterprise R&D personnel - Annual growth rate [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | | -28.2 | -30.2 | -15.2 |
| Hungary [3] | | -29.5 | -30.8 | -10.8 | -2.9 |
| Poland | | | | | |
| Slovak Republic [4] | | -29.6 | | -22.1 | |
| Russian Federation | | | | | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time personnel in the R&D base.
3. In full-time equivalent (FTE).
4. Break in series in 1992 and 1994.

*Source*: OECD.

**Table 19. Total business enterprise R&D personnel - Percent national total [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | 66.5 | 64.8 | 66.8 | 61.2 |
| Hungary [3] | 50.7 | 44.2 | 37.2 | 35.5 | 35.4 |
| Poland | | | | | |
| Slovak Republic [4] | 71.3 | 64.6 | 62.9 | 59.1 | 33.0 |
| Russian Federation | | | | | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time personnel in the R&D base.
3. In full-time equivalent (FTE).
4. Break in series in 1992; until 1993, average recalculated number of full-time personnel in the R&D base; in 1994, full-time equivalent (FTE).

**Table 20. Business enterprise researchers [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | 26 417 | 19 695 | 14 901 | 13 611 |
| Hungary [3] | 7 629 | 5 341 | 3 724 | 3 503 | 3 330 |
| Poland [3] | | | | 19 140 | |
| Slovak Republic [4] | | 6 984 | 4 964 | 3 906 | 2 648 |
| Russian Federation | | | | | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time RSE and technicians.
3. In full-time equivalent (FTE).
4. Break in series in 1992; until 1993, average recalculated number of full-time RSE; in 1994, full-time equivalent (FTE).

**Table 21. Business enterprise researchers - Annual growth rate [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | | -25.4 | -24.3 | -8.7 |
| Hungary [3] | | -30.0 | -30.3 | -5.9 | -4.9 |
| Poland | | | | | |
| Slovak Republic [4] | | | | -21.3 | |
| Russian Federation | | | | | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time RSE and technicians.
3. In full-time equivalent (FTE).
4. Break in series in 1992 and 1994.

*Source*: OECD.

**Table 22. Business enterprise researchers - Percentage national total [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | 59.7 | 58.9 | 63.0 | 58.9 |
| Hungary [3] | 43.5 | 36.9 | 30.2 | 29.6 | 28.3 |
| Poland [3] | | | | 46.1 | |
| Slovak Republic [4] | | 55.5 | 46.5 | 43.8 | 25.8 |
| Russian Federation | | | | | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time RSE and technicians.
3. In full-time equivalent (FTE).
4. Break in series in 1992; until 1993, average recalculated number of full-time personnel in the R&D base; in 1994, full-time equivalent (FTE).

**Table 23. Government total R&D personnel [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | 24 663 | 19 448 | 10 799 | 11 268 |
| Hungary [3] | 9 110 | 7 949 | 7 295 | 6 816 | 6 615 |
| Poland | | | | | |
| Slovak Republic [4] | 12 740 | 12 323 | 9 206 | 7 761 | 7 276 |
| Russian Federation | | | | | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time personnel in the R&D base.
3. In full-time equivalent (FTE).
4. Break in series in 1992; until 1993, average recalculated number of full-time personnel; in 1994, full-time equivalent (FTE).

**Table 24. Government total R&D personnel - Annual growth rate [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | | -21.1 | -44.5 | 4.3 |
| Hungary [3] | | -12.7 | -8.2 | -6.6 | -2.9 |
| Poland | | | | | |
| Slovak Republic [4] | | -3.3 | | -15.7 | |
| Russian Federation | | | | | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time personnel in the R&D base.
3. In full-time equivalent (FTE).
4. Break in series in 1992 and 1994.

*Source*: OECD.

**Table 25. Government researchers [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | 15 348 | 12 227 | 7 195 | 7 567 |
| Hungary [3] | 4 717 | 4 204 | 3 833 | 3 769 | 3 833 |
| Poland | | | | 7 090 | |
| Slovak Republic [4] | | 4 737 | 4 439 | 3 918 | 3 903 |
| Russian Federation | | | | | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time RSE and technicians.
3. In full-time equivalent (FTE).
4. Break in series in 1992; until 1993, average recalculated number of full-time RSE; in 1994, FTE.

**Table 26. Government researchers - Annual growth rate [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | | -20.3 | -41.2 | 5.2 |
| Hungary [3] | | -10.9 | -8.8 | -1.7 | 1.7 |
| Poland | | | | | |
| Slovak Republic [4] | | | | -11.7 | |
| Russian Federation | | | | | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time RSE and technicians.
3. In full-time equivalent (FTE).
4. Break in series in 1992 and 1994.

**Table 27. Government researchers - Percentage national total [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | 34.7 | 36.5 | 30.4 | 32.8 |
| Hungary [3] | 26.9 | 29.1 | 31.1 | 31.9 | 32.6 |
| Poland | | | | 17.1 | |
| Slovak Republic [4] | | 37.7 | 41.6 | 43.9 | 38.1 |
| Russian Federation | | | | | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time RSE and technicians.
3. In full-time equivalent (FTE).
4. Break in series in 1992; until 1993, average recalculated number of full-time RSE; in 1994, FTE.

*Source*: OECD.

**Table 28. Higher education total R&D personnel [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | 2 797 | 1 781 | 2 741 | 3 397 |
| Hungary [3] | 8 843 | 8 458 | 7 917 | 7 776 | 7 611 |
| Poland | | | | | |
| Slovak Republic [4] | 2 101 | 1 850 | 1 713 | 916 | 4 285 |
| Russian Federation [5] | 108 700 | 90 600 | 72 600 | 53 200 | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time personnel in the R&D base.
3. In full-time equivalent (FTE).
4. Until 1993, average recalculated number of full-time RSE; in 1994, data also include teaching personnel performing R&D activities and are in FTE.
5. In head counts; higher education teaching personnel working as part time researchers excluded.

**Table 29. Higher education total R&D personnel - Annual growth rate [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | | -36.3 | 53.9 | 23.9 |
| Hungary [3] | | -4.4 | -6.4 | -1.8 | -2.1 |
| Poland | | | | | |
| Slovak Republic [4] | | -11.9 | -7.4 | -46.5 | |
| Russian Federation [5] | | -16.7 | -19.9 | -26.7 | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time personnel in the R&D base.
3. In full-time equivalent (FTE).
4. Break in series in 1994.
5. In head counts; higher education teaching personnel working as part time researchers excluded.

**Table 30. Higher education researchers [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | 2 458 | 1 534 | 1 545 | 1 918 |
| Hungary [3] | 5 204 | 4 926 | 4 754 | 4 546 | 4 589 |
| Poland | 15 750 | 15 384 | 15 210 | 15 250 | |
| Slovak Republic [4] | 880 | 855 | 1 156 | 613 | 3 698 |
| Russian Federation [5] | 71 100 | 60 800 | 52 100 | 40 000 | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time RSE and technicians.
3. In full-time equivalent (FTE).
4. Until 1993, average recalculated number of full-time RSE; in 1994, data also include teaching personnel performing R&D activities and are in FTE.
5. In head counts; higher education teaching personnel working as part time researchers excluded.

*Source*: OECD.

**Table 31. Higher education researchers - Annual growth rate [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | | -37.6 | 0.7 | 24.1 |
| Hungary [3] | | -5.3 | -3.5 | -4.4 | 0.9 |
| Poland | | -2.3 | -1.1 | 0.3 | |
| Slovak Republic [4] | | -2.8 | 35.2 | -47.0 | |
| Russian Federation [5] | | -14.5 | -14.3 | -23.2 | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time RSE and technicians.
3. In full-time equivalent (FTE).
4 Average recalculated number of full-time RSE.
5. In head counts; higher education teaching personnel working as part time researchers excluded.

**Table 32. Higher education researchers - Percentage national total [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic [2] | | 5.6 | 4.6 | 6.5 | 8.3 |
| Hungary [3] | 29.7 | 34.0 | 38.6 | 38.5 | 39.0 |
| Poland | | | 36.7 | 36.8 | |
| Slovak Republic [4] | 5.7 | 6.8 | 10.8 | 6.9 | 36.1 |
| Russian Federation [5] | 7.2 | 6.9 | 6.5 | 6.2 | |

1. Defence R&D personnel not included.
2. Average recalculated number of full-time RSE and technicians.
3. In full-time equivalent (FTE).
4. Until 1993, average recalculated number of full-time RSE; in 1994, data also include teaching personnel performing R&D activities and are in FTE.
5. In head counts; higher education teaching personnel working as part time researchers excluded.

**Table 33. National patent applications [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic | | | | 11 799 | |
| Hungary | 9 129 | 9 942 | 10 925 | 12 772 | |
| Poland | 5 420 | 8 816 | 11 373 | 13 752 | |
| Slovak Republic | | | | 9 459 | |
| Russian Federation | | | 59 225 | 43 703 | |

1. Including international patent applications.

**Table 34. Resident patent applications [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic | | | | 894 | |
| Hungary | 2 477 | 2 210 | 1 500 | 1 144 | |
| Poland | 4 105 | 3 389 | 2 896 | 2 658 | |
| Slovak Republic | | | | 282 | |
| Russian Federation | | | 39 528 | 28 541 | |

1. Including international patent applications.

*Source*: OECD.

**Table 35. Non-resident patent applications [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic | | | | 10 905 | |
| Hungary | 6 652 | 7 732 | 9 425 | 11 628 | |
| Poland | 1 315 | 5 427 | 8 477 | 11 094 | |
| Slovak Republic | | | | 9 177 | |
| Russian Federation | | | 19 697 | 15 162 | |

1. Including international patent applications.

**Table 36. External patent applications [1]**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic | | | | 1 258 | |
| Hungary | 3 089 | 2 425 | 2 006 | 3 364 | |
| Poland | 154 | 465 | 472 | 506 | |
| Slovak Republic | | | | 117 | |
| Russian Federation | | | 4 660 | 6 211 | |

1. Including international patent applications.

**Table 37. Dependency ratio (non-resident/resident applications)**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic | | | | 12.20 | |
| Hungary | 2.69 | 3.50 | 6.28 | 10.16 | |
| Poland | 0.32 | 1.60 | 2.93 | 4.17 | |
| Slovak Republic | | | | 32.54 | |
| Russian Federation | | | 0.50 | 0.53 | |

**Table 38. Autosufficiency ratio (resident/national applications)**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic | | | | 0.08 | |
| Hungary | 0.27 | 0.22 | 0.14 | 0.09 | |
| Poland | 0.76 | 0.38 | 0.25 | 0.19 | |
| Slovak Republic | | | | 0.03 | |
| Russian Federation | | | 0.67 | 0.65 | |

**Table 39. Inventiveness coefficient (resident patent applications/10000 pop)**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic | | | | 0.9 | |
| Hungary | 2.4 | 2.1 | 1.5 | 1.1 | |
| Poland | 1.2 | 0.9 | 0.8 | 0.7 | |
| Slovak Republic | | | | 0.5 | |
| Russian Federation | | | 2.7 | 1.9 | |

**Table 40. Rate of diffusion (external/resident patent applications)**

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Czech Republic | | | | | |
| Hungary | | | 0.91 | 2.24 | |
| Poland | | 0.11 | 0.14 | 0.17 | |
| Slovak Republic | | | | | |
| Russian Federation | | | | 0.16 | |

*Source*: OECD.

**Sources and methods**

**Czech Republic: Methodological Notes**

## 1. General

Frascati definitions are expected to be available and used for 1995 data, and a new survey based on OECD recommendations will be launched in 1996.

### *1.1. Agency*

The R&D unit (3 posts of which only 2 are occupied) of the Investment, Construction and Energy Division in the Czech Statistical Office is responsible for S&T statistics.

## 2. Sectors and surveys

### *2.1. Sectors of performance/employment*

Data by sector of performance using Frascati institutional classification (except for the PNP sector) have been available since 1991. Since 1993, SNA sectors have made the following breakdown:

- the SNA sector, "non-financial enterprises, corporate and quasi-corporate", corresponds to the business enterprise sector;
- the SNA sector, "non-profit institutions serving households", corresponds to the PNP sector; and
- the SNA sector, "government sector", is divided into the Frascati government and higher education sector.

### *2.2. Surveys*

A questionnaire entitled the "Annual report on science, technological development and licences" (VTR P 5-01) was prepared in 1992 and launched in 1993. It covers units of at least 25 employees. The number of responses totalled 593 and was distributed as follows: 408 in industry, 11 in construction, 156 research institutions, and 16 universities. A smaller and simpler questionnaire covers units of less than 25 employees: 43 units in all employing 357 persons, of which 212 persons work in R&D. The methodology for 1994 corresponds to the method used in 1993.

## 3. Coverage of main fields of science

Data by main fields of science corresponding to Frascati definitions is available for personnel.

## 4. Definitions and coverage of R&D

Defence R&D is not covered.

At this stage, data refer to the RDB (Research and Development Base) which covers:

- independent units whose principal activity is R&D; and
- non-independent units (employing at least 3 persons in R&D activities) in establishments whose principal activity is not R&D.

R&D activities outside the RDB are not taken into account except, since 1992, for R&D activity of university teachers. R&D activities of post-graduate students are not included. Data cover the whole activity of the RDB and pertain to scientific activity rather than R&D. In 1990 and 1991, data covered statistical units having at least 100 employees. Since 1993 (1992 for the business enterprise sector) data cover statistical units having at least 25 employees. In 1992, data did not cover units whose principal activity was classified in ISIC rev. 3 codes 50-55. Since 1993, data cover units whose principal activity is classified in ISIC rev. 3 codes 10-41, 45, 73, 803 (but not ISIC rev. 3 codes 01-05, 50-72, 74-802, 809-99).

## 5. Basic classifications

Before 1991, the Classification of the Branches of the National Economy (CBNE) was used to classify RDB data. Since 1992, the Branch Classification of Economic Activities based on NACE Rev. 1 is in use in the Czech Republic. Data broken down by ISIC in the business enterprise sector is available from 1992 onwards. Statistical units are defined as legal entities (called "organisations") registered on the territory. The criterion used for survey identification is the principal activity of the organisation.

## 6. R&D expenditure

### *6.1. Period covered*

Calendar year.

### *6.2. Other remarks on R&D expenditure and the role of government*

### *6.3. Sources of funds*

Only data on expenditure financed by the government are available.

### *6.4. Types of cost*

Data by type of costs have been available since 1991. Breakdown of capital expenditure is not available. Depreciation costs are not excluded.

### *6.5. Types of R&D activity*

Data not available.

### *6.6. Socio-economic objectives of R&D expenditure*

Data not available.

### *6.7. Defence GERD*

Not covered.

## 7. R&D personnel

Data are year averages.

### *7.1. Full-time equivalent*

Data are expressed in full-time personnel but do not indicate if activity is devoted to R&D only (except since 1992 for university teachers).

### *7.2. Head count*

### *7.3. Post-graduate students as R&D scientists and engineers in the higher education sector*

Not included in personnel data.

### *7.4. Occupation*

Data are not compatible with OECD categories. The categories of RDB personnel based on the former classification of occupations are:

- personnel engaged in R&D activities (roughly RSE + technicians according to OECD standards);
- non R&D personnel (i.e. administrative personnel);
- workers; and
- other support staff.

ISCO was adopted in 1992.

### *7.5. Formal qualification*

The categories of RDB personnel based on qualification and an approximate equivalent with ISCED are:

- "Candidates of science" and "Doctors of science" (ISCED 7 upper part);
- holders of university degree (ISCED 6 and 7 lower part);
- holders of secondary and post-secondary diplomas (ISCED 3, 5); and
- other qualifications.

## Hungary: Methodological Notes

## 1. General

### *1.1. Agency*

The Hungarian Central Statistical Office -- Department of Living Standards and Human Resources Statistics -- is responsible for R&D statistics.

## 2. Sectors and surveys

### *2.1. Sectors of performance/employment*

The following categories of R&D units are distinguished in the national system:

- *R&D institutes* are independent legal entities, whose main activity is scientific research and experimental development. They include R&D institutes, research centres and research laboratories and groups. They are controlled by branch ministries, the Hungarian Academy of Sciences or other governmental agencies.
- *R&D units of enterprises* are R&D units belonging to private or state-owned enterprises, joint-ventures, limited liability companies, stock companies and co-operatives.
- *R&D units of the higher education sector* include associated institutions.
- *Other R&D units* are units belonging to other institutions, such as health institutions, museums and libraries, controlled and financed by central and local governments.

A redistribution of units in these categories is made in order to report according to OECD sectors of performance and employment.

### *2.2. Surveys*

There are three different annual and mandatory surveys sent to:

1. scientific research and development institutes;

2. R&D units of higher education; and

3. units of enterprises performing R&D for an amount of at least 1 million HUF since 1994 (3 million HUF before 1994), or having at least 5 employees.

In 1992, the first pilot survey of small enterprises (limited liability companies, joint ventures, etc.) was carried out, but resulted in a very high non-response rate (75-80 per cent). Since 1993, data include liability companies with R&D activities. Surveys are sent mid-January, returned mid-March/beginning of April, processed end of July and the results are published end of October/beginning of November.

## 3. Coverage of main fields of science

The classification by field of science is compatible with OECD standards and broken down into five categories: natural sciences, engineering, medical sciences, agricultural sciences and social sciences and humanities. Social sciences and humanities are not given separately, but will be in the future.

## 4. Definitions and coverage of R&D

Defence R&D is not covered, except for the part conducted in the civil sector.

## 5. Basic classifications

The national classification is based on the principal activity of R&D units.

ISIC rev. 3 has been in use since 1992.

## 6. R&D expenditure

R&D expenditure includes purchase of licences and know-how.

### *6.1. Period covered*

Calendar year.

### *6.2. Other remarks on R&D expenditure and the role of government*

### *6.3. Sources of funds*

There is not a complete report of GERD by sources of funds: certain categories of funds are not allocated to OECD headings. There is also a question on how the Central Technical Development Fund (KMUFA) should be classified.

### *6.4. Types of cost*

R&D expenditure includes purchase of technology such as licences and know-how, which should be excluded.

### *6.5. Types of R&D activity*

### *6.6. Socio-economic objectives of R&D expenditure*

Not available.

### *6.7. Defence GERD*

Only defence R&D performed in the civil sector is covered.

## 7. R&D personnel

### *7.1. Full-time equivalent*

Data are available in FTE since 1981. Reporting units make the calculations of FTE for RSE and technicians. The calculation for other categories of personnel is derived using the time ratio applied to technicians. For research institutes, calculations are made by heads of the smallest individual organisational units (sections, laboratories and workshops) based on the time spent on R&D. The same applies for R&D units of enterprises. In the higher education sector, R&D units only report weight ratios. Though these methods are different, data are comparable from one sector to another.

### *7.2. Head count*

### *7.3. Post-graduate students as R&D scientists and engineers in the higher education sector*

### *7.4. Occupation*

Data are available by occupation on a comparable basis with OECD countries for RSE and technicians. Other personnel consist of manual and non-manual workers and include people in charge of financial and administrative tasks, and personnel dealing with activities related to safety and warehouse operations in R&D units.

### *7.5. Formal qualification*

Data by qualification are not available according to OECD standards. Surveys on personnel by qualification were carried out every five years until 1987. They provided data in head counts but not in FTE. A new questionnaire will be launched in 1995 and will include questions on qualification of personnel by field of study, age group, and foreign language skills.

## Poland: Methodological Notes

### *1.1. Agency*

The Production Division of the Central Statistical Office (GUS) is responsible for overall R&D surveys and statistics. The State Committee for Scientific Research (KBN) provides data on budget funding and has its own statistical unit (which is currently in organisation).

## 2. Sectors and surveys

### *2.1. Sectors of performance/employment*

Until 1992, only data for the Higher Education sector were available. The sectors were then organised as follows.

A. Units of the branch "Science and Technology Development":

- research units of Polish Academy of Sciences (PAN);
- government department and branch research units comprised of scientific and research institutes, central laboratories and R&D centres; and
- science and technology development service units comprised of scientific, technological and economic information centres, scientific libraries, state and Polish Academy of Science archives (data under this heading are not reported as R&D).

B. Development units in industrial enterprises.

C. Higher schools in the branch "Education".

The introduction of the new national classification -- EKD, see point 5 below -- has allowed 1993 data to be rearranged and 1994 data to be collected according to the OECD institutional classification. This is done as follows: each unit of the national economy has an EKD -- i.e. NACE -- code corresponding to its principal, secondary, tertiary and so-called auxiliary activity, which is included in its statistical identification number REGON (REGON is the register of the national economy).

- Among units having R&D as a principal activity -- NACE code 73 -- the Polish Academy of Sciences units are classified with the OECD government sector, and the branch R&D units with the OECD business enterprise sector, except for those which work on behalf of governmental bodies and are fully financed by them (such as the Institute of Finance which works for and is entirely financed by the Ministry of Finance).

- Among units having R&D as a secondary activity:

  – higher education institutions -- NACE code 73 -- are classified with the OECD higher education sector; and

  – agriculture and forestry (NACE codes 01-02), mining (NACE codes 10-14), manufacturing (NACE codes 15-37), electricity, gas and water supply (NACE codes 40-41), construction (NACE code 45), transport, storage and communications (NACE codes 60-64) are allocated to the OECD business enterprise sector.

- NACE codes 91.1 and 91.33 constitute the OECD private non-profit sector.

*2.1.1. Hospitals and medical centres*

The Medical Academy (university clinics) are included in the higher education sector.

*2.1.2. Private non-profit institutes*

*2.1.3. Higher education sector: borderline institutions*

### *2.2. Surveys*

Surveys are annual, postal surveys. They are designed by GUS and carried out by the 49 WUS which are the local agencies of the GUS at the level of each administrative region ("voivodship"). A new survey based on OECD recommendations was launched in 1995 to collect 1994 data. It is based on the former PNT-01, which has been changed and extended to all R&D performing units, including those of the business enterprise and private non-profit sectors.

Beforehand, there were four different surveys:

- the PNT-01 questionnaire on resources devoted to R&D activities, which was sent to units employing at least 5 persons in the government and higher education sectors;

- the PNT-02 questionnaire on innovation activities, which covered industrial enterprises employing at least 50 persons and requested information on resources devoted to R&D;

- the PNT-03 questionnaire on licence utilisation, which covered all units of the national economy (including industrial enterprises) employing at least 50 persons and using foreign licences;

- the Z-06 questionnaire on employment and earnings which provided data on R&D personnel (this survey was carried out by the Division for Labour Statistics of GUS in co-operation with

the Production and R&D progress division); it covered units employing at least 5 persons in the government and higher education sectors; and

- the PNT-04 questionnaire on techno-productive indicators.

The PNT-02, 03, 04 and the Z-06 questionnaires will gradually be changed and newly replaced in the near future.

## 3. Coverage of main fields of science

Data by main fields of science are available for total number of researchers only and researchers in the higher education sector.

## 4. Definitions and coverage of R&D

See point 6.7 below.

## 5. Basic classifications

The national classification of economic activities has been replaced, in co-operation with Eurostat and INSEE, by a new one called EKD -- European classification of activities -- derived from the NACE. Breakdown by ISIC rev. 3 should also become available.

## 6. R&D expenditure

### *6.1. Period covered*

Calendar year.

### *6.2. Other remarks on R&D expenditure and the role of government*

### *6.3. Sources of funds*

Data by sources of funds should become available for 1994.

### *6.4. Types of cost*

A breakdown between "labour costs" and "other current costs" as well as between "lands and buildings" and "instruments and equipment" has been introduced in the new questionnaire and data will become available for 1994. Beforehand, the breakdown was only available between “current expenditure” and “capital expenditure” (but capital expenditure in enterprises and in the higher education sector was excluded). Depreciation costs have been excluded for 1994 data for first time.

### *6.5. Types of R&D activity*

Data should become available for 1994.

### *6.6. Socio-economic objectives of R&D expenditure*

Not available.

### *6.7 Defence GERD*

Defence R&D is not systematically covered: only units registered in REGON such as the Technical Academy of the Army or the Medical Academy of the Army are included whereas "secret units" are not covered. However defence R&D is not expected to be large and the Bureau of Defence Affairs in GUS is currently negotiating with the Ministry of Defence on the possible inclusion of all military units (of which R&D performing units) into the GUS statistical reporting system. The aim is to have all defence R&D units covered for 1995 data.

## 7. R&D personnel

### *7.1. Full-time equivalent*

Data is collected in FTE.

### *7.2. Head count*

Head count data are also available from 1994 as a reference year and relate to the number of people as of 31 December.

### *7.3. Post-graduate students as R&D scientists and engineers in the higher education sector*

Post-graduate students -- students working on their doctor's thesis -- are included in the researchers categories.

### *7.4. Occupation*

Complete data on personnel by occupation should become available for 1994. Beforehand, data broken down by researchers and technicians were only available for totals and the higher education sector. There is a break in the series between 1991-92 for researchers: until 1991 research engineers engaged in R&D were excluded.

### *7.5. Formal qualification*

Data by qualification should become available for 1994.

**Slovak Republic: Methodological Notes**

## 1. General

The Frascati definitions have been adopted to a certain extent in 1994 questionnaires and 1995 data. Additional changes, based on OECD recommendations, are to be introduced in the questionnaires launched in 1996 (see point 2.2).

### *1.1. Agency*

The Department of Statistics on Main Production Branches of the Statistical Office of the Slovak Republic is responsible for the surveys.

## 2. Sectors and surveys

### *2.1. Sectors of performance/employment*

For 1993 the government sector consists of budgeted and subsidised institutions; the higher education sector consists of non-independent institutions under the Ministry of Education (universities and higher education institutions); and the business sector is assumed to consist of other organisations. As far as the PNP sector is concerned, data for 1993 were not available -- there was only one organisation in this sector in 1994, data will be available for 1995 and 1996. In the questionnaires launched in 1994, a specific question addressed to organisations asks where they classify themselves in these sectors (according to definitions in line with the Frascati Manual).

#### *2.1.1. Hospitals and medical centres*

Medical institutions complete the 01 questionnaire only when carrying out R&D activities -- tasks within the framework of a particular research programme. For 1994, in the register of the reporting units, faculty hospitals and other medical institutions are classified with the government sector.

#### *2.1.2. Private non-profit institutes*

#### *2.1.3. Higher education sector: borderline institutions*

### *2.2. Surveys*

For 1993 data there was only one questionnaire addressed to all organisations. For 1994 there were three types of questionnaires:

- one for small organisations with 1 to 24 employees having R&D as a principal activity; this questionnaire is called "Annual report of small organisation on R&D -- TECH P12-01";
- one for economic/business organisations having 25 or more employees, called "Annual entrepreneurial report on R&D" -- this questionnaire is sent to organisations having industry,

construction, agriculture, transport, communication, forestry and science and technological services as a principal activity; and

- one for government organisations, whatever the number of employees -- this questionnaire was created for budgetary organisations and universities and is called "Annual entrepreneurial report on R&D for budgetary organisations and universities and for other non-entrepreneurial organisations".

These questionnaires will also be valid for 1995. The questionnaires for 1996 will be extended to include fields of science as well as the breakdown of capital expenditures for lands and buildings, and instruments and equipment.

## 3. Coverage of main fields of science

## 4. Definitions and coverage of R&D

Defence R&D is not covered. For the moment, data still refer to the Research and Development Base (RDB) and covers the whole activity of institutions and not only R&D. For 1994 data, according to the new methodology, only R&D activities are to be covered; personnel will be expressed in FTE.

### *4.1. Software R&D*

### *4.2. R&D management, administration and other supporting activities*

#### *4.2.1. Management and administration*

#### *4.2.2. Libraries*

Libraries complete the questionnaire only when carrying out R&D activities -- tasks within the framework of a particular research programme. For 1994, there was one library in the register of reporting units which classified itself into the government sector.

#### *4.2.3. Computing departments*

Computer centres complete the questionnaire only when carrying out R&D activities -- tasks within the framework of a particular research programme. For 1994, the computing centres classified themselves into the business enterprise sector.

#### *4.2.4. Other ancillary services (security, maintenance, cleaning, etc.)*

## 5. Basic classifications

Until 1991, the classification of the Branches of the National Economy was used to classify RDB data. Since 1992, the Branch Classification of Economic Activities based on NACE Rev. 1 is in use in the Slovak Republic. ISIC rev. 3 data are available from 1992 onwards. Statistical units are defined as legal entities -- called organisations -- registered on the national territory. The criterion used for survey identification is the principal activity of the organisation.

## 6. R&D expenditure

### *6.1 Period covered*

Calendar year.

### *6.2. Other remarks on R&D expenditure and the role of government*

### *6.3. Sources of funds*

Only business enterprise and government data are available as sources of funds. Government data are official; business enterprise data are assumed to be the complement (it is calculated as a subtraction of government data from the total). In the 1995 questionnaire, there is a specific question on sources of funds, as defined in the Frascati Manual.

### *6.4. Types of cost*

Distribution of capital expenditure among "land and buildings" and "instruments and equipment" is not available, but will be in 1996. Depreciation costs are not excluded.

### *6.5. Types of R&D activity*

Data are not available for the moment.

### *6.6. Socio-economic objectives of R&D expenditure*

Data are not available for 1993. Questionnaires from 1994 onwards include a special section on objectives related to R&D projects.

### *6.7. Defence GERD*

Not covered.

## 7. R&D personnel

### *7.1. Full-time equivalent*

Not available for the moment, but will be from 1994 onwards.

### *7.2. Head count*

Indicates average number over the year. However, data cover the whole activity of the person and not only R&D.

### *7.3. Post-graduate students as R&D scientists and engineers in the higher education sector*

Not included in data for personnel for 1993. For 1994 these data will be included with researchers.

### *7.4. Occupation*

The breakdown of personnel data by occupation is an estimate by the Slovak Statistical Office (made according to the level of qualification among other criteria). The category "researchers" consists of R&D personnel with university titles. The category "technicians" consists of R&D personnel with secondary and primary education. The category "others" consists of non-R&D personnel, and operating and service personnel.

A national classification compatible with ISCO-88 exists since 1993.

### *7.5. Formal qualification*

Data not available for the moment. Question on this topic in the 1995 questionnaire.

## Russian Federation: Methodological Notes

## 1. General

### *1.1. Agency*

According to the Statute of the Ministry of Science and Technological Policy (MSTP), approved by the Government of the Russian Federation on 12 July 1993, the Ministry is generally responsible for the development of methodology on R&D statistics, implementation of the respective surveys, and introduction of international standards. In this connection, the MSTP and the State Committee for Statistics of the Russian Federation issued a common statement at the end of 1993. The statement is aimed at implementing joint efforts to raise efficiency on R&D statistics.

In accordance with the statement, the Centre of Science Research and Statistics (CSRS), established in early 1991 and subordinated both to MSTP and the Russian Academy of Sciences is officially responsible for the methodology on R&D statistics in Russia, including the implementation of

international statistical standards. The CSRS uses the local statistical offices for R&D data collection and Ministry of Science and Technological Policy channels -- for data collection on R&D budget funding.

## 2. Sectors and surveys

### *2.1. Sectors of performance/employment*

A distribution of R&D data by sector of performance according to OECD recommendations will be available for 1994 data. In national statistical practice, the R&D resources (personnel, expenditure, fixed assets) are traditionally grouped into four sectors.

- The *academy sector* includes research institutes of the Russian Academy of Sciences and the branch academies (the Russian Academy of Agricultural Sciences and the Russian Academy of Medical Sciences).

- The *industrial R&D sector* covers the research, projecting, design, technological experimental organisations serving industry and working independently of industrial enterprises as well as those serving government. Other R&D units are also included under this heading.

- The *higher education sector* includes R&D units of higher education institutes.

- The *enterprise sector* covers R&D units of industrial enterprises (research, projecting, design, technological, and experimental units).

Some indicators on R&D employment are also collected in the framework of labour statistics. These are presented in relation to the *science and scientific services* sector, the composition of which is specified by the obsolete Classification of Branches of the National Economy. This classification is not compatible with the System of National Accounts. Until 1992, the *science and scientific services* sector had included the following types of institutions:

1. establishments performing R&D:

    - academies (other than the educational ones), research institutes, independent research laboratories;

    - design organisations;

    - experimental and research stations, experimental bases performing R&D;

    - state archives performing research;

    - research institutions on nature protection (natural reserves, botanical gardens, etc.);

    - museums, libraries, book chambers performing research.

2. independent design and protecting organisations, excluding those for construction and forestry exploration;

3. experimental enterprises (factories, bases, units) manufacturing no products for sale;

4. hydrometeorological service organisations;

5. geological prospecting organisations; and

6. organisations providing services to research institutions: prospecting stocks of fish, sea animals, sea products and whales, experimental and technical laboratories, research and testing stations, central technical information bureaux, computer centres of research organisations and other organisations connected with serving research institutions.

Since 1992, the *science and scientific services* sector does not include:

- hydrometeorological services; and
- geological prospecting organisations.

The higher education institutions, industrial enterprises, construction projecting and exploration organisations are not incorporated in the *science and scientific services* sector regardless of whether they perform R&D or not. The data on employment in the *science and scientific services* sector are not compatible with that on R&D personnel and expenditure and are of minor use in R&D statistics and analysis.

### *2.1.1. Hospitals and medical centres*

Hospitals and medical centres which perform R&D are included in the industrial R&D sector in accordance with the national sectorial classification.

### *2.1.2. Private non-profit institutes*

This sector does not exist in the national classification.

### *2.1.3. Higher education sector: Borderline institutions*

As has already been mentioned above, the higher education sector includes R&D units or higher education institutes. Research institutes and experimental stations operating under direct control of or administered by or associated with higher education establishments generally are included in the industrial R&D sector.

## ***2.2. Surveys***

The main source of statistical data on R&D -- its distribution by region and sector of performance, the structure of R&D expenditure by type of activity, the number of researchers by field of science -- is the Russian questionnaire form No. 1 on science, entitled "Report of Enterprise Organisation on Performance of Scientific and Technological Projects". Statistical data cover R&D institutions, i.e. R&D-performing enterprises and institutions regardless of sectors of the national economy. Among these, the following main types of R&D institutions are distinguished between:

- research institutes working independently of enterprises;

- design organisations;
- construction projecting and exploration organisations;
- experimental enterprises manufacturing no products for sale;
- other organisations of the "science and scientific services" sector;
- R&D units of industrial enterprises; and
- other independent organisations performing R&D.

Collection of statistical data and R&D according to this survey has been introduced since 1989. The survey is mandatory and annual. It covers more than 4 500 R&D-performing institutions and enterprises.

## 3. Coverage of main fields of science (NSE and SSH)

All sector data cover all fields of natural sciences and engineering as well as social sciences and humanities. The Russian classification of fields of S&T is broadly compatible with that recommended by the Frascati Manual (and UNESCO) with some exceptions for several detailed fields. The classification which will be used in the new national R&D survey will be fully compatible with that of the OECD.

## 4. Definition and coverage of R&D

### *4.1. Software R&D*

Software experimental development is identified separately in the national questionnaire and included in R&D expenditure.

### *4.2. R&D management, administration and other supporting activities*

*4.2.1. Management and administration*

4.2.1.1. Specific R&D management and administration support

R&D personnel include management and administration supporting staff in all sectors. R&D labour costs include those devoted to R&D management and administration activities in all sectors.

4.2.1.2. Indirect (central) R&D management and administration

Expenditure on indirect R&D management and administration is included in overheads in the part they allocate to particular R&D projects. The respective personnel are not included in the R&D personnel series.

*4.2.2. Libraries*

4.2.2.1. Unit specific libraries

R&D personnel include staff of specific libraries. R&D labour costs and other current costs include resources devoted to specific library activities in all sectors.

*4.2.3. Central libraries*

Expenditure of central libraries in universities is only included in R&D when they provide some special services to R&D units.

*4.2.4. Computing departments*

4.2.4.1. Unit-specific

R&D personnel comprise personnel of computing staff in all sectors. R&D expenditure comprise resources devoted to computing activities in all sectors.

4.2.4.2. Central departments

The same convention is applied as to indirect management (see 4.2.1.2).

*4.2.5. Other ancillary services (security, maintenance, cleaning, etc.)*

Included in overheads.

## 5. Basic classifications

The main national classification used for the need of R&D statistics is the so-called All Union Classification of Branches of the National Economy, which is based on the concept of the material product balance. In national practice, definitions of reporting and statistical units coincide. All legal organisations performing R&D should report to the State Committee on Statistics. The new national industrial classification compatible with ISIC, rev. 3 and NACE, Rev. 1, is being introduced.

## 6. R&D expenditure

### *6.1. Period covered*

Data on expenditure relate to the calendar year.

### *6.2. Other remarks on R&D expenditure and the role of government*

Value-added tax is not included in R&D expenditure.

### *6.3. Sources of funds*

There is no R&D expenditure data collection by source of funds for the moment. The new R&D questionnaire, however, will contain a section on source of funds, including general university funds.

### *6.4. Types of costs*

Only the total sum of wages is extracted as one of the types of R&D costs in the national practice for each sector. Capital R&D expenditure is collected separately from current expenditure, in the framework of investment statistics, and is not available by sector. The new R&D survey will cover both current and capital expenditure.

### *6.5. Types of R&D activity (basic research, applied research, experimental development)*

Definitions of type of activity have been in concordance with Frascati Manual recommendations since 1989.

*Basic research* includes the experimental and theoretical research aimed at obtaining new knowledge which is not oriented to any concrete objective, or connected with practical use. The hypotheses, theories, and methods are the results of basic research. When completed, basic research may result in recommendations for arrangement of applied research to investigate possibilities or practical use of the results obtained, and in scientific publications.

*Applied research* is aimed at obtaining new knowledge for practical use for the development of technological innovations. Recommendations to create technological innovations represent the final results of the applied research.

*Development* covers design and technological projects, construction projecting, and production of prototypes.

### *6.6. Socio-economic objectives of R&D expenditure*

The classification by socio-economic objectives of R&D expenditure has not been used by the national statistics. It is envisaged in the new national R&D survey from 1996 onwards.

### *6.7. Defence GERD*

Defence GERD is not covered. It will be in the new survey with coverage extended to defence R&D performers.

## 7. R&D personnel

Data on personnel relate to 1 January of the year following the reported one.

### *7.1. Full-time equivalent*

R&D personnel are not measured in full-time equivalents. The new national R&D survey will attempt to measure full-time equivalents. As a first experimental attempt, the following approach has been chosen:

a) all personnel engaged in R&D on a full-time basis are equal to a FTE; and

b) for part-time personnel engaged in R&D, the enterprises under survey should report person-days for their R&D activity, which can easily be converted into person-years, i.e. FTEs.

The total FTE is calculated as a sum of (a) and (b).

### *7.2. Head count*

Personnel are estimated on the head-count basis at 1 January of the year following that reported.

### *7.3. Post-graduate students as R&D scientists and engineers in the higher education sector*

Researchers data series include post-graduate students engaged in R&D activity. R&D expenditure in HE institutes does not cover scholarships of post-graduate students.

### *7.4. Occupation*

The indicators of R&D personnel are based on the mixed occupation/qualification concept. The Nomenclature of Occupations of Scientific Workers, adopted by the former USSR State Committee on S&T in 1988, does not identify occupation (in the ISCO sense) but detailed fields of S&T. It includes 21 fields of S&T which incorporate more than 600 detailed specialities. On the whole, they can be grouped into major fields of S&T stipulated by the Frascati Manual.

### *7.5. Formal qualification*

The peculiarities of personnel recruitment and R&D labour organisation in Russia are taken into account in the definitions used. Researchers should therefore be graduates of higher education institutes, as a rule, with 4-5 years training (equal at least to ISCED level 6). R&D specialists with special secondary education, such as graduates of specialised secondary establishments (technical colleges) with 3-4 years training (equal to ISCED levels 3 and 5), usually work as technicians. The national survey also provides a separate estimation of higher education teaching staff working as part-time researchers.

The classification of R&D personnel by formal qualification is based on categories mentioned above and is connected to the Russian educational system. It proposes a subdivision into groups of staff with scientific degrees (Doctors and Candidates of Science) and higher education diplomas.

## SCIENCE AND TECHNOLOGY STATISTICS IN THE CZECH REPUBLIC

*by Jan Fischer, Helena Glatzova and Hana Slegrova (Czech Statistical Office) and Maria Vasakova (National Information Centre)*

### Generalities

R&D Statistics, along with other statistics, are now undergoing changes resulting from new social and economic conditions. In these new conditions, statistics play a different role (i.e. they have no direct ties to planning mechanisms) and different approaches and methods are used.

For 1995 the Czech Statistical Office made a substantial change in statistical surveying in the field of R&D -- the transfer to the methodology used in OECD countries and formulated in the Frascati Manual. The essence of the change mainly consisted in modifying questionnaire contents on science and technology to meet internationally adopted standards, for both indicators and their classifications. While implementing this transformation, past experiences in carrying out surveys on R&D as well as the requirements of domestic clients and international organisations for statistical data were used. An advantage during the preparatory stage was the fact that the Frascati Manual is an internationally recognised methodology and that statistical data clients also require the data according to the Manual recommendations. The questionnaire for the statistical survey on R&D for 1995 contains mainly data on human and financial resources.

Data on personnel in the R&D sector are based on the number of physical employees as of 31 December and the calculation of the number of full-time employees. The number of employees expressed in FTE is not acquired directly from respondents, but the number of employees whose portion of working time devoted to R&D activities accounts for either less than 30 per cent or 30 to 70 per cent or more than 70 per cent of full-working time. Based on this information the Czech Statistical Office will make the calculation of FTE. This approach was chosen following the experiences of some OECD countries which were presented during previous seminars. One of the reasons for this was the assumption that data quality is higher than that of respondents providing direct numbers expressed in FTE.

Data are obtained and broken down into researchers, technicians, and other auxiliary personnel (according to the Frascati Manual). This classification system follows the recent classification of occupations based on ISCO-88. The breakdown of R&D employees according to level of qualifications was left in its current form, keeping in mind the forthcoming revision of the ISCED, while applying the current national classification of education which is not compatible with ISCED. For this reason FTE conversion is not expected at a detailed level. A change of the classification system will be carried out subsequently to the revision of ISCED.

Expenditure on R&D are collected as intramural expenditure, in order to avoid data duplicity. Expenditures are broken down according to OECD recommendations in the following aspects:

- type of expenditure;

- non-investment costs:
  - wages,
  - others;
- investment costs:
  - premises,
  - equipment and installations;
- structure of financing of research and development sorted by sectors; and
- type of activity (basic and applied research and development).

The questionnaire also includes data on objectives in the financing of R&D projects, questions relating to the field of science in which the respondent predominantly provides R&D tasks, and data on licensing. The questionnaire contains detailed explanatory notes elaborated on the basis of the Frascati Manual for properly filling in the questionnaire. They contain definitions of R&D as described in the Frascati Manual (with a notice on the activities which are not to be assigned to R&D activities and necessarily excluded) as well as the explanations of individual indicators and sort keys.

The introduction of the questionnaire into the statistical survey process was preceded by a pilot test. In the test approximately 40 respondents from various sectors were contacted and were asked to fill in the new questionnaire. Twenty-five of them responded and none of them produced any serious remarks on its contents or comprehensibility. The questionnaire is used for the 1995 survey, which means that the first complete data of the survey will be available by the end of the first half of 1996 (deadline for the questionnaire return is 31 March 1996). Thorough analysis of the data will then take place including possible further consulting with the respondents for improving the questionnaire. In addition there is a quite simple questionnaire for very small reporting units (less than 25 employees) whose principal activities are not R&D and contain only indicators on employee structure and intramural expenditure.

Improving the questionnaire's clarity and finding a higher number of adequate indicators are two fundamental tasks for R&D statistics in the Czech Republic. It is based on the idea that the transformation of statistics consists not only in changing the indicators content, but mainly in changing methods and approaches, which necessitates efforts to use modern statistical methods, treat non-responses and use other techniques. There is potential for further improvement of data quality in these areas. One of the decisive tasks is identifying the respondents engaged in R&D activities which could enable sample surveys of certain respondent groups (especially for small units) including calculation of non-responses.

Preparing a questionnaire on innovations for a statistical survey in 1996 was another main step in statistical activities on science and technology inspired both by the questionnaire for joint survey of the OECD and Eurostat, and the experiences of Infostat Prague (the former statistical research institute), which surveyed innovations at the beginning of 1990s. It contains mainly questions on objectives and incentives for innovations, obstacles which prevent their implementation, costs for innovation, and all in a context of an overall company strategy. After the return of the questionnaires, data quality and quantity will be analysed before proceeding further.

**Conducting the R&D survey**

One of the basic changes in statistical surveying is a new style of co-operation with respondents. The former system, which strictly respected respondent duty to provide statistical data, led to a situation where there was no need to cope with non-responses, and the identification of respondents for a specific survey was quite simplified in relation to the planning activities and the activities of ministries and other central institutions. At present, the Czech Statistical Office faces similar problems to those of the statistical offices in the countries with a developed market economy, such as difficult respondent identification and non-responses. Efforts are made to reduce respondents' burden, to replace exhaustive surveys by sample surveys, and to prepare questionnaires in co-operation with respondents, testing them before their general use. The problems are gradually identified in statistical work and are solved by referring to the experience of countries with developed marked economies.

Identifying respondents in R&D activities is one of the main issues. The normal practice is for the questionnaire to be mailed to every selected group of respondents (in fields of manufacturing, construction, science and technology) which enables everybody engaged in R&D activities to answer. Information however on exactly who performs R&D is missing when the questionnaires are returned blank or not sent back. This approach is also economically disadvantageous. Another solution was therefore chosen to create an auxiliary register of units performing R&D activities. The register will be linked to the register of economic activities, and will use its attributes (Organisation Identification Number, activity code, SNA sector code, etc.). Information on R&D performers will result from:

- a questionnaire obtained in the past years;
- the innovation survey;
- a structural survey on production statistics (since 1997) which may include questions for identification of respondents in the field of science and technology, environmental protection, and possibly other statistics together with variables for the national accounting system, and statistics on labour and investments -- an advantage of such a survey is that it covers a large number of units;
- information from the state administration data sources (on subsidies from the state budget; and
- other information available.

The above sources will be used for permanent corrections and changes of the register.

An essential difference from the current status will be that identification will be based on whether units carry out R&D activities at all and not only as a principal activity. There will be the possibility to update the register annually using the sources mentioned. One of the reasons for the creation of a R&D sub-register was also a difference between Czech Statistical Office data and data supplied from other government sources. The Czech register of respondents was thus compared with that of those who received government subsidies. Detailed investigations are currently in process based on preliminary data disclosed to users, which will be adjusted following the findings of the survey.

The existence of a register on R&D performers is crucial for obtaining data of a high quality. If and only if there is such a sub-register will it be possible to urge response, make estimates on R&D efforts of non-respondents and include them in national totals in order to complete the survey procedure.

Collecting data from universities and other academic institutions will also require specific care. The Czech Statistical Office will co-operate with the respective section of the Ministry of Education in order to obtain data of a better quality and at the same to ensure the highest possible return of questionnaires.

Another important issue for a successful survey is the testing of a new type of questionnaire by the respondents, to estimate its comprehensibility (variables and explanatory notes) and to facilitate its completion. A similar test will be made before distributing the questionnaire on innovations. The Czech Statistical Office experience in the field indicates that the test should be made as a combination of interviews (with the respondents) when sent via post, and provide the possibility for respondents to comment in a written form.

**Use of classification systems for research and development**

Aligning statistical surveys on R&D with the methodological recommendations of the OECD (Frascati Manual) has been possible through the overall changes in Czech statistics for which the Czech Statistical Office plays a leading role. Use of international standards, owing to their importance in all the fields of statistics, is considered to be one of the crucial elements of the transformation and has been treated with appropriate care. Formerly used classifications were gradually replaced with international standards and are used in practice at the level required, despite the fact that frequent changes in the situation and position of respondents still complicate the situation. In the field of R&D, except for the ISCED classification which is expected to be subject to an extensive revision, the Czech Statistical Office uses national classifications which were built on the basis of international classifications. These are namely the classifications of sectors, activities and occupations.

The classification of the sectors for R&D is based on the classification of sectors of the national accounting system (built in accordance with the national accounting system of ESA). Decisions to allocate companies and enterprises to different sectors are based on completed privatisation and overall transformation of the economic system, according to the practice used in OECD Member countries. Every respondent has its own SNA code in the register of economic units (assigned by the staff of the register on the basis of directives common to the national accounting system as well).

For the needs of R&D statistics the following are used:

- the SNA sector "non-financial enterprises, corporate and quasi-corporate" as the Frascati "Business Enterprise sector";

- the SNA sector "non-profit institutions serving households" as the Frascati "PNP sector".

To achieve the same breakdown by sectors as in the OECD countries the SNA "government sector" (including the government funded institutes, e.g. the Academy of Sciences and the universities and other higher education institutes) is divided into the following Frascati sectors:

- the government sector;

- the Higher Education sector.

The Higher Education sector is isolated from the SNA government sector by means of the ISIC code 803 which unambiguously indicates the higher education activities.

In order to survey the structure of financing of R&D, it was necessary to include comments for the respondents to be able to assign subsidies they received for R&D into an appropriate section for financing. Because government subsidies are a major part of financial sources, no major problems are expected in this area. If a portion of financing from another sector than the government sector is growing, the issue will necessarily attract more attention. It will be inevitable to verify what way the respondents understand explanatory notes and carry out their classifications into the sectors or to look for other ways of making the data obtained more specific and exact. Nevertheless, the primary sources of financing may not be identified in every case.

The classification of activities (OKEC) has been used since 1992 and was built on the basis of NACE Rev. 1 at the four digit-level of the NACE classification system. The fifth digit has been added for the requirements of national statistics (the sixth position is empty for prospective further need). From this point of view the transfer of data in accordance with the requirements of international data users will not cause any problems. Possible insufficiencies in classifications are continuously solved (it has been demonstrated that some of the respondents registered R&D activities as their principal activity; however, they are actually engaged in other activities, for example consulting). The situation is sometimes complex from the aspect that the economic units perform a number of various activities (which are related to R&D in some ways) and under such conditions the principal activity could be changed depending on a concrete situation, though this aspect of the situation has been stabilising gradually.

Another trouble was caused by the use of the register of economic units of the Czech Statistical Office for various administrative purposes. The entities were registered on the basis of the appropriate administrative documentation. In this documentation, the entity declared its activities and the appropriate code of activity was assigned to the entity in the register. The changes of activity could be also registered only on the basis of the administrative documentation. This situation was not adequate for the needs of statistical surveying. Therefore a special activity code for the needs of the Czech Statistical Office only was introduced into the register. The code is used for statistical surveys of the Czech Statistical Office and may be changed or adjusted.

The classification of occupations (KZAM) was adopted in 1993, and is fully compatible with ISCO. In the new questionnaire for 1995, it was possible to include the new breakdown of R&D personnel into researchers, technicians, and other auxiliary personnel, providing that the explanatory notes to the questionnaire contain, besides the characteristics of the categories mentioned above, references to the job classification of occupations as follows:

- researchers - class 2 subgroup 1237;
- technicians and similar personnel - class 31 and 32; and
- other auxiliary personnel -- group 343 and main class 4,6,8 or 2 KZAM.

The coming period anticipates:

- further increasing of quality in the use of the valid classifications (adjustments, modifications, code changes, and evaluation of the classifications' use); and
- applying the revised classification of education and its use for R&D statistical surveys after approval.

**R&D databases in the Czech Republic**

Today there are numerous databases on R&D in the Czech Republic. The more important ones are:

- The Czech Statistical Office (CSO) database, containing information on all the institutions working on R&D, including details of their personnel and cost structures and their projects. The CSO also collects data on the purchase/sale of manufacturing licences, thereby creating a major source of information on technology transfer.

- The database set up by the Government Council for R&D, containing information on all projects awarded government funds. The base consists of data supplied by ministries and agencies on projects funded from the eighteen chapters of the national budget, and its purpose is to pool information on every project developed within the Czech Republic and prevent duplication. Funds are only released once the information has been submitted to the Council. Eighteen partial databases on R&D projects undertaken by ministries and agencies funded from the eighteen chapters in the national budget, including the Resource Allocation Agency, the Academy of Science, and individual ministries. The data on each project are more detailed than that supplied to the Government Council.

- The database created by the Czech Republic's Ministry of Finance. This lists all the financial support granted for R&D under the eighteen chapters of the national budget (to both public or semi-public establishments and private firms), allocated in the form of institutional or special funds.

- The database set up by the Agency for Industrial Property Rights. It lists all the Czech enterprises that have filed a technical patent for an invention, a prototype or an industrial model, as an indicator of R&D output; and

- the database run by the Office of the Czech Academy of Science. This contains information on each of the Academy's institutes, including details of its corresponding members, its history, a description of its work and the scientific and specialised sections it comprises.

All the databases above obtain their information from mandatory returns. Other databases, however, contain data supplied on a voluntary basis. They are:

- Another database run up by the Government Council on Research and Development, listing information on R&D work obtained from articles in the specialised press and details of changes in sectoral structure, personnel, costs, etc. over the period 1994-1995;

- the database of the National Information Centre, which describes the various institutes; and

- the database run by the Association of Research and Development Institutes, containing information on its members.

The field of R&D is monitored by Czech institutions, but also by international bodies and foreign companies in the private sector.

**Access to data**

The database set up by the Czech Statistical Office is for public use, the only constraint being a provision of the Statistical Act requiring that information be aggregated and structured so as not to reveal personal data. The data are used in particular for the analysis of sectoral trends. The Government Council for Research and Development is currently endeavouring to define the possible form, and scope, of public access to R&D data. There is no access to data on research within individual institutions. The publication of data concerning the ministries and agencies funded from the national budget is entirely a matter for each ministry or agency. The other databases make detailed information available to the general public, thereby enhancing awareness of the various institutes and agencies and the work that they do.

**Use of R&D data**

Two categories of data are vital to policy-makers:

- Aggregated data, of particular use in defining policy on scientific development, enabling improvements to be made in the system of government support for R&D. Most of the basic information comes from the CSO, while Ministry of Finance data are significant for national budget funding. Additional information is derived from surveys conducted by the Ministry of Education, Youth and Sport, and the Association of R&D Institutes; and

- individual data on the various actors, promoting international co-operation, and participation in international projects.

The information on R&D focuses on monitoring input. For the time being, there is less emphasis on assessing output, particularly in areas such as innovation and technology transfer.

# SCIENCE AND TECHNOLOGY STATISTICS IN HUNGARY

***by Ildiko Poden (Innovation Research Centre)***
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## R&D Definition

Scientific and Technological Activities: the concept of STA has been developed by UNESCO. The "Recommendation concerning the international standardisation of statistics on science and technology" defines which activities belong to it:

> "...systematic activities which are closely concerned with the generation, advancement, dissemination and application of scientific and technical knowledge in all fields of science and technology. These include such activities as R&D, scientific and technical education and training (STET) and the scientific and technological services (STS)..."

R&D, which is defined by UNESCO on the same lines as the OECD, must be distinguished from STET and STS. International Organisations use the same definition of R&D: creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of human beings, culture and society and the use of this stock of knowledge to devise new applications. Scientific R&D are characterised by the presence of the following joint fundamental elements: creation, novelty, the adoption of scientific methods, and the creation of new experiences. R&D is a term covering three activities: basic research, applied research and experimental development:

- *Basic research* is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view.

- *Applied research* is also original investigation undertaken in order to acquire new knowledge. It is however directed primarily towards a specific practical aim or objective.

- *Experimental development* is systematic work, drawing on existing knowledge gained from research and/or practical experience, that is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed.

The general definition of R&D and the types of research in Hungarian national statistics correspond conceptually to the statistical recommendations of UNESCO and the OECD (Frascati Manual).

**Institutional classification**

Institutional classification used by the HCSO (Hungarian Central Statistical Office) differs from that of the OECD. Types of organisations observed by HCSO are:

- *R&D institutes.* They are independent legal entities whose main activity is scientific R&D. R&D institutes, research centres and research laboratories and groups belong to it. They are controlled by branch ministries or the Hungarian Academy of Sciences.

- *R&D units of enterprises.* Those enterprises, joint ventures, limited-liability companies, stock companies and co-operatives are attached to this group, which established an independent but in-house research unit in the organisation (institute, department, laboratory or group). These units are owned by private enterprises, state-owned enterprises or joint-owned enterprises.

- *R&D units of higher education sector.* These are units of universities and high-schools that undertake research activities full or part time (institutes, laboratories and departments). Self-supporting organisations, such as research institutes working next to universities and other higher education institutions, are also attached to this group. They are mainly controlled and financed by the central government.

- *Other R&D units.* These include health institutions, museums, and libraries. Their main activity is not R&D but they permanently undertake research activities with their own workers and equipment. They provide data of those departments engaged in research activity. They are controlled and financed by the central or local government.

The statistical office collects data with the help of three different questionnaires: (1) for investigating R&D activities at R&D units of enterprises; (2) for R&D units of higher education; and (3) for R&D institutes and other R&D units. The scope of observation is wider and wider every year, but the survey is not yet full-scope. Until 1993 *R&D units of enterprises* were obliged to provide data whose R&D cost was more than 3 million HUF per year (since 1994 the limit is 1 million HUF), or had more than 20 employees (since 1994 the limit is 5 persons), or among the employees at least ten had higher education qualifications. Among *other R&D units* are those which had to fill in the questionnaires because they employed more than 10 persons (5 since 1994).

The institutional classification must adjust to the OECD classification. The regrouping is shown in Table 1. The order of columns illustrates the method of reclassifying. HCSO also provides data for UNESCO and first completes UNESCO requirements, upon which data are prepared according to OECD classification.

**Table 1. Relation among institutional classifications of HCSO, UNESCO and OECD**

| HCSO | UNESCO | OECD |
|---|---|---|
| **R&D units of enterprises** ➔ ➔ | **Productive sector (integrated R&D)** ➔ ➔ | **Business enterprise sector** |
| **R&D institutes** | **Productive sector (non-integrated R&D)** ↗ | **Non-profit sector** |
| • Units controlled by branch ministries ➔ ➔ | | |
| • Units controlled by the Hungarian Academy of Sciences ↘ | | |
| **Other R&D units** ➔ ➔ | ↘ **General service sector** ➔ ➔ | **Government sector** |
| **R&D units of higher education sector** ➔ ➔ | **Higher education sector** ➔ ➔ | **Higher education sector** |

Source: HCSO

Based on the description of organisations by HCSO, the reclassification of R&D units of enterprises, R&D units of higher education sector and other R&D units is evident, but the classification of R&D institutes needs an explanation. R&D institutes supervised by branch ministries are shifted to the business sector, because in spite of the fact that they are state-owned, the state has never financed their activities. The present tasks of the ministries is to reorganise and establish trustees. Ministries should also provide orders for research activities, but the government does not finance industrial research and is not able to promote private companies to do so. Lack of financial resources makes the ministries unable to provide even the minimum financial support for the institutes. The result is that today these institutes have begun using their machinery for production in order to obtain income. For most of them, R&D has become a part-time activity.

Most R&D institutes belong to the Hungarian Academy of Sciences (HAS) and have been in the ownership of HAS since the Act XL of 1994 when the Hungarian Academy of Sciences was codified. It means that they are still state-owned, but they belong directly to the HAS which is an independent public body based on the principle of self-government and functions as a legal entity. The institutes are basically financed by the state-budget, which explains why they are regrouped into the government sector. HCSO has been unable to handle the non-profit sector. Non-profit organisations are a newly emerging form in Hungary. Though the register was set up in 1993, the first attempt to assess them had little success.

**R&D personnel**

The general definition for R&D personnel is: "All persons employed directly as R&D managers, administrators and clerical staff. Those providing an indirect service, such as canteen and security staff should be excluded."

Three subgroups of R&D personnel can be distinguished when classifying by occupation:

- *researchers* are professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems, and in managing the projects concerned;

- *technicians* are persons whose main tasks require technical knowledge an experience in one or more fields of engineering, physical and life sciences, or social sciences and humanities; and

- *other staff* include skilled and unskilled craftsmen, secretarial and clerical staff participating in R&D projects or directly associated with such projects.

The conditions for inclusion in a particular group correspond basically to the detailed definitions indicated in international recommendations, so staff data are suitable for international comparisons. *Other staff* (manual and non manual workers) includes those engaged in financial and administrative tasks and activities related to safety work and warehouse operations. The number of safety and similar personnel include only persons dealing exclusively with such tasks within the R&D unit. The Frascati Manual specifies that "those providing an indirect service, such as canteen and security staff, should be excluded." The measurement of personnel employed on R&D involves two exercises:

- measuring their number (head-count data); and

- measuring their activities in full-time equivalent (FTE).

National statistics take into account the actual number of employees on the staff of R&D organisations recorded in statistics, but the indicator of the full-time equivalent is also used according to the international recommendation.

Data on the total number of persons mainly or partially employed on R&D are particularly important when examining the role of R&D employment in total stocks and flows of scientific and technological personnel. Table 2 outlines the employment of R&D units, head-count data.

**Table 2. Employment of R&D unit by type of organisation, 1993 (head-count data)**

| Categories of staff | R&D institutes | R&D units of enterprises | R&D units of higher education sector | Other R&D units | Total |
|---|---|---|---|---|---|
| Scientists and engineers | 4 062 | 3 305 | 13 874 | 1 771 | 23 012 |
| Technicians | 2 011 | 3 029 | 3 853 | 68 | 9 761 |
| Others | 3 036 | 750 | 4 302 | 38 | 8 226 |
| Total | 9 109[1] | 7 084 | 22 029[2] | 22 777 | 40 999 |

*Notes*:
1. In addition 718 retired persons and 278 in second employment were active.
2. In addition 581 persons in second employment were active.
Source: HCSO

The FTE signifies the staff number in R&D activities converted to employees working full time. Data suppliers calculate the distribution of scientist, engineer and personnel work time at data processing with the time-ratio of technicians. In the case of research institutes, calculations are done by the heads of the smallest individual organisational units (section, laboratories) on the basis of time spent on R&D. The same applies for R&D units of enterprises. In the higher education sector, R&D units only report weight ratios. Though these methods are different, data are comparable from one sector to another. The number of those engaged in R&D are expressed in FTE. In Hungarian statistical practice, the FTE calculation method has been applied since 1981. Full-time data are shown in Table 3.

**Table 3. Main data of R&D personnel (FTE)**

| Year | Total personnel | Of which scientists and engineers | Personnel as a percentage of total employment |
|---|---|---|---|
| 1988 | 45 069 | 21 427 | 0.94 |
| 1989 | 42 276 | 20 431 | 0.88 |
| 1990 | 36 384 | 17 550 | 0.81 |
| 1991 | 29 397 | 14 471 | 0.63 |
| 1992 | 24 192 | 12 311 | 0.57 |
| 1993 | 22 609 | 11 818 | 0.58 |

Source: HCSO

Data by occupation are available on a comparable basis with OECD countries for researchers and technicians. The other personnel consist of skilled and unskilled workers and include those in charge of financial and administrative tasks as well as personnel dealing with activities related to safety and warehouse operations in R&D units.

**Table 4. Total R&D personnel by sector of employment and occupation (FTE)**

| | 1992 | 1993 |
|---|---|---|
| Business Enterprise sector total | 8 980 | 8 017 |
| of which: researchers | 3 724 | 3 503 |
| technicians | 3 553 | 2 816 |
| Government sector total | 7 295 | 6 816 |
| of which: researchers | 3 833 | 3 769 |
| technicians | 2 034 | 1 527 |
| Higher education sector | 7 917 | 7 776 |
| of which: researchers | 4 754 | 4 546 |
| technicians | 1 565 | 1 660 |
| National total occupation | 24 192 | 22 609 |
| of which: researchers | 12 311 | 11 818 |
| technicians | 7 152 | 6 003 |

Source: HCSO

Qualification data are not available for every year according to OECD standards. Surveys on personnel by qualification were carried out every five years until 1987. A new questionnaire was launched in 1995 and will contain questions on personnel qualification by study field, age group, sex, and foreign languages skills. Data collection will be carried out with the systematic questionnaires. Data suppliers provide data in head count, in this field FTE is not used.

**R&D expenditures**

Observation of R&D expenditures has three sources: statistical R&D survey, business survey and data provided by the National Committee on Technological Development (OMFB) of the Central Technological Development Fund (KMÜFA). The *Statistical R&D survey* observes only intramural expenditures devoted to R&D. Among intramural expenditures current and capital ones are separated. Current expenses include labour and material costs, maintenance of machinery and equipment, costs of administration and insurance, depreciation, disbursement on purchase and adoption of foreign scientific and technological achievements (licences, know-how). Capital expenditures are annual gross expenditures on fixed assets used in R&D programmes of statistical units. They are composed of expenditures on buildings, and investments and equipment.

The inclusion of depreciation cost and disbursement on the purchase of technology, such as licence and know-how, does not conform to international specifications. HCSO therefore reduces the value of its data by eliminating depreciation costs. Calculations are done based on questionnaires containing depreciation cost questions. Table 2 on Gross Expenditures on R&D (GERD) illustrates the difference between Hungarian data and data reported to the OECD and UNESCO. Data in column A which are published in Hungarian statistical books include depreciation costs and outlays on licence and know-how. Data in column B are post-prepared for the OECD by reducing original data with depreciation cost. No other modification is made, so that data in columns, A and B include outlays on licence and know-how.

**Table 5. Hungary: Gross domestic expenditure on R&D**

| Years | GERD Billion HUF (current prices) | |
|---|---|---|
| | "A" | "B" |
| 1988 | 32.8 | 32.4 |
| 1989 | 33.8 | 33.4 |
| 1990 | 33.7 | 33.3 |
| 1991 | 27.1 | 26.7 |
| 1992 | 31.6 | 30.9 |
| 1993 | 35.3 | 34.7 |

Source: HCSO

Data on the Central Technological Development Fund (KMÜFA) cover the financial value of government support for technological development allocated by the National Committee on Technological Development and branch ministries (one-third of R&D support is allocated by branch ministries). Data include all organisations receiving R&D support from KMÜFA, not only those R&D units questioned in the statistical R&D survey.

The *Business survey* is a source for improving data on R&D expenditures. It is a full-scope survey of enterprises conducted by HCSO, which contains questions on R&D expenditures. Those enterprises that are not in the statistical R&D survey, but have significant expenses on R&D, can be reached with its help. Defence R&D is included in data if it is performed by a civil enterprise or institute and/or if it is funded from KMÜFA. There is no registration that would provide appropriate information about all institutions undertaking defence R&D, nor the performance of those institutions receiving support for it. There are two main sources of funding defence R&D: the state budget and KMÜFA. Information was available only on KMÜFA allocations (Table 6). It should be stressed that it is only a fraction of allocated support aimed at financing defence R&D (OECD, 1995).

**Table 6. Allocation of KMÜFA Fund for Defence R&D by OMFB on the basis of Contracts (Million HUF)**

| | 1990 | 1991 | 1992 | 1993 | 1994 | Total |
|---|---|---|---|---|---|---|
| Ministry of Defence | 3.6 | 1.0 | 10.3 | 55.0 | 21.5 | 91.4 |
| Office of War Industry | - | - | - | 98.9 | 77.5 | 176.4 |
| Office of National Safety | - | - | - | - | 85.0 | 85.0 |
| Total | 3.6 | 1.0 | 10.3 | 153.9 | 184.0 | 352.8 |

Sources: NCTD data bank, September 1994
NCTD=OMFB (National Committee for Technical and Technological Development)

**Gross Expenditures on R&D**

Gross Expenditures on R&D (GERD) is calculated on the basis of the main three data sources: the statistical R&D survey, data on KMÜFA and business survey. Since the scope of observation of the surveys and of data on KMÜFA is different and there is overlapping between them, simple summing of

data on R&D outlays does not produce proper data. Modification is necessary to calculate the Gross Expenditures on R&D. The Statistical Office therefore summarises R&D expenses according to the statistical surveys and reduces them by taking out survey data on KMÜFA. The sum of the result and data on KMÜFA provided by OMFB is the Gross Expenditures on R&D published by HCSO.

Data on KMÜFA provided by OMFB cannot be broken down by sectors, because governmental supports are registered according to governmental funds and organisations which received them in order to cover outlays. Certain funds and organisations finance only higher education units, or only research institutes, but others finance different kinds of organisations which belong to different sectors. It is not however represented in the government database. This means that one fraction of the GERD can be detailed by sectors -- its data source is the statistical R&D survey -- but the other fraction cannot be: it presents data on R&D support allocated through KMÜFA and received by those organisations that are not covered by the survey.

A difference therefore exists -- the outcome when summing up R&D expenditures of sectors is not equal to total R&D expenditures (see Table 7). The sum of current intramural expenditures on R&D of the business sector (9 568 million HUF), of the government sector (6 932 million HUF) and of the higher education sector (5 900 million HUF) is 22 400 million HUF while total current intramural expenditure on R&D is 27 629 million HUF. The difference was therefore 5 229 million HUF in 1992.[1]

**Table 7. Current Intramural Expenditure on R&D by Sector of Performance and Type of Activity, 1992**

| Sectors | Basic Research | | Applied Research | | Experimental Development | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Million HUF | % | Million HUF | % | Million HUF | % | Million HUF | % |
| Business Million HUF | 483 | 7.0 | 4 422 | 48.6 | 4 663 | 72.9 | 9 568 | 34.6 |
| *Business %* | *5.1* | | *46.2* | | *48.7* | | *100.0* | |
| Government Million HUF | 3 841 | 55.6 | 2 222 | 24.4 | 869 | 13.6 | 6 932 | 25.1 |
| *Government %* | *55.4* | | *32.1* | | *12.5* | | *100.0* | |
| Higher Education Million HUF | 2 579 | 37.4 | 2 453 | 27.0 | 868 | 13.5 | 5 900 | 21.3 |
| *Higher Education %* | *43.7* | | *41.6* | | *14.7* | | *100.0* | |
| Total | 6 903 | 100.0 | 9 097 | 100.0 | 6 400 | 100.0 | 27 629 | 100.0 |

Source: HCSO

Statistical R&D surveys investigate GERD by funding. Table 8 illustrates what sort of financial sources are distinguished by HCSO.

**Table 8. Breakdown of Funding of GERD at HCSO (Million HUF, current prices)**

| **Financial sources** | **1992** |
|---|---|
| Business sector | 9 907 |
| Central Technical Development Fund (KMÜFA) | 6 724 |
| State budget | 11 037 |
| Separated government funds | 2 131 |
| of which: OTKA | 1 648 |
| Other domestic funds | 921 |
| Foreign or international source | 911 |
| Total GERD | 31 632 |

Sources: Scientific Research and Experimental Development 1992, HCSO, Budapest
OTKA=National Fund for Scientific Research

It should be stressed that KMÜFA is not defined as a governmental fund nor as a business sector contribution to R&D expenditures. The question of its classification arises because previously KMÜFA was financed directly through a special levy. In 1994 state budget became the financier of KMÜFA. In the next step towards budget modernisation in 1995, its main source of finance was the Economic Development Fund (OECD, 1995).

In data reported to the OECD and UNESCO, KMÜFA is classified as a business R&D expenditure. The reason for defining KMÜFA as a business contribution is that until 1 January 1994,

every enterprise had to contribute to KMÜFA with 4.5 per cent of their own turnover before the taxes of the previous year. KMÜFA is therefore considered a fund financed by the business sector and a fund that supports business sector R&D activities. Nevertheless, KMÜFA has other financial sources (Table 9) and it is allocated by government organisations (OMFB and branch ministries).

**Table 9. The Financial Sources of KMÜFA, 1990-1993 (percentage)**

| | 1990 | 1991 | 1992 | 1993 |
|---|---|---|---|---|
| Open stock [1] | 29.7 | 22.7 | 53.7 | 37.3 |
| Special levy | 48.5 | 58.7 | 30.6 | 41.1 |
| Refunding [2] | 12.6 | 9.7 | 10.3 | 11.3 |
| Capital income [3] | 9.2 | 8.9 | 5.4 | 10.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 |
| Total (million HUF) | 14 041.5 | 12 020.2 | 12 668.7 | 11 181.8 |

*Notes*:

1. The amount that is at disposal on 1 January.
2. Some supports funded by KMÜFA has to be refunded by the enterprises.
3. Capital income, interest income.

Source: OMFB

Table 10 illustrates what kind of financial sources are distinguished by UNESCO and the OECD and what kind of items are classified into the different groups by the HCSO. Table 10 is compiled on the basis of HCSO's questionnaires.

**Table 10. Breakdown of Sources of Funds of GERD reported to Hungarian Authorities, UNESCO and the OECD**

| **Sources of funds** | **Hungarian authorities** | **UNESCO** | **OECD** |
|---|---|---|---|
| **Funds from business enterprises**[1] | Own assets | | |
| | Order from business enterprises, R&D units | | |
| | | **Central Technical Development Fund** | |
| **Government funds** | **Central Technical Development Fund** | | |
| | Support from ministries on the debit of state budget | | |
| | Institution financing from state budget | | |
| | Support from portfolio research funds and other separated state funds | | |
| **Foreign funds** | R&D agreement with international or foreign organisation or company | | |
| | Aid and/or support from international or foreign organisation or company | | |
| | Loan from international or foreign organisation or company | | |
| | Aid and/or support from international or foreign bank | | |
| | Loan from international or foreign bank | | |
| **Other domestic funds**[2] | Loans from domestic banks | Loans from domestic banks | |
| | Support from local government | Support from local government | |
| | Support from domestic foundations | Support from domestic foundations | |
| | Other domestic sources | Other domestic sources | |
| **Funds from private non-profit sector**[3] | | | Support from domestic foundations |

*Notes*:

1. In UNESCO classification is named as Productive enterprise funds and special funds.
2. OECD does not use this category.
3. This category is distinguished only by OECD.

Source: HCSO

**Table 11. Breakdown of Funding of GERD according to HCSO, UNESCO and OECD requirement, 1992**

| Source of funds | HCSO | | UNESCO[1] | | OECD[1] | |
|---|---|---|---|---|---|---|
| | Million HUF | % | Million HUF | % | Million HUF | % |
| All sources of funds | 31 632 | 100.0 | 30 988[a] | 100.0 | 30 988a | 100.0 |
| Business enterprise | 9 907 | 31.3 | 16 278 | 52.5 | 16 278 | 52.5 |
| of which KMÜFA | - | - | 6 724 | 40.4 | 6 724 | 40.4 |
| Government funds | 12 877 | 41.6 | 12 877 | 41.5 | 12 877 | 41.5 |
| KMÜFA | 6 724 | 21.3 | - | - | - | - |
| Foreign funds | 911 | 2.9 | 911 | 3.0 | 911 | 3.0 |
| Other domestic funds | 922 | 2.9 | 922 | 3.0 | | |
| Private-non-profit sector | | | | | 17[a] | 0.1 |

*Note*:

1. The data do not contain the amount of amortisation but includes purchase of technology such as licences, know-how etc. of which amount was 853 million HUF in year 1992.
   Source: HCSO

Tables 10 and 11 show incomplete data for the OECD. Summing up business enterprises contributions (16 278 million HUF), government support (12 877 million HUF), foreign aid (911 million HUF) and private non-profit sector's support (77 million HUF) the outcome (30 143 million HUF) is not equal to the total GERD (30 988 million HUF). The reason is that loans from domestic banks, support from local government and other domestic sources are not included in any source of funds distinguished by the OECD.

The HCSO counts business enterprise contributions to R&D expenditures as residuum. It is illustrated with the help of data reported to UNESCO. In Table 12, the order of columns shows the way to calculate. Total current intramural expenditures on R&D (27 628.6 million HUF) are reduced by the amount of government support (11 872.2 million HUF), foreign aid (360.8 million HUF) and other domestic fund contributions to R&D (700.2 million HUF). The outcome produces the business sector's contribution (14 695.4 million HUF).

**Table 12. Current intramural expenditures on R&D by financial sources and sectors of performance, 1992 (Million HUF)**

| Sectors /UNESCO/ | Sources | | | | |
|---|---|---|---|---|---|
| | Government | Foreign | Other | Business | Total |
| Productive sector (integrated R&D) | 164.5 | 14.9 | 52.8 | 6 673.1 | 6 905.3 |
| Productive sector (non-integrated R&D) | 817.3 | 155.3 | 161.0 | 1 527.9 | 2 661.5 |
| Higher education sector | 5 082.7 | 42.4 | 175.9 | 598.6 | 5 899.6 |
| General service sector | 5 201.7 | 148.2 | 310.5 | 1 272.8 | 6 933.2 |
| Total [1] | 11 872.2 | 360.8 | 700.2 | 14 695.4 | 27 628.6 |

*Note*:

1. It includes data (5 229 million HUF) which is not detailed by sectors.

*Source*: HCSO

**Technological Balance of Payments**

Hungarian Technological Balance of Payments (TBP) registers international payments not only for the acquisition of industrial property, licences, know-how, and patents, but also for author fees and concessions as well. The problem is that figures provided by the Hungarian National Bank (HNB) cannot be broken down by items or by countries because the HNB receives aggregate data from commercial banks. It is therefore not possible to compile an accurate table on TBP. TBP data in Table 13 include international payments on licences, know-how, patents, intellectual property rights, trademarks, author fees and concessions.

**Table 13. "Technological balance of payments" (current prices)**

| | Receipts | Payments | Balance | Receipts | Payments | Balance |
|---|---|---|---|---|---|---|
| | Million HUF | | | Million US$ [1] | | |
| 1988 | 1 727 | 2 723 | -996 | 34.2 | 54.0 | -19.8 |
| 1989 | 2 213 | 4 104 | -1 891 | 37.4 | 69.4 | -32.0 |
| 1990 | 2 718 | 800 | +1 919 | 44.2 | 13.0 | +31.2 |
| 1991 | 1 076 | 1 245 | -169 | 14.2 | 16.5 | -2.3 |
| 1992 | 2 754 | 2 110 | +643 | 32.8 | 25.1 | +7.7 |
| 1993 | 7 063 | 3 155 | +3 908 | 70.1 | 31.3 | +38.8 |
| 1994. Jan-June | 1 076 | 2 772 | -1 696 | 10.5 | 27.2 | -16.7 |

*Note*:

1. Official exchange rate on the last day of the year, and on 30 June 1994.

*Sources*: 1988-89 CSO, HNB, and 990-1994.06. HNB.
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## THE HUNGARIAN PILOT INNOVATION SURVEY

***by Annamaria Inzelt (Innovation Research Centre)***[2]

Technological change is central to competitiveness and should be placed on as good a statistical footing as other key areas of economic policy. Proper innovation policy cannot be formulated without good information. Measuring innovation means aiming at an extremely complex, moving target. Policy formulation has to embark on measured innovation and implies not neglecting the embarkation point (measured innovation). It must take the difficulties into account and combine quantitative studies with qualitative ones.

The process of developing a Hungarian innovation survey questionnaire was a time-consuming process.[3] The first step was the translation and dissemination of the document *OECD Proposed Guidelines for Collecting and Interpreting Technological Innovation Data* (Oslo Manual, 1992), the theoretical framework containing the definition for this process.[4] Then the Innovation Research Centre (IKU) developed a Hungarian questionnaire based on the internationally developed, harmonised postal innovation survey in the OECD/EU area. It was decided to run a pre-test of the innovation survey in 1993. IKU visited some firms and asked members of top management to fill in a draft questionnaire. The pre-testing period was followed by a pilot survey. The pre-test was done through interview. Every researcher had to fill out the pilot questionnaire and prepare a written report on his/her experiences with the interviews. Thirteen firms completed the questionnaire and seven others gave valuable, detailed comments on the questionnaire design.

After the preliminary questionnaires completed by the firms had been examined and collated, the pilot postal survey questionnaire was developed. That apart, it was necessary to find a suitable register for choosing firms. Pilot innovation postal survey questionnaires were sent out in January 1994. Enormous methodological experiences were established through the completed questionnaires, the working hours hotline, and follow-up phone calls[5].

This paper summarises the methodological problems that occurred. It proceeds in the following order: the first section describes the key characteristics of the sample; the second section presents the sampling method; the third section goes into some details of the questionnaires' questions; the fourth section discusses who the best target person is; the fifth section makes some remarks on international comparability; and the IKU ends with some general conclusions.

**Characteristics of the Hungarian pilot survey**

| | |
|---|---|
| Methodology | |
| Kind of survey: | Pilot survey |
| Survey unit: | Enterprise (mainly innovative firms with R&D activities) |
| Classification: | ISIC Rev. 3[6] |
| Obligatory/voluntary survey: | Voluntary |
| Size of survey (number of responses): | 110 |
| Cut-off-point: | Employees above 100 and/or net sales above HUF 300 million and/or total sum of balance sheet above HUF 150 million. If two criteria were completed in last three years firms have to fill up compulsory survey. The sample was chosen from this group. |
| Questionnaire: | Modified OECD/EC harmonised one |
| Combination with other survey: | No |
| Population and coverage: | All R&D performing enterprises from the 4 000-strong sample of the Hungarian Statistical Office (478 in number) were selected. These 478 enterprises operate in various industries (manufacturing, utilities, construction, services). Their ownership structure is also diverse (private, state-owned, domestic and foreign joint ventures). |
| Reference period: | 1990 to 1993 |
| Survey method & implementation: | Postal survey/phone calls for those missing the deadline |
| Response rate: | 23 per cent |
| Timing: | |
| • Start mailing the questionnaire: | 01.02.1994. |
| • Finished collecting/processing data: | May 1994 |
| • Results available: | November 1994 |

**Sampling method and response rate**

At the time of sampling, there was no up-to-date listing of Hungarian companies. Several ideas were proposed as to where to choose the population for the pilot survey.

1) The original idea was to choose them from the list of companies that filed a R&D project with OMFB between 1990 and 1993, i.e. during the period when the new project evaluation system was created following the systematic change (Inzelt, 1993). Unfortunately this list was not available at the time of starting the pre-test.

2) In autumn 1993 the list of those firms that completed the compulsory R&D statistical survey forms became available. The aim was not to test the composition of the list, but while pre-testing the questionnaire it became clear that many of the companies on the list had disappeared or re-deployed fundamentally (e.g. they had gone into bankruptcy, split up, privatised or regrouped) Only 50 per cent of the list seemed correct at the end of 1993. (A very common problem with registers under conditions of transition is that they quickly go out of date.) It would clearly have been unreasonable to use such a list for a postal survey. IKU had to find something else.

3) At the end of the pre-test period the list of respondents in the new statistical business survey of the Hungarian Statistical Office (3 600 responses from the sample of 4 000) was ready.

This new business survey contained some questions about R&D activities. On this basis IKU was able to pick out from the list all firms involved in any type of R&D.[7] Their number was 478. This was the target group[8]. Only 110 firms returned questionnaires amenable to statistical analyses. (Another 30 firms gave valuable information in letters or on the phone.)[9] The response rate was 23 per cent, which is not very high, but is quite good considering that this was a non-mandatory survey in a transition economy in which trade is not flourishing and where the key question for many business units is just how to survive from day to day.

**Contents of questions**

There were some remarkable differences among the number of answers to questions. It is very important to distinguish the reasons for missing answers. The analyses of the answers and phone-call memos showed that many non-responses were caused by reasons other than respondent laziness: IKU ignores this group.[10] The other group is worthwhile to investigate in detail. IKU will do the non-response analyses in connection to the innovation questionnaire. The issues investigated are the following:

1) Were the questions meaningful for the respondents?

2) Could they be answered accurately with the information readily available?

3) Could they find among the questions those which were most important for them when thinking about innovation constraints? (Which important questions were missing?)

***Meaningfulness of questions***

The following questions were problematic for different reasons, such as respondent uncertainty or poorly-posed questions.

*"If your enterprise is part of a group ... is it 'mother', 'daughter' or 'sister'?"*

Only 40 per cent of those enterprises which belonged to a group answered. The non-response was not caused by the carelessness of respondents, but by lack or uncertain knowledge of such business categories.

*"Did your enterprise engage in R&D in 1993?" and "Does the enterprise perform R&D on a continuous (as opposed to occasional) basis?"*

The differences between the two questions were meaningless for companies. During the transition period they cannot answer about continuity.

*"Please estimate the distribution of the enterprise's sales of its products at the different stages of the product life cycle in 1993."*

The life-cycle was not a clearly understood concept for the respondents.

For the following questions, it became clear after the pilot survey that they were badly designed. There were too many different aspects to the same question. Although the response rate of these was quite good, the responses were almost meaningless.

*"legislation, norms, regulations, standards, taxation"*

*"Please estimate the percentage of total current innovation expenditures which was spent on specialised services outside your enterprise; for example, for R&D, marketing, patenting, training, design) in 1993".*

*In the following case, the question itself was clear but respondents usually omitted part of the question.*

*"Estimated total capital expenditures spent on investment in plant, machinery and equipment in 1993, linked to new product innovation."*

The respondents ignored "new product generation" and gave the total investment (excluding only so-called social investment).

***Accuracy and availability***

There is concern as to which questions a firm can reasonably answer; whether certain answers require substantial research on the part of the respondents (thus reducing response rates); what questions firms can answer accurately and consistently; and whether answers will be reliable and theoretically meaningful.

*"If the proportion of assets is available from owners, please supply the data...."*

It was optional to supply data. IKU received it in very few cases. It would be too simple to speculate that respondents did not answer because it was optional and they did not spend the time to find data.[11] But this is only one reason. The other is typical of the transition period: during the pre-privatisation process and after privatisation by foreigners, many Hungarian managers presumed it was better to keep confidential the proportion of ownership. Maybe this problem would be manageable if IKU were to ask only the proportion of key owners.

*"R&D activity"*

Three types of answers were needed for these questions: "yes" or "no" answers, percentage answers and exact monetary value data. The number of answers decreased following the above rank.

*"Costs of innovation"*

The question on innovation expenditure did not work sufficiently. It must be restructured.

***Important questions for respondents***

Pre-test was a very useful action for completing the questionnaire with some important questions for respondents. It was the case for the services of information on innovation. General information was completed by professional associations, and chambers. The list of main reasons for developing and introducing innovations were completed with the following:

- increasing or maintaining market share;
- creating new markets within former CMEA countries; and
- improving production flexibility.

The list of difficulties that hindered the realisation of innovations in enterprise were completed by some other barriers:

- lack or weakness of innovation management;
- organisational structure of enterprise; and
- open-ended questions for other reasons.

**Identification of respondents**

One of the key points of a successful survey is to find out who is the best targeted person -- who could respond meaningfully to such a questionnaire. After the pre-test it became clear IKU must target the chief executive officer because his/her permission is needed to get information on firms. In a number of smaller firms, the respondents usually were the directors because they were the only persons who could respond meaningfully.

In larger firms, directors usually delegated the tasks. If the director was the "integrator" of the questionnaire, IKU could receive equal-quality answers on each part of the questionnaire. If managers delegated to other professional managers, they usually replied to only one part of the questions and neglected the others. They preferred to answer spontaneously, without speaking to colleagues and without looking into the firm's archives. So the answers to certain questions were missing (see Annex). It was not only the time-consuming problem but also inside co-operation among managers (this reason became clear during the follow-up calls). IKU cannot distinguish among the firms and respondent information levels. That some questions had no meaning for respondents does not mean the "company" itself was unable to answer. This is a typical example of missing information caused by a respondent:

*"TEÁOR (the Hungarian abbreviation of ISIC rev. 3 code)"*

It was not caused by changes in the classification system (as was a common problem in the first year of the new system). The problem was that a lot of engineers and researchers did not know about this classification.

**International comparability**

In the age of globalisation of innovations, it is not possible to neglect either the national or international aspects of innovations. Politicians need information on the national development process and results and on the position of their country in the international competition. A survey could help fulfil the task of evaluation in an international framework. The investigated questionnaire used internationally-accepted definitions, classifications and harmonised questions. In other words the Hungarian questionnaire used the definition of the Oslo Manual, the ISIC rev. 3. classification and the main questions of the harmonised OECD/EU questionnaire.

**COMPARISON OF THE STRUCTURES OF THE STANDARD OECD/EU AND HUNGARIAN QUESTIONNAIRES**

| OECD/EU HARMONISED | | HUNGARIAN MODIFICATION |
|---|---|---|
| I. | General Information | Ownership Structure |
| II. | Sources of Information for Innovation | Educational/research establishments<br>more subgroups |
| . | . | professional associations, chambers |
| III. | Objectives of Innovation | Increasing or maintaining market share<br>creating new markets within former CMEA countries<br>improve production flexibility |
| IV. | Acquisition/Transfer of Technology | __ |
| V. | R&D Activity | __ |
| VI. | Factors of Hampering Innovation | Enterprise factors<br>lack or weakness of innovation management<br>organisational structure of enterprise |
| VII. | Costs of Innovation | estimated share of total current innovation expenditures<br>by branches |
| VIII. | Impact of Innovation Activities | Innovative products were new<br>globally<br>in Hungary<br>in the enterprise/group only |

The main differences between the harmonised and Hungarian questionnaires were the following:

"*General Information*" was completed by a question on ownership structure. The well-known privatisation process is one of the most important tasks of the transition period; the questionnaire needs to investigate the impacts of privatisation on innovation.

Among the "*external sources*" of information for innovation:

- Two subgroups were distinguished: national and international. It was reasonable to make this distinction because Hungarian firms are much less internationalised than those in Western Europe. The first step towards internationalisation is to collect information. Openness of thinking could help to improve competitiveness.

- The following types of existing domestic institution "educational and research establishments" were categorised into more subgroups.

- Among the general available information, "professional conferences, meetings and professional journals" were split into two groups because their evaluation significantly differed.

*"Please indicate the importance of the ... according to the following scale"*

A five-point scale used by most OECD countries was not enough for Hungarian respondents. (During the pre-test process interviewed people refused to mark "1" in atypical cases.) IKU had to split the group "insignificant" into two groups ("0" meant atypical and "1" meant insignificant).

One more question was added: "estimated share of total current innovation expenditures by branches, and by main activities" to the three others.

A question on domestic instead of total sales.

The question on newness of innovation products was modified. The harmonised questionnaire asked only about two groups, which caused a lot of misinterpretation in Hungary. If the newness was categorised as new in terms of "sector", it meant only in domestic terms. The pilot survey therefore used three groups: "globally", "in Hungary" and "the enterprise/group only"[12].

**Concluding remarks**

Having highlighted the similarities and differences between the harmonised and Hungarian questionnaires, it may be concluded that the questionnaire itself is not a constrained version of international comparison. The OECD/EU harmonised questionnaire is feasible during this phase of the transition period.

The pilot survey was an extremely valuable exercise. It produced useful information on the innovation process and its supporting and hampering environment (Inzelt, 1995). Besides these, it gave IKU a number of valuable pointers for further questionnaire design and it reaffirmed the notion that one should never launch a large-scale survey without checking the consistency of answers by means of such a pre-test and pilot-survey. A nation-wide survey is therefore only a question of financing.

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## SCIENCE AND TECHNOLOGY STATISTICS IN POLAND

*by Grazyna Niedbalska (Central Statistical Office)*

The agency responsible for the collection of almost all official R&D/S&T statistics in Poland is the Central Statistical Office (Polish acronym: GUS). The entire statistical system in Poland has in recent years undergone very significant changes in order to adopt internationally recognised standards when possible and reasonable. The Polish statistical transformation is now well-advanced.

A new and modern Law on Statistics passed by Parliament in 1995 outlines a general framework to develop a modern statistical system which meets the information needs of a democratic society. The law emphasizes the protection of data confidentiality and the need to further improve the hitherto existing register REGON in order to develop a comprehensive, modern register of the national economy, servicing multifarious -- statistical and administrative -- purposes, covering all units of the national economy and systematically updated. Preparing Polish versions of European and other international classifications and nomenclatures, and implementing them, is being performed by the Centre for R&D of Statistics, an agency affiliated to GUS.

The former Classification of the National Economy (KGN -- Klasyfikacja Gospodarki Narodowej) was replaced by the Polish version of NACE Rev.1 named EKD -- European Classification of Activities. The EKD will soon be replaced by the PKD (Polish Classification of Activities) -- the next, improved Polish version of NACE. Apart from NACE, other international classifications such as the International Standard Classification of Occupations (ISCO-88) or the Standard International Trade Classification (SITC) are already in practice. Polish R&D/S&T statistics have a rather long history and rich tradition. GUS has worked on R&D/S&T statistical and indicator collection and compilation since the early 1960s. R&D/S&T statistical time series were extensive and stable for many years. However, at the turn of 1980s and 1990s, there were dramatic cuts in the number and content of questionnaires.

After a period of stagnation, significant efforts are now in progress to build a new, comprehensive R&D/S&T statistical system in line with international OECD-based standards. The work on the transformation of the Polish R&D/S&T statistical system is currently moving from the preparatory to the operational stage. In 1995 a general conceptual framework of the new R&D/S&T statistics and indicators system was prepared to make plans for overall development in this domain of statistics and postulate close co-operation between GUS, the State Committee for Scientific Research (Polish acronym: KBN), scientists and other data users. The prime objective is to assess the current state and trends of the country's science and technology system. Two priority tasks have been set for the near future -- the first is to improve and further develop surveys on R&D activities, the second to establish a comprehensive system of innovation surveys (monitoring innovation activities). In 1994 a new system was launched to survey R&D activities in line with Frascati Manual recommendations.

The survey on R&D activities is an obligatory annual census survey covering almost all R&D performers. Only some units performing R&D occasionally may be omitted. For R&D military units, GUS is currently in negotiation with the Ministry of Defence to possibly include them all in the regular

system of surveying. According to GUS tradition, one type of questionnaire was designed for all types of units performing R&D, although some parts of the questionnaire are destined to be completed only by selected types of units. Comprehensive explanatory notes presenting R&D definitions based on the Frascati Manual and detailed directions for completion are attached to each copy of the questionnaire. The new survey on R&D activities worked surprisingly well though certain units had some difficulties understanding the new approach.

The questionnaire is composed of four parts. Section 1 is devoted to R&D expenditures by type of costs and source of funds. Section 2 is devoted to R&D personnel by occupation, on a head-count basis and in full-time equivalents (FTE). Section 3 is devoted to R&D personnel by level of highest qualification. Section 4 comprises supplementary data such as R&D intramural expenditure by type of activity, basic and applied research and experimental development, value of research equipment, - i.e. gross value and depreciation -- and costs of other activities performed by the reporting unit -- different from R&D activity -- such as general technical assistance or production and services (in new market conditions many R&D institutions decide to deal not only with R&D but also with other, more profitable, kinds of activities in order to survive hard times of financial stringency).

The two first sections of this questionnaire constitute the core, invariable part of the survey. Other data are intended to be collected periodically, at intervals of several-years. Next year's plans are to include, according to the suggestions of the RECESS (Research Centre for Economic and Statistical Studies of the Central Statistical Office and the Polish Academy of Sciences), questions concerning the problems of the so-called brain-drain, instead of questions on the level of qualification which are intended to be collected on two- or three-year bases. The hitherto existing rigid system of yearly statistical reports will gradually be replaced by the flexible system of statistical surveys *sensu stricto* touching upon different topical problems linked to R&D activities in Poland.

The survey designed for 1995 as a reference year has been changed compared to last year in questionnaire content and the surveyed population. The questionnaire content was extended by introducing questions on the number of women in R&D personnel by occupation, and personnel by qualification and age. Such data are not available nowadays, although there is high demand, especially for data on personnel by age, expressed among others by the KBN. The reason for this recurrent demand from policy-makers is the alarming process of "ageing" of personnel in R&D institutions in Poland and the emerging "generation gap" caused by the significant outflow of younger staff to the other branches of the national economy which offer more competitive salaries. There is a strong need for precise statistical evaluations of this phenomenon.

A significant change for the surveyed population has been made in the higher education sector. Until now the reporting unit in this sector comprised the whole higher education institution, i.e. university, medical academy, academy of music, technical university, and polytechnic. Precise breakdowns of data in this sector by field of science are not possible, but only more or less accurate estimations. In the survey designed for 1995 the reporting unit in the higher education sector is the smallest -- the organisational unit of the higher education institution, i.e. the chair or the research institute. This solution, which enlarges significantly the surveyed population, will enable precise input-output analyses and split up data for the higher education sector by field of science.

The RECESS -- Research Centre for Economic and Statistical Studies of the Central Statistical Office and the Polish Academy of Sciences -- has also been involved for some time in the work on R&D statistics and indicators. Initially it mainly focused on the problems of calculating R&D deflators and expenditures in constant prices. These first efforts were crowned with success and two publications presenting the outcomes were issued recently[13]. The RECESS is now beginning work on a system of

satellite accounts for R&D in line with the latest version of SNA (System of National Accounts). This task will be performed in close co-operation with and under the supervision of GUS R&D/S&T Statistics Division. The system of satellite accounts for R&D is intended to be implemented into GUS regular practice within the next two years.

GUS has attached great importance to the problems of innovation surveys for a long time. Since the early 1980s it has systematically collected annual data on the number and value of new and significantly improved products introduced to the market by industrial enterprises, which were supplemented later by data on innovation sources and expenditures. In 1993, for 1992 as reference year, the first truly comprehensive survey was carried out on technological innovation in industry based to a great extent on OECD Oslo Manual recommendations. The experience and results gained constitute a good starting point for preliminary analyses of industrial enterprises' innovation behaviour and for further development of a regular system of innovation surveys in line with international standards. Polish authorities currently attach great importance to building a modern national system of innovation which will be able to catalyse innovation activities in all parts of the society. Timely and detailed statistical information is an indispensable tool in building such a strategy.

Such a system should be composed of several parts. The basic component of this system will be the comprehensive survey on innovation activities based on the so-called OECD/EC harmonised questionnaire. The Polish version of this questionnaire is currently in development. This survey was planned to be carried out every three or four years but consultants from scientific institutes believe that every two years would be better when considering the great consequences of enterprise innovation activities for the transformation and development of a modern, knowledge-based economy. It is also preferable to harmonise it as much as possible with the successive rounds of the EU/CIS Project. In the intermediary years of the cycle, special *ad hoc* surveys devoted to specific important aspects of innovation activities will be carried out such as the problems of the appropriability of benefits from innovations -- survey based on the so-called Yale questionnaires -- or the problems of organisational changes currently taking place in enterprises in connection with the transition from planned to market economy and with the process of adjusting to the resulting stepped-up competition -- survey based on the French experience. A compilation of an innovation database based on new product announcements is also being considered.

These two priorities are not the only areas of interest. A rather new feature of the R&D/S&T statistical system is a recent attempt to develop the scientific and technological output and impact measures, such as the technology balance of payments (TBP), patents statistics, trade in high-technology products and industries, and bibliometrics. GUS entered into close co-operation with the Patent Office and the Central Bank (NBP -- National Bank of Poland). It plans to significantly broaden the scope of patent indicators compiled for the purposes of S&T activities analyses. Negotiations began in 1995 with the Central Bank of Poland concerning the modification of the Bank statistical nomenclature in order to adapt it to international requirements on the technology balance-of-payments data-collection methodology: it is precisely the Central Bank of Poland that collects the TBP data within the framework of the general balance-of-payments data collection system.

A particular noteworthy effort was recently made by the KBN in the domain of bibliometrics -- the field of S&T statistics which had been almost completely unrecognised until then in Poland (this effort impressed OECD examiners involved in the Review of Science and Technology Policy in Poland). Two years ago the KBN acquired bibliographic databases compiled by the American Institute for Scientific Information (ISI). A system of bibliometric indicators was developed by the KBN to evaluate the relative international output and impact of Polish science in different fields. The publication depicted the findings of the first analyses and the studies were issued some time ago[14]. These analyses give evidence of the fact that Polish science, notwithstanding the problems encountered, contributes a significant share to world-

wide scientific activity. It ranks among the first twenty in number of publications. The system of bibliometric assessments is planned to be extended to individual institutes and research groups. It will be used by policy-makers *inter alia* as a useful tool for the concentration of resources devoted to R&D in national centres.

The GUS R&D/S&T Statistics Division plans to launch another new survey -- on the use of advanced manufacturing technology (AMT), based on the OECD list of "Key Survey Questions"[15], and the experience gained to date by some OECD Member countries which performed such a survey. There is great demand for such data among economic policy-makers in Poland. A first attempt to develop such a survey was made a few years ago when the survey on computer equipment usage was designed. The AMT usage is intended to replace the current survey on techno-productive indicators which aims to assess industry equipment and technologies, though the methodology used is considered outdated.

GUS would like to encourage close co-operation of all actors engaged in R&D/S&T statistics collection and analyses and to create a special permanent group of experts from data-user institutions and academia. Their role will be to facilitate collaboration and exchange of information between GUS, policy-makers, scientists and other data-users, to assist GUS in developing a modern R&D/S&T statistical system in line with international standards, and to meet the specific needs of Polish data-users taking into account the circumstances in Poland. GUS intends to play a clearing-house role in this group, regularly reviewing and exchanging information on international methodologies and surveys carried out in OECD Member countries. It is also important to establish unofficial, informal every-day contacts and strict partnerships, especially with the KBN S&T Indicators Unit which is currently in organisation.

# SCIENCE AND TECHNOLOGY STATISTICS IN THE SLOVAK REPUBLIC

*by Frantisek Bernadic (Infostat), Edita Novotna (Statistical Office of the Slovak Republic) and Stefan Zajac (Institute for Forecasting of the Slovak Academy of Science)*

This paper presents a brief overview of the previous methodology used for statistical surveys on science and research before 1993, and of the recently elaborated methodology which needs improvement and updating to meet OECD standards. It also discusses some problems arising when introducing Frascati-based methodology and other not previously provided indicator series.

## Description of the methodology formerly used and differences with the current methodology

Until 1993, the Statistical Office of the Slovak Republic maintained research and development indicators which, in terms of content and methodology, resembled those used by UNESCO. The methodology used on personnel indicators differed from the Frascati manual. Personnel and expenditures for R&D indicators were presented in the broader science and technology concept. According to Slovakian terminology, this concept corresponded to the Research and Development Basis (RDB). The Frascati manual refers more to the concept of R&D (the share of R&D amount was approximately equal to 70 per cent of the RDB performance only). Research personnel was not recorded in accordance with the full-time equivalent (FTE) but in accordance with the "average recalculated registered number".

Research personnel data were consequently overestimated. Research and development activities themselves were not considered separately in terms of employee numbers or expenditures within the whole organisation when R&D was the principal activity. The same pattern used when reporting employees of the whole institution was adopted when presenting expenditures of the whole organisation as R&D expenditures. Overall data on R&D expenditures were overvalued.

Another difference occurred when presenting university personnel data. Only employees entirely committed to research issues were reported, while research activities of university teachers were not. This way of reporting reduced the actual number of R&D employees by 2 000 (FTE) per year. That the former Czech and Slovak Federative Republic did not structure its economic statistics according to the System of National Accounts was considered to be another serious issue. It was difficult to cover the R&D system owing to the well-known structure in the OECD: the business enterprise sector, government sector, private non-profit sector (in reality this did not exist), and higher education sector and abroad. These difficulties multiplied because Slovakia, as an independent state was missing certain tools which had been obviously used in other post-socialist countries before the transformation period -- methodological work was never developed before. It was consequently impossible to fill in OECD questionnaires for 1991-93 completely.

**Transition to the new methodology**

The new methodology for recording scientific R&D was elaborated in 1993 and corresponds to that of the OECD. Data for this new methodology were statistically surveyed for the first time in the 1994 questionnaires. With the new methodology two substantial changes have been introduced:

- The Research and Development Basis concept as the institutional base for this part of the national economy is not used anymore and the scientific R&D system is structured according to the System of National Accounts. Only activities related to R&D and not the whole organisation have been included in the statistical survey on R&D.

- The number of employees was reported according to full-time equivalents (FTE).

All those performing R&D activities, and/or direct R&D services for a minimum of 200 hours in the course of a year (10 per cent of the fixed annual capacity) were included in statistical surveys. Reports are submitted by organisations where the scope of working time for R&D activities exceeds one person-year. This change is especially closer to OECD standards because of consistent linkages with R&D expenditures. Individual organisations, and/or individual parts were included to one of the five sectors according to the elaborated methodology and in consistence with the System of National Accounts. Structuring expenditures of the state budget for scientific projects, scientific technical projects and state orders according to the basic socio-economic objectives represented another partial change.

**Problems, expected proposals for finding solutions**

Completing reports became more difficult than under the previous methodology, because these new questionnaires had to introduce the new primary registration of both employees and R&D expenditures. This was an important issue in universities, where it became extremely difficult to obtain data on numbers of employees. The total numbers of employees on 31 December 1994 (in physical persons) under the previous and new methodology are:

| | 1993 | 1994 |
|---|---|---|
| Total in the Slovak Republic | 24 677 | 24 896 |
| Ministry of Education of the Slovak Republic | 1 955 | 9 523 |

*Source:* Statistical Office of the Slovak Republic.

It is obvious that the total number of employees employed in the R&D area remained unchanged in 1994, only as a consequence of the change in the statistical survey on R&D employees in the higher education sector, where teachers were included owing to the new methodology, the significant increase of employees within the Ministry of Education appeared as the consequence of the changed methodology. The minimal increase in the total number for the whole Slovakian Republic signifies that there was a further decrease of the research potential in comparison with 1993. This assumption of a real decrease concerning employees is confirmed also by the trends in R&D expenditures, the total volume decreased by 21 per cent in comparison with 1993, equal to 4 473 million SK.

In the case of R&D expenditures, it became clear that universities reported expenditures only for those employees entirely committed to research activities, and not those related to R&D activities performed by university teachers. The official university data became undervalued. The main question is whether all reporting units understood and reported expenditures data following the methodological

instructions. These problems should be handled in such a way as to minimise any deviations of trends observed in the number of personnel and R&D expenditures. Simplifying the current methodology for the higher education sector, and/or defining an estimation procedure as a basis for obtaining reliable and trustworthy data on science and research in universities have recently been taken into account within the Statistical Office of the Slovak republic.

Innovation issues were not covered by the new questionnaires. Before 1989, industrial products innovation indicators were statistically reported, but did not correspond to the innovation pattern presented by OECD methodology and were consequently cancelled. Elaborating innovation process reporting techniques and other indicators, such as the technological balance of payments and human resources for science and technology, will remain a subject of interest during coming years.

# SCIENCE AND TECHNOLOGY STATISTICS IN THE RUSSIAN FEDERATION: NEW NATIONAL SURVEYS

*by Leonid Gokhberg (Centre for Science Research and Statistics)*

## Introduction

At the OECD Conference on S&T Indicators in central and eastern European countries held in Paris on 22-24 November 1993, Russian S&T statistics and projects to align the system with international standards (Gokhberg, 1993) were presented by the Centre for Science Research and Statistics (CSRS).

Owing to the joint statement of the Ministry of Science and Technological Policy (MSTP) and the State Committee on Statistics of the Russian Federation issued in December 1993, the CSRS has increased its responsibilities for the methodology of R&D and innovation statistics, surveying, data analysis, and publications. Methodological activities combined with practical efforts have resulted in a new programme of systematic surveys developed by the CSRS which provide policy-makers, the public and the international community with relevant, reliable and transparent information. General requirements were to meet user needs, peculiarities of the national R&D system, and international standards as well. In this respect, an access to the OECD methodological experience and observership in NESTI actions cannot be underestimated in terms of knowledge gaining and adapting to Russian statistics.

The CSRS is strongly supported by Eurostat in the framework of the TACIS-financed Project on R&D and Innovation Statistics in the Russian Federation for 1995-97. The project involves Eurostat experts and consultants, and also some EU Member country national authorities in assisting the CSRS in establishing new, internationally compatible R&D and innovation statistics in Russia. As its priority subject areas, the project covers statistics on government R&D funding, human resources in science and technology, innovation, sectoral and regional R&D and innovation statistics, and output and impact of R&D. The project also focuses on statistical methods, data bases, software, and publications.

This paper briefly describes the recent changes in Russian R&D and innovation statistics emphasizing the revised system of annual surveys. It now includes the national R&D survey, the survey of government R&D funding, and the national innovation survey.

**The national R&D survey**

The new annual national R&D survey is generally based on Frascati Manual recommendations. It covers all R&D-performing units and is limited only to R&D, versus the previously dominated broader concept of S&T activity. Due to this approach, the surveyed population was decreased by some 200 units involved in S&T activities (other than R&D), and constituted nearly 3.9 thousand units performing R&D.

The obsolete sectoral classification which reflected artificial barriers between R&D, higher education and universities, was replaced by another which is compatible with the OECD sectoring. It was adapted to the institutional structure of the domestic R&D base, taking into consideration functions, sources of funds, legal status and mode of control over R&D units (see Figure 1). Other general classifications in the survey include those by ISIC (according to the newly introduced Russian Classification of Economic Activities, Products and Services), region, type of institutions, and size of reporting unit (in terms of employment). The classification of major fields of S&T was developed with respect to the breakdown of personnel and expenditure data. Fields of S&T cover:

- natural sciences (mathematics and mechanics; physics and astronomy; chemistry and pharmaceutical chemistry; biology and psychophysiology; geology; geography (excluding economic and social));
- engineering;
- medical sciences;
- agricultural sciences;
- social sciences (economics; law; pedagogy; psychology (excluding psychophysiology); sociology; political sciences; other); and
- humanities (history; philosophy, philology; arts).

***R&D personnel***

This section of the questionnaire contains indicators on the stock of full-time R&D personnel by occupation and qualification, and researchers by age and gender (biennially) and field of S&T. Plans are also in store to biennially collect data on flows of R&D personnel by occupation, with the emphasis on major inflows (after graduating universities, from other R&D institutions) and outflows (voluntarily, due to staff reduction).

**Figure 1. Sectoral classification of R&D units in Russia**

**Government sector**

R&D units administered by:

legislative and executive bodies;
law and order bodies;
Ministry of Foreign Affairs;
Ministry of Finance; Central Bank;
Ministry of Defence;
Ministry of Health Services, Russian Academy of Medical Sciences;
Russian Academy of Sciences and its departments (Urals Department, Siberian Department, Far East Department);
Russian Academy of Agricultural Sciences;
R&D institutes serving primary and secondary education; culture, physical training and sport.

**Business enterprise sector**

R&D - units of :

industry (industrial ministries and departments, concerns, joint-stock companies, intersectoral state associations, associations, intersectoral scientific and technological complexes);
agriculture and forestry;
construction;
transport;
communications;
financing and crediting (excluding the Central Bank);
trade;
communal and consumer services.

**Higher education sector**

higher education institutions;
R&D units, experimental stations, clinics administered by or associated with higher education institutions;
R&D units serving higher education.

**Private non-profit sector**

R&D institutes of:

voluntary professional and scientific societies and associations;
public (non-governmental) organisations;
philanthropic foundations;
private individuals, etc. humanities (history; philosophy; philology; arts).

Along with the above head-count data, implementing full-time equivalent (FTE) estimations of R&D personnel by occupation are also planned. Indicators on person-days (by occupation) were therefore included in the questionnaire. Data on part-time employees divided by the normal annual number of working days and added to the number of full-time R&D personnel will provide respective national totals in FTE. As the FTE concept has never been used earlier in Russian R&D statistics, such a simplified technique for its calculation is considered a first attempt.

***R&D expenditure***

In the second section of the questionnaire, R&D expenditure is collected by type of costs (excluding depreciation), major field of S&T, type of activity, source of funds, socio-economic objective, and product field. The specific conditions of the Russian R&D system required expenditure breakdowns by all sectors of performance when, for instance, universities or the Academy of Sciences institutes (which belong by definition to the government sector) perform R&D for industry. The distribution of intramural R&D expenditure by socio-economic objective (biennially available) is based on the NABS, and at the same time reflects national specificities. It enables the grouping of objectives in the following six major groups: economic development; social objectives; general advancement of research; exploration and exploitation of the earth and atmosphere; civil exploitation of space; and defence.

Some disaggregation of those major objectives into detail is envisaged which will subsequently be regrouped into socio-economic objectives used internationally. Table 1 illustrates the correspondence between the Russian, the OECD and Eurostat NABS classifications of socio-economic objectives. In the case when it is impossible to link a particular basic research project to a concrete objective, it should be treated within the objective "General advancement of research". It covers projects intended for general advancement of natural and social sciences, and the humanities. Research in economics, policy and management of science should also be included in this sub-group. Contrary to the OECD and Eurostat classifications, general university funds are not considered in the list of socio-economic objectives, as, according to the Russian practice, all respective projects may be allocated to particular objectives. The same approach was applied to the government budget R&D survey providing for compatibility of performer and funder-based data.

The distribution of intramural current R&D expenditure by product field according to the respective national ISIC-compatible classification (see Table 2), is also planned biennially, along with product and process R&D expenditure. Indicators on total value of projects, including those in S&T, have been retained. This maintains continuity of data series and indicates re-orientation of R&D units to non-R&D activities.

***R&D fixed assets***

This short section is aimed at measuring stock of R&D fixed assets, such as of equipment. The first survey data collected for 1994 will be processed by the beginning of 1996 followed by publications. Data on R&D personnel flows, expenditure by product field and by R&D product and process will be collected in 1996. In order to facilitate current decision-making in the rapidly changing economic situation, an abridged mid-year survey will be implemented in 1996.

**Survey of government budget R&D funding**

A more complex description of this survey is given in the next section of this chapter. Until 1994 data collection on government R&D funding had been implemented only as a part of the administrative procedure of budget planning. It covered only governmental department totals (both budget R&D expenditure for the previous year, that expected for the current year, and appropriations for the next year).

In 1994 the CSRS made a first attempt to survey government R&D funding. Since then it has become a subject of statistical studies which certainly are still related to budget planning procedures but which have their own objectives. As it traditionally used to be, the 1994 survey was aimed at measuring all the funds spent by governmental departments under the Section 05 "Science and Technology" of the federal budget. This assumption made the data internationally incompatible. The survey also did not cover newly established budget funds (the Russian Fund for Basic Research, the Fund for Promotion of Small Enterprises in Science and Technology), as well as budgetary financed priority R&D programmes, which require specific methodological approaches.

Analysis of the survey results and better knowledge of OECD/EU experience provided the opportunity to develop Russian statistics methodology anew in order to survey government R&D funding and meet national peculiarities and internationally standardised practice. In accordance with the composition of the budget R&D funding system, the survey is being designed as a set of partial surveys targeted to: ministries, governmental agencies, and specific budget funds, government S&T programmes, state research centres, and federal goal-oriented programmes.

**Table 1. Key between Russian, OECD and Eurostat NABS (1993) socio-economic objectives**

| Russia | | OECD | NABS(1993 |
|---|---|---|---|
| 1. | Economic development | 1+2+3+4 | 2+5+6+7 |
| 1.1 | Agriculture, forestry and fishery | 1 | 6 |
| 1.2 | Production, distribution and rational utilisation of energy | 3 | 5 |
| 1.3 | Industry | 2 | 7 |
| 1.3.1 | Increasing economic efficiency and technological development | | 7.0+7.1.7.2 |
| 1.3.2 | Extraction and processing of non-energy development | | 7.3 |
| 1.3.3 | Chemical industry | | 7.4 |
| 1.3.4 | Manufacture of motor vehicles and other means of transport | | 7.5 |
| 1.3.5 | Electronic industry, manufacture of radio, television and communications equipment | | 7.6.1+7.6.2 |
| 1.3.6 | Software development | | 7.63 |
| 1.3.7 | Manufacture of electrical machinery and apparatus | | 7.7 |
| 1.3.8 | Manufacture of instruments | | 7.9 |
| 1.3.9. | Manufacture of non-electronic and non-electric machinery | | 7.8 |
| 1.3.10 | Manufacture of textile, clothing and leather goods | | 7.11 |
| 1.3.11 | Manufacture of food products and beverages | | 7.10 |
| 1.3.12 | Other manufacturing products | | 7.12+7.13 |
| 1.4 | Construction | | 2.2 |
| 1.5 | Transport | 4 | 2.4 |
| 1.6 | Communications | 4 | 2.5 |
| 1.7 | Infrastructure and urban and rural planning | 4 | 2.0+2.1+2.3+2.6+2.9 |
| 1.8 | Services | 2 | |
| 2. | Social objectives | 5+6+7+9.1 | 3+4+8+11 |
| 2.1 | Environment protection | 5 | 3 |
| 2.2 | Protection of human health | 6 | 4 |
| 2.3 | Social development and structures | 7 | 8 |
| 3. | General advancement | 9.1 | 11 |
| 4. | Exploration and exploitation of the Earth and the atmosphere | 8 | 1 |
| 5. | Civil exploitation of space | 10 | 9 |
| 6. | Defence | 11 | 13 |

**Table 2. Classification of product groups for R&D expenditure distribution**

| | Title | ISIC Rev.3 Division/Group/Class |
|---|---|---|
| 1. | AGRICULTURE, HUNTING AND FORESTRY | 01+02+05 |
| 2. | MINING | 10-14 |
| 3. | MANUFACTURING | 15-37 |
| 4 | Food, beverage and tobacco | 15-16 |
| 5 | Textiles, wearing apparel, fur and leather | 17-19 |
| 6. | Wood, paper, printing, publishing | 20-22 |
| 7. | Wood and cork (not furniture) | 20 |
| 8. | Pulp, paper and paper products | 21 |
| 9. | Publishing, printing and reproduction of recorded media | 22 |
| 10. | Coke, petroleum, nuclear fuel, chemicals and products, rubber and plastics | 23-25 |
| 11. | Coke, refined petroleum products and nuclear fuel | 23 |
| 12. | Chemicals and chemical products (less pharmaceuticals) | 24 less 2423 |
| 13. | Pharmaceuticals | 2423 |
| 14. | Rubber and plastic products | 25 |
| 15. | Non-metallic mineral products (“Stone, clay and glass”) | 26 |
| 16. | Basic metals | 27 |
| 17. | Basic metals, ferrous | 271+2731 |
| 18. | Basic metals, non-ferrous | 272+2732 |
| 19. | Fabricated metal products (except machinery and equipment) | 28 |
| 20. | Machinery, equipment, instruments and transport equipment | 29-35 |
| 21. | Machinery, n.e.c. | 29 |
| 22. | Office, accounting and computing machinery | 30 |
| 23. | Electrical machinery | 31 |
| 24. | Electronic components (included semiconductors) | 321 |
| 25. | Television, radio and communications equipment | 322,323 |
| 26. | Medical, precision and optical instruments, watches and clocks (instruments) | 33 |
| 27. | Motor vehicles | 34 |
| 28. | Ships | 351 |
| 29. | Aerospace | 353 |
| 30. | Other transport n.e.c. | 352+359 |
| 31. | Furniture, other manufacturing n.e.c. | 36 |
| 32. | Recycling | 37 |
| 33. | ELECTRICITY, GAS AND WATER SUPPLY (UTILITIES) | 40+41 |
| 34. | CONSTRUCTION | 45 |
| 35. | SERVICE SECTOR | 50-99 |
| 36. | Wholesale, retail trade and motor vehicle, etc. repair | 50-52 |
| 37. | Hotels and restaurants | 55 |
| 38. | Transport and storage | 60-63 |
| 39. | Communications | 64 |
| 40. | Financial intermediation (including insurance) | 65-67 |
| 41. | Real estate, renting and business activities | 70-74 |
| 42. | Computer and related activities | 72 |
| 43. | Research and development | 73 |
| 44. | Other business activities n.e.c. | 70+71+74 |
| 45. | Community, social and personal service activities, etc. | 75-99 |
| 46. | Education | 80 |
| 47. | Health and social work | 85 |
| 48. | Other community, social and personal service activities | 90-99 |
| 49 | GRAND TOTAL | 01-99 |

All surveys should be co-ordinated from the viewpoint of methodology, data collection and processing procedures. Such an approach of co-ordinating specific surveys to compile national totals is new for Russian R&D statistics.

**National innovation survey**

The CSRS has begun establishing innovation statistics of a new type in Russia. The gradual introduction of market mechanisms has caused the need in methodological approaches for innovation studies, including innovation types and sources, stimulating factors and obstacles, and resources and output. Implementing the first national innovation survey in Russia in line with the Community Innovation Survey (CIS) is expected to be one of the major results.

The survey will be conducted in two stages. The first so-called introductory survey was completed in autumn 1995. It was implemented according to an abridged programme, covering approximately 17 thousand extracting and manufacturing enterprises which respond to industrial statistics.

Basic principles of the survey were determined in line with the Oslo Manual, namely:

- focusing on technological innovations;
- considering an enterprise as a statistical unit; and
- distinguishing product and process-innovations new for a surveyed enterprise.

To reflect the real state of innovation activities in Russia, an attempt was made to cover any type of innovation. The bulk of enterprises contributing to innovation includes those which have purchased disembodied technologies -- patents, licenses for use of inventions, industrial prototypes, and other types of industrial property -- or those which have been engaged in any other kind of activity connected with the introduction of new or improved products/processes.

The questionnaire consisted of two sections:

1) major economic indicators (output, sales, exports, employment); and
2) indicators of innovation activity expressed as numbers of new products or processes introduced, and those of acquired technologies (in the form of patents, licenses, industrial prototypes, and contracts for R&D).

Such a "numerical" approach is related to traditional domestic statistics based primarily on the quantitative measurement of phenomena under examination. The interpretation of the concept of "introduction" was also widened. With the purpose of fuller coverage of enterprises intending to introduce innovations in production, innovation is identified not only at its final stage, when the equipment is already in operation, but also at the initial and interim stages of introduction, when for example new equipment is still being assembled but not yet in action. Respondents were also asked whether they planned to develop or introduce new or improved products and processes during the next three years. The survey covered enterprises of all types, sizes, forms of property, including small-sized and foreign-related joint ventures. Newly established enterprises which do not yet manufacture products as well as temporarily idle enterprises will also be included. As expected, economic data for surveyed enterprises allow comparisons between economic indicators and results of innovation activities. This analysis will be performed on the following types of enterprises:

- active in innovation;
- inactive in innovation;

- those foreseeing innovation activity for the near future; and
- those engaged in the main kinds of innovation activity.

For analytical purposes, various classifications and distributions of enterprises will be used according to the following criteria: employment; sales; exports; main economic activity; main products manufactured; organisational and legal form; kind of property; and privatisation (privatised/non-privatised).

The introductory survey provides a general picture of innovation activity in Russian industry, and identifies a population of innovative enterprises (3 800). This survey was expected to enable enterprises to adjust themselves to new methodologies in order to facilitate the transition to the more complicated second stage with an enlarged programme. The aggregates will be compiled by the end of 1995 in a subsequent publication.

The second stage planned for 1996 will be represented by a sample survey covering only innovative enterprises, for a detailed study of trends in innovation and determining factors. A draft questionnaire for the survey of enterprises active in innovation consists of the following major sections:

- expenditure on technological innovations by type of activity and type of costs;
- expenditure on product and process-innovations (e.g. on R&D) by source of funding;
- sales of innovative products (e.g. exports);
- distribution of product and process-innovations by goal of innovation activity; and
- acquisition and transfer of new technologies.

**Other activities**

Human Resources on Science and Technology (HRST) statistics are being developed by the CSRS in two domains:

- statistics of R&D personnel; and
- organisation of an integrated data collection system on HRST.

The transformation of R&D personnel statistics is related to the introduction of a new national R&D survey (see above). HRST as such represents a much broader category than R&D personnel. This is why an ambitious idea of integrated data collection on HRST concerns different sections of national statistics: population, employment, education, R&D, and life standards. It requires not only methodological contributions but also strong co-ordination of data collection exercises undertaken by different agencies (State Committee on Statistics, MSTP, Higher Certification Commission, Ministry of Interior).

A theoretical model of HRST stock and flows applicable to Russian conditions must first be developed. An inventory of existing data and, subsequently, recommendations on a comprehensive data

collection system will be the second stage of the study which will be completed in January-February 1996. The above inventory will allow the production of a data book on HRST in Russia in 1996.

**Technology balance of payments (TBP)**

The CSRS has started to develop recommendations on collecting data on trade in technologies and TBP compilation at the national level.

**Short-term (monthly) forecasting of major R&D indicators**

The CSRS initiated the project on monthly forecasts of employment and average wages in R&D for eventual use in current budget adjustments in the Ministry of Science and Technological Policy. They are based on a combination of various statistical methods (time series decomposition, regression, rhythm models). It is expected to develop the system further, expanding it to medium (yearly) and long-term horizons.

**Publications**

In order to meet demand and follow statistical developments, the CSRS is preparing new publications both in Russian and in English for wide dissemination. They include:

- *Russian R&D Indicators and R&D in Brief*, both based on the new survey results*;*
- *Innovations in Industry;*
- *Regional R&D Indicators;*
- *S&T in the CIS Countries;*
- *Higher Education Indicators; and*
- *Directory of R&D Institutions (updated).*

The Russian translation of the 1993 version of the Frascati Manual was published by the CSRS in mid-1995.

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# STATISTICS ON R&D BUDGETARY ALLOCATIONS IN RUSSIA

*by Leonid Gokhberg and Natalia Gorodnikova (Centre for Science Research and Statistics)*

## Introduction

The transition to a market economy has had a profound impact on Russian science and technology. Changes in the objectives of economic, social and political development are reflected in the transformation of the institutional structure of the economy, the fast growth of the private sector, the conversion of military industries, and the gradual integration of Russia into the world economy. These processes take place under conditions of economic recession, rapid inflation, a growing deficit of the state budget, a worsening social situation, and political instability. Along with the main characteristics of the science and technology system inherited from the former USSR, this creates basic problems and difficulties which should be solved in order not only to prevent the erosion of science, but also to provide a market-oriented R&D base necessary for the future economic and social renewal of the nation.

In spite of substantial institutional transformations, the government budget still remains the largest source of R&D funding. Its share accounts for more than 90 per cent of total R&D financing. This situation has consequently a strong dependency on the budget R&D funding policy in order to maintain the transition of the national R&D potential. Successful development and implementation of a strategy for government R&D funding require comprehensive statistical information. This paper is devoted to the current methodological developments related to the compilation of statistics on budgetary allocations and outlays for R&D. It contains a description of the current budget R&D funding system and current surveying practice. An analysis of the data obtained from the new government R&D funding survey is also presented. Special attention is given to further improvement of the survey.

## The budget R&D funding system in Russia

The federal budget is the most important part of the government R&D funding system in Russia, whereas local budgets account for a nearly negligible share of the total (see Figure 1). The federal R&D budget is composed of two parts targeted to civil, and defence and defence-related R&D. The civil R&D budget, which is the main target of a detailed statistical survey, is co-ordinated by the Ministry of Science and Technological Policy (MSTP) of the Russian Federation. It covers all civil R&D supported by the government, including that performed by defence research units. At present, the following means of financing are distinguished in the structure of budget appropriations on civil R&D.

- The financing of R&D through ministries, public agencies and other bodies (associations, academies, independent research centres). It consists of money mainly intended for supporting the R&D base of particular agencies, sometimes without any visible output.

However, a growing proportion of those funds is allocated within the framework of federal economic programmes, which include an R&D element. Among the most important are the Federal Space Programme and the Civil Aviation Development Programme, which together constitute 20 per cent of total budget appropriations on civil R&D; other programmes are on electronics, agricultural machinery, new medical equipment, and ecological security.

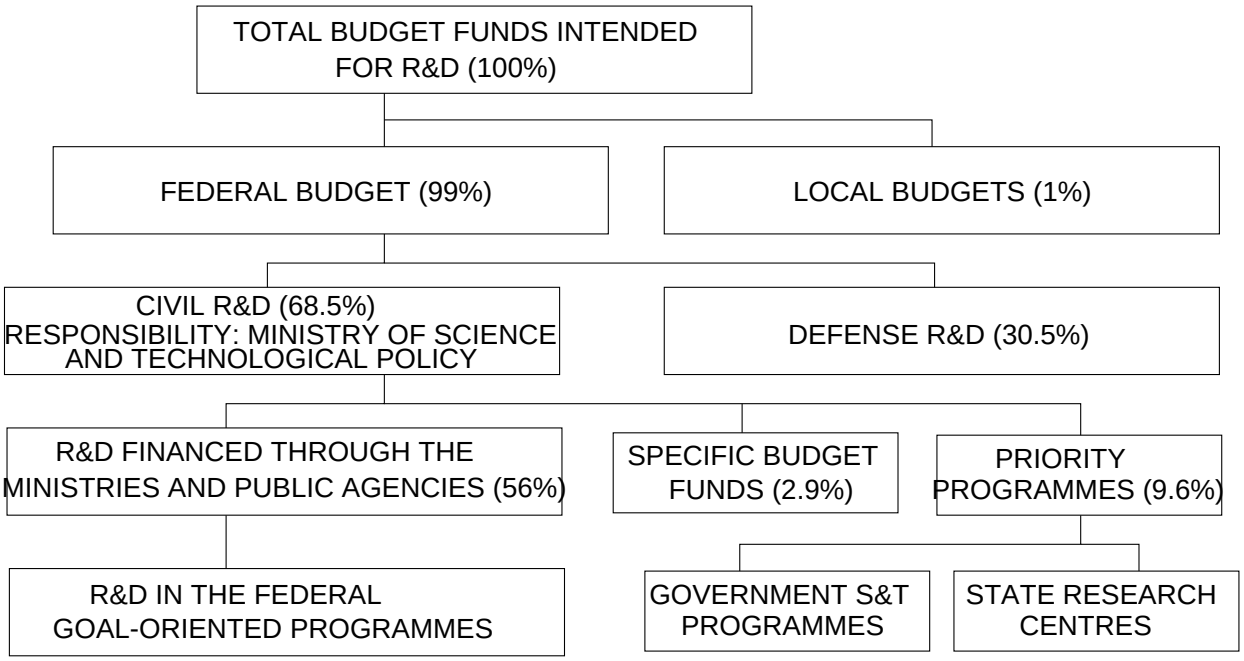
- The financing of R&D from recently established specific budgetary funds. For example, the Russian Fund for Basic Research operates as a self-governing institution offering open competition for grants to finance basic research by research institutes, universities, and small teams of researchers and individual scientists, as well as the development of material and equipment bases of R&D institutions, the acquisition of scientific literature, and the granting of fellowships. Funding is important for the support of research in specific fields (like theoretical mathematics, botany, zoology), which, outside governmental programmes, are not provided with financing in the framework of R&D budget priorities. In addition, the Fund for Humanities Research was established in 1994. The role of those funds is limited, since their overall share does not exceed 3-4 per cent of the civil R&D budget.

  Another type of newly-established foundation are those aimed at supporting small businesses involved in S&T and innovation, namely the Russian Fund for Promotion of Small Enterprises in S&T. It accounts for 0.5 per cent of budget appropriations on civil R&D.

The financing of R&D in priority areas includes government S&T programmes which cover S&T issues of future importance for scientific, technological, economic, and social progress (41 programmes in 1995). They cover both basic research on new phenomena and R&D in areas aimed at practical application. Among them are programmes of basic space research, high-energy and nuclear physics, new materials, future agricultural technologies, high-temperature superconductivity, ecologically clean power engineering, and exploration of oceans and seas. Funds for priority programmes are usually distributed on a competitive basis and are allocated directly to R&D-performing units by the MSTP without going through the Russian Academy of Sciences administration or branch departments.

In the current economic situation, R&D units must adjust to budgetary constraints and decreasing industry demand. In order to preserve large research institutes, which are the leaders in Russian science and are internationally famous for their unique achievements in basic research and high technologies, the Programme of Support to the State Research Centres was adopted in Russia in 1993. The programme does not seek to establish new institutional bodies, but is a comprehensive mechanism of state support to the most prominent among those already existing. By mid-1995, owing to special governmental acts, 61 recognised research institutes received this status, including the Kurchatov Institute of Atomic Energy, the State Optical Institute, the Research Centre for Shipbuilding, as well as other research institutes in nuclear physics, aviation, space, chemistry, biotechnology, electronics, and instruments-making. It is expected that their number will increase to 70-75 by the beginning of 1996.

FIGURE 1. PRINCIPAL SCHEME OF THE BUDGET R&D FUNDING IN RUSSIA *




* SHARES ARE ESTIMATED AS OF JANUARY 1, 1995.

The main criterion for decision-making on assigning the status of "state research centre" to a particular institution is the conformity of the institution's orientations, purposes and tasks to priorities of government S&T policy and perspectives for the structural reorganisation of the national R&D base. The state research centres will co-ordinate the most valuable strategic long-term S&T priorities. Planned support measures include budgetary financing of R&D and experimental plants, reduced tariff rates for communal services and communications, tax concessions and accelerated depreciation rate.

While setting a new S&T policy, national authorities try to strengthen a goal-oriented approach to budget R&D funding which is considered a key prerequisite to restructuring the R&D system. The proportion between the two large parts of the civil R&D budget -- funds allocated via ministries and those on priority programmes -- has in fact a political importance. While the first urges keeping a huge number of research institutions, the second one is a step towards establishing mechanisms of government policy implementation under market conditions. The above proportion reflects the degree of actual transformation of S&T policy.

**The data collection on budget R&D funding until 1993**

The former strongly-centralised system allowed the predecessor of the MSTP -- the State Committee on S&T of the USSR -- to obtain detailed data on the distribution of budget allocations on R&D by type of costs (expenditure on personnel, purchase of equipment, overhead expenditure, capital investment, other) and by ministry for the whole territory of the former Soviet Union. Data on budget R&D appropriations for Russia have been available only since 1991, when due to the USSR's disintegration, Russia and other republics started forming their own full-scale national budgets. However, R&D units became more flexible, and the MSTP was less provided with the required information. Until 1994, data collection on government R&D funding had been implemented only as a part of the administrative procedure of budget planning. After summarising applications of agencies and individual units for R&D appropriations, a draft annual R&D budget was developed by the MSTP.

In order to obtain more detailed data, in 1992-93 the CSRS attempted to organise a pilot survey of government R&D funding conducted under the auspices of the MSTP. It was aimed at collecting data on budget R&D expenditure in 1991 and appropriations (ex-ante), both for 1992 and expected for 1993, from ministries, governmental agencies and other bodies (concerns, associations, academies, and independent research centres). The questionnaire included indicators reflecting the distribution of budget's current expenditure by type of costs (labour, equipment, other). R&D financed from own funds of R&D units and through contracts were also estimated. Unfortunately, the rate of response did not exceed 60 per cent.

There were several principal reasons influencing the low quality of the data. For example, the uncertain situation resulting from the government budget being under the pressure of rapid inflation made R&D units uninterested in providing detailed data on expenditure financed from the budget. Legal mechanisms sometimes were ineffective to force R&D units to provide required data. Furthermore, the scope of information on government R&D funding was limited by the then existing administrative procedures of data collection, and did not correspond to that on R&D expenditure obtained from the national performer-based surveys. Discrepancies between government R&D funding and general R&D statistics complicated the comprehensive analysis and planning of the budget appropriations. The classification by socio-economic objectives had not been used for statistical purposes, and available data were poorly grouped together. Taking into consideration the negative experience in collecting inaccurate and imperfect data on budget R&D funding, a decision was taken to revise both the methodology and organisation of the survey in line with the OECD/Eurostat standards.

**The survey of budget R&D funding in 1994**

***Methodological approach***

Following the needs of policy-makers for relevant statistical data, the CSRS made a first attempt in 1994 to survey government R&D funding in a way more or less conform to international standards. Since then, it has become a subject of statistical studies which are certainly still related to budget planning procedures, but has its own objectives[16]. Several principal requirements were taken into consideration:

- To meet the current practice of R&D budget planning and analysis. The annual procedure of R&D budget planning includes accounting for actual expenditure of the previous year, development of a preliminary plan for the current year and its final adjustment, as well as estimation of appropriations required for the next year. Besides, one should take into

consideration that, in the framework of the federal budget, the planning of capital R&D investment is made separately from that of current expenditure.

- To provide information for detailed comprehensive analysis of budget R&D funding. This requires obtaining data on budget R&D expenditure by type of costs, type of activity, field of science and technology, and socio-economic objective.

- To take into consideration national characteristics of R&D management, accounting and statistics in Russia. It is important to ensure compatibility both with the Eurostat NABS and Frascati recommendations, and with specificities of national classifications, e.g. socio-economic objectives and types of costs.

The 1994 survey was aimed, as it traditionally used to be, at measuring all the funds spent by governmental departments under the Section 05 "Science and Technology" of the federal budget. For the first attempt, owing to a request of the MSTP, it was assumed that all appropriations from this budget section were devoted to R&D. However, not only R&D but also S&T services, training, and sometimes administration (in case of the Russian Academy of Sciences) are partly financed from those funds. This assumption made the survey less accurate from the viewpoint of internationally-accepted definitions. Appropriations on R&D from newly established budgetary funds (the Russian Fund for Basic Research, the Fund for Promotion of Small Enterprises in Science and Technology), as well as budgetary-financed priority R&D programmes, which require specific methodological approaches, were not covered by the survey. The survey, targeted to civil budget, did not cover appropriations on defence-oriented R&D. The questionnaire included three sections (see Annex 1):

a) Budgetary appropriations on R&D by type of costs (both actual and planned for the current and next years). Funds from the Section 05 of the federal budget cover only current expenditure, therefore capital expenditure was presented in a separate position. The breakdown of intramural current expenditure by type of costs was similar to types of expenditure, used in the classification accepted in R&D budget planning in Russia, namely:

   - labour costs;
   - social fees;
   - purchasing of equipment (at the expense of current costs);
   - energy costs;
   - rental fees; and
   - other costs, n.e.c.

b) Current expenditure on R&D from the federal budget (both actual for 1993 and estimated for 1994) by type of activity (including basic research, applied research, development) and field of S&T.

Fields of S&T cover:

- natural sciences (mathematics and mechanics; physics and astronomy; chemistry and pharmaceutical chemistry; biology and psychophysiology; geology; geography (excluding economic and social));
- engineering;
- medical sciences;
- agricultural sciences;
- social sciences (economics; law; pedagogy; psychology (excluding psychophysiology); sociology; political sciences; other); and
- humanities (history; philosophy; philology; arts).

Such a classification is related to the officially-accepted Russian Nomenclature of Specialities of Scientists, and provides general comparability with the UNESCO/Frascati classification of S&T fields at the level of major fields.

Actual intramural current expenditure on R&D financed from the federal budget by socio-economic objective and field of S&T. This section of the questionnaire gives an opportunity to identify actual priorities in budget R&D financing versus those officially claimed. The classification of socio-economic objectives is based on the NABS and at the same time reflects national practice. It explains the grouping of objectives in the following 5 major groups: economic development; social objectives; exploration and exploitation of the earth and atmosphere; civil exploitation of space; and defence.

Breaking down those major objectives into detail would subsequently allow them to be regrouped into socio-economic objectives used internationally. Table 1, page 82, illustrates the correspondence between the Russian, OECD and Eurostat NABS classifications of socio-economic objectives.

In the case where it is impossible to link a particular basic research project to a concrete objective, the latter should be treated within the objective “General advancement of research”. It covers projects intended for general advancement of natural and social sciences, and humanities. Research in economics, policy and management of science should also be included in this subgroup. Contrary to OECD and Eurostat classifications, general university funds are not considered in the list of socio-economic objectives, for the reason that, according to the Russian practice, all projects may be allocated to particular objectives. Another reason is that allocations on R&D from general university funds are not related to Section 05 of the federal budget which is the focus of the survey.

***Data analysis***

The 1994 survey covered 69 ministries and other agencies which received appropriations from Section 05 of the federal budget. Only two of them -- the Russian Academy of Sciences and the Ministry of Construction -- did not respond. The rate of response accounted for 97 per cent of reporting units, or 89.4 per cent of budgetary appropriations on civil R&D intended for ministries. Annex 2 contains the aggregated survey data. Minor discrepancies (far less than 1 per cent) in the totals for intramural current expenditure in the sections I and II of the questionnaire are connected with data non-response. Some agencies did not fill in sections II or III of the survey questionnaire (for example, the Russian Association for S&T Information, the Higher Certification Committee, and the State Committee for Sanitary and Epidemiology Control). Nevertheless, the survey data gave an information base for general analysis.

It was expected that 1994 budgetary appropriations for ministries and other agencies would reach 3348.2 billion roubles, or 5.1 times as much as those in 1993. According to preliminary estimations, they were to increase 4.9 times more in 1995. Measured at constant prices (using the GDP deflator) expected budgetary appropriations in 1994 accounted only for 752.4 billion roubles, or 115.4 per cent of those in 1993. Making a type-of-costs analysis of budgetary appropriations is extremely important, especially when taking into consideration differentiated inflation rates affecting particular R&D items costs. The structure of R&D appropriations was notably influenced by trends in labour and material costs, e.g. energy costs and purchases of equipment (see Table 2).

Efforts to compensate for the sharp inflationary rise in the cost of living by increased wages resulted in increasing shares of labour costs which, together with social fees, grew from 39.5 per cent to 43.1 per cent in 1993-94. Plans to decrease them in 1995 to 39.1 per cent of the total (or to the 1993 level) were unrealistic in light of the further growth of nominal wages in budgetary financed institutions during 1995. This was done at the expense of other, notably material, costs. However, further rise in the prices of material costs' principal items -- small equipment, materials, reagents, fuel, and electric energy -- has made the composition of current R&D expenditure impossible to change in favour of any component. Minor relative increases in allocations for purchasing of equipment, which were envisaged for 1994-95 due to rapid price growth, did not lead to replacement of obsolete fixed assets. It was foreseen that capital investment would complement current expenditure in order to improve the equipment infrastructure of R&D institutions. The analysis of budgetary appropriations by fields of S&T shows a disproportion in structure, and a strong share of the engineering field.

**Table 2. Percentage distribution of appropriations from the Section 05 "Science and Technology" of the federal budget by type of costs[1]**

| | 1993 (actual) | 1994 (expected) | 1995 (application) |
|---|---|---|---|
| **Total** | **100.0** | **100.0** | **100.0** |
| Intramural current expenditure | 80.9 | 83.0 | 84.1 |
| Labour costs | 27.8 | 30.7 | 27.7 |
| Social fees | 11.7 | 12.4 | 11.4 |
| Equipment | 6.1 | 6.9 | 8.9 |
| Energy costs | 8.4 | 9.8 | 14.4 |
| Rental fees | 1.4 | 1.0 | 1.6 |
| Other | 25.6 | 22.4 | 20.1 |
| Extramural expenditure | 19.1 | 17.0 | 15.9 |

*Note*:
1. Details may not add to totals because of rounding.
Source: Centre for Science Research and Statistics.

**Table 3. Percentage distribution of appropriations from the Section 05 "Science and Technology" of the federal budget by field of S&T and type of activity[1]**

| | 1993 (actual) | | | | 1994 (expected) | | | |
|---|---|---|---|---|---|---|---|---|
| | Total | Basic research | Applied research | Deve-lopment | Total | Basic research | Applied research | Deve-lopment |
| Intramural current R&D expenditure | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Natural sciences | 18.3 | 55.2 | 11.4 | 3.4 | 16.9 | 37.9 | 11.9 | 5.2 |
| Engineering | 63.8 | 15.4 | 52.1 | 91.9 | 50.1 | 11.0 | 41.1 | 83.8 |
| Medical sciences | 7.8 | 6.9 | 23.4 | 2.2 | 12.2 | 18.1 | 19.9 | 3.2 |
| Agricultural sciences | 5.2 | 16.4 | 3.3 | 0.6 | 14.8 | 26.8 | 17.0 | 5.0 |
| Social sciences | 3.8 | 4.3 | 8.7 | 1.2 | 4.8 | 4.4 | 9.1 | 2.0 |
| Humanities | 1.1 | 1.8 | 1.1 | 0.7 | 1.2 | 1.9 | 1.2 | 0.8 |

*Note*:
1. Details may not add to totals because of rounding.
Source: Centre for Science Research and Statistics.

For many years, the main emphasis was on engineering. Under the centralised planning system and in the absence of market regulators, the government financed most industrial R&D, and has continued to do so during the transition period, but to a more modest extent. In 1993, 63.8 per cent of budgetary appropriations were intended for R&D in engineering; it was planned to decrease this share to 50.1 per cent in 1994. The decrease in pilot, future-oriented research in engineering is alarming: basic research amounted to 6.2-6.6 per cent of the total appropriations in this field against a background of general decrease in the latter share. On the opposite side, 77.1 per cent of budget funding of engineering R&D was devoted to experimental development in 1993, and for 1994 this indicator is expected to be approximately the same (71.5 per cent).

Natural sciences dominate the pattern of budgetary-financed basic research. At the same time, the expected decline of the basic research share in appropriations to natural sciences from 77.1 per cent in 1993 to 68.1 per cent in 1994 was mainly related to physics (from 89.2 to 82.5 per cent) and chemistry (from 66.4 to 58.7 per cent). That the government budget is basically the only one source of financing for basic research in natural sciences should be considered. Increasing budgetary support of agricultural research to 14.8 per cent, and medical research to 12.2 per cent, of the national total was planned, which is important in order to provide a basis for higher efficiency of the agricultural sector and strengthening of health services. The survey provided for the first time data on the distribution of budgetary allocations by socio-economic objectives (Table 4).

Contrary to major OECD countries, industrial development is still one of the most resource-consuming orientations of the civil budget for S&T (40.6 per cent of the total), especially in engineering. R&D oriented to transportation equipment (aviation and missiles) accounted for 43.3 per cent of the industry total. General research on increasing economic efficiency and technology improvement occupied the second place in this respect among industry objectives (22.4 per cent). Electronics and communications equipment (16.6 per cent), as well as software development (8.9 per cent) were also important orientations of the budgetary support of R&D. General advancement of research, mainly represented by natural sciences, occupied the second place in the pattern of budgetary allocations (18.2 per cent), accompanied by civil space (10.3 per cent), health (9 per cent), social development (8.3 per cent), and agriculture (6.6 per cent). Among other objectives of budgetary appropriations, the share of those on energy R&D seems to be insufficient.

**Methodological improvements for the future**

Analysis of survey results and better knowledge of the OECD/EU experience highlighted both the methodological and practical issues which should be solved for the further improvement of budgetary R&D appropriation surveying.

**Table 4. Percentage distribution of budgetary allocations from the Section 05 "Science and Technology" of the federal budget by major socio-economic objectives and field of S&T in 1993[1]**

| | Total | Natural sciences | Engi-neering | Medical sciences | Agricul-tural sciences | Social sciences | Huma-nities |
|---|---|---|---|---|---|---|---|
| Intramural current expenditure | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Development of agriculture | 6.6 | 0.6 | 2.3 | - | 97.6 | 0.1 | - |
| Production and rational use of energy | 0.7 | 0.2 | 1.1 | - | - | 0.1 | - |
| Industry | 40.6 | 3.7 | 62.0 | 0.1 | 0.2 | 8.1 | - |
| Construction | 0.4 | 0.01 | 0.7 | - | 0.4 | 0.02 | 0.5 |
| Transport | 1.5 | - | 2.1 | - | - | 4.6 | - |
| Communications | 0.2 | 0.05 | 0.2 | - | - | - | - |
| Infrastructure, urban and rural planning | 0.1 | 0.01 | 0.1 | - | 1.1 | 0.3 | - |
| Services | 0.1 | - | 0.1 | - | - | 1.2 | - |
| Environment protection | 1.7 | 1.6 | 1.6 | 1.0 | 0.3 | 6.6 | 0.1 |
| Health | 9.0 | 0.6 | 2.8 | 90.5 | - | 2.0 | - |
| Social development | 8.3 | 0.3 | 8.6 | 0.1 | - | 53.8 | 63.8 |
| General advancement of research | 18.2 | 81.8 | 2.1 | 6.7 | 0.4 | 23.3 | 35.6 |
| Exploration of the earth and atmosphere | 2.2 | 11.1 | 0.2 | - | - | - | - |
| Civil space | 10.3 | 0.03 | 16.0 | 1.5 | 0.01 | - | - |
| Defence | 0.1 | 0.04 | 0.2 | 0.1 | - | 0.05 | - |

*Note:*

1. Excluding budgetary appropriations on defence R&D. Details may not add to totals because of rounding.

Source: Centre for Science Research and Statistics.

Methodological grounds for improving the budget R&D funding survey are determined by the following principles:

- The survey should satisfy the needs of national policy-makers for comprehensive data, meeting existing budgetary procedures and covering various forms and channels of budget R&D fund allocation. As requested by the Russian Ministry of Science and Technological Policy, the survey should provide both totals and details for the Section 05 "Science and Technology" of the federal budget (e.g. budgetary financed civil R&D and related activities).

- The focus should be on R&D rather than on S&T. Taking into account that not only R&D, but other activities are also partly financed from Section 05 of the federal budget, which should be considered separately.

- Concepts, definitions and classifications used in the survey should be in line with those of the new national R&D survey, aligning funder and performer-based data.

These requirements are to be followed by a new pilot survey of government R&D funding. In accordance with the composition of the budget R&D funding system, the survey is being designed as a set of partial surveys targeted to:

- ministries, governmental agencies, and specific budget funds;
- government S&T programmes;
- state research centres; and
- federal goal-oriented programmes.

All surveys should be co-ordinated from the viewpoint of methodology, data collection and processing procedures. Co-ordinating specific surveys to compile national totals is new for Russian R&D statistics. Questionnaires will include indicators of total appropriations from Section 05 of the federal budget by type of costs and type of activity (R&D, S&T services, S&T education, administration, other), intramural current R&D expenditure by field of S&T, and type of activity (basic research, applied research, development). Sub-totals for socio-economic objectives will be compiled from those for ministries and state research centres, and data on state S&T programmes by sub-programme. The pilot survey will cover the period 1994-96 and will be launched before the end of 1994. Since questionnaires are evaluated and the final survey methodology is approved, it is expected that the collected data will fill in tables M6 and O1 of the OECD questionnaire on R&D.

**ANNEX 1- QUESTIONNAIRE FOR THE GOVERNMENT BUDGET**
**R&D SURVEY – 1994**

*N 1 (FB)*

# R&D FUNDING FROM THE FEDERAL BUDGET

**Before filling in please CAREFULLY read instructions**

Code

Ministry (agency) _____

Address

Telephone Fax _____

Head

(name)

## I. Funding from the Section 05 “Science and Technology” of the federal budget by type of costs

*(thousand roubles)*

| | N | 1993 | | 1994 | | 1995 | |
|---|---|---|---|---|---|---|---|
| | | Plan | Actual | Plan | Expected | Application | Draft Plan (not to fill in) |
| À | B | 1 | 2 | 3 | 4 | 5 | 6 |
| Total funding from the Section 05 of the federal budget | 01 | | | | | | |
| Of which federal goal-oriented programs | 02 | | | | | | |
| Intramural current expenditure | 03 | | | | | | |
| Labour costs | 04 | | | | | | |
| Social fees | 05 | | | | | | |
| Equipment | 06 | | | | | | |
| Energy costs | 07 | | | | | | |
| Rental fees | 08 | | | | | | |
| Other | 09 | | | | | | |
| Extramural expenditure | 10 | | | | | | |
| 2. Capital R&D expenditure from the federal budget | 11 | | | | | | |

## II. Funding from the Section 05 “Science and Technology” of the federal budget by field of S&T and type of activity

*(thousand roubles)*

| | N | 1993 (actual) | | | | 1994 (est.) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Total | Basic research | Applied research | Development | Total | Basic research | Applied research | Development |
| A | B | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Intramural current R&D expenditure | 30 | | | | | | | | |
| 1. Natural sciences | 31 | | | | | | | | |
| 1.1. Mathematics, mechanics | 32 | | | | | | | | |
| 1.2. Physics, astronomy | 33 | | | | | | | | |
| 1.3. Chemistry, pharmaceutical chemistry | 34 | | | | | | | | |
| 1.4. Biology, psychophysiology | 35 | | | | | | | | |
| 1.5. Geology | 36 | | | | | | | | |
| 1.6. Geography (excluding economic and social) | 37 | | | | | | | | |
| 2. Engineering | 38 | | | | | | | | |
| 3. Medical sciences | 39 | | | | | | | | |
| 4. Agricultural sciences | 40 | | | | | | | | |
| 5. Social sciences | 41 | | | | | | | | |
| 5.1. Economics | 42 | | | | | | | | |
| 5.2. Law | 43 | | | | | | | | |
| 5.3. Pedagogy | 44 | | | | | | | | |
| 5.4. Psychology (excluding psychophysiology) | 45 | | | | | | | | |
| 5.5. Sociology | 46 | | | | | | | | |
| 5.6. Political sciences | 47 | | | | | | | | |
| 5.7. Other | 48 | | | | | | | | |
| 6. Humanities | 49 | | | | | | | | |
| 6.1. History | 50 | | | | | | | | |
| 6.2. Philosophy | 51 | | | | | | | | |
| 6.3. Philology | 52 | | | | | | | | |
| 6.4. Arts | 53 | | | | | | | | |

## III. Funding from the Section 05 “Science and Technology” of the federal budget by socio-economic objective in 1993 (actual)

*(thousand roubles)*

| | N | Total | Natural sciences | Engi-neering | Medical sciences | Agricultural sciences | Social sciences | Huma-nities |
|---|---|---|---|---|---|---|---|---|
| A | B | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Intramural current R&D expenditure | 54 | | | | | | | |
| 1. Economic development | 55 | | | | | | | |
| 1.1. Agriculture, forestry and fishery | 56 | | | | | | | |
| 1.2. Production, distribution and rational utilisation of energy | 57 | | | | | | | |
| 1.3. Industry | 58 | | | | | | | |
| 1.3.1. Increasing economic efficiency and technological development | 59 | | | | | | | |
| 1.3.2. Extraction and processing of non-energy minerals | 60 | | | | | | | |
| 1.3.3. Chemical industry | 61 | | | | | | | |
| 1.3.4. Manufacture of motor vehicles and other means of transport | 62 | | | | | | | |
| 1.3.5. Electronic industry, manufacture of radio, television and communications equipment | 63 | | | | | | | |
| 1.3.6. Software development | 64 | | | | | | | |
| 1.3.7. Manufacture of electrical machinery and apparatus | 65 | | | | | | | |
| 1.3.8. Manufacture of instruments | 66 | | | | | | | |
| 1.3.9. Manufacture of non-electronic and non-electrical machinery | 67 | | | | | | | |
| 1.3.10. Manufacture of textile, clothing and leather goods | 68 | | | | | | | |
| 1.3.11. Manufacture of food products and beverages | 69 | | | | | | | |
| 1.3.12.Other manufacturing products | 70 | | | | | | | |
| 1.4. Construction | 71 | | | | | | | |
| 1.5. Transport | 72 | | | | | | | |
| 1.6. Communications | 73 | | | | | | | |
| 1.7. Infrastructure and urban and rural planning | 74 | | | | | | | |
| 1.8. Services | 75 | | | | | | | |
| 2. Social objectives | 76 | | | | | | | |
| 2.1. Environment protection | 77 | | | | | | | |
| 2.2. Protection of human health | 78 | | | | | | | |
| 2.3. Social development and structures | 79 | | | | | | | |
| 2.4. General advancement of research | 80 | | | | | | | |
| 3. Exploration and exploitation of the earth and atmosphere | 81 | | | | | | | |
| 4. Civil exploitation of space | 82 | | | | | | | |
| 5. Defence | 83 | | | | | | | |

## ANNEX 2 - SURVEY DATA

### I. Funding from the Section 05 “Science and Technology” of the federal budget by type of costs

*(thousand roubles)*

| | N | 1993 | | 1994 | | 1995 |
|---|---|---|---|---|---|---|
| | | Plan | Actual | Plan | Expected | Application |
| À | B | 1 | 2 | 3 | 4 | 5 |
| Total funding from the Section 05 of the federal budget | 01 | 698 081 276 | 652 083 381 | 3 204 349 847 | 3 348 225 583 | 16 530 218 948 |
| Of which federal goal-oriented programs | 02 | 78 827 409 | 100 154 864 | 2 271 991 200 | 2 044 466 200 | 11 513 972 100 |
| Intramural current expenditure | 03 | 561 465 844 | 527 651 217 | 2 563 381 265 | 2 778 922 852 | 13 899 212 029 |
| Labour costs | 04 | 198 652 105 | 181 269 354 | 901 419 875 | 1 028 357 593 | 4 579 083 521 |
| Social fees | 05 | 81 468 822 | 76 336 025 | 369 162 430 | 413 915 391 | 1 878 450 375 |
| Equipment | 06 | 40 377 719 | 39 638 197 | 202 697 395 | 229 445 419 | 1 465 984 381 |
| Energy costs | 07 | 56 835 841 | 54 749 115 | 274 082 281 | 326 446 947 | 2 387 081 671 |
| Rental fees | 08 | 5 389 335 | 8 939 378 | 32 341 485 | 31 811 178 | 268 544 801 |
| Other | 09 | 178 742 019 | 166 719 146 | 783 677 797 | 748 946 322 | 3 320 067 278 |
| Extramural expenditure | 10 | 136 615 432 | 124 432 164 | 640 968 582 | 569 302 731 | 2 631 006 919 |
| 2. Capital R&D expenditure from the federal budget | 11 | 17 382 247 | 22 999 997 | 150 261 100 | 145 859 789 | 920 492 400 |

## II. Funding from the Section 05 “Science and Technology” of the federal budget by field of S&T and type of activity

*(thousand roubles)*

| | N | 1993 (actual) | | | | 1994 (est.) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Total | Basic research | Applied research | Development | Total | Basic research | Applied research | Development |
| A | B | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Intramural current R&D expenditure | 30 | 527 662 029 | 135 173 648 | 108244506 | 282 640 774 | 2 893 624 939 | 881 554 061 | 771 406 128 | 1 236 529 748 |
| 1. Natural sciences | 31 | 96 718 128 | 74 596 615 | 12388047 | 9 733 466 | 489 463 520 | 333 426 620 | 91 584 783 | 64 452 116 |
| 1.1. Mathematics, mechanics | 32 | 9 754 467 | 7 338 397 | 1389050 | 1 027 020 | 57 891 011 | 41 914 956 | 10 349 614 | 5 626 441 |
| 1.2. Physics, astronomy | 33 | 46 530 207 | 41 525 515 | 2397168 | 2 607 524 | 178 139 921 | 146 937 681 | 16 022 392 | 15 179 848 |
| 1.3. Chemistry, pharmaceutical chemistry | 34 | 12 923 172 | 8 582 666 | 2425550 | 1 914 956 | 79 970 583 | 46 912 008 | 18 228 601 | 14 829 974 |
| 1.4. Biology, psychophysiology | 35 | 7 600 605 | 4 623 524 | 1339053 | 1 638 028 | 47 716 718 | 27 561 722 | 10 199 167 | 9 955 828 |
| 1.5. Geology | 36 | 10 469 890 | 8 501 631 | 605832 | 1 362 427 | 61 546 986 | 48 623 931 | 4 600 468 | 8 322 587 |
| 1.6. Geography (excluding economic and social) | 37 | 9 439 787 | 4 024 882 | 4 231 394 | 1 183 511 | 64 198 301 | 21 476 322 | 32 184 541 | 10 537 438 |
| 2. Engineering | 38 | 336 792 202 | 20 798 774 | 56 354 993 | 259 638 435 | 1 449 192 415 | 96 540 651 | 316 793 299 | 1 035 858 465 |
| 3. Medical sciences | 39 | 41 032 823 | 9 333 166 | 25 360 458 | 6 339 198 | 352 706 826 | 159 678 320 | 152 946 465 | 40 082 040 |
| 4. Agricultural sciences | 40 | 27 369 057 | 22 171 574 | 3 518 363 | 1 679 120 | 429 378 026 | 236 616 226 | 131 250 780 | 61 511 020 |
| 5. Social sciences | 41 | 20 128 383 | 5 844 029 | 9 407 279 | 3 273 975 | 137 624 086 | 38 367 530 | 69 851 420 | 25 270 136 |
| 5.1. Economics | 42 | 7 640 999 | 1 967 237 | 2 719 510 | 1 351 152 | 40 525 012 | 10 335 182 | 13 322 769 | 12 732 061 |
| 5.2. Law | 43 | 2 125 036 | 78 506 | 1 244 086 | 802 444 | 18 601 635 | 394 964 | 14 095 112 | 41 115 59 |
| 5.3. Pedagogy | 44 | 4 226 601 | 1 883 489 | 1 525 002 | 818 110 | 39 094 659 | 18 005 852 | 14 431 295 | 66 57 512 |
| 5.4. Psychology (excluding psychophysiology) | 45 | 151 195 | 51 548 | 81 271 | 18 376 | 989 175 | 372 087 | 445 595 | 171 493 |
| 5.5. Sociology | 46 | 2 049 813 | 485 713 | 1 494 443 | 69 657 | 18 735 789 | 2 784 248 | 15 513 565 | 437 976 |
| 5.6. Political sciences | 47 | 14 786 | 115 | 199 | 14 472 | 151 265 | 574 | 985 | 149 706 |
| 5.7. Other | 48 | 3 919 952 | 1 377 421 | 2 342 767 | 199 764 | 19 526 551 | 6 474 623 | 12 042 099 | 1 009 829 |
| 6. Humanities | 49 | 5 621 434 | 2 429 490 | 1 215 365 | 1 976 579 | 35 260 064 | 16 924 714 | 8 979 379 | 9 355 971 |
| 6.1. History | 50 | 2 453 917 | 805 308 | 124 686 | 1 523 923 | 11 890 465 | 4 070 136 | 923 521 | 6 896 808 |
| 6.2. Philosophy | 51 | 488 161 | 357 785 | 78 332 | 52 044 | 3 256 050 | 2 379 698 | 556 789 | 319 563 |
| 6.3. Philology | 52 | 545 196 | 95 204 | 115 965 | 334 027 | 3 180 986 | 525 080 | 674 300 | 1 981 606 |
| 6.4. Arts | 53 | 2 134 160 | 1 171 193 | 896 382 | 66 585 | 16 932 563 | 9 949 800 | 6 824 769 | 157 994 |

## III. Funding from the Section 05 “Science and Technology” of the federal budget by socio-economic objective in 1993 (actual)

*(thousand roubles)*

| | N | Total | Natural sciences | Engineering | Medical sciences | Agricultural sciences | Social sciences | Humani-ties |
|---|---|---|---|---|---|---|---|---|
| A | B | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Intramural current R&D expenditure | 54 | 527 662 029 | 96 718 128 | 336 792 202 | 41 032 823 | 27 369 057 | 20 128 383 | 5 621 434 |
| 1. Economic development | 55 | 265 121 204 | 4 319 497 | 230 669 965 | 45 134 | 27 181 018 | 2 877 890 | 27 700 |
| 1.1. Agriculture, forestry and fishery | 56 | 35 047 130 | 547 521 | 7 770 861 | | 26 718 748 | 10 000 | |
| 1.2. Production, distribution and rational utilisation of energy | 57 | 3 796 301 | 170 485 | 3 614 882 | | | 10 934 | |
| 1.3. Industry | 58 | 214 070 425 | 3 542 951 | 208 802 983 | 45 134 | 51 050 | 1 628 307 | |
| 1.3.1. Increasing economic efficiency and technological development | 59 | 48 040 270 | 569 643 | 46 989 573 | | | 481 054 | |
| 1.3.2. Extraction and processing of non-energy minerals | 60 | 316 464 | 128 800 | 187 664 | | | | |
| 1.3.3. Chemical industry | 61 | 5 181 690 | 1 986 341 | 3 152 481 | 42 868 | | | |
| 1.3.4. Manufacture of motor vehicles and other means of transport | 62 | 92 694 448 | 10 000 | 92 652 948 | | | 31 500 | |
| 1.3.5. Electronic industry, manufacture of radio, television and communications equipment | 63 | 35 519 508 | 20 000 | 35 499 508 | | | | |
| 1.3.6. Software development | 64 | 19 095 324 | 631 586 | 18 318 544 | | | 159 029 | |
| 1.3.7. Manufacture of electrical machinery and apparatus | 65 | 500 712 | | 416 312 | | | 84 400 | |
| 1.3.8. Manufacture of instruments | 66 | 6 505 517 | 190 581 | 6 275 626 | 1 475 | | 24 000 | |
| 1.3.9. Manufacture of non-electronic and non-electrical machinery | 67 | 585 680 | | 463 090 | | 3 790 | 118 800 | |
| 1.3.10. Manufacture of textile, clothing and leather goods | 68 | 3 790 301 | | 3 790 301 | | | | |
| 1.3.11. Manufacture of food products and beverages | 69 | 226 075 | 4 000 | 171 024 | 791 | 47 260 | 3 000 | |
| 1.3.12.Other manufacturing products | 70 | 1 614 434 | 2 000 | 885 910 | | | 726 524 | |
| 1.4. Construction | 71 | 2 288 404 | 6 000 | 2 152 204 | | 99 500 | 3 000 | 27 700 |
| 1.5. Transport | 72 | 7 845 213 | | 6 928 685 | | | 916 528 | |
| 1.6. Communications | 73 | 831 369 | 44 540 | 786 829 | | | | |
| 1.7. Infrastructure and urban and rural planning | 74 | 662 301 | 8 000 | 278 621 | | 311 720 | 63 960 | |
| 1.8. Services | 75 | 580 060 | | 334 899 | | | 245 161 | |
| 2. Social objectives | 76 | 195 889 867 | 81 575 283 | 50 959 890 | 40 334 827 | 185 239 | 17 240 893 | 5 593 734 |
| 2.1. Environment protection | 77 | 8 948 449 | 1 591 129 | 5 545 374 | 404 120 | 74 985 | 1 332 018 | 4 000 |
| 2.2. Protection of human health | 78 | 47 519 526 | 571 217 | 9 397 976 | 37 141 678 | | 405 475 | |
| 2.3. Social development and structures | 79 | 43 567 310 | 251 483 | 28 860 002 | 46 200 | | 10 821 443 | 3 588 182 |
| 2.4. General advancement of research | 80 | 95 854 581 | 79 161 453 | 7 156 538 | 2 742 827 | 110 254 | 4 681 957 | 2 001 552 |
| 3. Exploration and exploitation of the earth and atmosphere | 81 | 11 362 686 | 10 753 084 | 608 292 | 1 309 | | | |
| 4. Civil exploitation of space | 82 | 5 585 037 | 32 331 | 53 925 562 | 624 344 | 2 800 | | |
| 5. Defence | 83 | 703 233 | 37 933 | 628 492 | 27 207 | | 9 600 | |

## NOTES

[1] Since the total intramural expenditure include those amounts which are not detailed by sector of performance and type of activity.

[2] A first preliminary draft of the present paper was presented at the "Workshop on innovation, patents and technological strategies" OECD 8-9 December 1994. I am grateful to Philippe Kaminski, Geneviève Muzart and Keith Pavitt for the comments they made.

[3] It was financed by the OMFB (National Committee for Technical and Technological Development) and organised by IKU (Innovation Research Centre).

[4] The translation and publication of the Oslo Manual was supported by the Science Policy Committee in 1992.

[5] Reminder letters were largely a waste of money. If firms did not answer on the first letter, they were phoned in order to achieve a higher response rate. This is a more time and cost-consuming process, but it was the only workable method.

[6] The principle underlying the classification based on ISIC Rev. 3 subgroups (below two digit level) in some cases are different.

[7] Sales from R&D activities, non-intangible assets, gross fixed capital from R&D, direct cost of own production R&D, indirect cost of own production R&D, and cost of bought-in R&D activities.

[8] It would have been useful to choose not only these, but also a similar number of firms from among those that did not report any R&D activities. Unfortunately, because of financial limitations, only 500 questionnaires were sent out.

[9] R&D firms as a rule did not give information but wrote subsequently to ask for the results of the survey.

[10] During elaboration processes these non-respondents may be put in the group "insignificant".

[11] Apart from the problem of combining the ownership with other answers, it is only important to find the reasons why they did not deliver these figures. For the analyses, these missing data made it difficult to categorise the respondents by type of owner. However it is very important to know the impacts of the changes in ownership on the innovation process.

[12] The response rate was better than the pre-test survey. Many companies were able to answer because they had knowledge of the issue, but they simply were not accustomed to thinking in an international framework.

[13] Boguslaw Rejn (1994), “Expenditures of Polish Academy of Sciences and branch R&D units in the course of social and economic transformation process”, RECESS, Warsaw; Boguslaw Rejn (1995), “Expenditures on R&D activities in Poland”, RECESS, Warsaw.

[14] Jan Kozlowski (1994), “Polish science against a background of the world-wide scientific activity -- on the basis of Science Citation Index”, KBN, January 1994, Warsaw.

[15] *Government Policies and the Diffusion of Micro-electronics* (1989), OECD.

[16] Improvement of the budget R&D funding statistics is being developed in the framework of the Project on R&D, and Innovation Statistics in the Russian Federation by Eurostat and the CSRS under the TACIS Programme.