ANALYSIS OF THE EXISTING STATE O
RESEARCH AND DEVELOPMENT IN THE CZECH
REPUBLIC AND A COMPARISON WITH
THE SITUATION ABROAD – 200

Office of the Government of CR
Research and Development Council

Office of the Government of CR
Research and Development Council

ANALYSIS OF THE EXISTING STATE OF RESEARCH AND DEVELOPMENT IN THE CZECH REPUBLIC AND A COMPARISON WITH THE SITUATION ABROAD – 2003

Prepared by working group in following composition:

RNDr. M. Blažka (Secretariat of the Research and Development Council), Ing. J. Dvornák (Industrial Property Office), Prof. Ing. V. Haasz, CSc. (Council of Universities), RNDr. J. Hanzlík, CSc. (Ministry of Education, Youth and Sport), Ing. M. Hayer, CSc. (Grant Agency of CR), Ing. F. Hronek, CSc. (Secretariat of Research and Development Council), Ing. M. Mana (Czech Statistical Office), Ing. M. Marek, CSc. (Ministry of Education, Youth and Sport), Ing. Karel Mráček, CSc. (Association of Research Organisations), RNDr. J. Rákosník, CSc. (Academy of Sciences of CR)

PRAGUE, December 2003

Research and Development Council

Published by: © Office of the Government of CR
Research and Development Council
Nábřeží Eduarda Beneše 4, 118 01 Praha 1

ISBN 80 -86734-13-7

TABLE OF CONTENTS

The Preface

The importance of research and development rises also in the Czech Republic. The private and public sectors, general public and the Government expect that the efficient, effective and well-structured research will become the major condition of the competitiveness of the Czech economy and growth in the quality of life of people of the Czech Republic.

Act on research and development support (Act No. 130/2002 Coll.) imposes on the Research and Development Council to submit to the Government each year the analyses and evaluations of the existing state of research and development in the Czech Republic and a comparison with the situation abroad. These analyses are to form basis for formulation of the National Research and Development Policy and implementation of this policy.

The Czech Republic has become involved in all activities for creation and development of the European Research Area. By accession of the Czech Republic to the European Union this involvement will grow even deeper. In its five chapters the analysis evaluates the inputs and outputs of research and development in the Czech Republic and compares them with indicators of certain selected countries. Last chapter, the sixth, cites several examples of extraordinary results of research and development attained through the support from public funds in 2002.

In the Czech Republic we appreciate the benchmarking of research and development policies made in the member and candidate countries of the European Union and organised by the EU bodies. We consider benchmarking to be a very useful source of information for directing the evolution of research and development. The content of the analysis pays regard to the procedures of the benchmarking made. The analysis is based upon data of OECD, Eurostat, Research and Development Council, Czech Bureau of Statistics, Office of Industrial Property and other foreign and domestic bodies and institutions. Data of the information system of research and development, the administrator of which the Research and Development Council is, have been used as well.

I believe that those interested at home and in abroad will find information on research and development in the Czech Republic in this publication to be worthwhile.

Petr Mareš
Vice-premier of the Government and
Chairman of the Research and Development Council

A. Basic indicators of research and development

This part of the analysis compares the basic indicators of research and development (R&D) that are periodically ascertained by the national bureaus of statistics, EU bodies, or by repeated inquiries of the renowned international organisations. Essential part of data has been taken from the OECD publication "Main Science and Technology indicators" 1/2003/(MSTI). It is published by OECD twice a year.

When selecting the indicators the contents of publications of the European Commission on the results of benchmarking the research and innovation policies of the member and candidate countries of the EU[1] have been taken into account. The content of Section A is similar to that of the R&D analysis approved by the Government in May 2002. The indicators are broken down to four main groups:

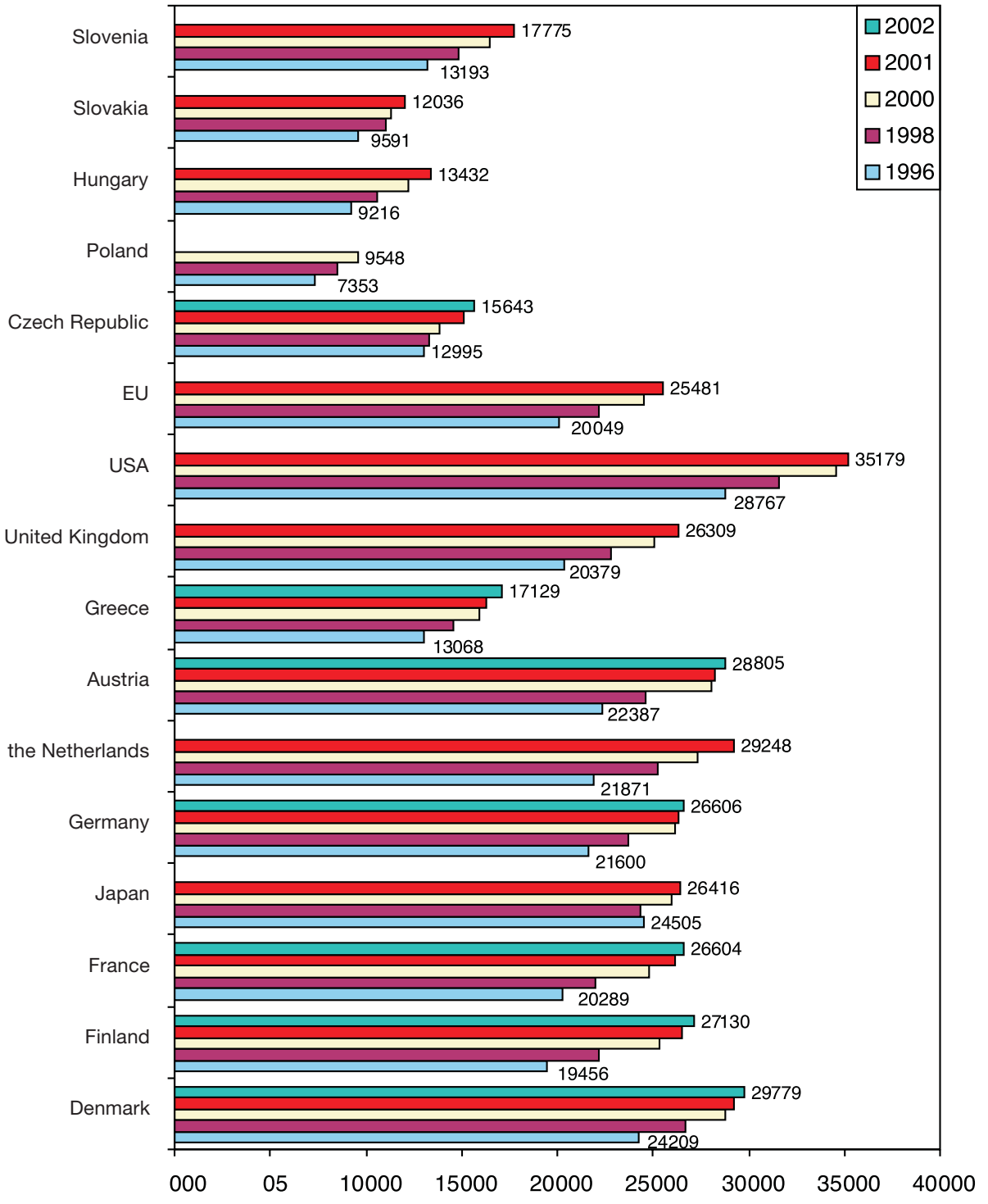
- Basic indicators determining the economic level of a particular country, or the impact of R&D on this level respectively (GDP per head; foreign trade with advanced products, technologies and services; employment in the industry and services with advanced technologies) – 7 graphs in total
- Human resources for R&D – 4 graphs in total
- Expenditures on R&D and their structure – 5 graphs in total
- Structure of the R&D funds utilisation in three main sectors: private, state (governmental) and on universities – 3 graphs in total

Methodical note

The benchmarking is a process of learning and improving by means of a comparison. It helps to find the best procedures leading to high performance and competitiveness. It helps to understand how these procedures work and enables their adaptation and application. It is a rapidly evolving method being recommended also in the documents of the EU bodies on the Lisbon Strategy that were adopted on the 2002 spring session of the European Council in Barcelona. This method is not aimed at glorifying of the best, neither rejecting of those behindhand, but at searching and applying the best procedures with regard to specific conditions of each particular country. The European Commission uses benchmarking in the ever growing number of spheres of its authority.

[1] Besides others the publication "Benchmarking National Research Policies, 2002", ISBN 92-894-4568-8.

A.1.1 GDP per head (USD per head; current prices, PPP)



(in USD at PPP per head)

Source: OECD (MSTI 1/2003)

Commentary:

(1) The share of gross domestic product (GDP) per head is generally considered to be the basic indicator of the economic level or development of a particular country. GDP increments are carefully monitored parameter of the economic policies of all countries and integration groupings.

(2) GDP per head values are given in current prices in USD per head and as converted using the Purchasing Power Parity (PPP). The conversion of national currencies to USD at official rates is not absolutely correct and realistic. The conversion at PPP allows for expressing the different levels of prices (life cost) in various countries. In stable economies the changes in the purchasing power parity of national currencies are very small. In the countries going through transformation PPP is changing more markedly and these countries also experience large differences between the rate of the applicable currency and PPP. The official documents of OECD (MSTI 1/2003) state following values of PPP for the Czech crown.

	1996	1998	2000	2002
PPP (CZK/USD)	11,69	13,42	14,00	14,19

(3) In 2001 the GDP per head value reached in the Czech Republic ca 60 per cent of the average value of this indicator in the EU. Of the countries that should become members of the European Union in 2004 this indicator is higher in Slovenia (17 775 USD per head) and on Cyprus (more than 18 thousand USD per head – not shown in the graph).

(4) The amounts and development of the indicator of GDP per head are given in the following table. The values of GDP per head for 1990, 1995 and 2000 are given as the percentage of GDP per head in the United States. With the exception of Luxembourg (in all three given years) and Switzerland (in 1990) in all other countries this indicator was lower than in the United States.

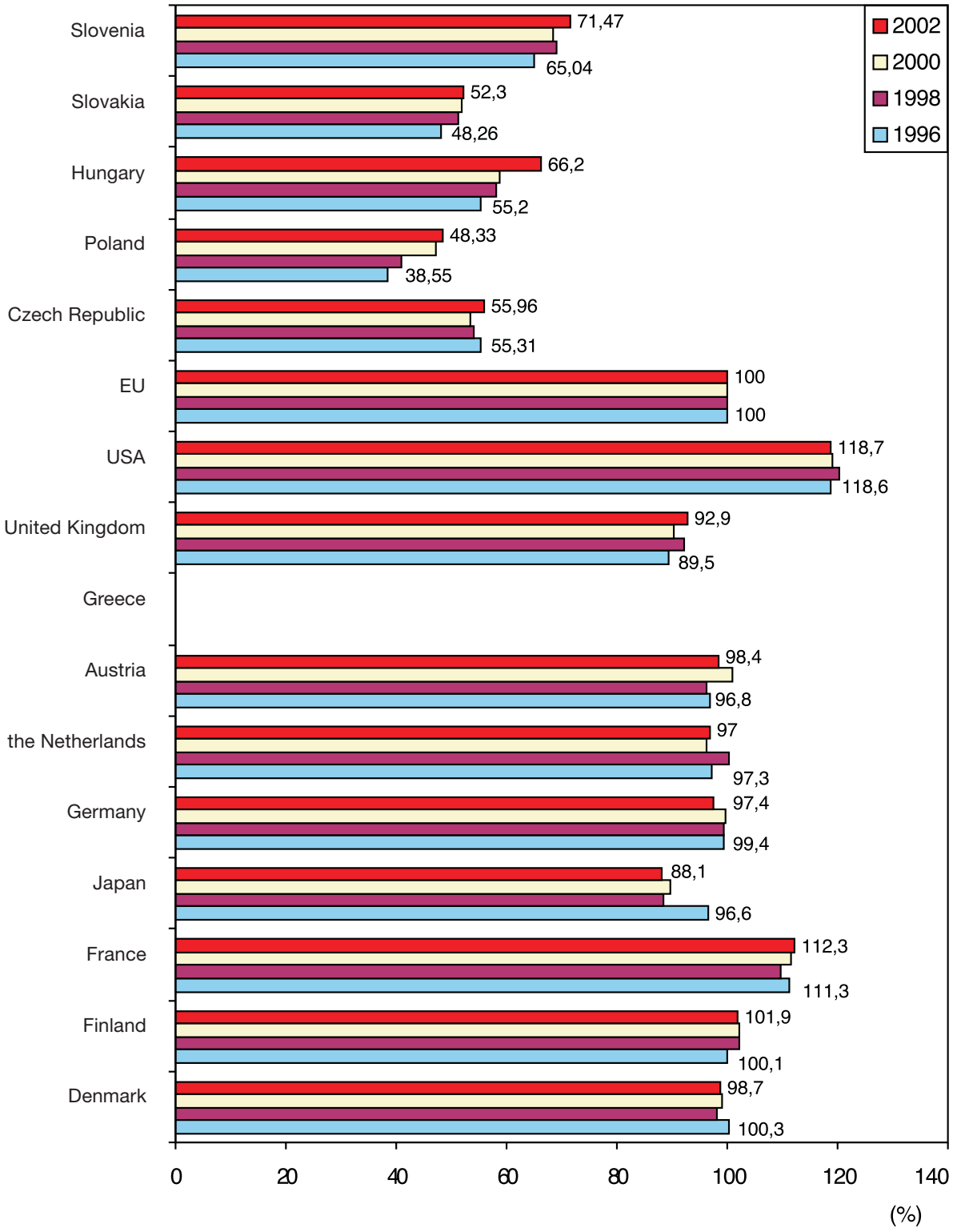
GDP per head in % of GDP per head in the United States			
	1990	1995	2000
USA	100	100	100
Denmark	82	79	78
Finland	77	65	72
France	78	72	70
Japan	85	81	75
Germany	89	74	71
the Netherlands	76	74	75
Austria	78	74	73
Greece	48	44	46
United Kingdom	66	66	65
EU	75	69	68
Czech Republic	41	43	40
Poland	25	24	27
Hungary	–	31	34

Source: OECD Science, Technology and Industry Outlook 2002

On the basis of values given in the table it may be put that the distance between most countries, including the European Union as a whole, and the United States is getting larger. The distance remains constant only with the Netherlands and the United Kingdom. The significant increase of the distance of Germany was caused by the unification.

(5) It results from the papers of EUROSTAT covering both the member countries and candidate countries that the level of GDP per head at PPP in the Czech Republic amounted to 63.9 % of value in the EU as a whole in 1996, then decreased below 60 per cent and basically stagnates on this value. Of the EU member countries GDP per head grows most rapidly in Ireland (between 1995 and 2000 ca by 10 per cent p.a.) and in Finland. In 2000 the level of GDP per head in Ireland and Finland amounted to 115.2 % and 103.2 % respectively of the value of the European Union as a whole.

A.1.2 Overall productivity of labour (GDP per number of workers; PPP, as share of the overall EU productivity = 100 %)



Source: Eurostat, 2003

Commentary:

(1) The productivity of labour expressed as amount of GDP per 1 worker or hour of work is another frequently used indicator of the economic performance. It is expressed either by annual increments in per cents or as a percentage of a particular country's productivity to the productivity of the compared country or integration grouping. Graph A.1.2 depicts overall productivities of the monitored countries as percentage to the overall productivity of EU as a whole. The 2002 figures are estimates.

(2) The United States experience the highest level of the overall productivity; they basically keep their distance of roughly eighteen per cent points ahead of the EU. There occur no marked changes in the monitored EU member countries against the level of the EU as a whole.

(3) The overall productivity in the candidate countries is substantially lower than in the EU. The highest productivity is attained by Slovenia – around 70 % of the EU overall productivity. The overall productivities in the Czech Republic and Slovakia are basically evolving by the same pace as in the EU. The difference against the EU is decreased in Hungary and Poland, in Poland from a very low 1996 level – less than 40 per cent of the overall productivity in the EU.

(4) The differences in the overall productivity and its changes are confirmed also by the following table. The table depicts the overall productivity of labour as GDP per one hour of work and as percentage of the overall productivity level in USA.

Productivity of labour in % of the US productivity			
	1990	1995	2000
USA	100	100	100
Denmark	90	93	90
Finland	74	79	83
France	100	101	99
Japan	70	73	73
Germany	105	93	92
the Netherlands	118	121	121
Austria	105	109	109
United Kingdom	70	75	74
EU	91	90	90
Czech Republic	37	38	38

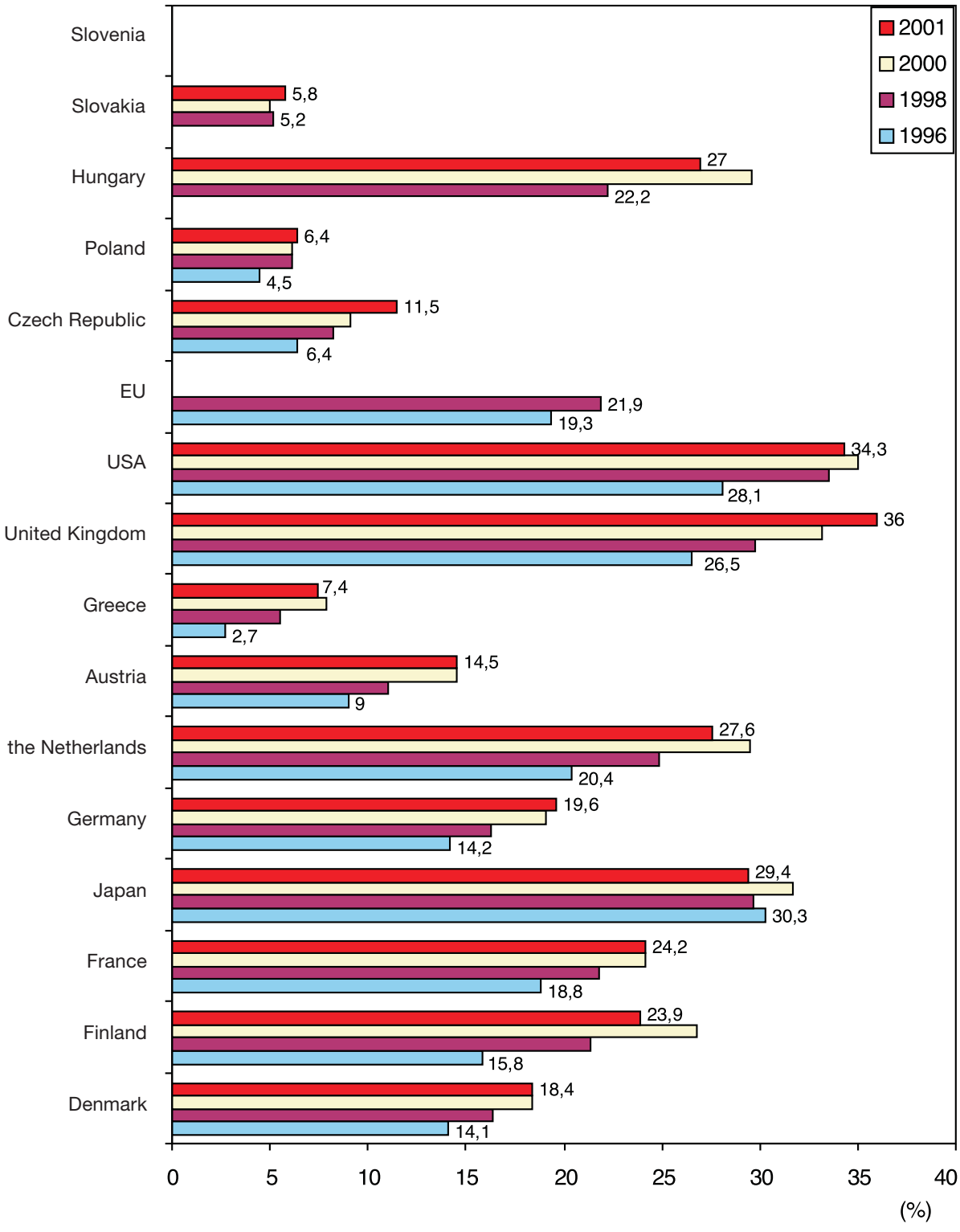
Source: OECD Science, Technology and Industry Outlook 2002

(5) The relatively favourable figures of the productivity indicator in many EU member countries, e.g. the Netherlands, France and Germany in comparison with the United States result from the differently oriented economic policies – lower working hours fund than the working hours in the United States. These relatively high figures of the productivity of labour are attained by the European countries in question at lower working hours fund than in USA. But no conclusion as that by shortening the working hours the productivity in Czech Republic would grow may be deduced from it.

(6) It follows from the more detailed statistics of Eurostat that in the recent years the productivity of labour (GDP per 1hour of work) has been growing more rapidly in Ireland (5.7 % per year) and Finland (3.3 % per year).

(7) It further follows from the same statistics that in 1996 the productivity of labour in the Czech Republic as evaluated by GDP at PPP per 1 hour of work amounted to 44.8 per cent of the productivity of the EU as a whole, until 1998 it has grown to 48.3 per cent and in 2000 it has fallen to the level of 41.6 per cent of the productivity in the EU.

A.1.3 Percentage of the high-tech products export of the total export (in per cent)



Source: OECD Statistics Directorate, OECD/ITCS, Volume 2002/Supplement 1, revision 2

Commentary:

(1) Among the high-tech branches, according to the international methodology ISIC[2] Rev. 3, the aircraft industry (branch 353), electronic industry (manufacturing of radio, television and communication equipment and apparatuses – branch 32), manufacturing of office technology and computers (branch 30), pharmaceutical industry (branch 2423) and manufacturing of instruments and apparatuses (medical, accurate, optical and time-measuring – branch 33) are classified.

(2) The percentage of export of the high-tech branches in the Czech Republic is growing in an agreeable manner, however still significantly lagging behind the value of this indicator in most of the compared member countries of the EU, as well as of the EU as a whole. It is higher than in Greece and is approaching Austria.

(3) Surprisingly high figures are reached by export of the high-tech branches in Hungary. It is caused by the right structural orientation of direct foreign investments in this country. The percentage of export of the high-tech branches in Poland and Slovakia is basically stagnating on low figures between 5 and 6 per cent.

(4) This indicator reaches the highest figures – over 30 per cent – in large countries with high industrial development: in the United States, Japan, and United Kingdom.

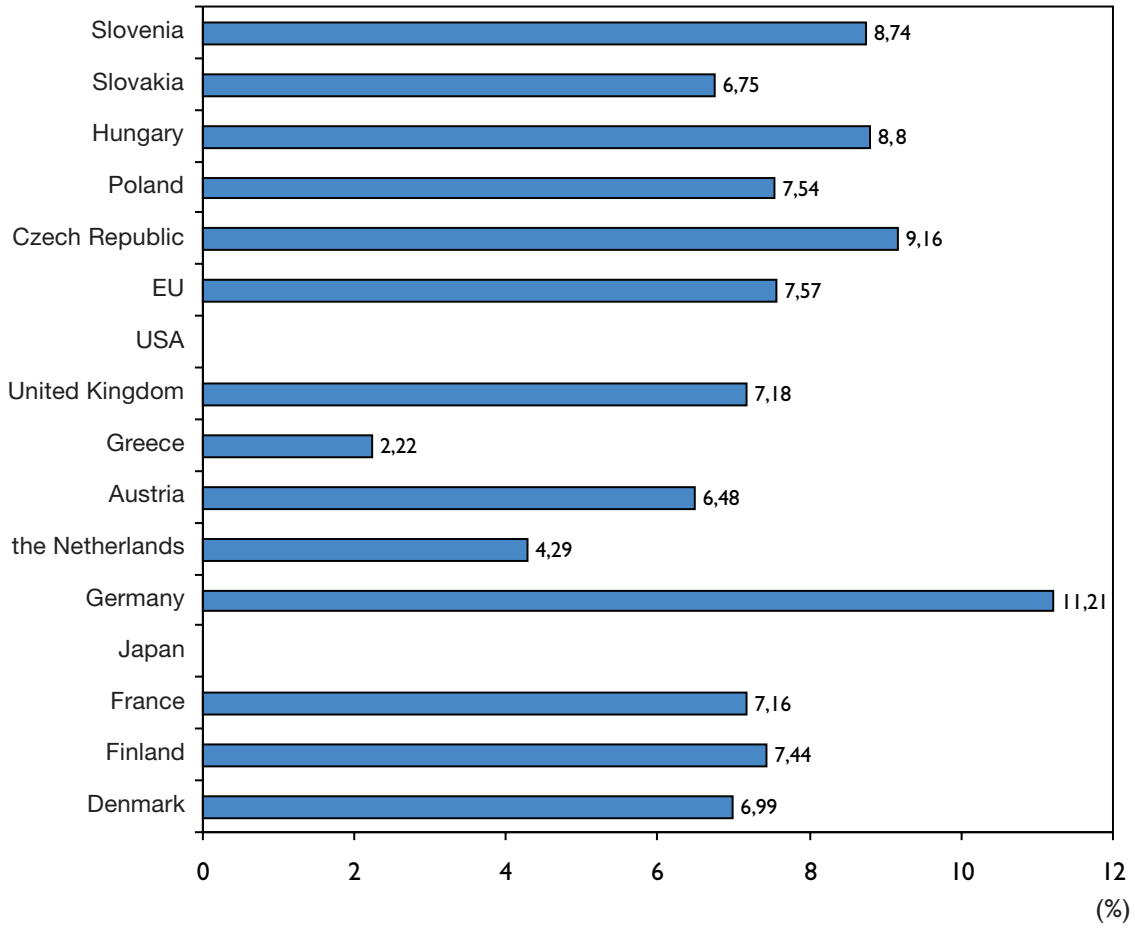
(5) An interesting indicator expressing the extent of the economic openness is the volume of export per head. The following table gives the export in 2000 in current prices in USD per head.

	FIN	F	JAP	D	NL	A	UK	USA	CR	PL	H	SK
Export per head	8 597	5 076	3 777	6 702	13 171	7 912	4 732	2 758	2 823	820	2 796	2 201

The Netherlands, Finland and Denmark are highly open economics with high values of export per head.

[2] ISIC – International Standard Industrial Classification.

A.1.4 Employment in the processing industry with medium high-tech and high-tech technologies in 2001 (in cent of overall employment)



Source: 2002 European Innovation Scoreboard, European Commission – SEC (2002) 1349

Commentary:

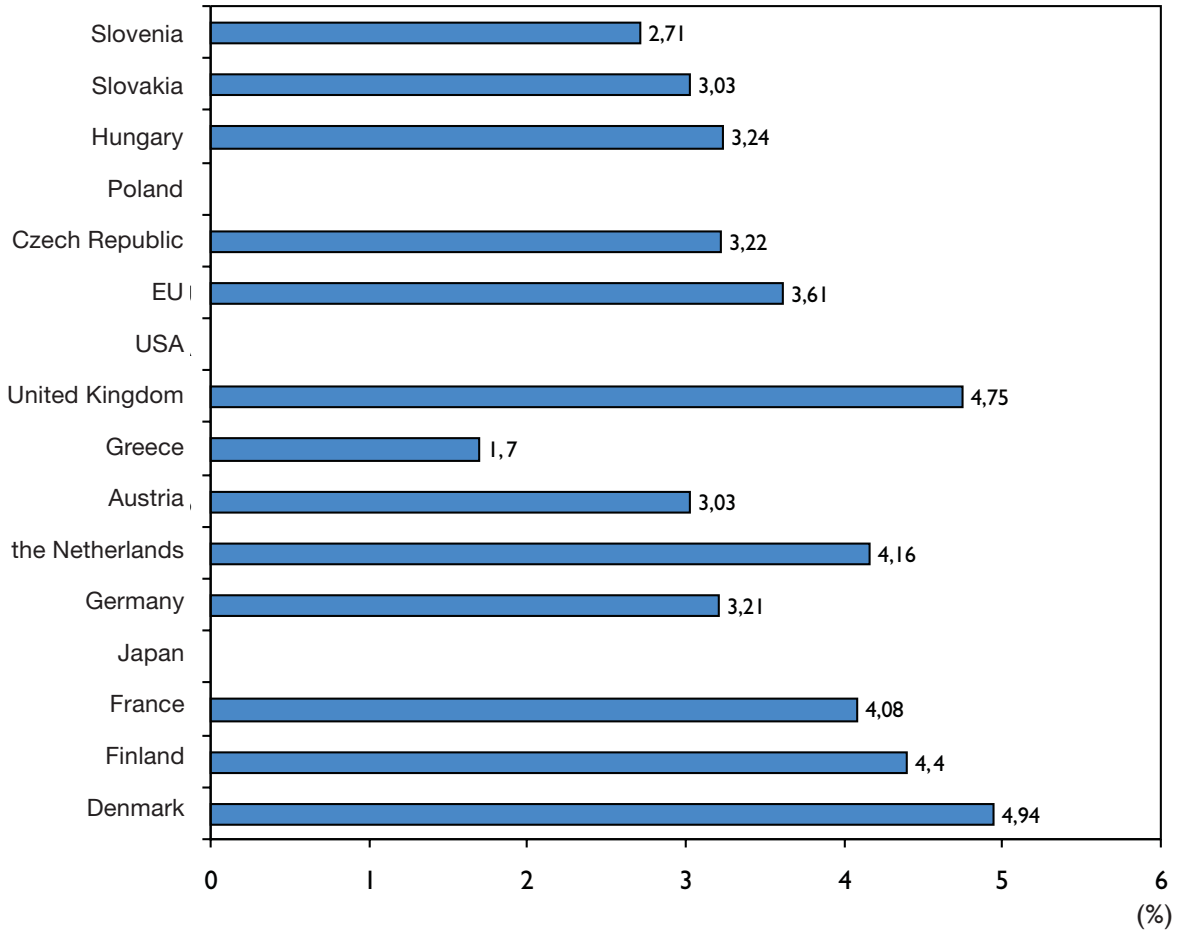
(1) The share of employment in the Czech Republic and other candidate countries is surprisingly high. The mentioned documents of the European Commission even admit that certain methodical mistakes may occur. Values for member countries of the EU (Germany, Finland, United Kingdom) are undoubtedly reliable and in compliance with results of the economic and employment policies of these countries. The value for the United States is not given; the United States use different classification of manufacturing branches.

(2) The indicator is based upon a legitimate belief that R&D must lead to introduction of new competitive technologies and products showing itself in the growth of employment in the processing industry with medium high-tech and high-tech technologies. This indicator is used also in analytical documents in the United States and in Japan.

(3) Data are taken from the official document of the European Commission "2002 European Innovation Scoreboard SEC (2002) 1349". Coincident data are given also in the European Commission Yearbook "Key Figures Research 2002". The branches of high-tech and medium high-tech technologies are defined in the document of OECD STI – OECD/GD/97-216[3].

[3] In the Czech Republic they include branches 244, 29, 30, 31, 32, 34, and 35 without 351 of Industrial Classificati of Economic Activities.

A.1.5 Employment in the high-tech services in 2001 (in per cent of overall employment)



Source: 2002 European Innovation Scoreboard, European Commission – SEC (2002) 1349

Commentary:

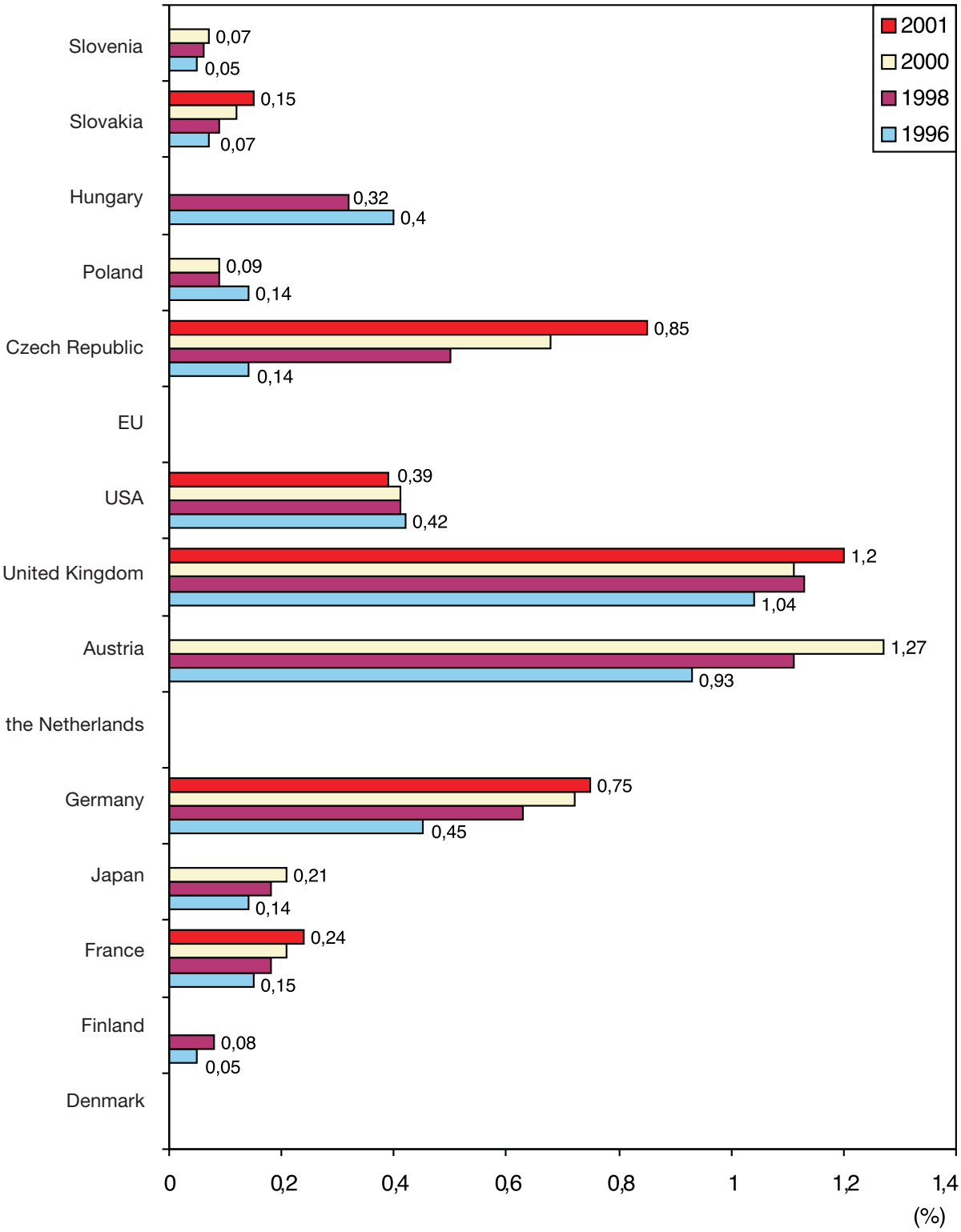
(1) The statement mentioned in point (1) to graph A 1.4 applies for this graph as well. Generally speaking, the importance of services rises.

(2) The high-tech services include services in the area of post offices and telecommunications (NACE[4] 64), services in the area of information technologies, including software development (NACE 72) and R&D services (NACE 74); that is in branches using telecommunication techno-logies, computing technique, scientific and other complex apparatuses, etc. in large extent.

(3) As the previous indicator of employment in the processing industry with medium high-tech and high-tech technologies, this indicator reaches high values in Denmark, United Kingdom and the Netherlands. Situation in Germany is somewhat different. Germany shows the highest share as regards the employment in the high-tech processing industry; in contrast the employment in the high-tech services is low, agreeing in principle with the employment in the Czech Republic.

[4] NACE – Statistical Classification of Economic Activities in the EU.

A.1.6 Technological balance of payments (income/GDP in per cent)



Source: Czech Republic – Czech National Bank, other countries – OECD (MSTI 1/2003)

Commentary:

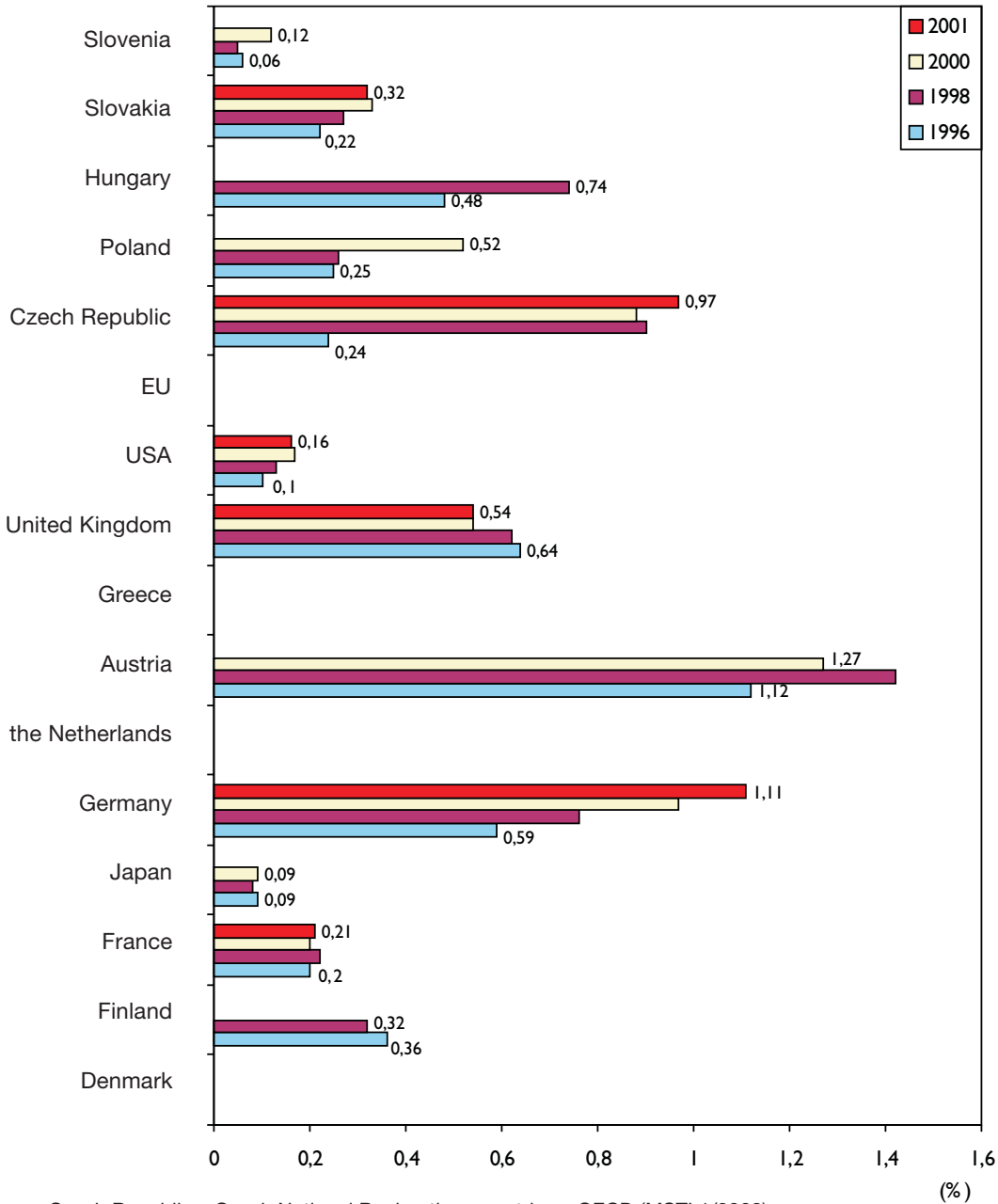
(1) Also this indicator – particularly income of the technological balance of payments – implies the technological level of economy of a particular country, or more exactly the scope of trade with products, technologies and services based on advanced technologies. No doubts that high technological level may be attained also in other way than by realisation of the results of the domestic R&D, e.g. by purchase of licences, and direct purchase of plants and technologies. Nevertheless the importance of good level of domestic research and development and prompt implementation of its results is beyond any dispute.

(2) The trade with technologies, the technological balance of payments, includes telecommunication and radio communication services, services of computing technique, technical services (project, design, testing and certification – not internal), author's fees and licence fees, research and development, purchase and sale of ownership rights and non-financial assets, etc.[5]

(3) The highest income is reported by Austria, United Kingdom – more than 1 % of GDP and by Germany – 0.75 % of GDP. The income of the Czech Republic in the technological balance of payments (0.85 % of GDP) is markedly higher than in other candidate countries. The income in the Czech balance experiences a dynamic growth.

[5] In the Czech Republic the branches classified in the technological balance of payments are determined by the Ordinance of the Czech National Bank No. 514/2002.

A.1.7 Technological balance of payments (expenditure/GDP in per cent)



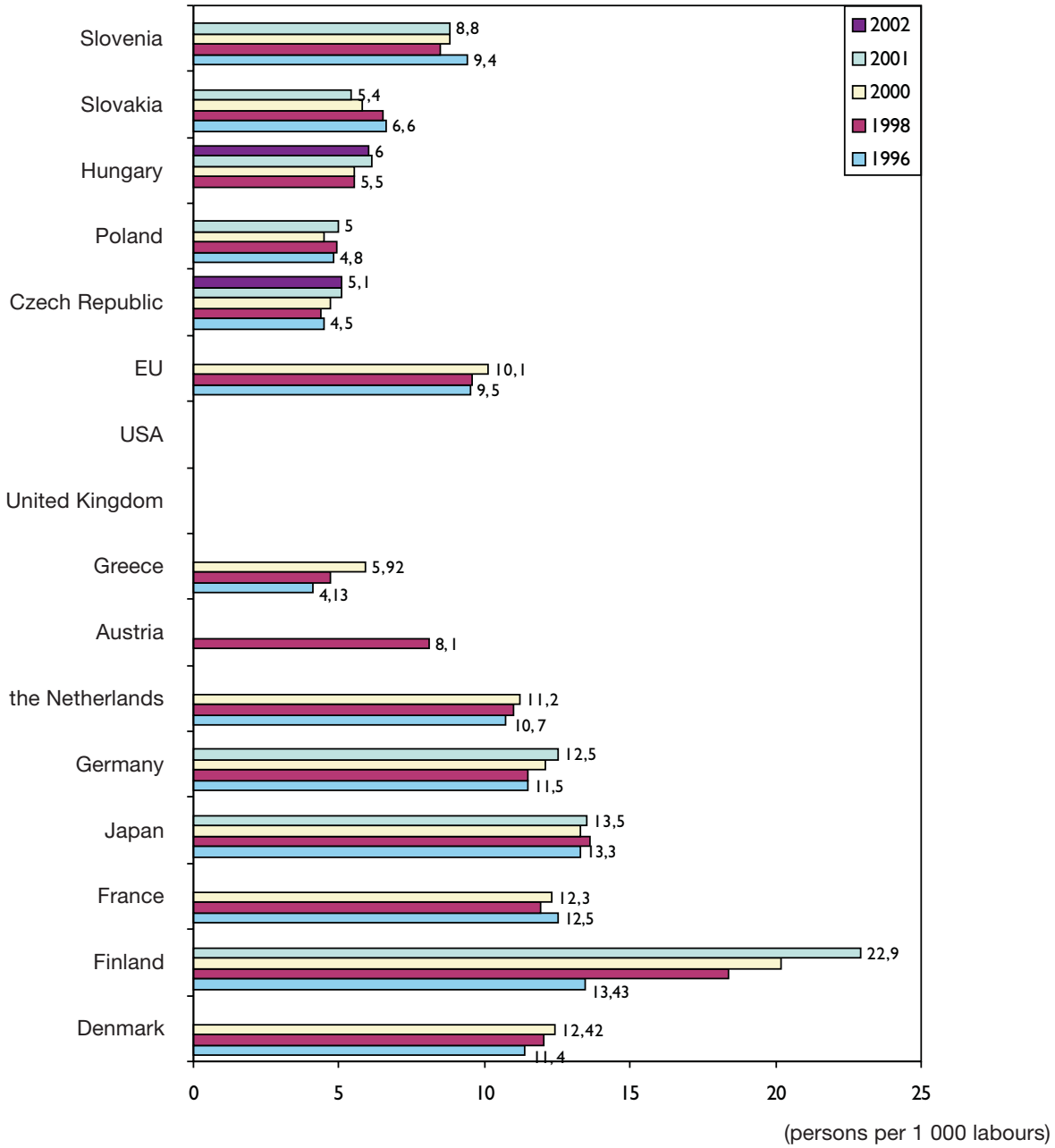
Source: Czech Republic – Czech National Bank, other countries – OECD (MSTI 1/2003)

Commentary:

(1) Text under points (1) and (2) of the commentary on the previous graph of income of the technological balance of payments applies to the expenditure graph as well.

(2) Purchases in the Czech Republic in branches classified within the technological balance of payments attain the level of purchases in Germany. The level of income and expenditure in the Czech Republic in these branches show evidence that there is a lot to sell and purchase. The level in other candidate countries, except for Hungary, is substantially lower.

A.2.1 Number of R&D employees (FTE) (persons per 1 000 labours)



Source: Czech Republic – Czech Statistical Office (VTR-01), other countries – MSTI 2/2002

Commentary:

(1) The R&D employees mean the research workers performing research and development, and auxiliary, technical, administrative and other employees on the R&D workplaces. The OECD official statistics monitor two indicators – number of R&D employees per 1 000 of all employees and per 1 000 labours. The category of employees includes all persons being fifteen years old and older, and paid within the employment. The formal relation to employment means the employment, contract of services and contract for work. On the other hand, the category of labour includes all persons being fifteen years old and older and meeting the requirements for being classified into the employed or unemployed. For most of the monitored countries data are available on the number of R&D employees per 1 000 labours.

(2) For employees concerned also with other activity than research and development only the relevant part of their working capacity is included in accordance with the OECD methodology (FTE = Full Time Equivalent).

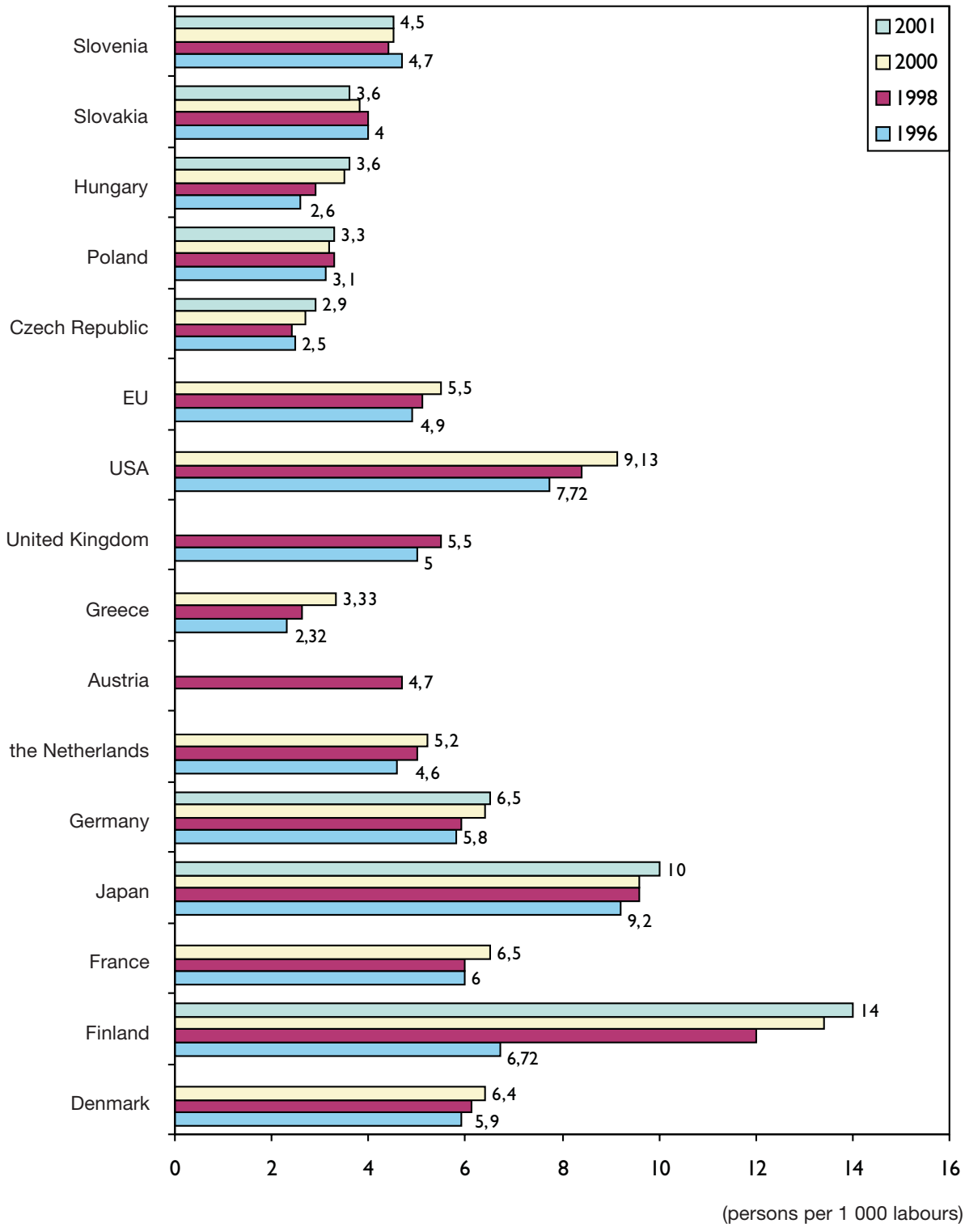
(3) For Denmark and Greece the 1996, 1997 and 1999 values are given. For Finland the value given for 1996 is the value for 1995.

(4) Relative numbers of employees basically correspond with the amount of total R&D expenditures in individual countries. Of the monitored countries the highest are in Finland experiencing sharply dynamic increase since 1996. In 2001 Finland reported 22.9 R&D employees per 1 000 labours, which is double the number for the EU as a whole (10.1). A moderate increase is reported by Denmark, from 11.4 in 1996 to 12.4 in 2000, or 1999 respectively. Relative numbers of employees in other countries in principle stagnate.

(5) The relative number of R&D employees in the Czech Republic is only half as big (5.0 in 2002) when compared with number of these employees in the EU as a whole (10.1), by far lower than in Slovenia (8.8 in 2001).

(6) In the Czech Republic 5.5 employees working in R&D were reported per 1 000 persons of the overall employment in 2002.

A.2.2 Number of research workers (FTE) (persons per 1 000 labours)



Source: Czech Republic – Czech Statistical Office (VTR-01), MSTI 2/2002

Commentary:

(1) The term research workers mean persons really performing research and development. Otherwise the methodical note (2) to graph A 2.1 applies to this indicator.

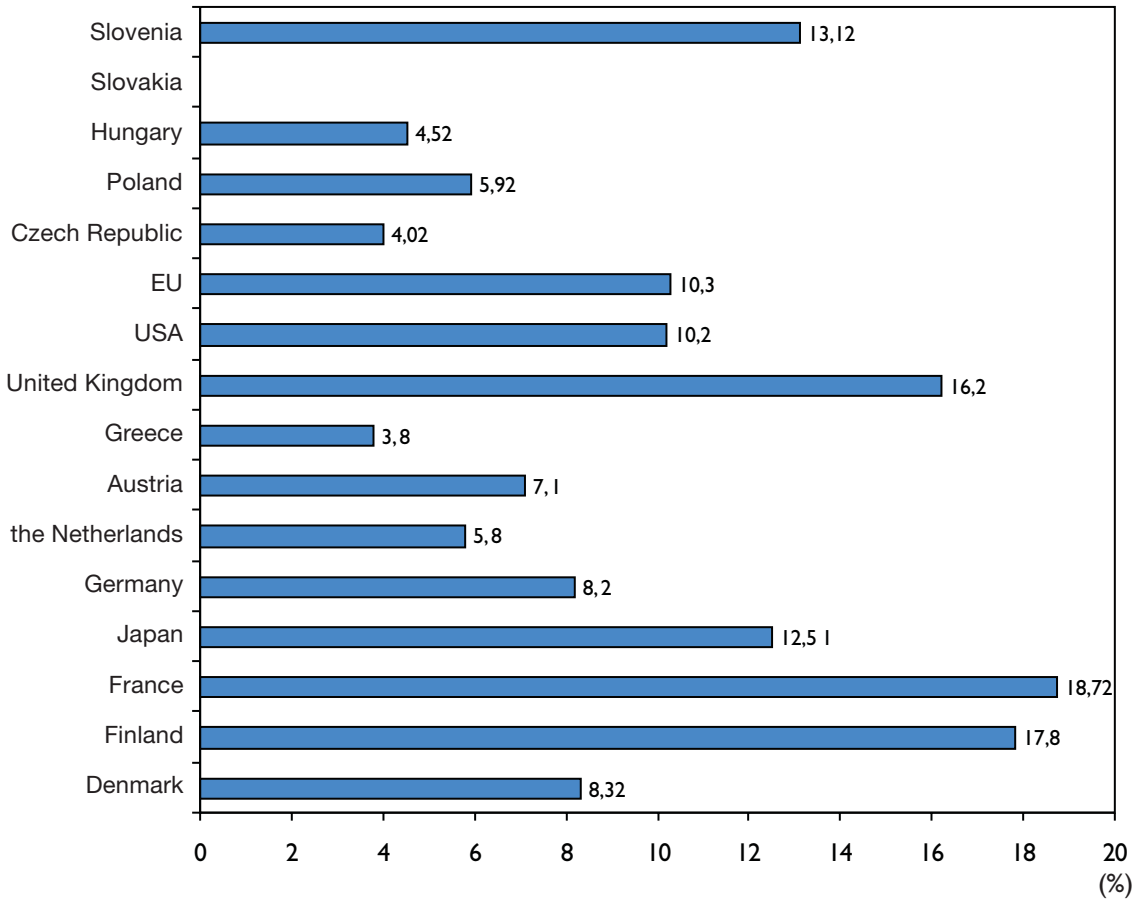
(2) For Denmark, Greece and the United States the 1996, 1997 and 1999 values are given. For Finland the value given for 1996 is the value for 1995.

(3) The 2000 average figure of the EU as a whole (5.5 research workers per 1 000 labours) is significantly exceeded again by Finland (14.0 in 2001), Japan (10.0 in 2001), and the United States (9.1 in 2000).

(4) The number of R&D workers in Czech Republic stagnates in principle on the figure lower than 3 workers per 1000 labours and is slightly lower than in other candidate countries. At the same time the expenditures on research and development are higher in the Czech Republic than in any other candidate country (except for Slovenia).

(5) It results from comparison of figures between A.2.2 and A 2.1 graphs that in most of the monitored countries the research workers themselves amounts to ca 50 per cent of the overall number of R&D employees. Only Japan differs, the share of the research workers being higher than 70 per cent. It gives evidence of the somehow different organisational arrangement of research and development in Japan and on the lower “provision” of the Japanese research with auxiliary and technical workers. This fact is confirmed also by the Japanese analytical materials on research and development.

A.2.3 Share of the natural science and technical study programmes graduates on universities from inhabitants of the 20–29 age category in 2000 (natural science and technical study programmes graduates per number of inhabitants of the 20–29 age category, in per cent)



Source: 2002 European Innovation Scoreboard, European Commission – SEC (2002) 1349

Commentary:

(1) This share represents very frequently used indicator for evaluation and mutual comparison of research and innovation policies, and the overall competitiveness (EU, United States, Japan, papers for the annual session of the World Economic Forum). Sometimes the indicator is used in the form of a share from the total number of university graduates of the same age category between 20 and 29 years. This fact does not mean any underestimation of the social science studies. The graduates in the natural science and technical study programmes on the universities are considered, however, the basic potential for activity in that part of research and development that are able to influence the competitiveness most.

(2) Data for this graph are taken from the official document of the European Commission "2002 European Innovation Scoreboard", SEC (2002) 1349.

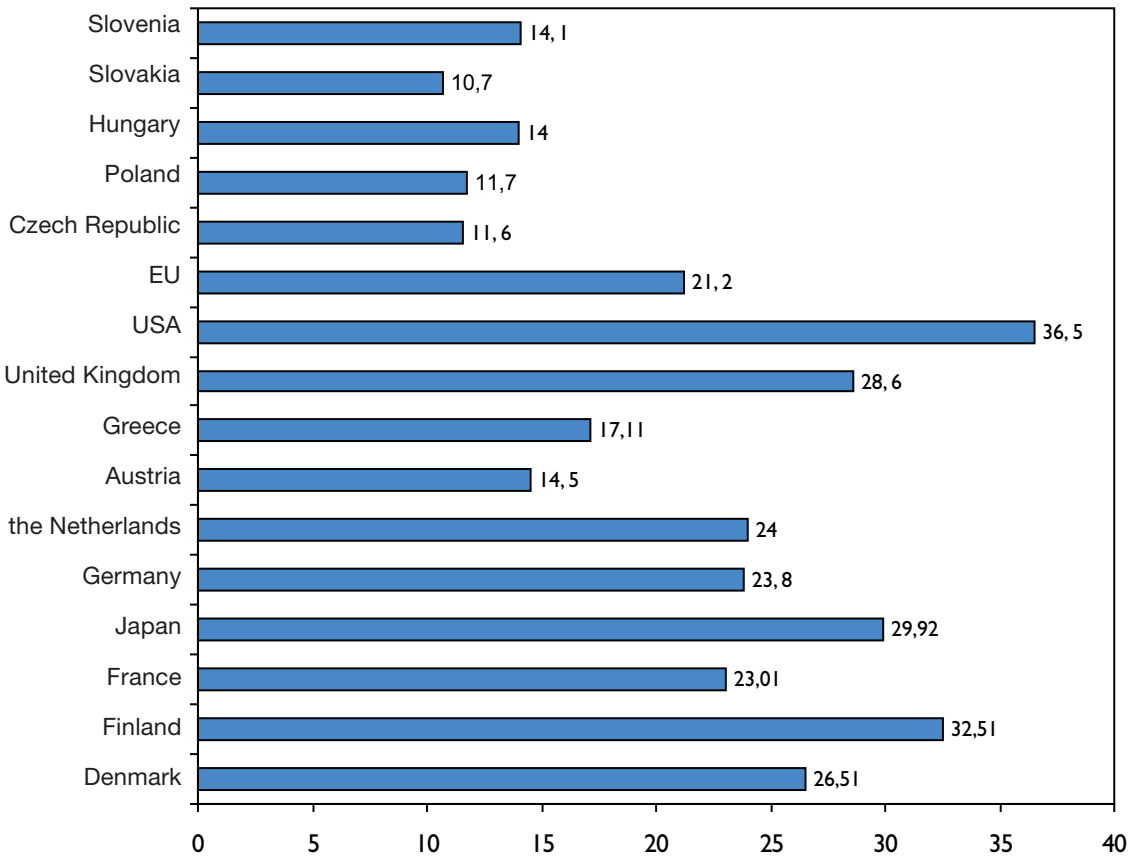
(3) Of the monitored countries the share of graduates in natural science and technical study programmes in the Czech Republic is the second lowest (4.02 %), lower being only in Greece. It may be state on aggregate that with the exception of Slovenia this share in the candidate countries is approximately half as big as the figure for the EU as a whole (10.3 %).

(4) This indicator reaches the highest values in France (18.72 %), Finland (17.8 %) and in the United Kingdom (16.2 %). For its remarkable success[6] Finland is indebted to the well thought-out R&D policy – high R&D support, high number of R&D workers, useful and promptly implemented R&D results. Surprisingly low shares are in the Netherlands (5.8 %), Denmark (8.32 %) and in Germany (8.2 %).

(5) This shortage of adequately qualified workers for research and development in many countries is caused by reasons of two kinds. The study of natural science and technical branches is generally regarded to be more difficult and fruitification of the gained knowledge used to be postponed as a rule. The R&D careers in enterprises and at publicly funded R&D workplaces are slower as a rule than in the case of graduates in the social science studies. The second reason is the cultural and social awareness. The young generation in many countries feels aversion against technique and technologies. The solution does not consist in determination of certain indicative numbers for the university enrolment. As can be seen in many countries the solution may not be left only on the action of market forces, the supply and demand. In the successful countries – by this indicator – the combination of the young research workers support programs etc. and special scholarships is applied, and funds of these scholarships are supplemented from private (corporate) resources.

[6] For many years Finland has been taking the foremost places in the evaluation of competitiveness for the annual session of the World Economic Forum.

A.2.4 Share of the inhabitants with university education in the total number of inhabitants in the 25–64 age category in 2000 (%)



Source: 2002 European Innovation Scoreboard, European Commission – SEC (2002) 1349

Commentary:

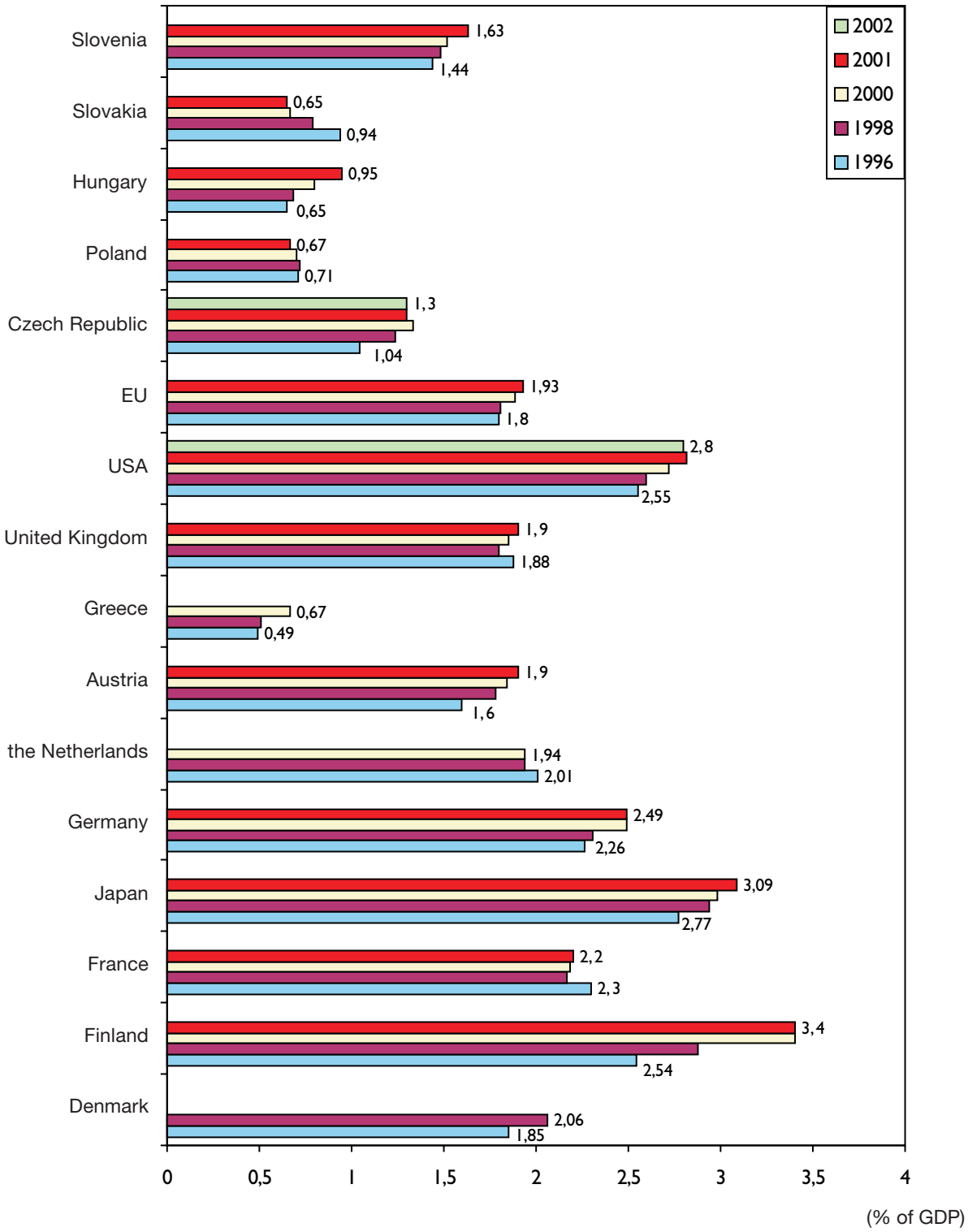
(1) The graph depicts another very frequently used indicator for evaluation of potential capacities of the human sources for research and development and employment of their results. As with the previous indicator, the values are taken from the official document of the European Commission "2002 European Innovation Scoreboard, SEC (2002) 1349". The document defines the categories of the university education, natural science and technical study programmes. In some countries, the interpretation variations cannot be avoided.

(2) The values have been acquired by the Eurostat inquiry on labours and include all forms of post-secondary education (International Standard Classification for Education – ISCED 5 and 6). Recently, minor methodical modifications have been made with the aim to consolidate the so far different classifications in the EU and the United States.

(3) It is generally known that in Czech Republic the share of inhabitants having university education is one of the lowest of all OECD member countries (11.6 %). Similar situation is in other candidate countries, with the exception of Estonia that is not mentioned in the graph. The value (29.4 %) stated in various documents of the European Commission is surprising.

(4) This indicator reaches the highest values in the United States (36.5 %), again in Finland (32.5 %), Japan (29.9 %) and in the United Kingdom (28.6 %).

A.3.1 Total R&D expenditures (% of GDP)



Source: Czech Republic – Czech Statistical Office (VTR5-01), other countries – OECD (MSTI 1/2003)

Commentary:

(1) The R&D expenditures are the most famous and most frequently used indicator for the international comparison of research and development. These expenditures represent overall expenditures from public, private (business or non-business) and foreign sources. Data, as with all following graphs A 3.2 to A 4.3, are taken from the official publication of OECD "Main Science and Technology Indicators"(MSTI) 1/2003[7]. Data for the Czech Republic come from Czech Bureau of Statistics (CBS) and are collected through the VTR5-01 questionnaire. CBS gives data to OECD and Eurostat, similarly as statistical bureaus in other countries. For Greece the 1995, 1997, and 1999 values are given.

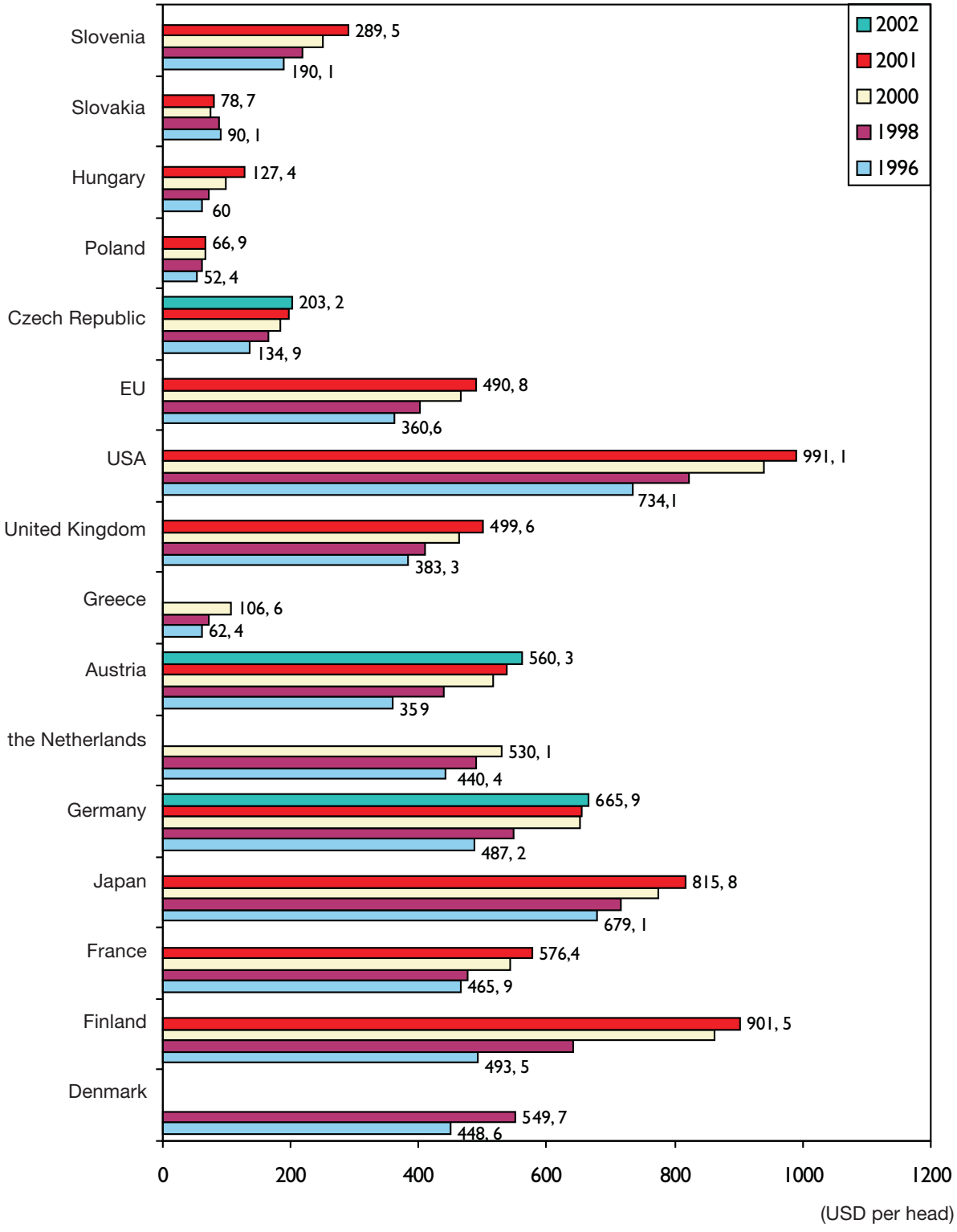
(2) Total R&D expenditures in the EU as a whole experienced a moderate increase from 1.8 % to 1.93 % of GDP in the monitored period between 1996 and 2000. In many member countries the R&D expenditures basically stagnate. A dynamic increase has been experienced in Finland (from high value of 2.54 % to 3.4 %). A significant increase of R&D expenditures has taken place also in Germany, Denmark and Austria. It can be expected that not many member countries of the EU, neither the EU as a whole, will reach the target for 2010 determined on the 2002 spring session of the European Council in Barcelona, namely the expenditures of 3 % of GDP, of this 1 % from public sources and 2 % from corporate sources.

(3) The R&D expenditures have grown also in the monitored non-European countries, the United States and Japan. In Japan they exceeded the level of 3 per cent (3.09 % of GDP) in 2002.

(4) Of the monitored candidate countries the R&D expenditures are highest in Czech Republic (1.3 % of GDP in 2002), with the exception of Slovenia (1.63 per cent of GDP in 2002). They are significantly lower than in the EU as a whole; in 2002 the expenditures in the Czech Republic reached 67 % of the EU expenditures. This value corresponds relatively well with the level of GDP per head that represents for the Czech Republic ca 60 per cent of the level of the EU as a whole. It is generally known that the developed "richer" countries spend on research and development more than countries less developed. Great fall took place in Slovakia, from 0.95 % of GDP in 1996 to 0.65 % in 2002.

[7] OECD Secretariat issues these publications twice a year, marked with numbers 1 or 2 and the respective year.

A.3.2 Total R&D expenditures (in USD per head; current prices, PPP)



Source: Czech Republic – Czech Statistical Office (VTR5-01), other countries – OECD (MSTI 1/2003)

Commentary:

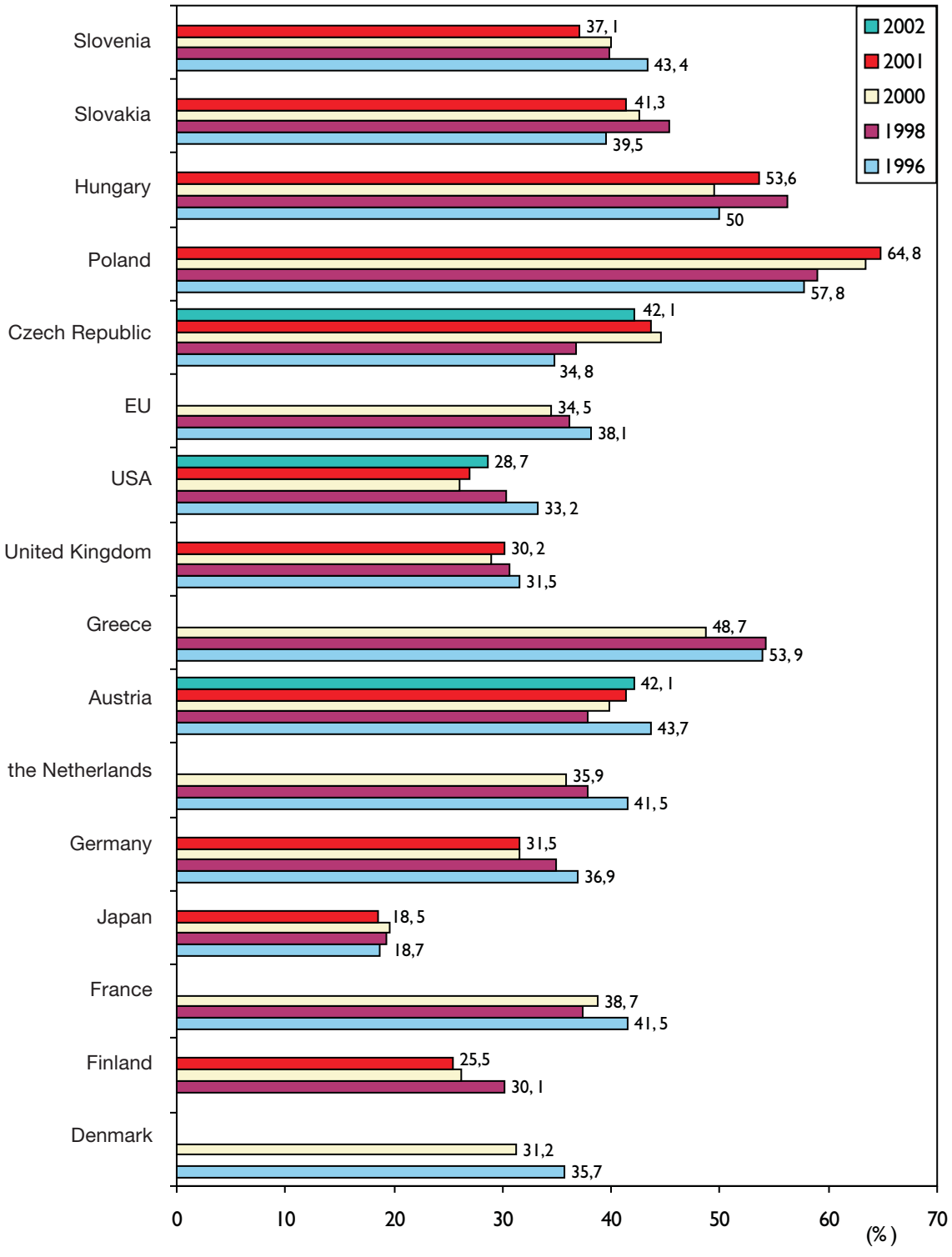
(1) The indicator of total R&D expenditures in per cent of GDP gives only incomplete information. The really spent funds depend on the amount of GDP. Therefore the analytical materials use another indicator – total R&D expenditures in USD per one inhabitant of the country in question. As a rule this indicator is given in currency of the respective country converted to USD using the purchasing power parity (PPP). At this conversion a small distortion may occur because some inputs to research and development (apparatuses, materials, etc.) are generally bought in abroad according to the official rate of exchange of the currency in question. Nevertheless, the indicator is considered highly objective. The chart values are given in current prices of respective years. For Greece, the 1995, 1997, and 1999 values are given.

(2) Data for Greece are given only for odd years in the MSTI publication.

(3) The markedly highest are expenditures in the United States (991.1 USD per head in 2001), then comes the already successful Finland (901.5 USD per head in 2001) and Japan (815.8 USD per head). In view of the GDP growth in most countries the growth of the indicator of specific R&D expenditures exceeds the growth of indicator of the R&D expenditures in per cent of GDP. High dynamic is shown in Finland, the United States, and Austria.

(4) Specific R&D expenditures in the Czech Republic (203.2 USD per head in 2002) reach the level of 41.4 % of the figure for the EU as a whole (490.8 USD per head in 2002), that is significantly lower than 67 % in case of the indicator of R&D expenditures reported as % of GDP. On the other hand, with higher GDP per head in the Czech Republic there is a larger distance from Slovakia, Poland and Hungary.

A.3.3 Share of public sources in total R&D expenditures (in per cent)



Source: Czech Republic – Czech Statistical Office (VTR5-01), other countries – OECD (MSTI 1/2003)

Commentary:

(1) This indicator gives account on the degree of liberalism of the economy (scope of the private sector) and is influenced by the structure of economy, particularly by share of large enterprises, and structure of the research base. The conception materials on research and development often express opinion that the optimum share of public sources moves in the range from 30 % to 40 % of the total R&D expenditures. The already mentioned Lisbon Strategy of EU anticipates the total R&D expenditures in the amount of 3 % of GDP, of this 1 % from public funds and 2 % from corporate funds.

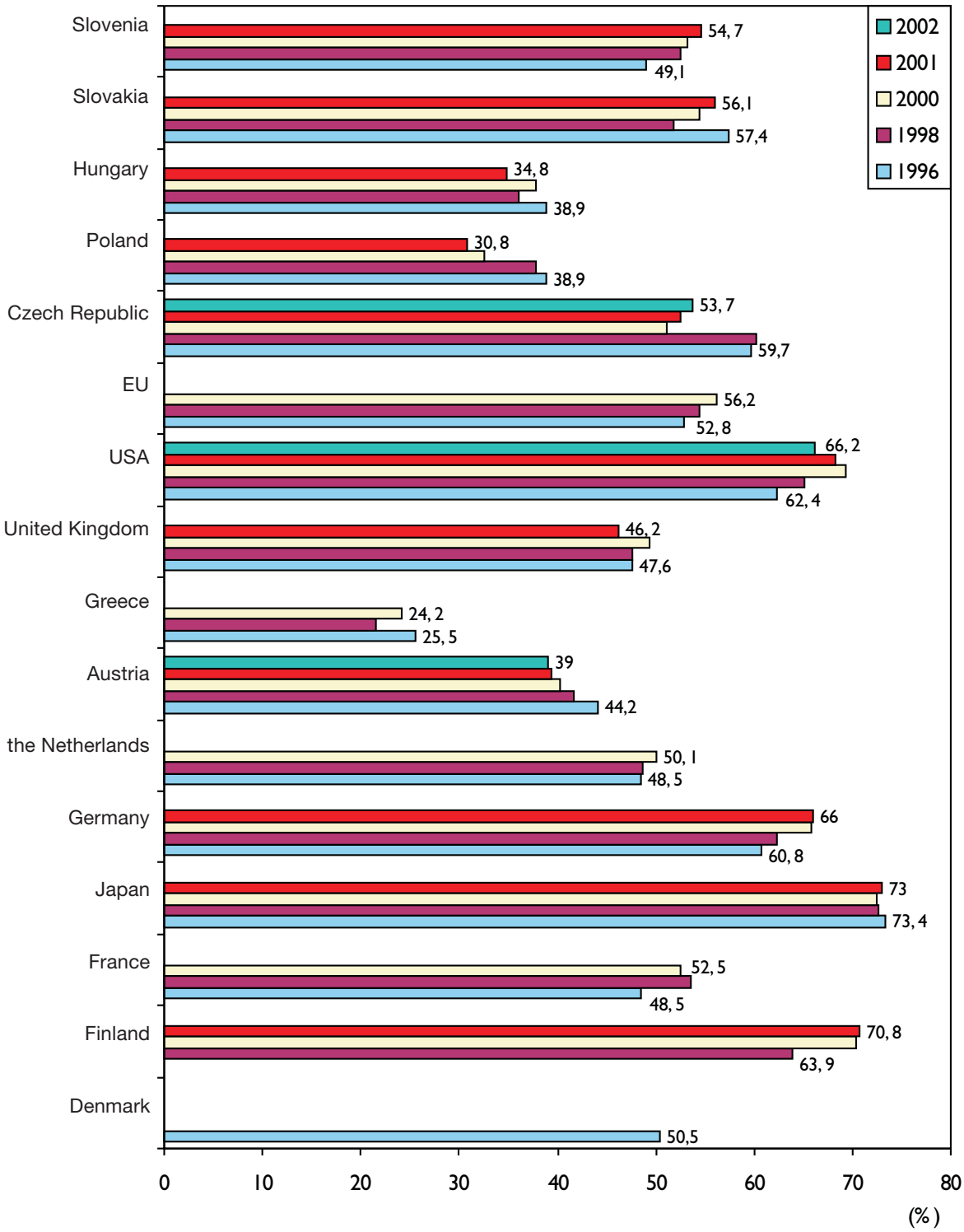
(2) For Greece, the 1995, 1997, and 1999 values are given.

(3) In most of the monitored countries this indicator slightly goes down; in the EU as a whole from the value of 38.1 % in 1996 to 34.5 % in 2000. The 2002 figure is not available at this moment. The share in Poland experienced a relatively dynamic growth, up to 64.8 % in 2002. This growth is evidently caused by economic problems suffered by parts of the Polish industry and efforts of the Polish government to maintain at least the amount of the total R&D expenditures (see Graph A.3.1). Significantly lowest is the share of public expenditures on research and development in Japan – less then 20 %. The reasons are high R&D expenditures in the huge Japanese enterprises and considerably limited scope of the so called public R&D sector. Very low share of public R&D expenditures is reported also by Switzerland (ca 25 %) that is not mentioned in the graph.

(4) The values of public funds shares in the United States and United Kingdom reflect the liberalism of both economics, including lower redistribution of funds through the state budget.

(5) The Czech Republic, together with Slovenia and Slovakia, reports the share of public support of R&D below 50 % (Czech Republic has share of 42.1 % in 2002) and approaches the recommended range of the share between 30 and 40 %.

A.3.4 Share of private funds in total R&D expenditures (in per cent)



Source: Czech Republic – Czech Statistical Office (VTR5-01), other countries – OECD (MSTI 1/2003)

Commentary:

(1) Values of the private funds shares in the total R&D expenditures for most of the countries, or more exactly countries with low support of research and development from abroad, logically supplement values given in Graph A.3.3. In most of the monitored countries private funds are the largest source of funds for the R&D support. The same applies to the increase and decrease of the private funds shares. The share of public funds falls down in most countries, while the private funds share increases.

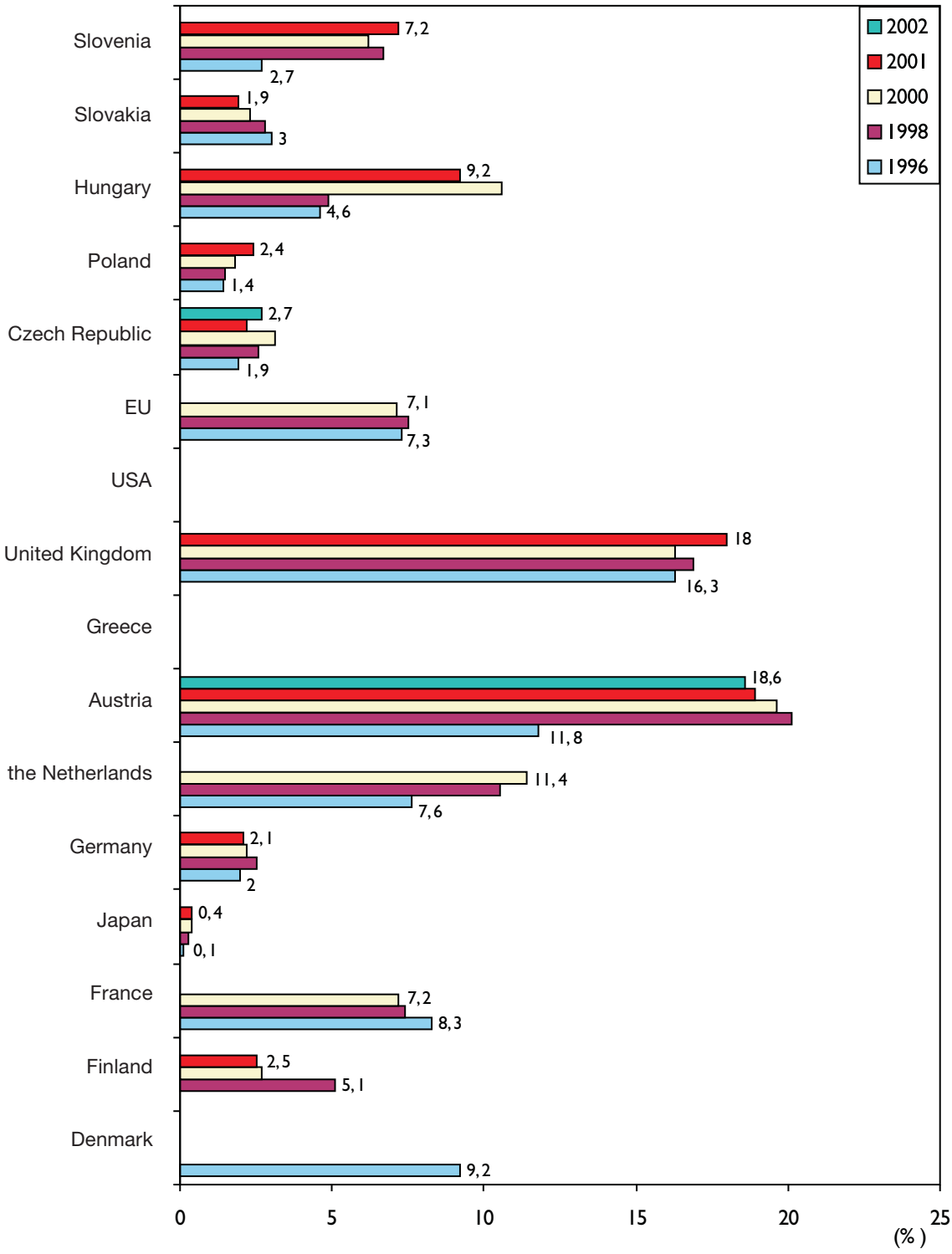
(2) For Greece, the 1995, 1997, and 1999 values are given.

(3) The share of private funds in the EU as a whole increased from 52.8 % in 1996 to 56.2 % in 2000.

(4) Very high shares of private funds are reported by Japan, Finland, the United States and Germany. Besides other things it gives account on the structure of the industry with large share of sectors imposing high demand on R&D.

(5) In the Czech Republic the share of private funds fell down from 59.7 % in 1996 to 53.7 % in 2002. This decline is compensated by increased public funds expenditures.

A.3.5 Share of foreign funds in total R&D expenditures (in per cent)



Source: Czech Republic – Czech Statistical Office (VTR5-01), other countries – OECD (MSTI 1/2003)

Commentary:

(1) The foreign funds are the third most important source of R&D financing. The share of the fourth source being the private non-business sources (private foundations, etc.) is marginal, except for the United States. The foreign funds include both private funds and public funds (EU programmes, other international programmes, etc.).

(2) The MSTI 1/2003 paper does not give any data for Greece, neither United States.

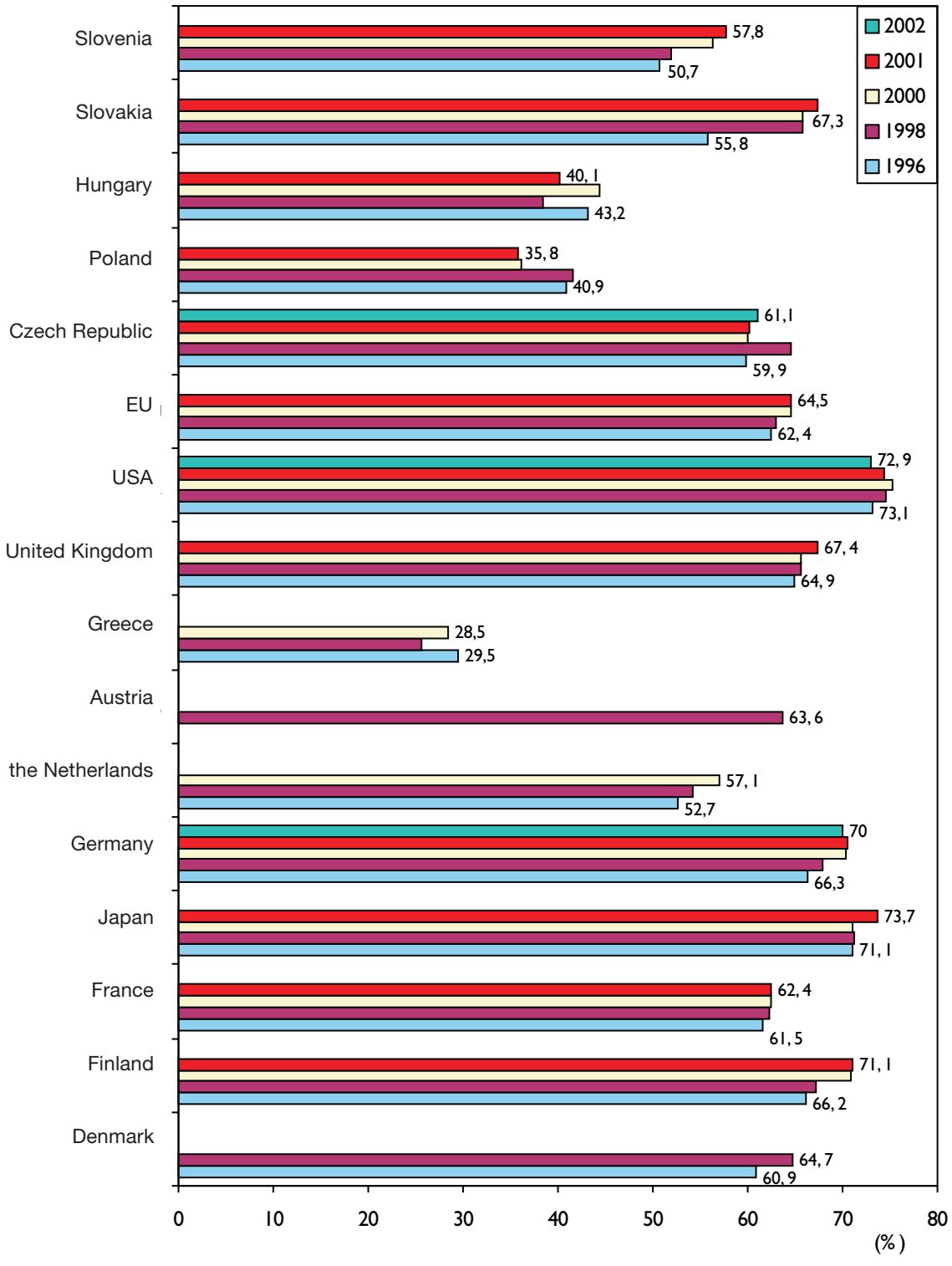
(3) In the EU as a whole the share of foreign funds moves slightly above 7 per cent. Data for 2002 are not available yet.

(4) The highest share of foreign funds is reported by Austria – a moderate decline in monitored years to 18.6 % in 2002 – and the United Kingdom – growth to 18 % in 2002. Relatively high shares, higher than the average of the EU as a whole, are shown by the Netherlands and France. In the mentioned countries, the expenditures are particularly of large foreign and multinational enterprises having their branches in these countries.

(5) Very low shares are reported by Japan – less than 0.5 %. The reason is a very low share of branches of foreign enterprises and considerably limited scope of the direct foreign co-operation in research and development financed from foreign funds.

(6) In the Czech Republic, Poland and Slovakia the shares of foreign funds move around 2 % of the total R&D expenditures. In other two candidate countries, Hungary and Slovenia, they are substantially higher and reach the level of the EU as a whole.

A.4.1 Share of R&D funds used in private sector in the total R&D expenditures (in per cent)



Source: Czech Republic – Czech Statistical Office (VTR5-01), other countries – OECD (MSTI 1/2003)

Commentary:

(1) The foreign analyses and statistics monitor three user sectors: private, universities and the so called governmental sector. The governmental sector largely includes the research organisations of a non-business character supported from public funds. In the Czech Republic the governmental sector is formed by the Academy of Sciences of the CR and departmental research institutions.

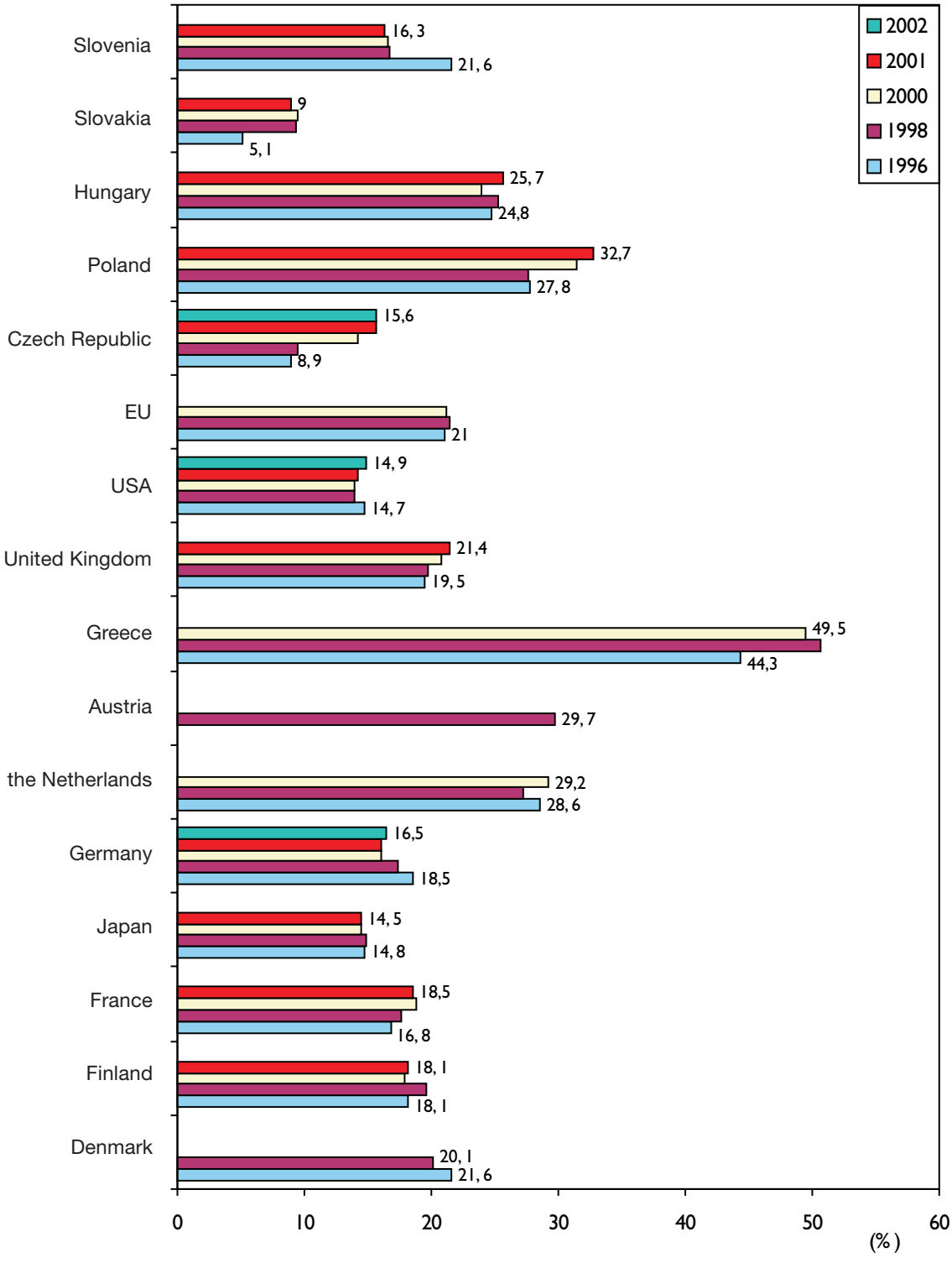
(2) The MSTI 1/2003 paper gives data for Greece for the years 1995, 1997, and 1999, for Austria only data for 1998.

(3) Member states of the EU are fully aware of the importance of the basic research and importance of co-operation of universities and governmental sector organisation with the industry, nevertheless the major part of funds for R&D is directed into the private sphere. In the EU as a whole more than 60 % of total R&D expenditures (64.5 % in 2001) are used within the private sphere. Data for 2002 are not available yet.

(4) The share of the private sector reaches highest values in Japan (73.7 % in 2002), in the United States (72.9 %), in Finland (71.7 %) and in Germany (70 %), the countries having significant shares of industrial sectors imposing high demand on R&D.

(5) In the Czech Republic, and to certain extent also in Slovenia, the share of funds used in the private sector approaches the average in the EU as a whole; Slovakia exceeds this level, however with generally very low support of R&D. The share of the private sector in the use of total R&D expenditures in Hungary and Poland is considerably lower than the share in the EU as a whole.

A.4.2 Share of R&D funds used at universities in the total R&D expenditures (in per cent)



Source: Czech Republic – Czech Statistical Office (VTR5-01), other countries – OECD (MSTI 1/2003)

Commentary:

(1) All over the world the universities belong among important sectors performing research and development. The benefit and necessity of uniting research with the university education is not doubted anywhere in the world. The shares of universities in the total R&D support differ according to various countries. First and foremost they are influenced by development and tradition until now, structure of the research base and structure of the industry, or share of industrial sectors imposing high demand on R&D respectively. No extreme changes – increase or decrease in the university share – occur and never have occurred. No extreme changes occur in the private or public sectors either.

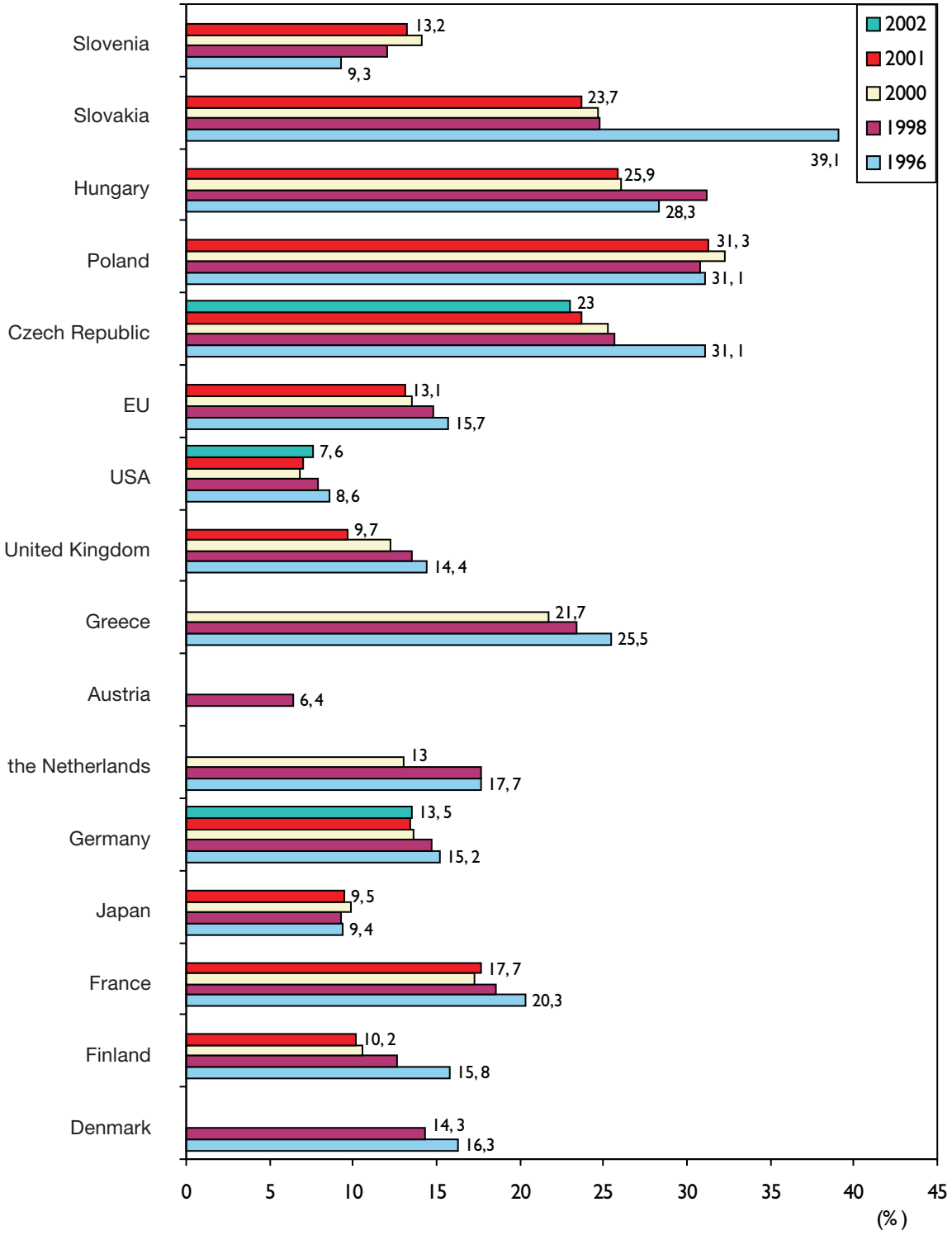
(2) For Greece the 1995, 1997 and 1999 values are given.

(3) In the EU as a whole the share of use of total R&D funds on universities has been moving around 21 % during the monitored years. Of the EU member states it is higher in Austria (29.7 % in 1998, for other years data are not available) and in the Netherlands (29.2 % in 2000).

(4) The non-European developed countries, namely the United States and Japan, report very low shares of use of funds on universities, in both countries below 15 %. Of the monitored countries less is reported only by Slovakia (9 % in 2002).

(5) In the Czech Republic the share of universities increased from 8.9 % in 1996 to 15.6 % in 2002, but still is lower than the average of the EU as a whole – the above mentioned 21 %.

A.4.3 Share of R&D funds used in the public (governmental) sector in total R&D expenditures (in per cent)



Source: Czech Republic – Czech Statistical Office (VTR5-01), other countries – OECD (MSTI 1/2003)

Commentary:

(1) The statements about the dependency of the evaluated sector's share on the development, traditions, structures of research and industry mentioned in point (1) of the commentary on Graph A. 4.2 applies also to the public (governmental) sector.

(2) With exception of Slovenia, where the share of public sector increases, and Poland and Japan, where it stagnates, in most of the monitored countries the share of public sector declines. It is the result of the already mentioned liberalism of economies and lower redistribution of funds through the state budget.

(3) In the EU as a whole the share of public sector fell from 15.7 % in 1996 to 13.1 % in 2002. Higher shares are reported by France and Germany (renowned associations of the Max Planck Society institutes, associations of the Helmholtz, Leibniz and Fraunhofer Society in Germany and CNRS institutes and other institutions in France). Very low and further decreasing share is reported by the United States (7.6 % in 2002).

(4) In evaluation by sectors in which the research is performed the share of public sector in the Czech Republic markedly decreased from 31.1 % in 1996 to 23 % in 2002. But the share of public sector in the Czech Republic is still higher than the share in the EU as a whole. In other candidate countries, with the exception of Slovenia, the share of public sector is higher than the share of this sector in the Czech Republic.

B. Analysis of R&D support from public funds

In accordance with Act No. 130/2002 Coll. on research and development support the Research and Development Council processes, inter alia, the proposals of medium term outlooks for the research and development support and estimates of total R&D expenditures of the individual budget chapters and their distribution. Within performance of this authority the Research and Development Council, in co-operation with the Ministry of Finance, collects, analyses and interprets data on the medium-term expenditure outlooks and state budgets for respective years.

The submitted R&D analysis in this Section follows up with the analysis approved by the Government in May 2002. Analysed is the trend of the overall R&D support from public funds, trend of the overall support at selected providers, and in addition the trend of institutional and targeted support at selected providers. The analysis of May 2002 evaluated the development between 1993 and 2002[1]. The presented analysis evaluates the period between 1996 and 2003.

Data on the public support of R&D in this Section slightly differ from information in the previous Section A that are based on data ascertained by inquiries of the Czech Statistical Office (CSO), while the source for the Section B data is the State Budget and medium-term outlook. Differences between data of the statistical bureaus and ministries of finance occur in most of the countries.

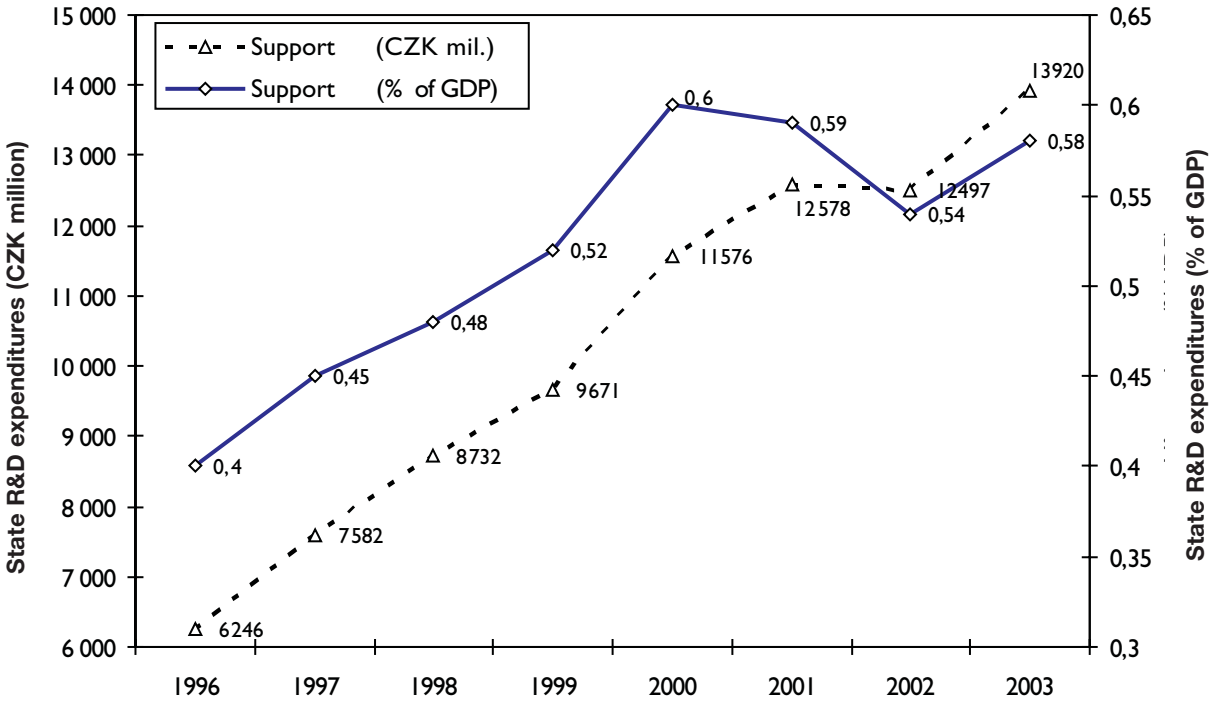
In the Czech Republic the public support of research and development is extended from the budget chapters of the central and other administrative agencies and from budget chapters of the Academy of Sciences of the Czech Republic and Grant Agency of the Czech Republic. Seven providers having the highest R&D expenditures from the public support have been included into the presented analysis: Academy of Sciences of the Czech Republic (AV ČR), Grant Agency of the Czech Republic (GA ČR), Ministry of Industry and Trade (MPO), Ministry of Education, Youth and Sport (MŠMT), Ministry of Health (MZ), Ministry of Agriculture (MZe), and Ministry of Environment (MŽP).

The following part of analysis includes 4 graphs:

- Trend of state R&D expenditures (CZK mil and % of GDP)
- Trend of state subsidies extended to research and development in some selected resorts (CZK mil)
- Trend of institutional support extended to research in selected resorts (CZK mil)
- Trend in targeted support of research and development in selected resorts (CZK mil)

[1] The 2002 analysis is available on Internet on www.vyzkum.cz in the part Dokumenty VaV.

B.1 Trend of state R&D expenditures (CZK mil and % of GDP)



Source: State budget of the Czech Republic, 1996—2003

Note: The figures referring to % of GDP and state R&D expenditures are based on data published by the Ministry of Finance. The latter differ from data promulgated by the Czech Bureau of Statistics (CBS), employed in Section A. Expenditures in CZK million are reported in current prices of respective years.

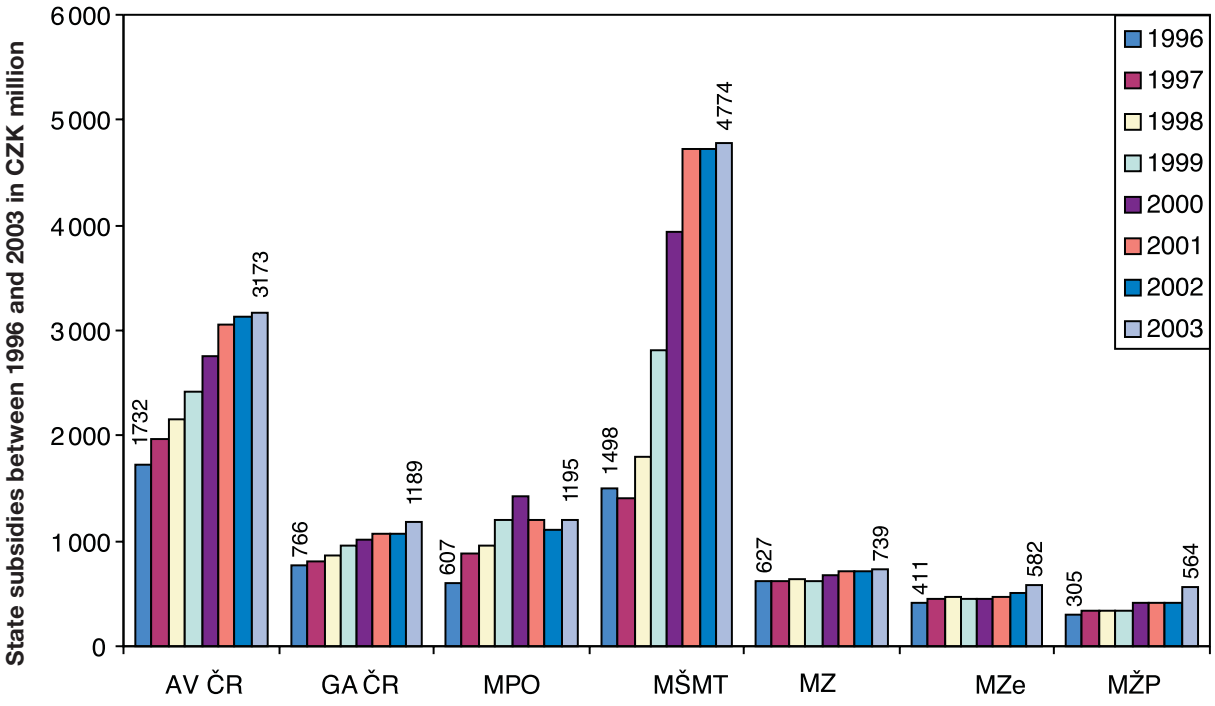
Commentary:

(1) The state R&D expenditures expressed in standard indicator % of GDP were rising till 2000; between 1998 and 2000 their rise was a relatively dynamic one. In 2000 they reached 0.6 % of GDP, the highest level throughout the existence of the Czech Republic. In the next two years the support was decreasing, in 2001 to 0.59 % of GDP and in 2002 even to 0.54 % of GDP. The year 2003 experienced a slight increase to 0.58 % of GDP.

(2) The decrease in 2001 and 2002 was the result of the fact that the Government and individual resorts started, as their budgetary priorities, to give preference to settlement of actual problems to creation of conditions for the economic growth in the future. The repeatedly announced target to reach the support level of 0.7 % of GDP is going into abeyance for the moment despite the frequent criticism from the EU bodies. The Czech Republic evidently will not satisfy the call of the EU to reach the overall R&D expenditures in the amount of 3 % of GDP until 2010, of this 1 % of GDP from public funds.

(3) The R&D expenditures in CZK million of current prices were raising influenced by the growth of GDP till 2001 (ca CZK 12.6 milliard). But in 2002 they decreased to ca CZK 12.5 milliard despite the GDP growth. In 2003 ca CZK 13.9 milliard is to be spent on research and development from the public funds.

B.2 Trend of state subsidies extended to research and development in some selected resorts (CZK million)



Source: State budget of the Czech Republic, 1996—2003

Note: AV ČR – Academy of Sciences of the Czech Republic, GA ČR – Grant Agency of the Czech Republic, MPO – Ministry of Industry and Trade, MŠMT – Ministry of Education, Youth and Sport, MZ – Ministry of Health, MZe – Ministry of Agriculture, MŽP – Ministry of Environment. Expenditures in CZK million are reported in current prices of respective years.

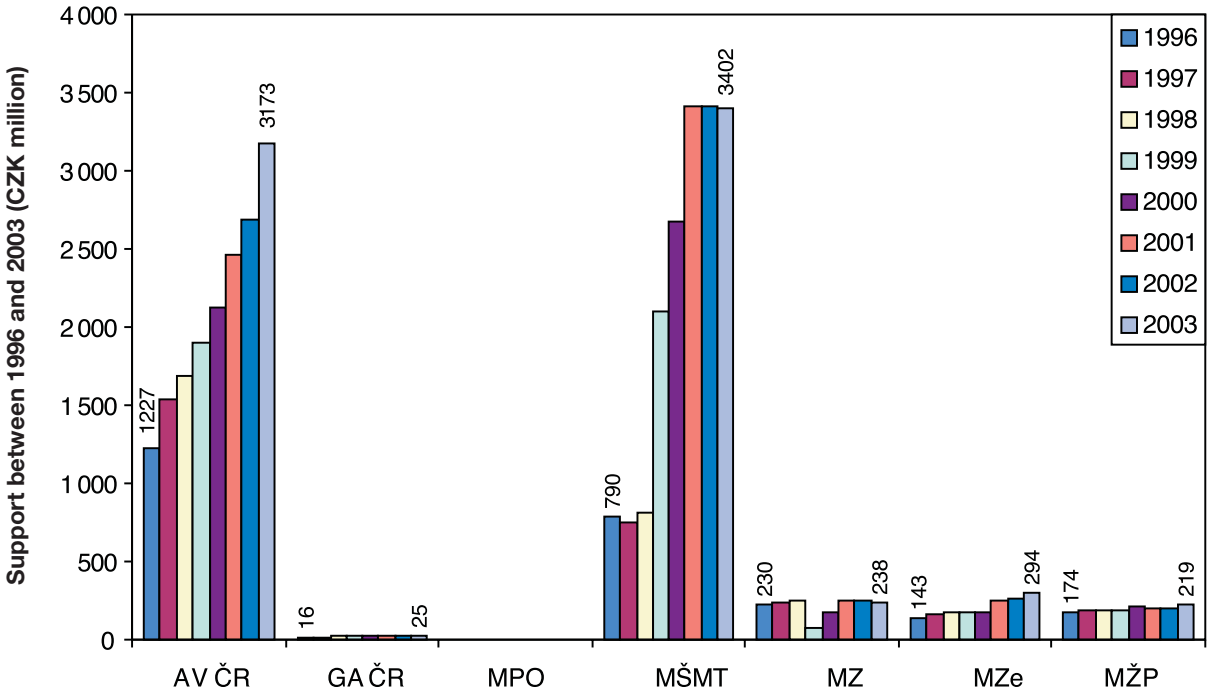
Commentary:

(1) The R&D expenditures increased in all resorts during the monitored period. But the dynamics of growth was different. With the exception of AV ČR and MZe all other providers reflect the decline of overall support in 2002 against 2001. The growth with AV ČR was the result of funds extended for increasing the wage tariffs.

(2) The largest growth was experienced by MŠMT; in 2003 the expenditures are more than triple fold when compared with 1996. This increase has resulted from the growth of international co-operation in research and development supported predominantly from the MŠMT funds, and also from the consistently enforced support of research and development on universities in compliance with the National Research and Development Policy of the Czech Republic. For AV ČR the expenditures increased in 2003 to 1.8 multiple of the 1996 expenditures. The expenditures of MZ, MZe and MŽP basically stagnate, or experience only a very slight growth.

(3) Serious problem is the trend of expenditures of MPO. The Ministry of Industry and Trade should be the major supporter of the applied research and development. Between 2000 and 2001 the expenditures of MPO declined, in the subsequent years the expenditures basically stagnate.

B.3 Trend of institutional support extended to research in selected resorts (CZK million)



Source: State budget of the Czech Republic, 1996–2003

Note: AV ČR – Academy of Sciences of the Czech Republic, GA ČR – Grant Agency of the Czech Republic, MPO – Ministry of Industry and Trade, MŠMT – Ministry of Education, Youth and Sport, MZ – Ministry of Health, MZe – Ministry of Agriculture, MŽP – Ministry of Environment. Expenditures in CZK million are reported in current prices of respective years.

Commentary:

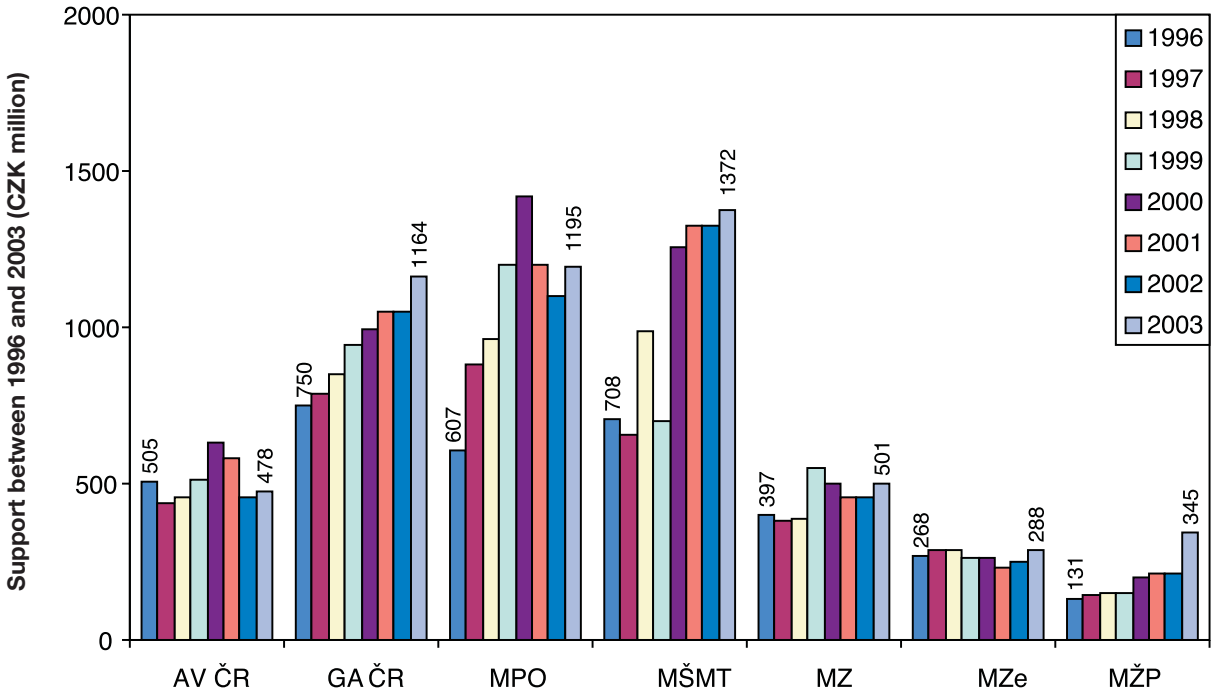
(1) The institutional support of research till 1998 acquired the form of a subsidy to contributory and budgetary R&D organisations of particular providers. Since 1999 this support is provided based on the research plans. With MŠMT this institutional support has another two forms (see point 4 of the commentary).

(2) MPO does not provide the institutional support. The research organisations under its authority, or authority of its predecessors respectively, were privatised in the beginning of nineties of the last century. The institutional funds of GA ČR are intended for ensuring its administration and management charges.

(3) The institutional support from the funds of AV ČR grows more quickly than its overall expenditures on research. The reason is that as a result of the generally limited funds the targeted support of research and development stagnates as depicted in the following graph.

(4) From the institutional funds MŠMT finances the research plans, supports the so called specific research on universities, i.e. research connected with education of students, in which the students themselves participate. From the institutional funds MŠMT covers also charges for participation of the Czech Republic in the EU framework programmes of research and development of technologies.

B.4. Trend in targeted support of research and development in selected resorts (CZK million)



Source: State budget of the Czech Republic, 1996–2003

Note: AV ČR – Academy of Sciences of the Czech Republic, GA ČR – Grant Agency of the Czech Republic, MPO – Ministry of Industry and Trade, MŠMT – Ministry of Education, Youth and Sport, MZ – Ministry of Health, MZe – Ministry of Agriculture, MŽP – Ministry of Environment. Expenditures in CZK million are reported in current prices of respective years.

Commentary:

(1) Targeted support of research and development is extended to R&D projects on the basis of the public tender results. GA ČR and AV ČR provide support to grant projects. Other providers, including AV ČR, support projects that are part of their announced R&D programmes and public contract in R&D.

(2) Targeted support of research and development from the MPO funds grew till 2002; in 2001 it declined significantly and still stagnates. See also the commentary to the chart B.2.

(3) Targeted support from the GA ČR funds continuously grows, as well as the total support. Targeted support provided by MŠMT also grows, accompanied by certain fluctuations.

(4) Targeted support of other providers, with the exception of MŽP, basically stagnates. MŽP experienced considerable increase of the targeted support in 2003.

C. Analysis of R&D information system data (R&D IS)

The research and development information system (R&D IS) is one of information systems of the public administration. It is managed and operated by the Research and Development Council. Its framework structure, purpose and other basic requirements are stipulated by Act No. 130/2002 Coll. on support of research and development. Details are regulated by Decree of the Government No. 267/2002 on the research and development information system.

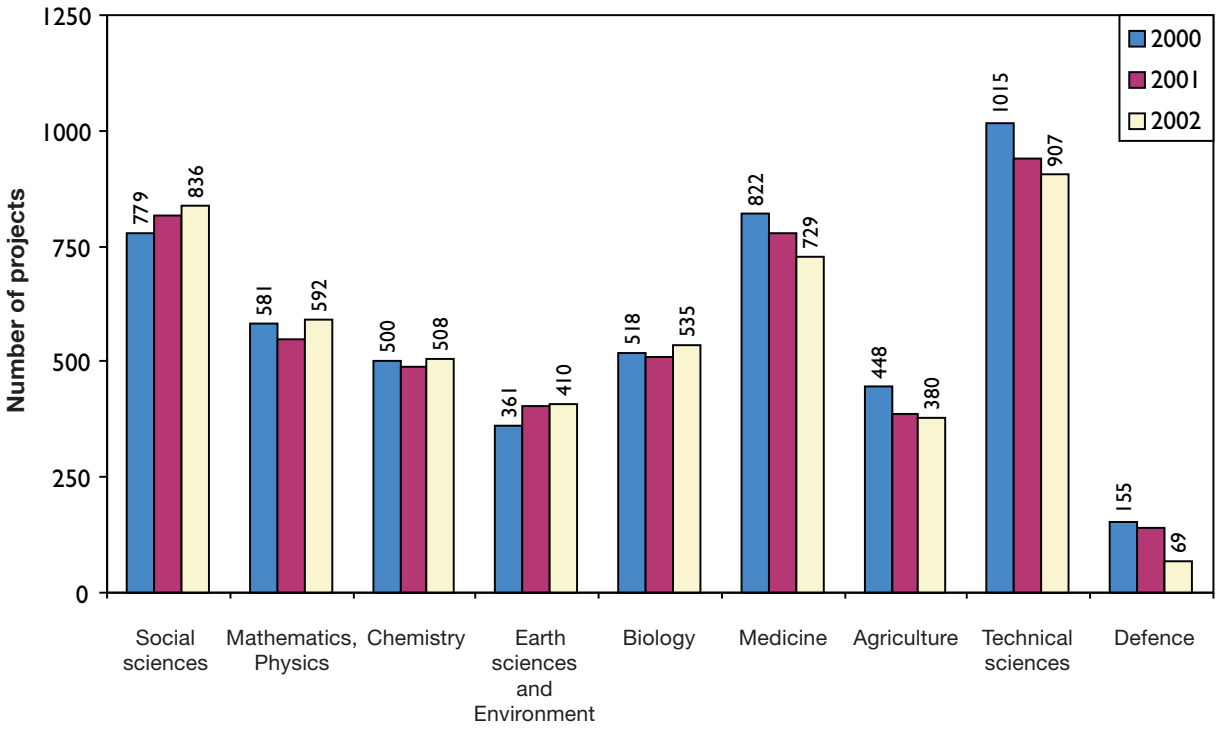
R&D IS has four interrelated parts: central evidence of R&D projects (CEP), central evidence of research plans (CEZ), register of information on results (RIV) and evidence of public tenders in R&D (VES).

Data from R&D IS were employed also in the R&D analysis approved by the Government in May 2002. This part of presented analysis follows up with the analysis of the previous year. It was supplemented by data for 2002, certain graphs were excluded. The graphs with related commentaries analyse the main parameters of two basic forms of R&D support in the Czech Republic, i.e. targeted support of R&D projects and institutional support of R&D on universities, institutes of the Academy of Sciences of the Czech Republic and research institutes of the resort ministries.

This part of analysis contains 10 graphs:

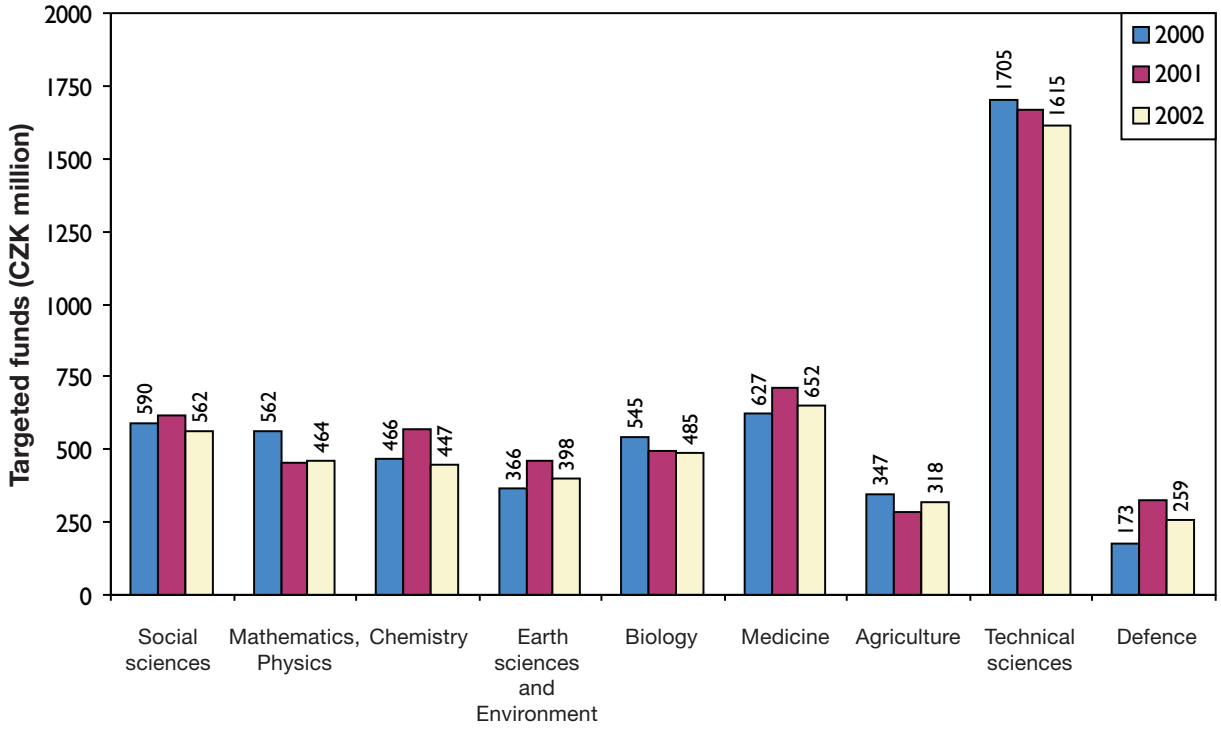
- Number of R&D projects classified by sector between 2000 and 2002
- R&D projects classified by sector between 2000 and 2002 pursuant to the amount of funds
- Number of R&D projects pursuant to the amount of targeted support between 2000 and 2002
- Age of R&D principal investigators between 2000 and 2002
- Number of research plans classified by sector between 2000 and 2002
- Research plans classified by sector between 2000 and 2002 pursuant to the amount of funds
- Number of research plans pursuant to the amount of institutional support between 2000 and 2002
- Age of principal investigators of research plans between 2000 and 2002
- Number of R&D results registered between 2000 and 2002, classified pursuant to the type of the result
- Number of R&D results registered between 1998 and 2002, classified pursuant to the categories of recipients and type of the result

C.1 Number of R&D projects classified by sector between 2000 and 2002



Source: R&D IS, Central Evidence of Research and Development Projects (CEP)

C.2 R&D projects classified by sector between 2000 and 2002 pursuant to the amount of funds



Source: R&D IS, Central Evidence of Research and Development Projects (CEP)

Commentary:

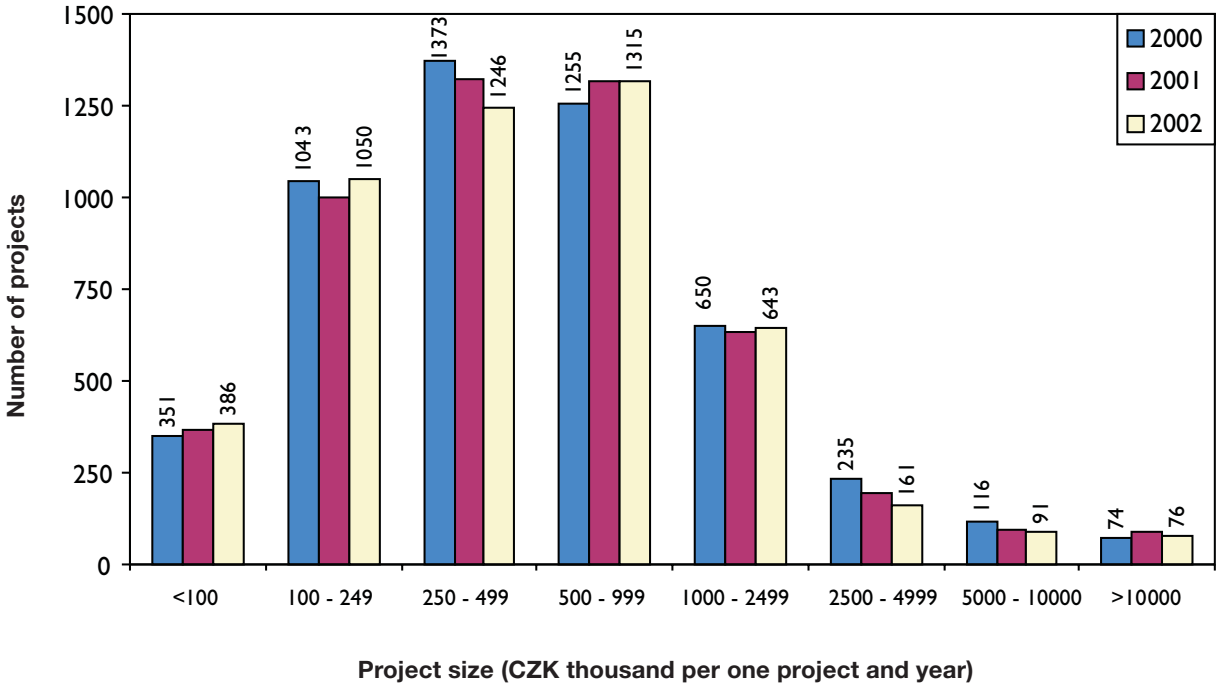
(1) The graphs provide information on the trend in the number of projects in particular fields of science and amount of targeted support to these projects. Data on the average support of one project in the monitored fields may be derived and compared with certain foreign conceptual documents on research and development. In the last years the efforts are manifested in the EU and various member states to increase the size of research projects and create the so called critical amount of capacities (people, financial means, etc.). Also the graph C.4 concerning research plans is processed likewise.

(2) The number of projects in the field of social sciences and Earth and environmental sciences has been increasing during the monitored (2000–2002) period. In other fields the number of projects stagnates or declines.

(3) In 2002, the largest average size is attained by projects in the field of technical sciences – ca CZK 1.5 million per one project. Then follows biology and Earth sciences and Environment – ca CZK 1 million per one project, and medicine and chemistry – ca CZK 0.85 million per one project. The least support is attained by projects in the field of social sciences – ca CZK 0.75 million per one project.

(4) The targeted support of research and development remains fragmented into large number of projects with small or medium support.

C.3 Number of R&D projects pursuant to the amount of targeted support between 2000 and 2002



Source: R&D IS, Central Evidence of Research and Development Projects (CEP)

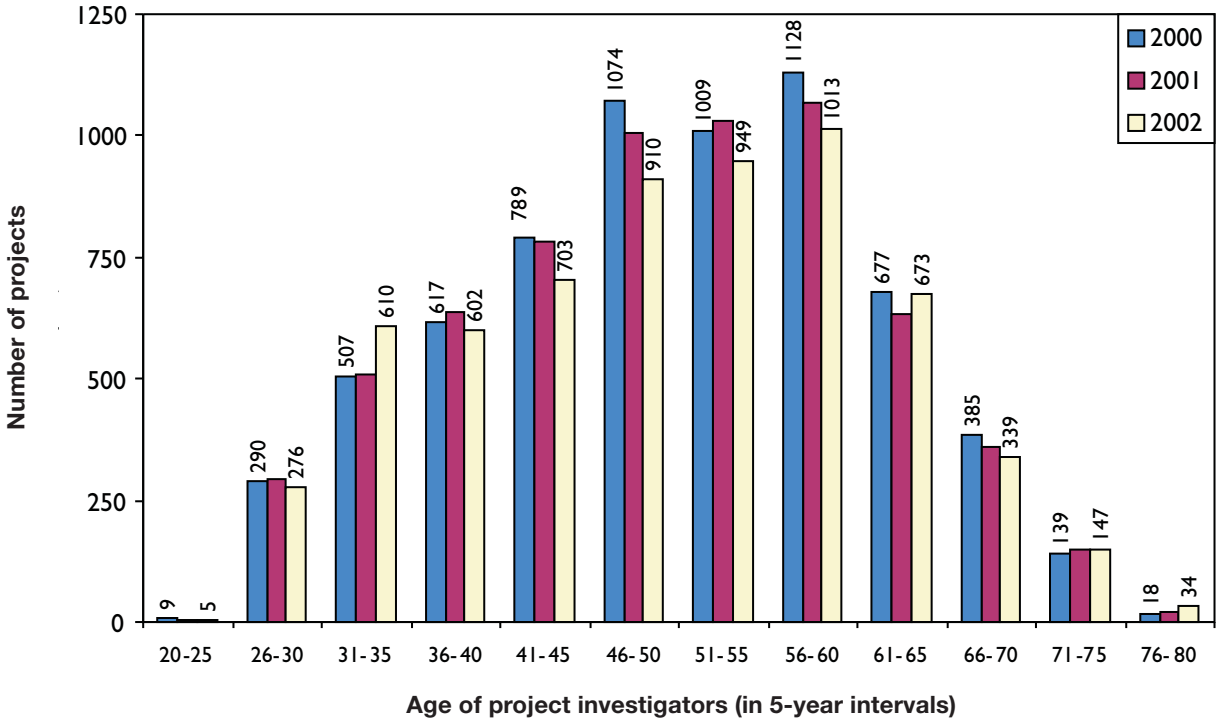
Commentary:

(1) This graph depicting the distribution of number of projects pursuant to the amount of support confirms the statements made in the commentary on the previous graph. In 2000, most of the projects belonged into the category between CZK 250 thousand and CZK 499 thousand of annual support. In 2002, the maximum moved into the category of larger projects, i.e. between CZK 500 thousand to CZK 999 thousand of annual support, but differences are minor.

(2) Other categories experienced a moderate increase in the number of projects with small support, and in turn a moderate decrease in the number of projects with larger support. The rise in the number of smaller projects was evidently contributed by the so called “post-doctorand grants”. The number of projects in the category having the annual support larger than CZK 10 million basically stagnates.

(3) Projects having annual support around CZK 0.5 million do not allow for creation of sufficient capacities for solution of more demanding scientific problems, not even in the social sciences. Excessive fragmentation of the support into large number of small projects burdens all participants in the processes of draft projects preparation, their evaluation and selection, contract conclusion, support extension and evaluation of attained results.

C.4 Age of R&D principal investigators between 2000 and 2002



Source: R&D IS, Central Evidence of Research and Development Projects (CEP)

Commentary:

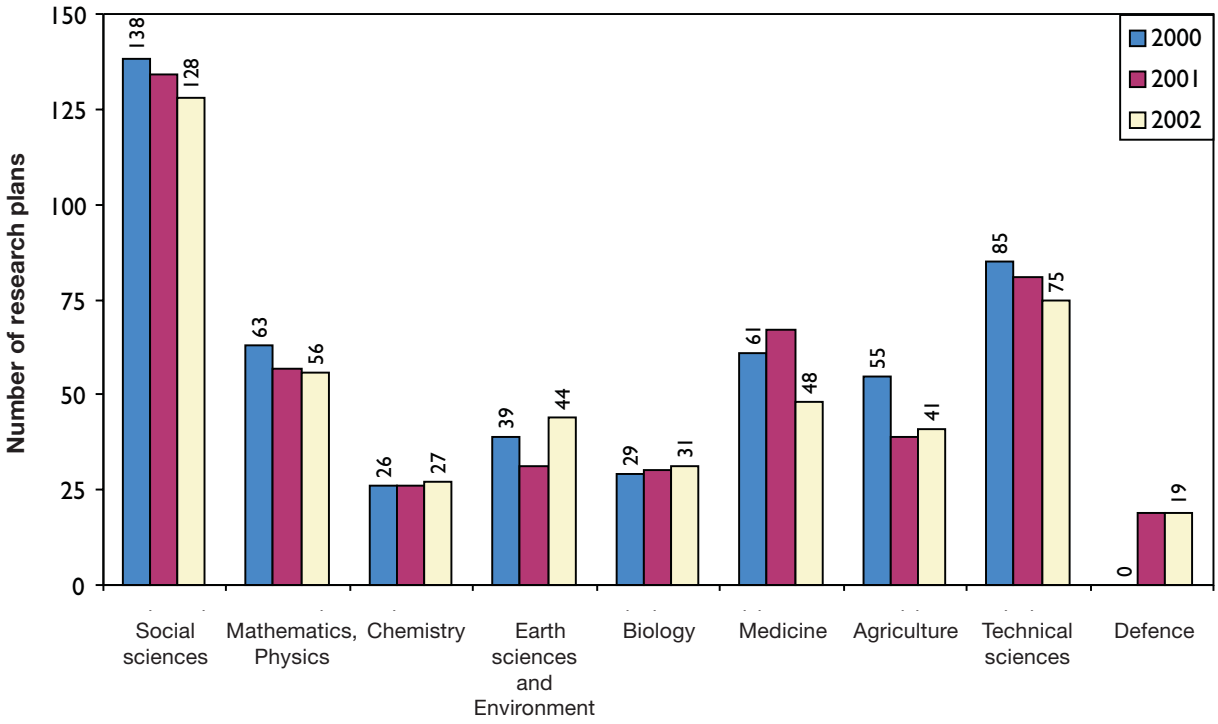
(1) In 2002, the two-peak curve of the average age of principal investigators in 2000 with maximums of 1 074 projects with the age of principal investigator between 46 and 50 years and 1 128 projects with the age of principal investigator between 56 and 60 years changed into one-peak curve with maximum of 1 013 projects in the category between 56 and 60 years. Relatively significant decline in the number of projects was experienced by categories between 41 and 45, 46 and 50, and 51 and 55 years.

(2) The increase in the number of projects with the age of principal investigator in a category between 31 and 35 years from 507 in 2000 to 610 in 2002 may be described as a positive one.

(3) In other age categories there are only minor changes.

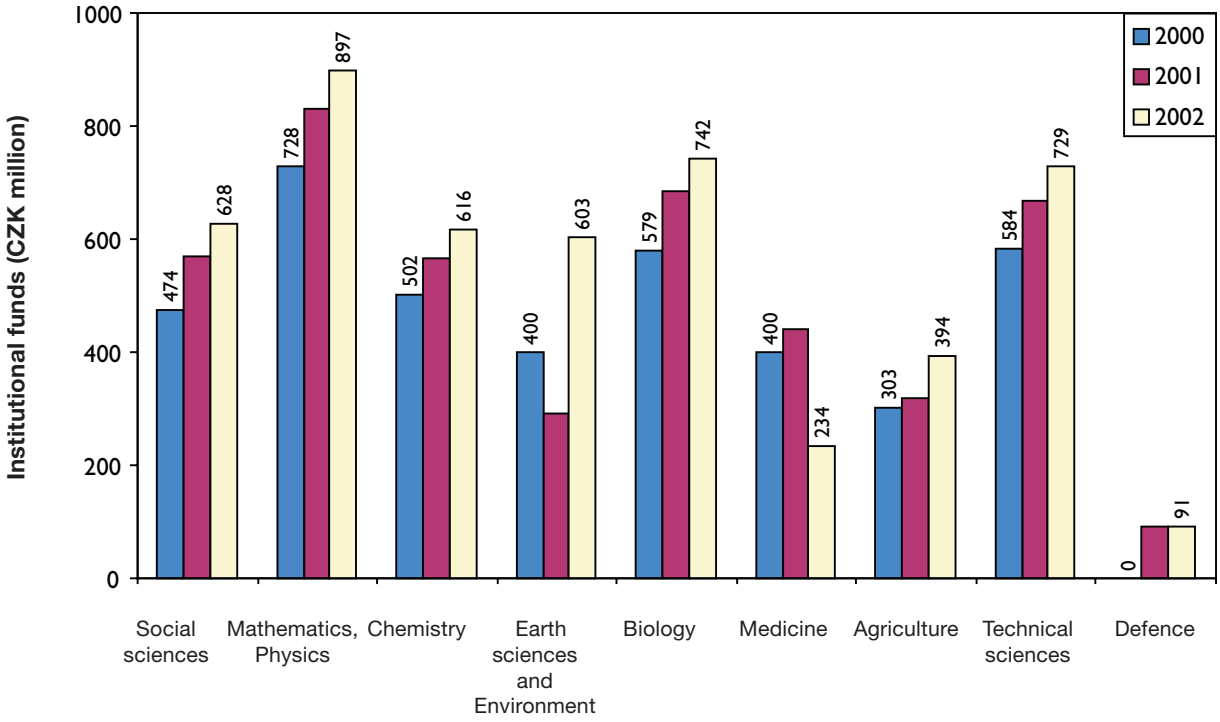
(4) It is premature to derive any conclusions from the favourable changes in 2002 against 2001. The age structure still remains a serious problem of the research base in the Czech Republic.

C.5 Number of research plans classified by sector between 2000 and 2002



Source: R&D IS, Central Evidence of Research Plans (CEZ)

C.6 Research plans classified by sector between 2000 and 2002 pursuant to the amount of institutional support



Source: R&D IS, Central Evidence of Research Plans (CEZ)

Commentary:

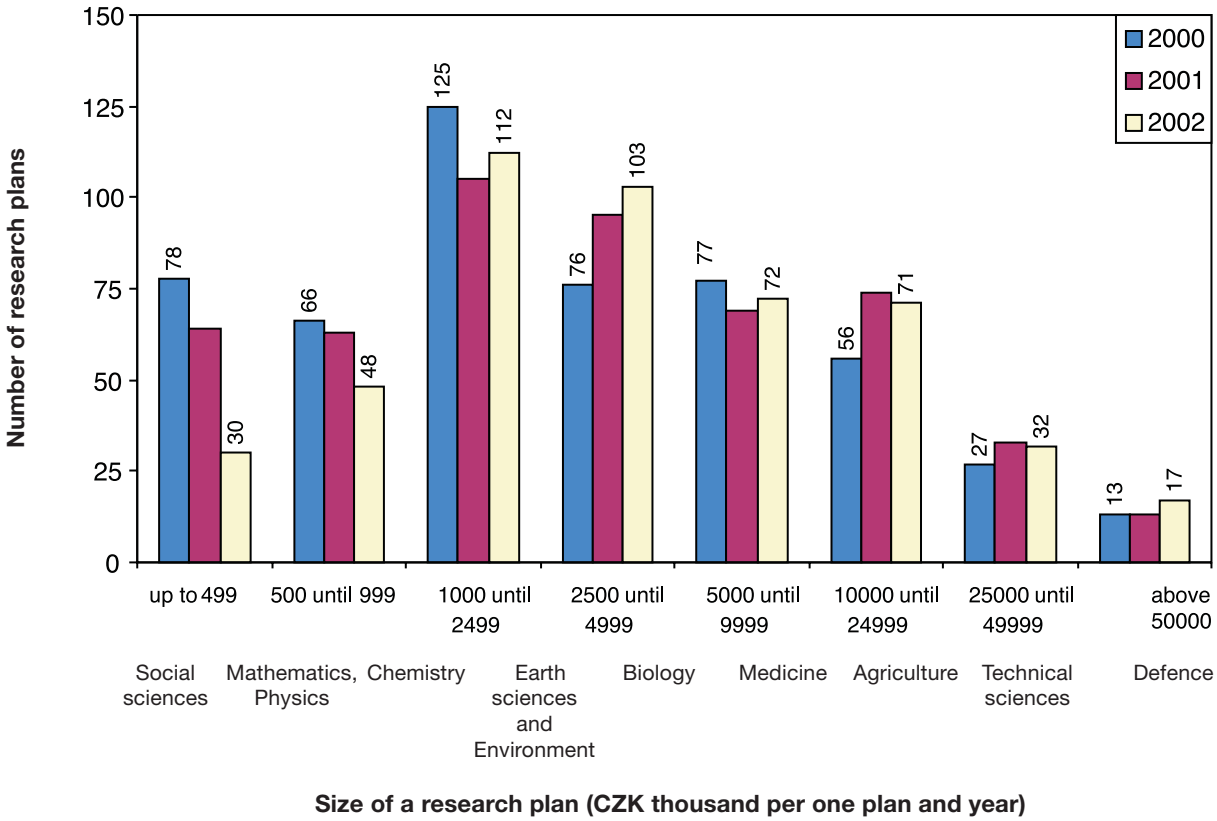
(1) No research plan was supported in the field of defence in 2000.

(2) With the exception of medicine the total support of research plans in other monitored fields grew. The largest support in 2002 was acquired by research plans in mathematics, physics (ca CZK 900 mil per year), then in biology and technical sciences – in both cases ca CZK 750 million per year.

(3) As far as the number of research plans is concerned, a moderate increase was experienced in chemistry and biology, most others slightly decreased. The highest number of research plans is in the field of social and technical sciences.

(4) The highest average support was extended in 2002 to research plans in biology (ca CZK 25 million per one plan and year), followed by plans in mathematics and physics (ca CZK 15.8 million per one plan and year) and in technical sciences (ca CZK 10 million per one plan and year). The lowest average support was extended in 2002 to research plans in medicine (ca CZK 5 million per one plan and year) and social sciences (ca CZK 4.8 million per one plan and year).

C.7 Number of research plans pursuant to the amount of institutional support



Source: R&D IS, Central Evidence of Research Plans (CEI)

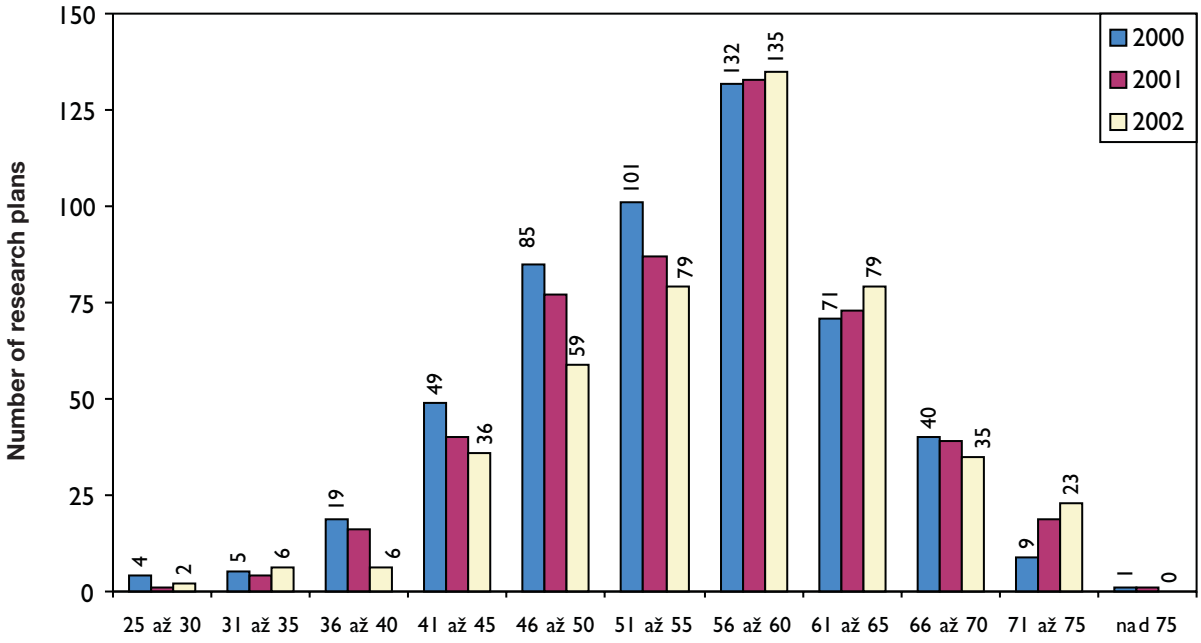
Commentary:

(1) The research plans are the principal form of extension of institutional support to research and development. "Institutions" (parts of institutes, teams, etc.) having annual support up to CZK 400 thousand, or CZK 900 thousand respectively, have many other possibilities how to enter for support, the form of research plans, however, is not suitable for them. This conclusion was arrived at by the R&D analysis from 2002 as well.

(2) It is satisfying that even at stability of research plans – they are drawn up and approved for the period of 5 years – relatively significant changes took place. Between 2000 and 2002, the number of small research plans, i.e. up to CZK 1 million or 2.5 million of annual support respectively, declined. And on the other hand the number of research plans having the annual support higher than CZK 10 million increased.

(3) Another concentration of funds – increase in the support of research plans – may not be obviously expected until the new research plans that are to be initiated from 2005.

C.8 Age of principal investigators of research plans between 2000 and 2002



Source: R&D IS, Central Evidence of Research Plans (CEI)

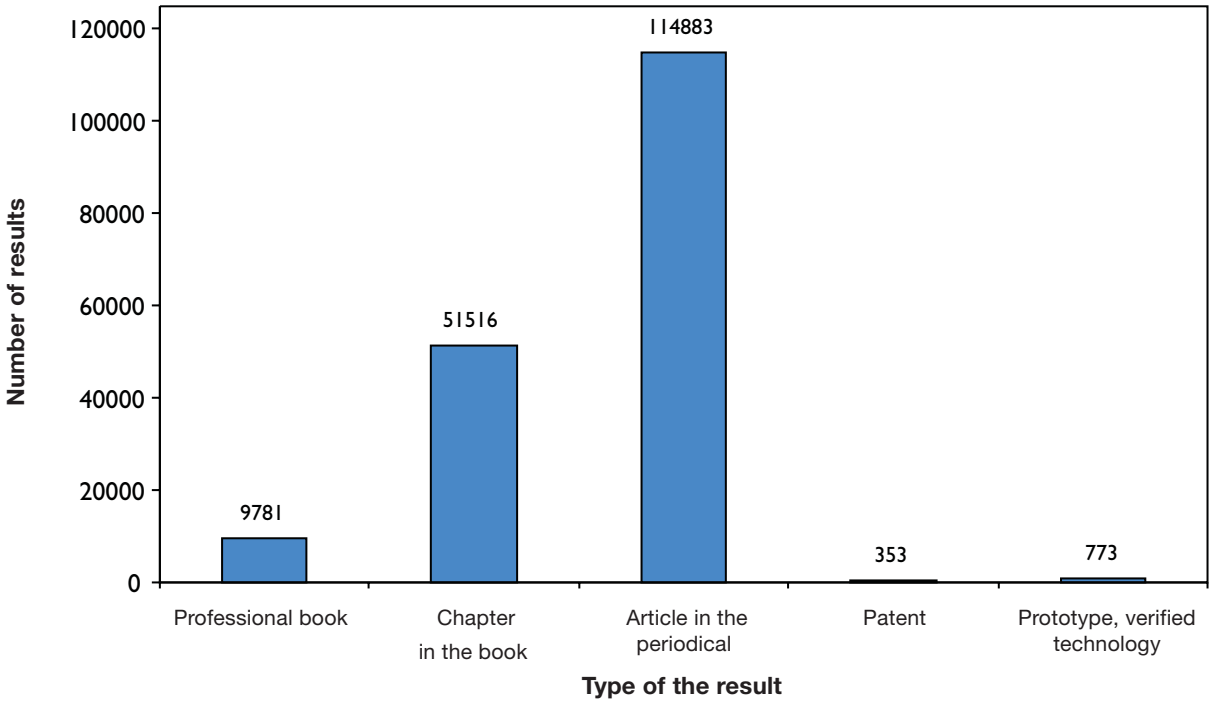
Commentary:

(1) The graph again confirms the fact that in the Czech Republic there is a high average age of research workers. Changes in respective years are mostly marginal. This follows from a certain stability of research plans. The research plans are formulated and approved for periods of 5 years in principle. Replacements in the persons of principal investigators are not frequent. In the period between 2000 and 2001, the only considerable shift took place from the category between 41 and 45 years to the category between 46 and 50 years.

(2) Particularly the "sharpness" of the graph is alarming. The prevailing part of the principal investigators – nearly one third – belongs into the category between 56 and 60 years. Also the number of principal investigators older than 61 years is remarkable. The principal investigators being younger than 40 years are rather an exception – 28 in 2000, 21 in 2001 and 14 in 2002.

(3) The age is not and may not be the criterion for selection of principal investigators of research projects and research plans, but situation described by C.4 and C.8 Figures is highly alarming in the light of knowledge of the situation in abroad.

C.9 Number of R&D results registered between 2000 and 2002 and classified pursuant to the type of the result



Source: R&D IS, Register of Information on Results (RIV)

Commentary:

(1) The graph columns depict the sums of registered R&D results, i.e. results of all R&D projects and research plans between 2000 and 2002 in following categories of results: professional books (monographs, etc.), chapters in professional books, articles in professional periodicals, invention applications (patents), prototypes, verification of technologies. The graph does not mention two other categories registered in the RIR register: presentation activities informing the public about the results of research and development; research reports – registered in cases of results containing official secrets under the special regulation. The number of results is given in thousands.

(2) The articles in professional periodicals significantly dominate. For the moment the register does not distinguish between articles in impact periodicals of the ISI system[1] and articles in other professional periodicals.

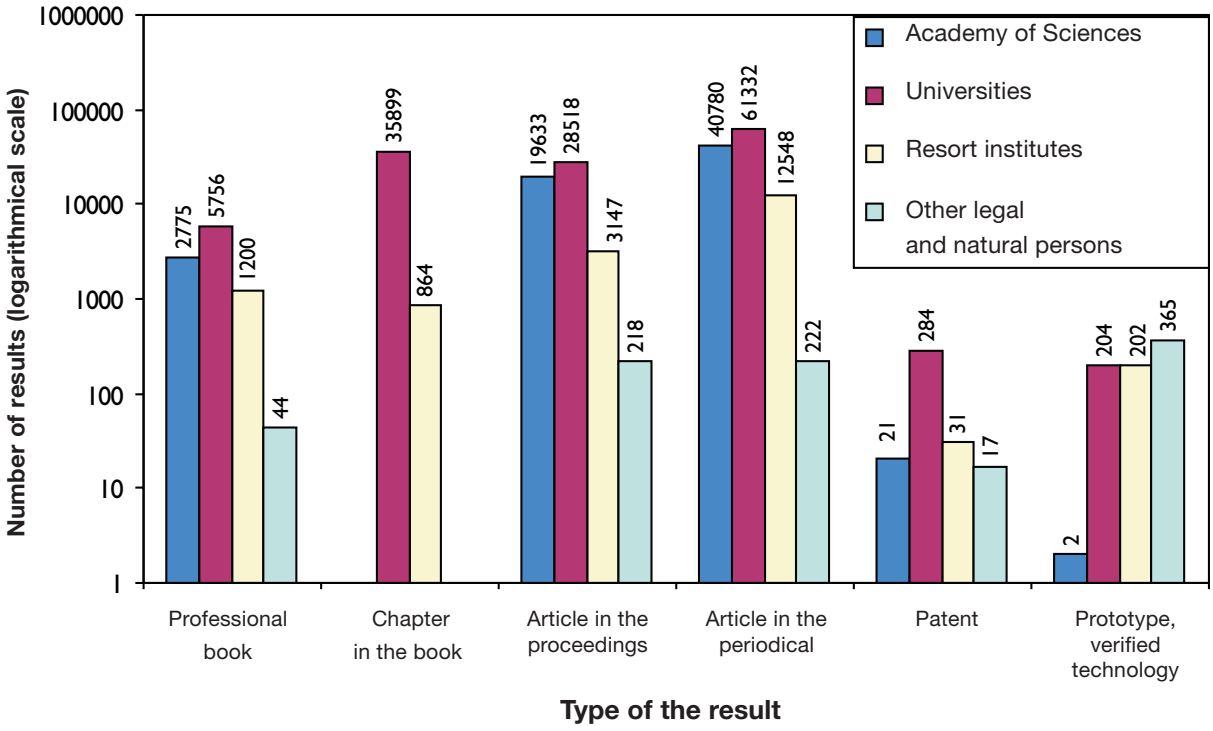
(3) The number of patent applications and verified prototypes or technologies is very low. During the three years period between 2000 and 2002 the numbers are: 353 patent applications and 773 verified prototypes or technologies.

(4) The graph reports on the wrong orientation of a significant part of research and development. The prevailing part of research and development supported from public funds[2] behaves as if being the basic research, for which the publication in renowned periodicals is the main criterion of success. This failure of research and development in the Czech Republic is testified also by appropriate graphs in Sections A and E of the presented analysis.

[1] ISI – Institute for Scientific Information, USA

[2] RIR registers only such R&D results that are attained with the support of public funds.

C.10 Number of results registered between 1998 and 2002 classified pursuant to the category of recipients and type of the result



Source: R&D IS, Register of Information on Results (RIR)

Commentary:

(1) This graph, the vertical axis of which applies a logarithmical scale, analyses data depicted in the previous graph C.7 in more details. Again it is the total number of results registered between 2000 and 2002. The number of patents, verified prototypes and technologies is very low. The results are given separately for each of the main categories of the public support recipients: Academy of the Sciences of the Czech Republic, universities, budgetary and contributory organisations (resort institutes, i.e. institutes of the line ministries) and for other legal and natural persons.

(2) With the exception of prototypes and verified technologies, in all other categories the universities report the largest number of registered results. The universities have larger personal capacities of R&D available then any other recipient of the public support.

(3) The envisaged changes in the RIR methodology allowing for distinguishing the level of published articles will lead evidently to more considerable differences between individual categories of the public support recipients, and obviously to the shift in the order.

(4) It can be expected that increase in the share of commercially applicable R&D results (patents, prototypes, etc.) will be encouraged also by provision of Act No. 130/2002 Coll. on the research and development support, under which the recipient of support in the applied research and development must conclude a contract on employment of the results with the provider, at least 180 days before termination of the contract on extension of the support.

D. Bibliometric analysis of R&D results

In the last years the bibliometric analysis, i.e. evaluation of the number of publications and their citations, despite all reservations against its objectivity, methodology and other aspects, became an integral part of documents evaluating the level of research in the member countries of OECD, as well as in the European Union. In abroad, the development of methodology of the bibliometric evaluation and interpretation of its results comes within the domain of large groups of experts, and frequent conferences and workshops are held on the issue of the bibliometric evaluation. The renowned scientific periodicals in abroad regularly publish the top-tens of research workers in individual scientific branches according to the number of publications or quotations. Published are the lists of top workplaces of individual scientific branches.

The most common and used source of data for bibliometric evaluation are information acquired and arranged by the Institute for Science Information – ISI (now ISI Thomson Scientific) in the United States. The Institute monitors and regularly evaluates several thousands of scientific periodicals all over the world. Considering the time, personal, and therefore financial demands the Institute provides information and products for their processing largely against payment. The information databases and program products for their processing experience a rapid development with the development of information and communication technologies in general.

The approach of the professional public to the bibliometric analysis in the Czech Republic has been and still is rather a reserved one. The reasons of this reservation may be summarised into three blocks. On one hand there is a legitimate critical warning of professionals on certain aspects reducing the objectivity of the bibliometry. The second block of reasons represent concerns of part of the professional public for the results of the bibliometry not to be misused by some simplified administrative approach to decision-making on the future of research and development in the Czech Republic. The third block of reasons may be briefly characterised as aversion against any evaluation of successiveness and effectiveness of research and development, any comparisons on the level of countries, institutions, organisations, teams or individuals.

But it may be put that the aversion against bibliometric evaluation is becoming rather weak. The bibliometric evaluation on the level of states was part of analyses submitted to the Government and approved by it in 1999 and 2002. The representatives of universities, the Academy of Sciences of the CR, and resort research workplaces, as well as representatives of research workplaces from the corporate sphere have been active in the working groups for preparation of the analyses in question. The analyses were made in a professional and objective manner and the discovered results were not interpreted in a bureaucratic way.

The presented analysis in this Section follows up with the analysis from May 2002. Minor changes in the selection of evaluated indicators and differences in the selection of evaluated countries in comparison with other parts of the presented analysis are caused by the product that was possible to be acquired at limited financial means from ISI Thomson Scientific.

The presented analysis evaluates seven indicators:

- Comparison of selected countries and the Czech Republic by the RPP indicator in 2000 (relative production of publications) in 2000
- Annual publications production of the Czech Republic between 1994 and 2002
- Comparison of selected countries and the Czech Republic by the RPC indicator in 2000
- Comparison of selected countries and the Czech Republic by the RelC indicator in 2000
- Comparison of selected countries and the Czech Republic by the RCI indicator in 2000
- Annual bibliometric quality of publications of the Czech Republic between 1994 and 2002
- Comparison of scientific disciplines in the Czech Republic by the RCIO indicator in 2000

D.1.1 Comparison of selected countries and the Czech Republic by the RPP indicator in 2000

Country	RPP
Finland	1.37
the Netherlands	1.15
USA	0.88
Austria	0.82
France	0.77
Germany	0.77
EU	0.71
Japan	0.54
Greece	0.43
Czech Republic	0.38
Slovakia	0.32

Source:

National Science Indicators (NSI), product of Research Services Group, Thomson ISI, Philadelphia USA,
OECD in Figures 2002/Supplement 1

Note:

RPP stands as abbreviation for indicator of the relative publications production indicating the number of publications produced by the research of a particular country in 2000 per 1 000 inhabitants of that country.

Commentary:

(1) The professional research publications production indicator enables one to compare bibliographic outputs of that part of research of a particular country the main result of which is a new knowledge diffused through a professional research publication. These are particularly parts of research that are as classified in the manual Frascati (Evaluation of scientific and technical activities, OECD, Paris 2002) identified as basic research and part of the applied research. The publications production measures the extent of these parts of research and their effectiveness and reflects the quality of the research system of a particular country. The indicator of simple publications production discriminates smaller countries having smaller scope of research than bigger ones. Therefore it is more just to use for comparison of the countries the indicator **relative publications production** implementing the correction to the size of each country.

(2) In our case the Czech Republic is compared within the group of 10 selected countries and the EU by the RPP indicator. Among those selected are great powers, technologically advanced European countries, countries with effective science, technology and innovations, neighbouring countries, and Greece. The average value of this indicator for the EU may serve as a comparison standard.

(3) In the monitored year 2000 the Czech Republic took last but one place as classified by value of the RPP indicator arranged in the descending order within the group of 10 selected countries and one region, with RPP = 0.38. It is a little more than a half of the value reported as the EU average. Slovakia reports a close value of the RPP indicator and takes the place after the Czech Republic.

(4) Remarkable is the value of the RPP indicator for Finland and the Netherlands reaching nearly double the value of the indicator corresponding with the average of the EU countries. These countries have developed and fully functional research system that together with a high quality management and effective funding enables the above-average results to be attained not only in the basic and applied researches. Therefore favourable conditions for maintenance of science and performance of research must be created by the state that is responsible for management of this area. But the key parameter for attainment of excellence (higher level than the world standard) in science (as well as in all areas of the society) is the personal input into the research – source of the human capital – the quality of which is determined by the level of the educational system of the country that is also under the management of the state.

(5) Decisive for the level of the RPP indicator is the research capacity (number of research workers – FTE) of the basic research in particular. The relation between the number of research workers per 1 000 inhabitants of the country (as well as of new PhD's per 1 000 inhabitants) and production of professional research publications is evident when comparing the countries.

D.1.2 Annual publications production in the Czech Republic between 1994 and 2002 (time dependence of the simple publications production)

Year	Publications
1994	3 217
1995	3 199
1996	3 628
1997	3 573
1998	3 802
1999	3 870
2000	3 945
2001	4 303
2002	4 478

Source:

National Science Indicators (NSI), product of Research Services Group, Thomson ISI, Philadelphia USA

Note:

Indicator of the annual publications production expresses the simple number of publications created by the research of the Czech Republic in the course of the year in question.

Commentary:

(1) The table shows that the simple annual production of professional research publications of the Czech Republic since 1994 till now has reported a positive trend of growth with small variations at the beginning of the monitored period. Considering the fact that the indicator of the simple publications production is above all the measure of the extent of the basic research of a country, the change in the annual number of publications of a country is evidently connected with the annual changes experienced during the considered period in the research capacities of the basic research in particular, and not with the increase in the productivity of the research itself. This conclusion is confirmed by the constant value (0.28) of the indicator of the bibliometric productivity expressed by the number of publications per one research worker (FTE), in case of the Czech Republic between 1996 and 2001. In addition, this fact documents that changes in the number of research workers in that period took place above all in the area of basic research.

D.2.1 Comparison of selected countries and the Czech Republic by the RPC indicator in 2000

Country	RPC
Finland	6.92
the Netherlands	6.62
USA	5.38
Austria	3.94
Germany	3.89
France	3.61
EU	3.27
Japan	2.12
Greece	1.43
Czech Republic	1.14
Slovakia	0.73

Source: National Science Indicators (NSI), product of Research Services Group, Thomson ISI, Philadelphia USA, OECD in Figures 2002/Supplement 1

Note:

RPC stands as abbreviation for indicator of the relative production of citations that indicates the number of citations of those publications that were produced by the research of a particular country in 2000 per 1 000 inhabitants of that country.

Commentary:

(1) The Czech Republic and Slovakia close the table of 10 selected countries and the EU made in the descending order as classified by value of the RPC indicator. The table is headed by Finland with the value of the RPC indicator more than double the value of the EU countries average. Austria, France and Germany with very near values of that indicator hold closely above the value of RPC for the EU countries average.

D.2.2 Comparison of selected countries and the Czech Republic by the RelC indicator in 2000

Countries	RelC
the Netherlands	1.13
Finland	1.11
USA	1.09
Germany	1.06
Austria	1.06
France	1.05

Countries	RelC
EU	1.05
Japan	1.02
Greece	0.97
Czech Republic	0.93
Slovakia	0.85

Source: National Science Indicators (NSI), product of Research Services Group, Thomson ISI, Philadelphia USA

Note: RelC stands as abbreviation for the indicator of the relative citation of publications of a particular country (region) in given time period, which is defined as a proportion of percentage of cited publications produced by research of a particular country in 2000 and percentage of cited publications from the overall number of publications registered in the database of Thomson ISI for 2000.

The value RelC = 1 means that the percentage of cited publications of the country is equal to the percentage of cited publications of the whole database Thomson ISI in the given time period. For RelC > 1 the percentage of cited publications of the given country is above standard, meanwhile for RelC < 1 the level of cited publications of the given country is below average in view of the state of the world database Thomson ISI in the given time period.

Commentary:

(1) In the year 2000 for which the comparison of countries is made pursuant to the value of the RelC indicator, the database Thomson ISI reports 71 % of cited publications of all publications published in all indexed periodicals.

(2) The table comparing 10 selected countries and the EU average by value of the RelC indicator in descending order is of the same character as any comparisons mentioned before. Greece, the Czech Republic and Slovakia report the below-average values of the RelC indicator, while the table is headed by the Netherlands, followed by Finland, both countries with the above-average value of the RelC indicator.

(3) The average value of the RelC indicator for the EU countries indicates that of all publications of this region published in all periodicals indexed by Thomson ISI, 75 % of publications have been cited. The Netherlands has 80 %, and the Czech Republic only 66 % of cited publications of all publications of the respective country.

(4) Any higher value of the RelC indicator for a country in question reports that research workers of that country publish results of their work in professional scientific periodicals that have received a higher mark of bibliometric quality measured by the indicator periodical impact factor (see product of Thomson ISI Journal Citation Reports, which is part of the basic instrument of the science information infrastructure Web of Knowledge). Publication of any work in a renowned periodical making heavy demands on the quality of publication during the review procedure has bigger impact on the discipline itself and the increased interest of peers is manifested by increased citation of publications.

(5) The successfulness of publication of the results of a basic research in particular in a renowned professional scientific periodical is preceded by the above-average level of attained results (priority, original solution, etc.). The intensive international collaboration and attainment of excellence (level higher than the world standard) in the own discipline has led to the increased interest of peers. Therefore the RelC values reflect in the integral manner the level of quality of the whole research system of a particular country, including the system of education.

D.3.1 Comparison of selected countries and the Czech Republic by the RCI indicator in 2000

Country	RCI
USA	1.42
the Netherlands	1.34
Finland	1.18
Germany	1.18
Austria	1.12
France	1.10
EU	1.08
Japan	0.92
Greece	0.78
Czech Republic	0.69
Slovakia	0.53

Source:

National Science Indicators (NSI), product of Research Services Group, Thomson ISI, Philadelphia USA

Note: RCI stands as abbreviation for the relative citation impact of a given country (region) defined as the citation impact of a given country (region) divided by the citation impact of the world data base (citation register) of Thomson ISI. The citation impact of a given country (region) indicates the mean number of citations per publication produced by the research of a given country (region) in 2000 irrespective of the difference of disciplines. The RCI indicator compares the level of bibliometric quality of publications of a given country (region) with the average level of bibliometric quality of publications of the world data base Thomson ISI set for 2000.

The value of RCI = 1 means that the given country (region) has the same level of bibliometric quality of publications as is the average bibliometric quality of publications of the Thomson ISI data base. RCI > 1 indicates that the level is higher than average, RCI < 1 indicates that the level is lower than average.

Commentary:

(1) The Czech Republic followed by Slovakia closes the group of 10 selected countries and the EU region ordered according to the decreasing value of RCI. The list is headed by the United States followed by the Netherlands having their values of the RCI indicator highly above the average. These countries are so different as far as the geography and population are concerned, but what is common to them both is that they are leading countries in the level of the research performance.

(2) In 2000, the bibliometric quality of publications of the basic research in particular for the countries of the EU as a whole approaches the average level of bibliometric quality of publications irrespective of the difference of disciplines of the world database (the world standard). The Czech Republic arrives only at 69 % of this level, while the Netherlands reports 134 % and the United States 142 % of the world standard. It comes down that in this case the United States has the advantage of the favourable publication and citation environment allegedly discriminating the European research workers. This fact cannot, however, formally weaken in any significant manner the position of the United States as the world power of science, technology and innovations. The only way how to equalise this alleged handicap is to struggle for creation of equal conditions in the EU as in the United States and strengthen the international collaboration, particularly with the United States. The effort at building the European Research Area and harmonisation of the national research policies of the EU countries is the way how to reduce the distance between EU and the United States.

(3) Other selected advanced countries as France, Austria, Germany and Finland report the values of the RCI indicator above the average. A moderately below-average value of the RCI indicator for Japan may be the consequence of the still not completed transformation of the research system of the country from the state of prevailing orientation to the applied research and technological development with direct outputs into the economy into a new state characterised by strengthening of the basic research on the universities in particular, as well as of the level of tertiary education.

D.3.2 Annual bibliometric quality of publications in the Czech Republic between 1994 and 2002

(time dependence of the RCI indicator – relative citation impact)

Year	RCI
1994	0.50
1995	0.55
1996	0.55
1997	0.59
1998	0.60
1999	0.65
2000	0,69
2001	0.71
2002	0.76

Source:

National Science Indicators (NSI), product of Research Services Group, Thomson ISI, Philadelphia USA

Note:

Annual bibliometric quality of publications is expressed by the RCI indicator (for definition of the RCI indicator see the table D.3.1) for publications and their citations produced by the research of the Czech Republic for each given year.

Commentary:

(1) Time dependence of the RCI indicator for the Czech Republic is equal for 1994 to one half of the world standard (state of the Thomson ISI database). Since then the value of RCI for the Czech Republic experienced a steady growth in the year intervals (with the exception of the years 1995 and 1996 when the value of RCI stagnated on the level of 0.55) and for 2002 it is equal to 0.76. (This level was reached by Spain and Ireland between 1994 and 1997 see. The 1999 Analysis of the previous trends and existing state of research and development in the Czech Republic and a comparison with the situation abroad.) This means a positive development particularly in the field of basic research.

(2) A conclusion can be deduced that the ever increasing bibliometric quality of publications reflects the structural changes made particularly in the field of basic research in the course of transformation of the Czech research and development at the beginning of the 1990's. The emphasis is evidently laid upon the quality of the research made, effective publication policy is maintained and the international collaboration raises above all due to the involvement of our research workers in the EU framework programmes.

D.3.3 Comparison of the scientific disciplines in the Czech Republic pursuant to the RCIO indicator in 2000

Scientific discipline	RCIO
Mathematics	1.22
Engineering	1.14
Clinical medicine	1.11
Material sciences	1.05
Computer science	0.97
Ecology and environment	0.92
Pharmacology	0.92
Multidisciplinary sciences	0.89
Chemistry	0.88
Earth sciences	0.85
Physics	0.81
Plant and animal sciences	0.69
Education	0.59
Immunology	0.57
Psychology and psychiatry	0.56
Space sciences	0.56
Agricultural sciences	0.56
Neurosciences	0,52
Molecular biology and genetics	0.44
Microbiology	0.40
Biology and biochemistry	0.39
Social sciences, general	0.38
Economy and business	0.10
Law	0.00

Source:

National Science Indicators (NSI), product of Research Services Group, Thomson ISI, Philadelphia USA

Note:

RCIO stands as abbreviation for the relative citation impact of a discipline of a country defined as the citation impact of a discipline of the given country (region) divided by the citation impact of the same discipline of the world data base (citation register) of Thomson ISI. These are publications and their citations produced by research of the given discipline in the Czech Republic in 2000 and publications of individual disciplines and their citations registered in the ISI database for the year 2000. The RCIO indicator compares the level of bibliometric quality of publications of the given discipline in a particular country (region) with the level of the world average bibliometric quality of publications of the same discipline in the given time period.

RCIO = 1 means that the discipline in a particular country (region) has the same level of bibliometric quality of publications as is that of the world average bibliometric quality of publications of the same discipline. RCIO > 1 means the level higher than average, while RCIO < 1 means the level lower than average.

Within the NSI product the classification of disciplines is based on the categorisation used with certain ISI modifications in the Current Contents periodical. Individual publications are broken down by disciplines referred by the periodicals, in which they are published. In the applied NSI instrument - standard version each periodical is classified in one of 24 disciplines. Therefore the definition of disciplines is bibliometric by purpose and not based strictly upon the definition of a discipline used in the scientific methodology.

Commentary:

(1) In the descending order of 24 scientific disciplines in the Czech Republic by the value of the RCIO indicator the leading position is taken by four disciplines with RCIO > 1. These are mathematics (1.22), engineering (1.14), clinical medicine (1.11) and material sciences (1.05). All these disciplines have higher values of the RCIO indicator for 2000 than between 1994 and 1997 (see the "1999 Analysis") and it is pleasant that clinical medicine and material sciences were classified among disciplines in the Czech Republic having higher than average value of the indicator of the bibliometric quality of publications in 2000 for that discipline in question.

(2) Another 14 disciplines of the Czech Republic show good level of bibliometric quality of publications of a particular discipline (higher than one half of the world standard). Of them the highest increase in the value of the RCIO indicator from the period 1994-1997 was experienced by ecology and environment, and also pharmacology. Improved values were attained by disciplines with traditionally higher level of RCIO (to which the technique of bibliometry used for evaluation of publication output applies), namely physics, chemistry, Earth sciences, as well as agricultural sciences. On the other hand the decline in value may be reported in the RCIO indicator for the neuroscience.

(3) In terms of this indicator the remaining disciplines are below average, among them the molecular biology and genetics, microbiology, and biology and biochemistry. The bottom of the table is occupied by social sciences, economy and business, and law.

E. Patent applications – patents

The number of patent applications or number of granted patents respectively, is traditionally considered as one of the indicators of fruitfulness of research and development. At the same time the limited reporting ability of this indicator is taken into account. Part of inventions comes into being also in other way than by research and development, many applications are filed from other, notably competition reasons, than to certify the world-wide newness of a particular technical solution. Many R&D results are promptly applied in new products and technologies, which are difficult to imitate, without being protected. The example is a very low employment of protection of topographies of the semi-conductor products (chips). Despite this the reports evaluating research and development in various countries and integration groupings usually do not lack the section concerning patents. In the long-term data on evaluation of activities in this sphere form part of the R&D statistics in the OECD Main Science and Technology Indicators (MSTI) published twice a year.

The methodology of evaluation of activities in this sphere is subject to relatively frequent changes and has not reached any stable shape so far. The number of patent applications and utility model applications per number of inhabitants or research workers is evaluated, as well as the extent of protection of inventions in abroad. The number of patent applications at the domestic patent offices is evaluated. The national activities at three world largest patent offices (patent offices of the United States, Europe and Japan) are monitored. Some monitoring may encounter differences in the concept of protection of industrial rights, legislative and methodological differences, e.g. just between the United States, Europe and Japan despite all harmonisation efforts. Sometimes only the number of patents from the sphere of advanced technologies is evaluated, where it is more certain that they resulted from research and development. The unstable methodology of evaluation of application activities is caused also by changes in the opinion on what is and what is not patentable. The view is changing on the patentability of computer programs as such, trade methods, biotechnologies, including respecting of the so-called traditional knowledge, etc.

The evaluation will be influenced also by significant changes being prepared in Europe. After many years of delays and postponements the 2003 spring session of the European Council in Greece make it probable that the Community Patent will be introduced, i.e. single patent that will not be only centrally granted as in case of the European Patent today, but will be valid in all member states of the EU.

The presented analysis evaluates activities in this sphere somehow differently than the R&D analysis approved by the Government in May 2002. The presented analysis has employed the methodology of the reports of the European Commission on benchmarking of research and innovation policies in the member and candidate countries of the EU. Five graphs accompany the evaluation:

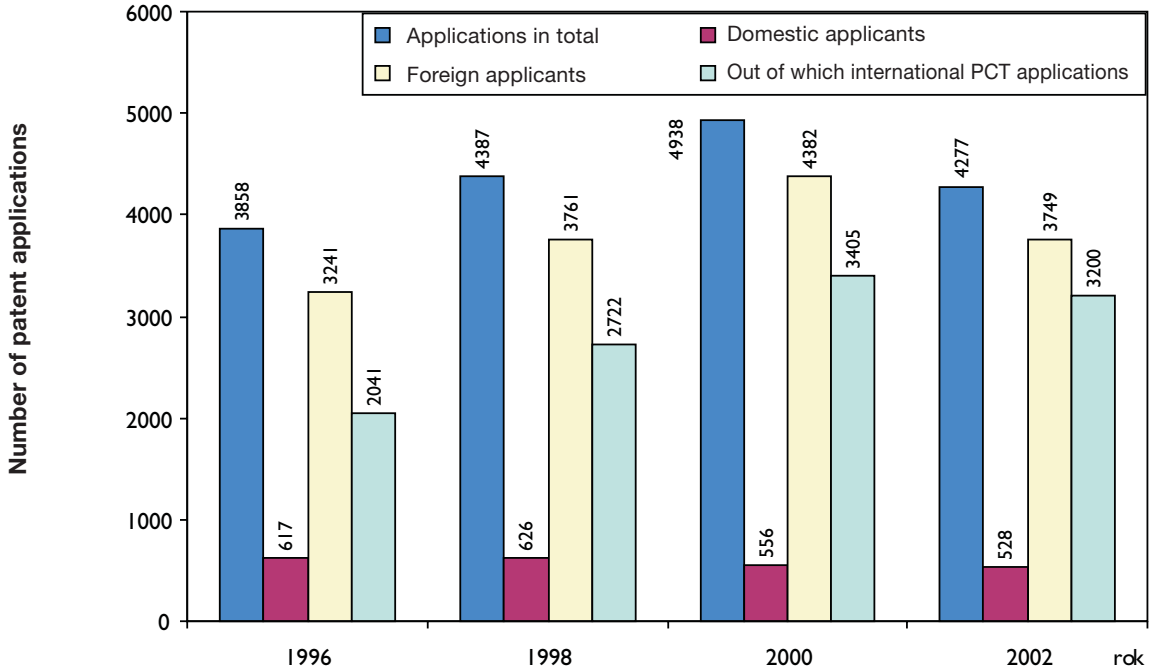
- Patent applications filed in the Czech Republic at the Industrial Property Office (IPO), total numbers
- Patent applications filed in the Czech Republic at the OIP, relative numbers of applications per one million of inhabitants
- Patent applications filed at the European Patent Office (EPO) per one million of inhabitants
- Patents granted by EPO, numbers per one million of inhabitants
- Patents granted by the Patent Office of the United States (USPTO), numbers per one million of inhabitants

Methodical institutional note to EPO

One of the results of the integration efforts in Europe was the signing of the European Patent Convention (EPC) in 1973. Upon this convention the European Patent Office (EPO) was established as the executive body. The European Patent Office grants the so called European Patent on the basis of one application and a single procedure. The patent is effective only in the member states designed by the applicator. Through the European Patent it is possible to reach the foreign protection of an invention in more simple and cheaper way. The protection is granted by the renowned institution guaranteeing the necessary legal safeguard both to the patent holder and its rivals. Through EPO the considered system of the Community Patent will be implemented.

The Czech Republic became the member state of the European Patent Convention in July 2002. At present the Convention has 27 members.

E.1 Patent applications filed in the Czech Republic at IPO



Source: IPO Yearbook 2002

Note: International PCT applications – patent applications filed in the PCT (Patent Cooperation Treaty) members states, in which the Czech Republic was designed by the applicant as the country, in which the applicant seeks to obtain protection.

Commentary:

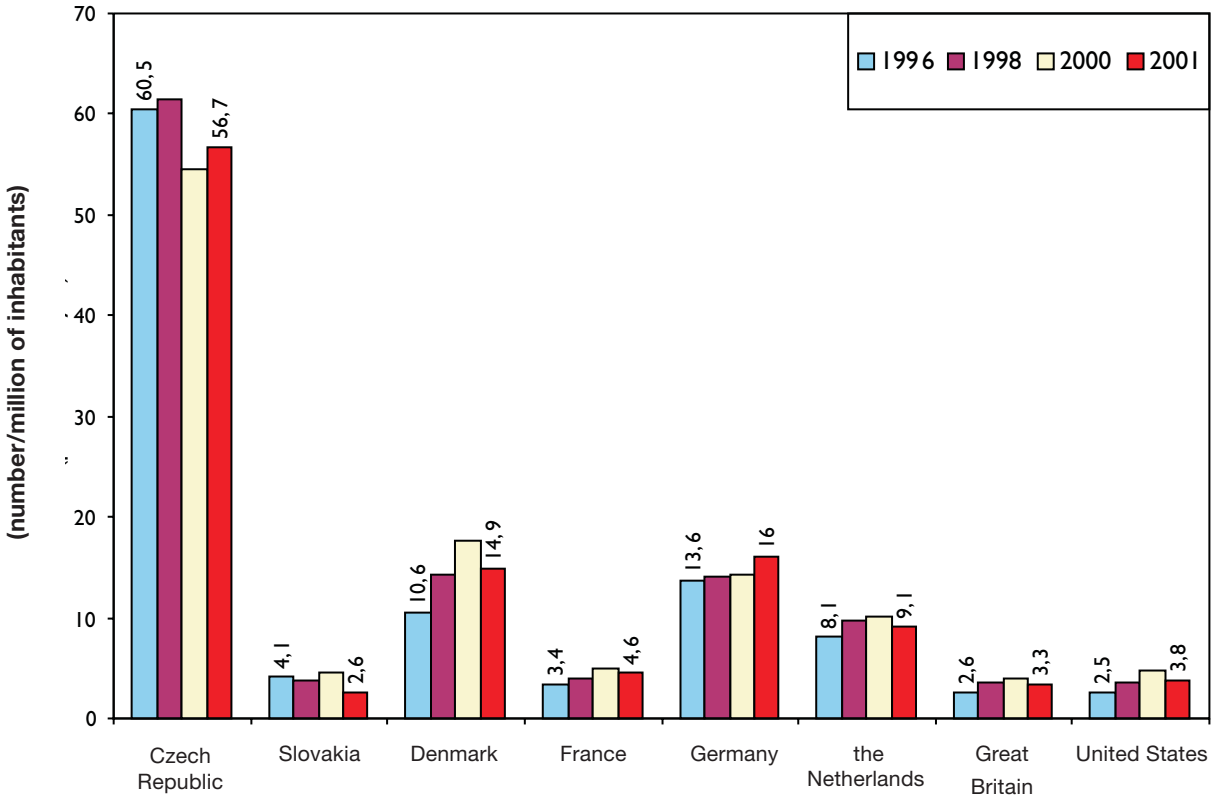
(1) The graph depicts the overall numbers of applications filed at the Office of Industrial Property of the Czech Republic (IPO) broken down by domestic and foreign applicants. The fourth column shows how many foreign applications filed through the PCT (Patent Cooperation Treaty) entered the national phase of procedure for each of the evaluated years.

(2) The overall number of patent applications filed at IPO has been experiencing a slight increase till 2000. Since 2001 the decrease has taken place (4 277 applications in 2002 against 4 938 applications in 2000). This trend will continue also in the future in connection with the accession of the Czech Republic to the EPC.

(3) The applications of domestic subjects stagnate on very low figures. Between 2000 and 2001 they even experienced a slight decrease against 1996 and 1998. The causes of the low activities of the Czech subjects are complex: combination of lack of high-quality R&D results, general underestimation of their legal protection, including insufficient allocation of financial means on their protection and lack of qualified professionals for the area of the industrial rights protection in R&D institutions. Certain improvements may be brought by the Act No. 130/2002 Coll. on the research and development support allowing for inclusion of the industrial rights protection cost into the allowable expenses of R&D projects, thus obtaining contribution for protection from the public funds.

(4) The number of foreign applications has been increasing till 2001. Their share in the overall number of applications grew from 84 % in 1996 to 88 % in 2002. The share of PCT applications in the total applications of foreign subjects grew from 63 % in 1996 to 81 % in 2002 within the PCT. The fall in the number of applications mentioned in paragraph 2 will relate particularly to the foreign applications.

E.2 Patent applications filed in the Czech Republic at IPO (number per one million of inhabitants)



Source: IPO Yearbook 2001 – total number of applications; RVV – conversions to one million of inhabitants

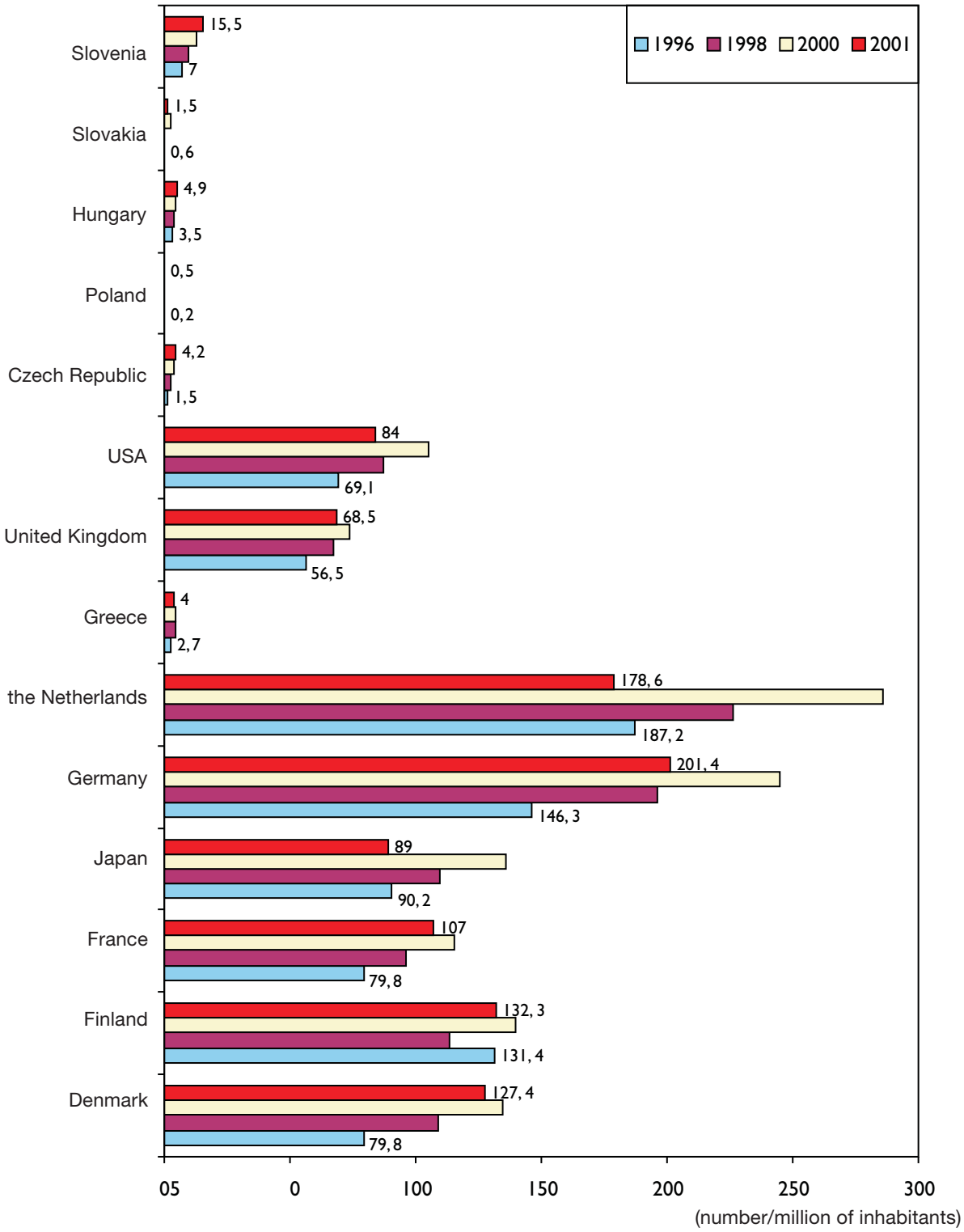
Commentary:

(1) The graph depicts data on relative numbers of patent applications (per one million of inhabitants) filed in the Czech Republic and in seven countries with the highest number of applications filed at IPO.

(2) As with other national patent offices also for IPO the applications of domestic subjects prevail at this type of comparison. At other national patent offices the difference between domestic and foreign subjects is even more distinctive.

(3) The relative numbers of applications of the Czech subjects stagnate in the monitored period. Numbers of applications from other countries slightly grew. More than 10 applications per one million of inhabitants filed at IPO is reported by Germany (16 applications in 2001) and Denmark (14.9 applications in 2001).

E.3 Patent applications filed at EPO (number per one million of inhabitants)



Source: European Patent Office Yearbooks, 1996 to 2001, Section of Statistics – total numbers of applications; RVV – conversions to one million of inhabitants.

Commentary:

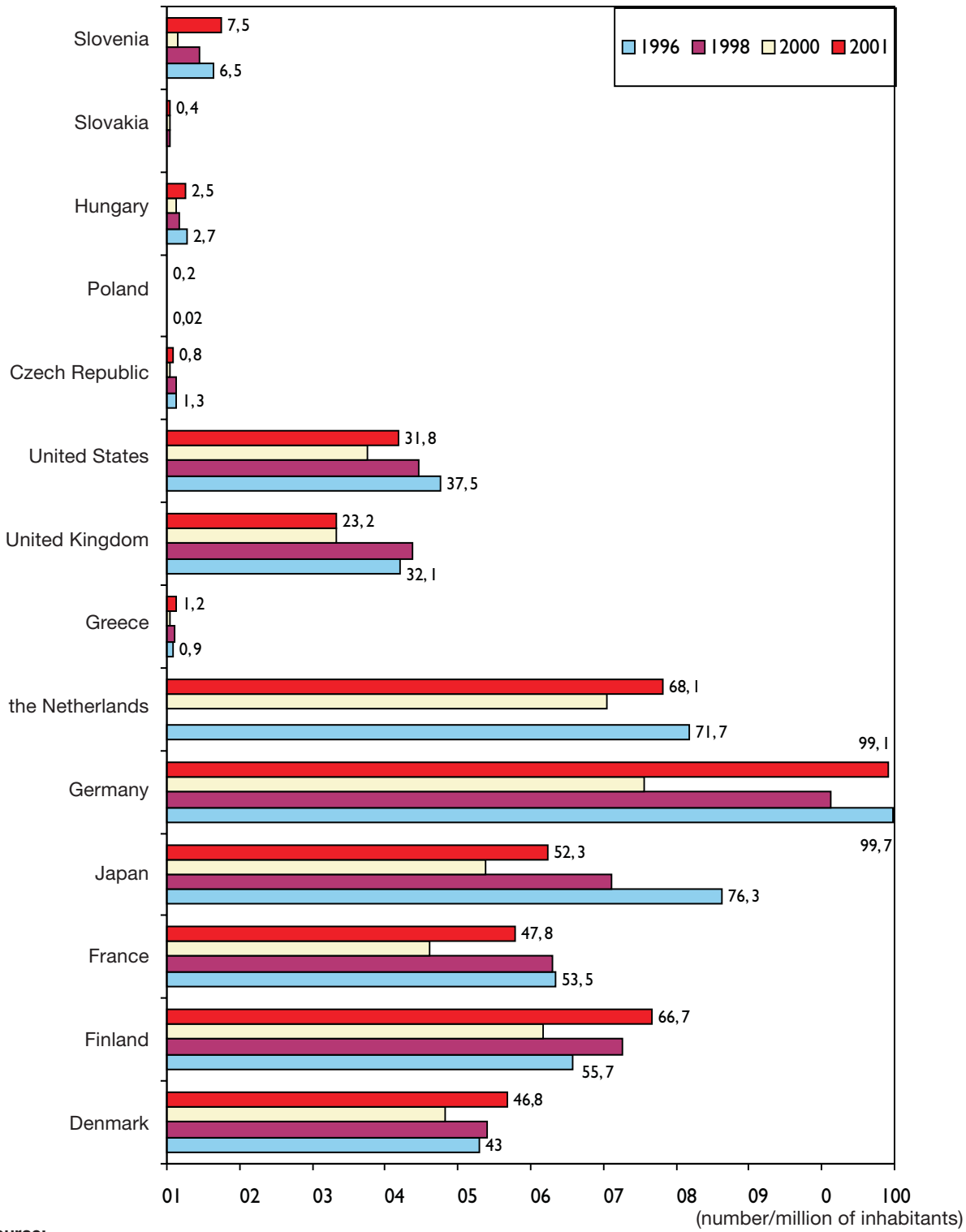
(1) The graph depicts the relative numbers of applications filed at EPO, including the so-called EURO-PCT (PCT applications that entered the regional phase of procedure before EPO).

(2) The highest number of applications is reported by Germany and the Netherlands – the Netherlands 286.1 applications per one million of inhabitants in 2000 and Germany 244.9 applications per one million of inhabitants also in 2000. For both countries a dynamic increase in applications is characteristic, however with a distinctive decline in 2001. Dynamic increase in the number of applications is experienced also by Finland. Applications from other countries stagnate, or eventually grow moderately to values being many times higher than numbers of applications from the candidate countries and Greece.

(3) The patent applications from the Czech Republic and Hungary report a moderate increase. Numbers of applications in 2001 (Czech Republic 4.2, Hungary 4.9) are only a little bit higher than applications from Greece (4 applications per one million of inhabitants). The number of applications from Slovenia is nearly three times higher in comparison with the numbers from Hungary and the Czech Republic. The number of applications from Slovakia is the lowest of all monitored countries. These numbers are so low that no conclusive results may be drawn from them.

(4) The difference between the number of applications from the Czech Republic and from the developed countries (the Netherlands, Germany, and Finland) is enormous. The number of applications from the Czech Republic amounts to little more over 2 % of applications from the Netherlands, or over 3 % of applications from Finland respectively. The given numbers testify on the surviving underestimation of the importance of concrete and marketable R&D knowledge in the research organisations in the Czech Republic and other candidate countries and on totally different business strategies of enterprises in the Czech Republic and candidate countries in comparison with strategies of enterprises in the developed countries. The process of transformation of the economy is obviously more demanding and longer than expected.

E.4 Patents granted by EPO (number per one million of inhabitants)



Source:

European Patent Office Yearbook, 1996 to 2001, Section of Statistics – total numbers of applications; RVV – conversions to one million of inhabitant.

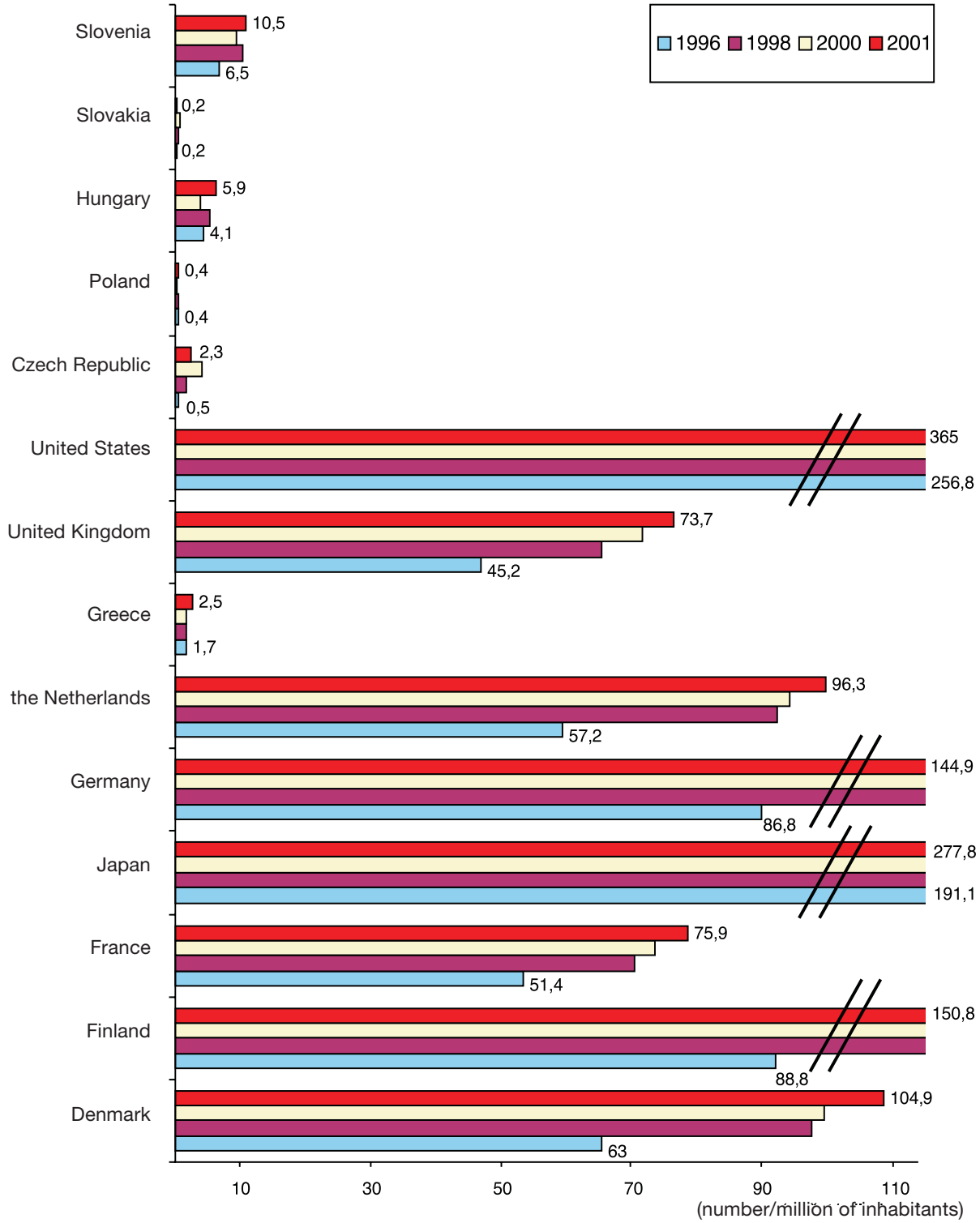
Commentary:

(1) Numbers of patents really granted by EPO are generally in line with numbers of patent applications in accordance with the previous graph E 3. The advanced countries report several times higher numbers of patents granted when compared with the candidate countries and Greece. The statements in point (4) of the commentary on the previous graph apply also to the patents granted.

(2) The “fruitfulness” of applications, i.e. share of really granted patents in the number of applications moves around 50 % on average. The “fruitfulness” of the applicants from Japan is significantly higher – ca 65 %. It follows from the comparison with the previous graph that the “fruitfulness” of applicants from Germany is higher than that of applicants from the Netherlands.

(3) The rank of the candidate countries is in principle the same as for the number of patent applications. Slovenia reaches three times higher number of patents granted than Hungary and the Czech Republic. Slovakia and Poland fall behind. But for small number of cases this comparison has only a limited reporting value.

E.5 Patents granted by USPTO (number per one million of inhabitants)



Source:
Patent Counts by country and year, all Patents, all types January 1, 1997 – December 31, 2001; United States Patent and Trademark Office, June 2003 – total numbers of applications; RVV – conversion to one million of inhabitants.

Commentary:

(1) The relative numbers of patents granted by USPTO (United States Patent and Trademark Office) to applicants from the monitored countries have the same basic characteristics as numbers of applications and really granted patents by EPO. The advanced countries dominate. The share of the candidate countries and Greece slightly exceed the level of 2 % of the most advanced countries. The lead of the applicants from the United States over the best foreign applicants (Japan, Finland, and Germany) is not as marked as at other national patent offices.

(2) The numbers of patents granted for most of the countries grew in the monitored period, most quickly for Finland and Denmark. If Denmark took last place from the monitored advanced countries in the number of patents granted by EPO, in case of patents granted by USPTO it caught up both with France and the Netherlands.

(3) Also the situation in the candidate countries is little different from patents granted by EPO. The number of patents granted by USPTO to the applicants from Hungary (5.9 per one million of inhabitants in 2001) is more than double when compared with the number of patents of the Czech applicants (2.3 per one million of inhabitants). Slovenia is again best one of the candidate countries (10.5 per one million of inhabitants in 2001). Poland and Slovakia again fall behind.

F. Employment of the venture capital in the area of R&D

Various surveys and analyses being organised by the OECD and EU bodies since the second half of the nineties come with the statement that one of the major causes why Europe lags behind the United States and Japan at implementation of the R&D results is the complicated access of the holder of the R&D results to the capital necessary for commercial utilisation of the results. The surveys, analyses and studies have proved that traditional sources of capital as bank loans and stock markets are basically unavailable for a person interested in establishment of a venture implementing the R&D results.

Experiences from the United States confirm that in these cases the suitable source of funding may be the venture capital. Large attention is dedicated to the issue of funding sources for implementation of the R&D results, and to the venture capital in particular, also in all EU documents connected with the so-called Lisbon strategy. Various forms of public support of the venture capital are tested, e.g. in Ireland and United Kingdom.

The indicator of employment of the venture capital for investments into the area of high-tech became regular part of the EU documents on evaluation of research and development, benchmarking of research and innovation policies. The documents mention the values of the indicator for the EU member countries, and also for some candidate countries. So far the indicators have not been monitored by the national bureaus of statistics, neither Eurostat. Data are received from banks or associations of funds and venture capital companies, e.g. the European Venture Capital Association.

The indicator of the venture capital employment is included in the analysis of research and development for the first time, the analyses approved by the Government in 1999 and 2002 did not mention it.

F1. Employment of the venture capital in the area of research and development (% of GDP)

Country	Venture capital investments into high-tech area (% of GDP)		Total venture capital investments (% of GDP)
	2000	2001	2001
Denmark	0.064	0.046	0.165
Finland	0.138	0.057	0.157
France	0.074	0.024	0.088
Japan	Data not reported	Data not reported	0.121
Germany	0.070	–	0.130
the Netherlands	0.162	0.023	0.216
Austria	0.011	0.014	0.061
Greece	0.004	0.016	0.070
United Kingdom	0.256	0.024	0.168
USA	Data not reported	Data not reported	0.326
EU – average	0.108	0.024	0.129
Czech Republic	0.036	0.008	0.018
Poland	0.005	–	–
Hungary	–	0.004	–
Slovakia	–	–	–
Slovenia	0.015	–	–

Source:
European Innovation Scoreboard 2001, 2002; Third European Report on Science and Technology Indicators 2003; CVCA/DBG; own calculations

Note:
In the United States and Japan data concerning the extent of the venture capital investments into the high-tech sectors are not monitored, and therefore not available. For Germany the last available data on the venture capital investments into the area of high-tech are for 2000, data for Hungary and Slovenia are from 1999.

Commentary:

(1) The venture capital as strictly defined includes the investments of initial capital into the seed and start up phase of the firm and capital investments into the expansion phase, the venture companies are the new ones, with new business activities and promise of the future considerable increase in the value of the invested funds. In the European Union an increased attention is dedicated to directing these investments to the very area of high-tech (within financing of the forming economy of knowledge). At the same time the venture capital is part of the overall so-called private equity covering professionally extended capital investments in all phases of the life cycle of the publicly non-traded firm (from entry of the venture capital to the management buyouts, restructuring and admission to the stock exchange).

(2) Since the last half of the nineties, 1998 in particular, the venture capital investments in the advanced economics have grown up. The United States have recorded significantly higher dynamics when compared with the EU and so maintain their traditionally prominent position in this specific financial instrument. The crisis of the "new economy" in 2001, however, led to the decline of overall investments of venture capital, by 62 % in the United States and 38 % in the EU having impact also on decrease of these investments into the area of high-tech. In the next years the restoration of dynamics is expected.

(3) In the EU (with the exception of Finland) and United States the venture capital investments are aimed especially into the phase of expansion, meanwhile in Japan the investments into the early stages of the firm are predominant. As far as the investments into the high-tech areas are concerned, higher share in the EU is reported also by investments into the expansion phase.

(4) The United Kingdom, Finland, Sweden and the Netherlands usually move above the European average in the venture capital investments share. Very low share is reported by Austria and Greece.

(5) Experiences with the venture capital invested into the research, development and innovations in the area of high-tech are relatively small in the Czech Republic. By its extent it is rather a marginal form of financing from the private funds. The share in GDP of the venture capital investments into high-tech is significantly lower both in comparison with the EU average and most of its member countries. Investments into high-tech are aimed basically only into the area of information technologies; investments into bio-technologies and other nowadays monitored high-tech technologies are lacking. In general, the investments of capital of the seed and start up type for commercial realisation of good ideas or inventions are lacking (seed and start-up phase) with reference to the small market lacking specialists and unfamiliarity with the domestic environment on the part of foreign investors. With a view to the life cycle of a firm the venture capital in the Czech Republic is at present aimed predominantly at financing of expansion of the already existing firm (approximately from more than two thirds) and then on funding of acquisitions.

G. Extraordinary results of research and development in 2002

For the purpose of the R&D analysis the Research and Development Council asked the leading providers of public funds for research and development to send it examples of extraordinary results of R&D achieved in 2002 with their support.

The Council asked the Academy of Sciences of the CR, Grant Agency of the CR, Ministry of Industry and Trade, Ministry of Education, Youth and Sport, Ministry of Health, Ministry of Agriculture, Ministry of Environment, and, in addition to the mentioned providers also the Association of Research Organisations (ARO), to send information processed under one single layout. All of them sent the reference documents.

The reference documents should be processed in accordance with the following layout:

a) name of the R&D result,
b) author(s) (individuals or institutions),
c) linkage to the R&D activity (project, program, research plan of domestic or foreign origin, or any other activity safeguarded by the "author" mentioned in the previous point),
d) brief explanation (characteristics) of the extraordinariness of the R&D result and its benefits,
e) place where the proof of the excellent result of R&D is kept.

More than forty suggestions of extraordinary results were submitted in all. Many of them, however, lacked any convincing explanation in what the extraordinariness of the result consisted, or the activity (project, etc.) was described, and not its result. Eleven of them were chosen to represent all the invited providers. In the 2004 analysis that will be presented to the Government in the second half of 2004 different methodological procedure will be chosen (assumed are extraordinary results awarded by awards of the respective providers).

G.1 Examples of extraordinary R&D results in the Academy of Sciences of the CR

G.1.1 New methods of non-invasive diagnostics of nervous and cardio-vascular diseases

Authors: Josef Halámek, Pavel Jurák (Institute of Instrument Technology of the Academy of Sciences of the CR), Tomáš Kára (Faculty hospital U sv. Anny, Brno), Virend K. Somers (Mayo Clinic, Minnesota, USA)

Linkage to the R&D activity: The result is linked to the research plan Z2065902 Development of physical methods, special technologies and instrumental principles using electron and light beams and radio-frequency spectroscopy. The activity of authors was supported further by projects no. K4055109 (Physics, chemistry and informatics for biological, ecological and medical applications) and no. K1067601 (Applied physics as a basis of technical sciences) of the Programme of explorational research development in the key areas of science, and the grant project no. 102/02/1339 of the Grant Agency of the CR (Evaluation of defects of the short-term regulation of the blood pressure and pulse intervals).

Brief explanation (characteristics) of the extraordinariness of the result and its benefits:
The determination of stability of the autonomous nervous system by means of calculation of the instantaneous reaction of change in the pulse intervals to the change of blood pressure (ANS) belongs among the most significant methods being developed. In addition, the new methods facilitate to determine the risk rate of the sudden cardiac death, classification of candidates for the heart transplantation and monitoring of the heart innervation level, application of cardio stimulator and defibrillator, and setting of optimum time delays at simultaneous stimulation of ventricles and atria. Methods are used as well for diagnostics of various types of hypertension and ischemic heart disease, for clinical diagnostics of pharmacoresistent epilepsy and parkinsonism.
In-house system was built for data measurement and analysis and new instruments were developed. The detector of the vagal stimulator activity was applied for a patent in the United States in December 2002.
The work was appreciated by the North American Society of Paciny and Electrophysiology, it was awarded Honorable Mention in Clinical Research Session.

Place where the proof of the excellent R&D result is kept:
Selection of publications:
Kára, T., Jurák, P., Šumbera, J., Halámek, J.: The phase shift between blood pressure and heart rate signals - new approach in non-invasive sudden cardiac death stratification, Journal of Heart Failure 1998, vol. 5, p. 107, ISSN 1388-9842, IF 2.112
Davies LC, Francis DP, Jurák P, Kára T, Piepoli M, Coats AJS: Reproducibility of methods for assessing baroreflex sensitivity in normal control and patients with chronic heart failure, Clinical science 1999, vol 97, p. 515-522, ISSN 0143-5221, IF 2.336
Lanfranchi, P., AShamsuzzaman, AS., Ackerman, MJ., Kára, T., Jurák, P., Wolk, R., Somers, VK.: Sex-selective QT prolongation during rapid eye movement slep. Circulation, 2002, vol 106, no. 12, p.1488-1492, ISSN 009-7322, IF 10.5

G.1.2 Drug against B hepatitis

Authors: Holý Antonín and colleagues (Institute of Organic Chemistry and Biochemistry) in co-operation with the Leuven University (Belgium) and the company Gilead Sciences (USA)

Linkage to the R&D activity: The result is linked to the research plan Z 4055905 Chemical principles of selected biological phenomena in medicine and ecology.

Brief explanation (characteristics) of the extraordinariness of the result and its benefits: The third of antiviral substances developed by Dr. Holý in the Institute of Organic Chemistry and Biochemistry was approved in the United States as a drug against B hepatitis. The active substance itself, adefovirus, is converted into propharmacon adefovirus dipivoxil, the oral medicamentous (tablet) form of which is named Hepsera(r). The properties of this drug, particularly its low daily dosage and high resistance against development of a resistance are giving it a promising future.

Place where the proof of the excellent R&D result is kept:
The results were published gradually by publications in international periodicals and filed as patent applications. The patents are kept with the author and publications in the Institute of Organic Chemistry and Biochemistry of the Academy of Sciences of the CR.

Selection of patents:

1) *Antonín Holý a kol.: ANTIRETROVIRAL ENANTIOMERIC NUCLEOTIDE ANALOGS, US Patent No 6,057,305*
2) *Antonín Holý, E. D. A. De Clercq: N6 – SUBSTITUTED NUCLEOTIDE ANALAGUES AND THEIR USE, US Patent No 5,977,061*
3) *Antonín Holý, I. Rosenberg, E. D. A. De Clercq: N- PHOSPHONYLMETHOXYALKYL DERIVATIVES OF PY AND PURINE BASES AND A THERAPEUTICAL COMPOSITION THEREFROM WITH ANTIVIRAL ACTIVITY, US Patent No 5,142,051*

Selection of publications:

1) *Keith, K.A., Hitchcock, M.J.M., Lee, W.A., Holý, A., Kern, E. R.: Evaluation of Nucleoside Phosphonates and Their Analogs and Prodrugs for Inhibition of Orthopoxvirus Replication. Antimicrobial Agents and Chemotherapy, 47, 2193-2198, 2003*
2) *Snoeck, R., Holý, A., a kol.: Antivaccinia Activites of Acyclic Nucleoside Phosphonate Derivatives in Epithelial Cells and Organotypic Cultures. Antimicrobial Agents and Chemotherapy, 46,3356-3361,2002*
3) *Zídek, Z., Franková, D., Holý, A.: Chemokines, nitric oxide and antiarthritic effects of 9-(2-phosphonomethoxyethyl)adenine (Adefovir). European Journal of Pharmacology 376, 91-100, 1999*

G.1.3 Middle of Europe around 1000 a.d. (two volumes of essays and catalogue to exhibition)

Authors: Petr Sommer and colleagues (Archaeological Institute of the Academy of Sciences of the CR, Prague, in co-operation with other institutions)

Linkage to the R&D activity: Z 8002970

Brief explanation (characteristics) of the extraordinariness of the result and its benefits:
This international exhibition being significant within the European context was the 27th exhibition project of the Council of Europe. The group of Czech historians and archaeologists in co-operation with the Central European experts created the concept of the beginnings of the Czech state as part of the Central Europe around 1000 a.d. This image of the Central Europe was documented by a series of original studies and a unique collection of authentic sources documented by synthetic references in the three volumes catalogue that accompanied the exhibition. The project proved beyond the shadow of a doubt that the Middle Europe had been for thousand of years already the culturally identical environment of various communities, the present coalescence and interconnection of which is not motivated only by the actual political programme, but stands for the logical result of apparent historical tendencies. This unity of interests and tendencies is strengthened today also by the respect for the diversity of cultures.

Place where the proof of the excellent R&D result is kept: texts were published by publishing houses Lidové noviny (Prague 2002) and Theiss (Stuttgart 2002).

G.1 Examples of extraordinary R&D results in the Grant Agency of the CR

G.2.1 Telometric repetitive sequence TTAGG in the chromosomes of insects and other articulates

Authors: Doc. RNDr. František Marec, CSc., Entomological Institute of the Academy of Sciences of the CR, in co-operation with Sahara K., Graduate School of Agriculture, Hokkaido University, Sapporo, Japan, Traut W., Wolf K.W., Institut fur Biologie, Medizinische Universitaet zu Luebeck, Germany

Linkage to the R&D activity: project GA206/00/0750

Brief explanation (characteristics) of the extraordinariness of the result and its benefits:
The project dealt particularly with evolutional mutational modifications of the highly repetitive telometric sequence in insects and representatives of other groups of articulates and tried to interpret the findings within the phylogenetic framework. The results brought significant and priority knowledge not only for the comparative and evolutional cytogenetics and cytotaxonomy of the invertebrates, but for the multicellular organisms in general and revealed the evolutional changes of the critically important part of the end section of a chromosome. For solution of the project the original procedures of the molecular cytogenetics were partly applied and partly also developed, generally applicable in the comparative studies of articulates. The direct application of these methods, in this case the molecularly cytogenetic physical mapping of the primary ribosomal genes then gave birth to very important work (published in the highly prestigious periodical Science) that resulted from the project (Weeks a kol. 2001): description of the permanently haploid complex organism with 1 chromosome, where the haploid state is caused by the symbiotic bacteria living in the digestive tract of this type of aphis. This is a entirely priority knowledge cited already now, and certainly many times in the future in works concerning the number of chromosomes with Metazoí, as well as in any papers on the size of the functional genom – the organism in question certainly will become the object of the descriptive genomics.
Results of this research were published in prestigious foreign periodicals. One of the project outcomes is really a significant discovery of general biological character, on top of it published in highly prestigious periodical Science. Undoubtedly this study will be cited many times and so it has an extraordinary importance not only for the Grant Agency of the CR, but for the whole Czech genetics and biology.

Place where the proof of the excellent R&D result is kept: The proof of results is kept with the investigator, documents on the project evaluation in the office of the Grant Agency of the CR.

G.2.2 Material models of concrete for evaluation of the over-project nuclear power station breakdowns

Authors: Prof. Ing. Zdeněk Bittnar, DrSc., Czech Technical University in Prague, Building Faculty, prof. Ing. Břetislav Teplý, CSc., Technical University in Brno, Building Faculty
Linkage to the R&D activity: project GA103/97/K003
Brief explanation (characteristics) of the extraordinariness of the result and its benefits:
Reliability and probability analyses – methodology of determination of reliability of concrete constructions with inclusion of the size effect; Solution of complex issues of fracture mechanics with utilisation of the suitable combination of Monte Carlo and computer non-linear fracture mechanics methods; The effect of size on the bending strength; Statistical effect of the size; Interaction between the effect of size and reliability proposal; The probability analysis – own software FREET; Stochastic analysis of carbonation; Evaluation of input parameters for computer models based on the fracture theory from experiments of three types – three-spot bending, tests on cubes with two cuts, and impact tests with Sharpy's hammer; Propagation of heat and moisture in the porous material (concrete) – measurement of heat conductivity, specific heat, thermal expansion at various level of saturation and at different temperatures, the heat range up to 1 000° C; Moisture diffusivity as function of temperature – up to 80° C; Highstrength concrete, concrete reinforced by wires;. Computer model for simulation of the heat and moisture transport facilitating the prediction of the long-term behaviour of the concrete constructions in nuclear power stations; Simulation of concrete creeping at various temperatures and moistures; Weakened combined task; Fracture mechanics for reinforced structures – experimental research of eccentrically pressed columns with small eccentricity;. Evaluation of the effect of stirrups on the softening; Computer model – microflat constitutive relation for concrete, elasto-plastic relation for reinforcement; Geometrical nonlinearity for the longitudinal reinforcement; Non-local formulation for simulating localisation; Adaptivity; Computer implementation into parallel object-oriented own program OOFEM; Dynamic behaviour of reinforced structures loaded by impact; The impact of aircraft into the containment.

The results of the complex grant project have high contribution in the wide spectrum of knowledge from the area of quasi brittle materials and their failure, probability analysis of physical properties and degradation of these materials, effect of size, time, moisture and temperature on their behaviour, knowledge from the field of numerical modelling of behaviour of reinforced structures, including automatic creation of suitable models. The attention is drawn particularly to the effect of size, its interaction with the reliability proposal and statistical analysis. The extended evaluation of the material input parameters for computer models is suggested based on the theory of fracture from the three-spot bending, tests on cubes with two cuts and Sharpy's tests. In addition, the project came out with sets of thermal and moisture characteristics of various types of fibrous concrete, including models for simulation of the heat and moisture transport and concrete creeping. Valuable are also results of the reinforced elements and structures research aimed at failure of slightly eccentrically pushed columns, study of the effect of stirrups on the softening, elasto-plastic constitutive relation for reinforcement, and dynamic behaviour at impact loading, particularly by the aircraft falling on the protective cover of the nuclear reactor. The project is very important for the proposal and evaluation of the security of the protective reinforced cases of nuclear reactors, as source of much fundamental and earlier unattainable knowledge for research in the field of theory of the quasi brittle materials and reinforced structures. The project contributed to the education of many doctorands, three successful habilitation procedures, for enrichment of relevant subjects of the study programmes of the Czech Technical University and Technical University in Brno and came with practical results for the estimates of rates of concrete degradation due to the decreased quality of atmosphere. The publication activity is marked and includes 99 works predominantly on the international conferences, of them 3 articles in international periodicals and two chapters in foreign books.

Place where the proof of the excellent R&D result is kept: The proof of result is kept with the investigator, documents on the project evaluation in the office of the Grant Agency of the CR.

G.3 Example of extraordinary R&D results attained with support of the Ministry of Industry and Trade

G.3.1 Research and development of new-generation weaving machines with electronically controlled servo systems (FB-C3/87)

Author: Research Institute of Textile Machines, joint stock company Liberec
Linkage to R&D activity: project of MPO

Brief explanation (characteristics) of the extraordinariness of the result and its benefits:
The outcome of the project is a new generation of jet weaving machines of unique concept, the performance parameters of which (i.e. operating speed of 600 rpm at 220 cm width) meet the project terms of reference and belong among the world best. The machine is intended for processing of medium and medium-heavy materials for technical fabrics, e.g. glass fibres. Two patent applications were filed during its solution and the machine under the name VERA 220 was exhibited with remarkable success on the world exhibition of textile machines ITMA 2003 in Birmingham this October.

Place where the proof of the excellent R&D result is kept: Documents kept with MPO (Division 5200) and RITM Liberec.

G.4 Example of extraordinary R&D results attained with support of the Ministry of Education, Youth and Sport

G.4.1 Trans-disciplinary research in the field of biomedical engineering

Author: Czech Technical University in Prague, prof. Ing. Svatava Konvičková, CSc.

Linkage to the R&D activity: Research plan MSM 210000012

Brief explanation (characteristics) of the extraordinariness of the result and its benefits:
The research activity concentrates on three fundamental research directions: human biomechanics, engineering issues of biology and medicine, biomedical research of tissues and biological aspects of their interaction with radiation.
The most significant result in the field of biomechanics is the development of the ceramic femoral component of the knee substitute Walter Dias Modular. At its development the bio ceramics of a new generation was applied that is bio inert and bio tolerant; the investigative team succeeded in development of this new modular system and closing of clinical tests as first one in the world. For presentation of research results in this field the investigative team was awarded on the XVIIth Congress of International Society of Biomechanics. In the area of substitutes of the big human joints a new type of sandwich fossa from bio ceramic materials was developed. These fossae are currently utilised in the clinical practice and imported to international markets. Another remarkable success in the field of skeletal substitutes is the proposal of an entirely new type of total spinal substitute of the intervertebral joint not manufactured in the world so far. The solution is protected by industrial designs and the patent procedure is in progress at present. As far as the spinal substitutes are concerned, the interest in the carbon-carbon composite based intervertebral spacer was shown by the Danish company Danfoss A/S, division “Danfoss Bionics”. Also these spacers are protected by industrial design and the patent procedure is pending. A general theory of bone tissue remodelling was formulated being the world priority.
The most significant result in the field of the engineering biology and medicine is the Neural Response Telemetry (NRT) as a clinical method and development, and construction of TGI dosing device – filed patent application. The results are already employed in the medical practice.
In the field of biomedical research of tissues and biological aspects of their interaction with radiation the work started (world priority) on measurement of temperature of biological tissues by means of ultrasound images (i.e. through the B-mode). The patent application was filed for this methodology. Due to the unique character of this method the work raised a great interest in abroad (Germany, the United States). Also the patent procedure for solution of the project “Alert Car” is in progress – development of a device that would be able to identify contactlessly the situation when the driver is not able to control the vehicle without mistakes, eventually when the micro sleep may occur.

Place where the proof of the excellent R&D result is kept: Czech Technical University in Prague

G.5 Example of extraordinary R&D results attained with support of the Ministry of Health

G.5.1 Evoked potentials of the brain-stem (EABR) and auditory nerve (EAP, CAP) at electrical stimulation of the internal ear

Author: prof. MUDr. Jan Betka, DrSc. (FN Motol) in co-operation with: MUDr. Jiří Skřivan, CSc., MUDr. Jaroslav Valvoda, CSc., MUDr. Martin Světlík, MUDr. Tomáš Šmilauer, MVDr. Věra Ungerová, Ing. Tomáš Tichý, CSc., Ing. Stanislav Sedlák, CSc. Ing. Martin Topol and MUDr. Jan Kluh

Linkage to the R&D activity: project IGA MZ Reg. No. NK 5259

Brief explanation (characteristics) of the extraordinariness of the result and its benefits:
The project "Evoked potentials of the brain-stem (EABR) and auditory nerve (EAP, CAP) at electrical stimulation of the internal ear" followed up with the formerly addressed projects concerning cochlear implants for deaf. The grant project was specifically aimed at patients after the bilateral operation of auditory nerve tumours with subsequent deafness. During operation a plate with 22 electrodes is inserted into the area of auditory karyons in the brain-stem. After union, connection and rehabilitation the patients are able to hear sounds, and in certain cases to understand the speech. The programme of stem implantations is complex and multidisciplinary. This workplace performed 5 of these unique operations. The Czech group was included in the European grant projects of stem implantations, where we belonged among the leading contributors.
Place where the proof of the excellent R&D result is kept: National Medical Library

G.6 Example of extraordinary R&D results attained with support of the Ministry of Agriculture

G.6.1 New legally protected apple-tree variety „Rubinstep“ introduced into growing in the EU

Author: Research and Breeding Institute of Fruit-Growing, Holovousy Ltd., Ing. Jan Blažek, CSc.

Linkage to the R&D activity: EUREKA EU 1868 GENIMPROVEDAPPLE

Brief explanation (characteristics) of the extraordinariness of the result and its benefits:
The new variety of the apple-tree “Rubinstep” (cultivated at the Research and Breeding Institute of Fruit-Growing Holovousy) was selected on the basis of extensive testing of broad set of preliminarily guessed genotypes realised in co-operation with foreign partners for introduction in the EU. The variety is marked by high quality of fruit and is suitable for organic systems of the apple growing. It was applied for the legal protection in the CR and in the EU. The propagation licence was granted to the Belgium company Johan Nicolay N.V. Except for the legal protection of the variety under the convention UPOV, the trademark „Piroutte“® was obtained for this variety. The assumption for the following years is that besides the Czech Republic and Belgium this variety will be propagated also in England, Denmark, and Norway. In addition it started to be successfully tested also in other EU countries. The scope of propagation in the first years may be estimated at 500 thousand of nursery plants per year. This number corresponds with the annual income from royalties in the amount of EUR 150 000. The estimated time of the variety utilisation is 20 years.

Place where the proof of the excellent R&D result is kept: Research and Breeding Institution of Fruit-Growing, Holovousy Ltd., Holovousy 1, 508 01 Hořice v Podkrkonoší.

G.7 Example of extraordinary R&D results attained with support of the Ministry of Environment

G.7.1 Reduction in the non-point pollution of surface and ground waters in the CR

Author: Water Economy Research Institute of T. G. Masaryk - Mgr. Pavel Rosendorf and colleagues

Linkage to the R&D activity: Programme: Hydrosphere, project VaV/510/4/98. In addition, the result followed up with the long-term research activities of Water Economy Research Institute of T.G.M. in the area of ground waters and analyses of environmental directives of the EU, particularly the Council Directive 91/676/EEC (the so called "Nitrate Directive") and Framework Directive (under preparation) on the water management policy (2000/60/EC). Considering the wide spectrum of co-operating organisations the outcomes of another relevant all-European projects were used, particularly of the project Mapping of critical burdens of the forest ecosystems (all-European project with the participation of the Czech Ecological Institute), Project of the 5th Framework programme of the EU – LOWRGREP (European project with the participation of the Faculty of Natural History of the Charles University, Institute of Hydrogeology, Engineering Geology and Applied Geophysics). Within the project the investigators significantly participated in the Twinning Project (Great Britain, Austria, France) to the Nitrate Directive between 2000 and 2002.

Brief explanation (characteristics) of the extraordinariness of the result and its benefits:
The result covers three currently important problem areas of the non-point water pollution – nitrates, acidification and phosphorus – and in all cases the water vulnerability on the territory of the entire Czech Republic is processed in highly professional manner, i.e. it predicts areas with high exposure to the risk of water pollution. The subject of the result is the definition of the so called vulnerable areas under the Nitrate Directive and adoption of the Government Order No. 103/2003 Coll. establishing the vulnerable areas and regulating the use and storage of yard manures, crop rotation and taking of erosion control measures in these areas. Highly usable are maps of vulnerability of the rock setting for nitrates and acidification, maps of critical loads for nitrates and acidification, erosion exposure of soils and loss of total phosphorus by water erosion (solution exceptional for its level of detail within the whole Europe) – all for the territory of the CR, and also the regional solution in selected areas, as in case of maps of the water vulnerability by acidification of Krušné Mountains and Šumava, modelling of non-point pollution by nitrates in the north part of the Třeboň basin, and in the catchment area of the impounding reservoir Švihov or modelling of the water erosion and transport of the total phosphorus by the water erosion in the catchment area of the impounding reservoir Vrchlice. Part of the result are the proposals for measures for reduction in the denudation of nitrates from the farm land into waters that became referent documents for the processing of measures in the Government Order No. 103/2003 Coll. or draft scenarios of measures for reduction in the denudation of phosphorus by water erosion and eutrophication of water reservoirs.
Definition of vulnerable areas, maps of vulnerability of the rock setting and principle of drawing up the critical loads are further utilised for implementation of the Framework Directive for the water management policy of EU (2000/60/EC).
The project utilised consistently the latest knowledge in all critical areas for the precise analysis of vulnerability of the territory, and what is particularly of merit, it used all available formerly processed reference documents and methods of the resort projects of Ministry of Environment and Ministry of Agriculture and the research and development projects. By the same manner also the results of international projects were employed – Mapping of critical loads, LOWRGREP (5th Framework Programme of the EU) and procedures of implementation of the Nitrate Directive in the EU countries.

Place where the proof of the excellent R&D result is kept: All principal and partial results and outputs, including the reference documents, are kept at the Water Economy Research Institute of T.G.M. The information and educational seminars to the implementation of the Nitrate Directive organised by ÚZPI: on the Internet address http://www.agronavigator.cz/nitrat/.

G.8 Example of extraordinary R&D results attained in member organisations of the Association of Research Organisations (ARO)

G.8.1 Development, manufacturing and installation of testing devices for measurement of crazing installed at the nuclear power stations Chinsan and Kuosheng on Tchai-wan

Author: Institute of Nuclear Research, joint stock company Řež

Linkage to R&D activity: The result is linked to similar projects addressed within the International Atomic Energy Agency (IAEA) Vienna, for laboratories in Mexico and Brazil.

Brief explanation (characteristics) of the extraordinariness of the result and its benefits:

a) Two pieces of testing devices of the autoclave type are developed. The device serves for monitoring of the crazing of testing samples of materials in BWR environment of the nuclear power station. The devices were delivered as a set, including the control computer that in co-operation with the programmable automatic machine secures the control, data collection and graphic visualisation of the course of the long-term material testing.
b) For the first time the control of the testing sample loading was employed with maintenance of the constant load factor also at changing cross section of the testing sample (crazing).
c) Institute of Nuclear Research managed to win recognition in the area being previously the domain of Western firms of renowned names. On the basis of successful co-operation another two commissions for delivery of technology has been signed.

Place where the proof of the excellent R&D result is kept: Papers on the result are available at the Institute of Nuclear Research

Comment:

Comment: