S&T&I SYSTEM IN SERBIA: research prospective – part I

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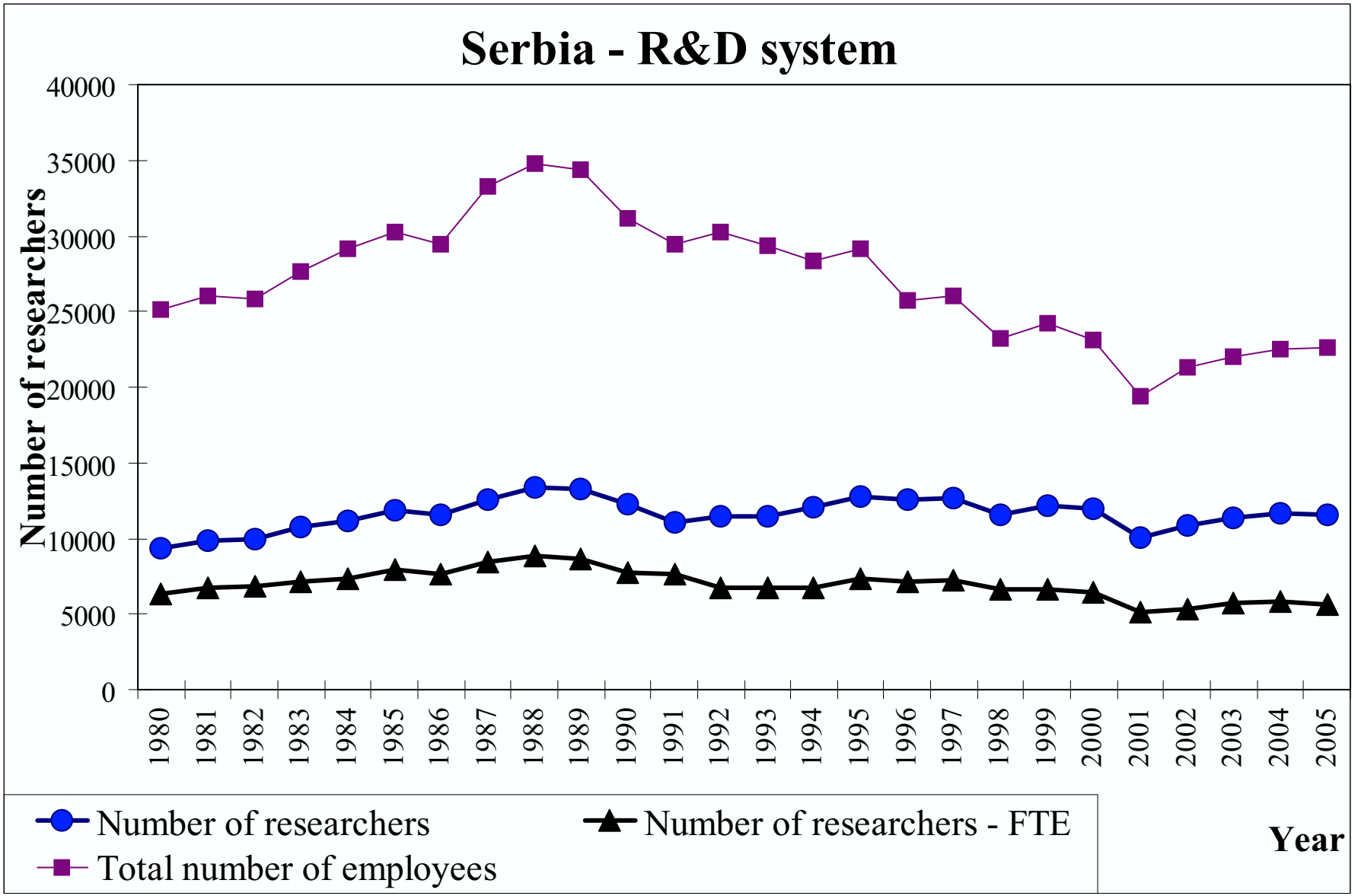
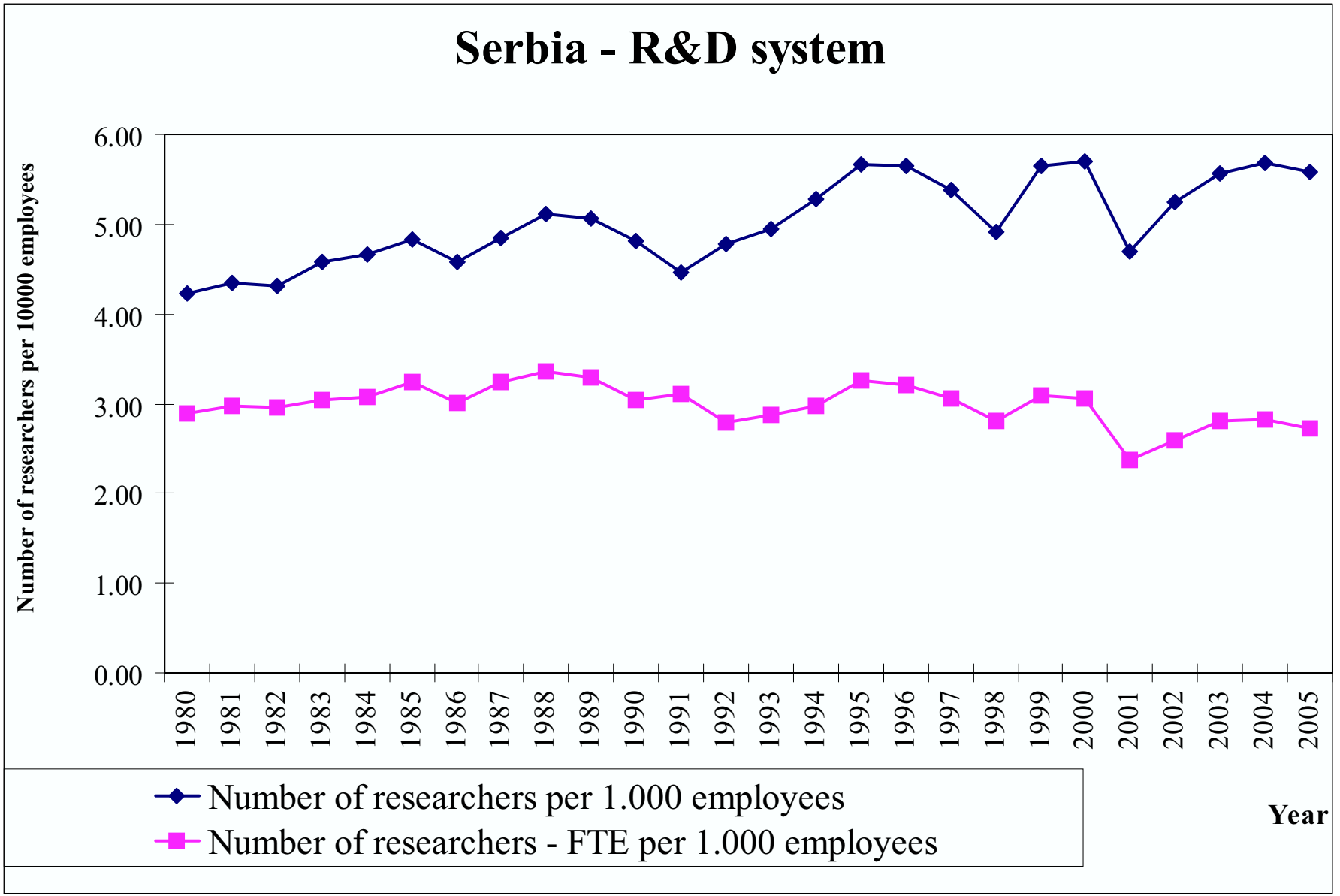
Content – part I:

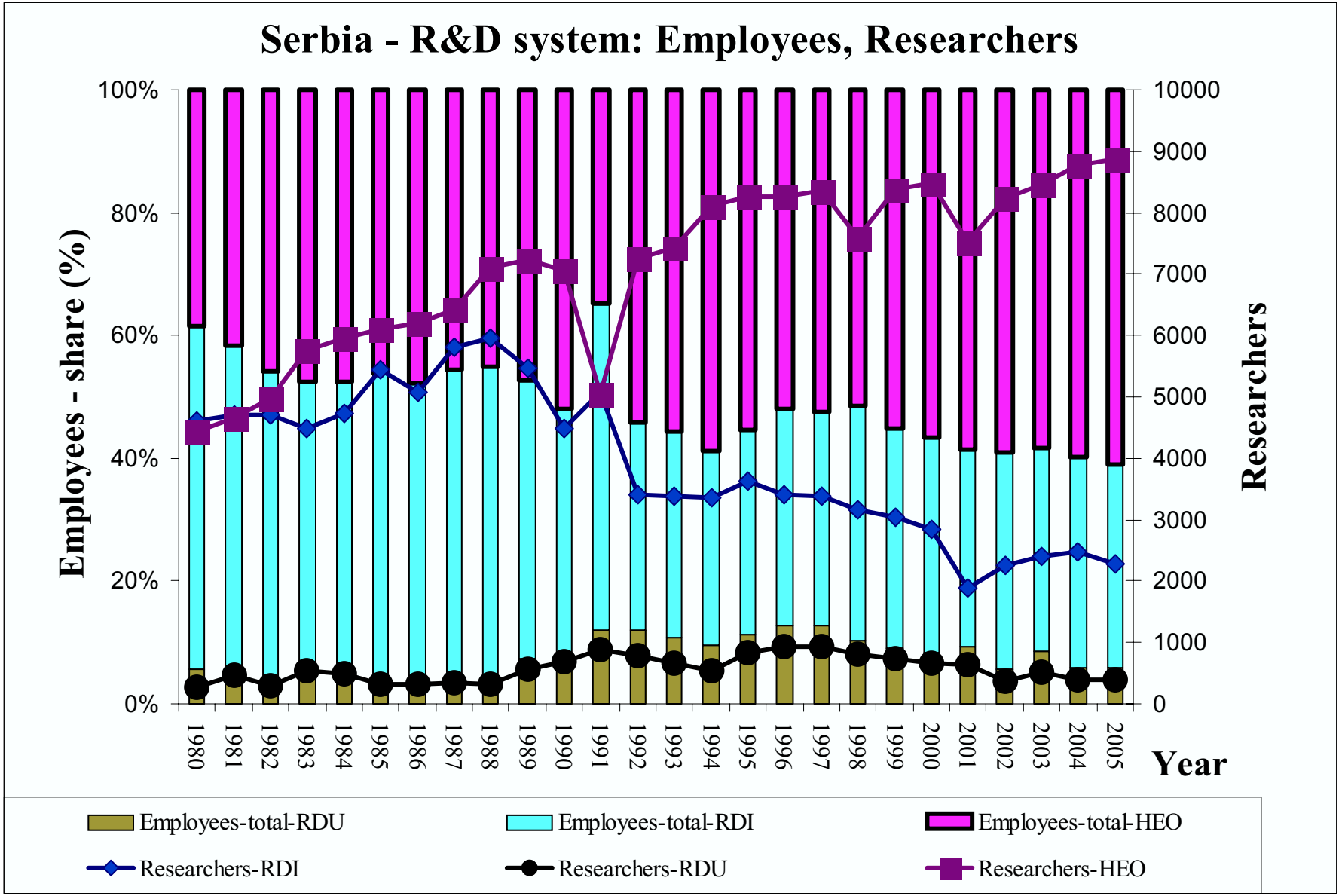
1. **Science and innovation in Serbia: country perspectives** ☺☹
2. **Key challenges of science and innovation policies in Serbian' economy** ☺ ☹
3. **S&T and innovation policy in Serbia: how far it is from the best practice models?** ☹☹

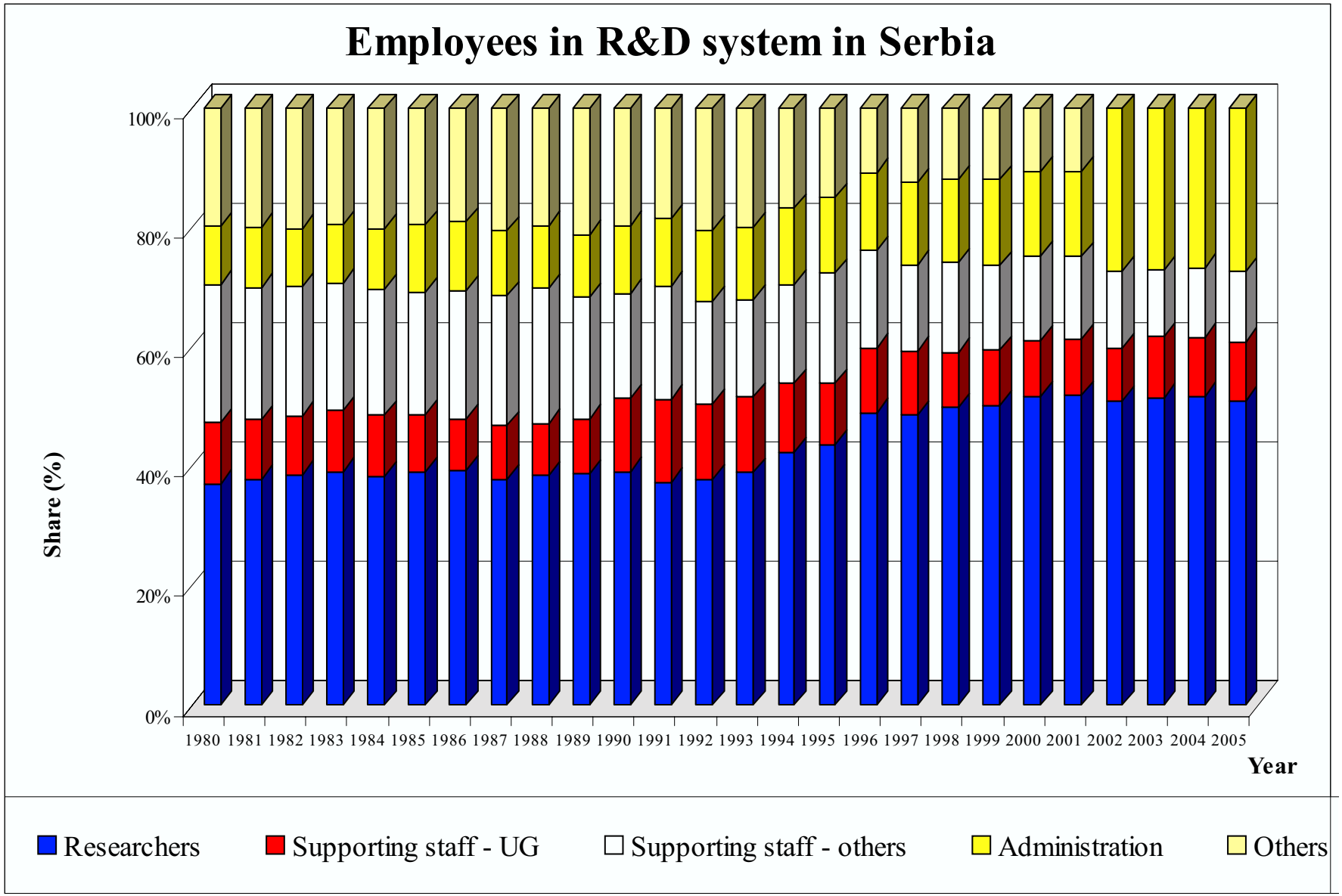
1.

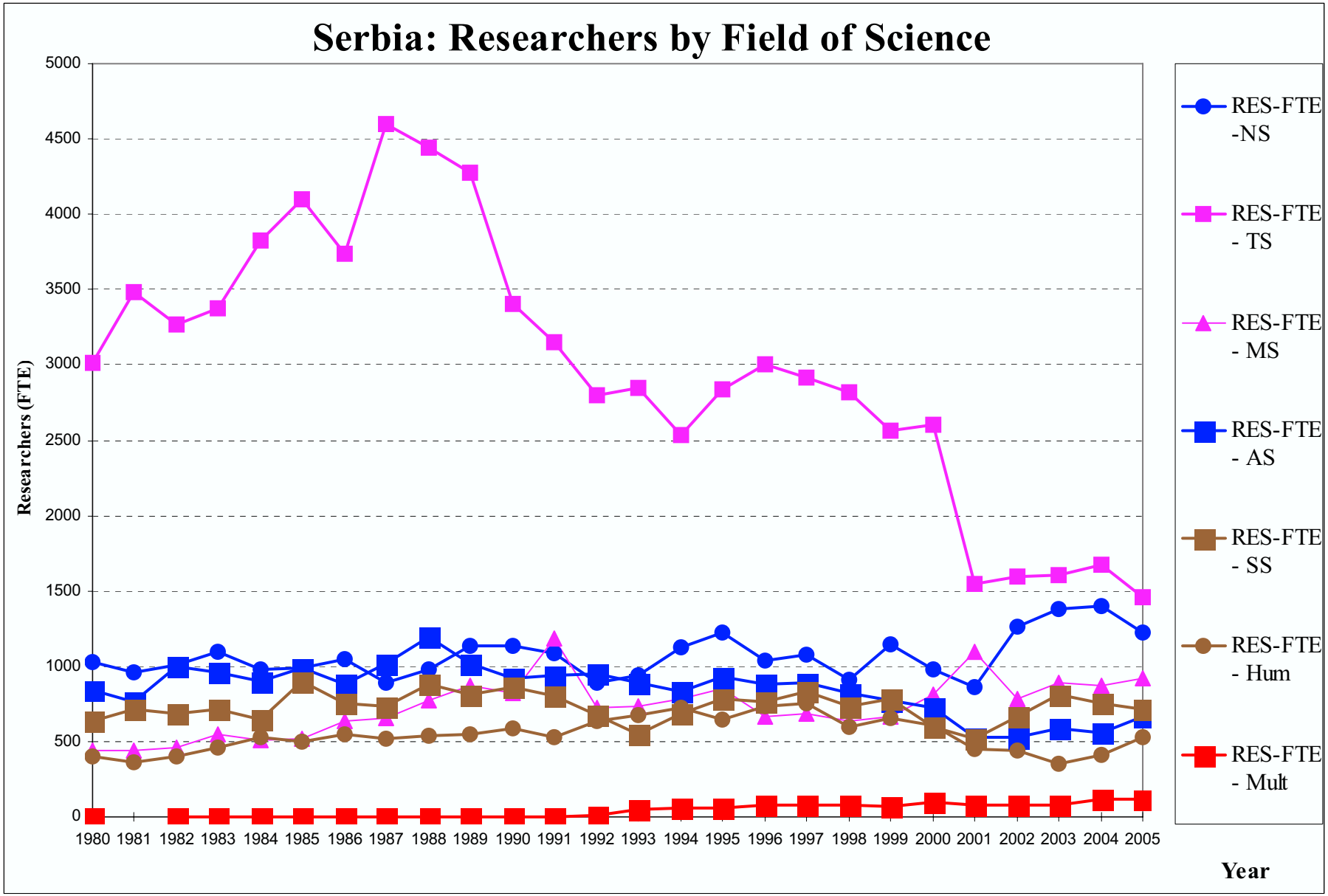
Science and innovation in Serbia: country perspectives

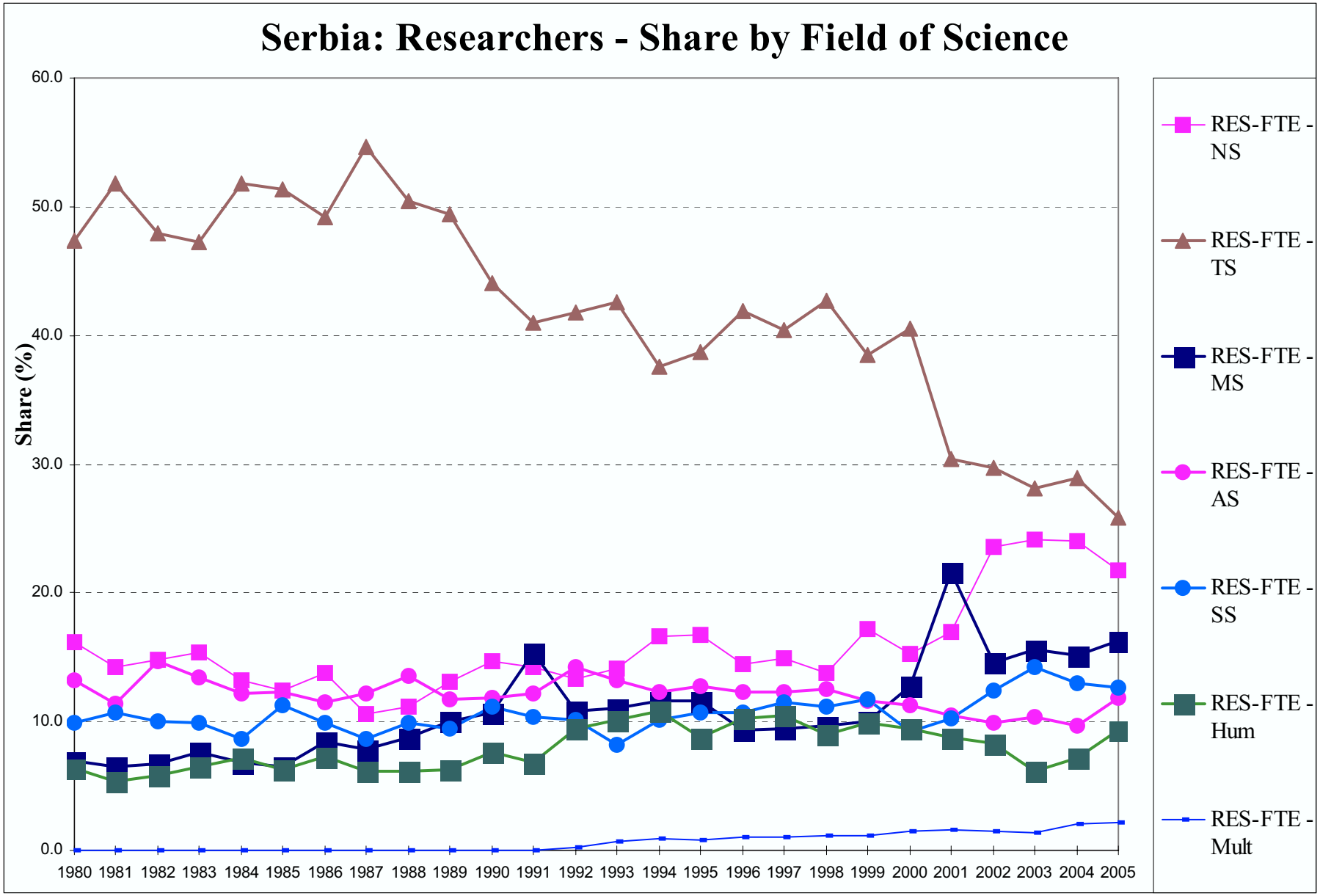

Serbia - R&D system
Number of researchers
40000
35000
30000
25000
20000
15000
10000
5000
0
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year
Number of researchers
Number of researchers - FTE
Total number of employees

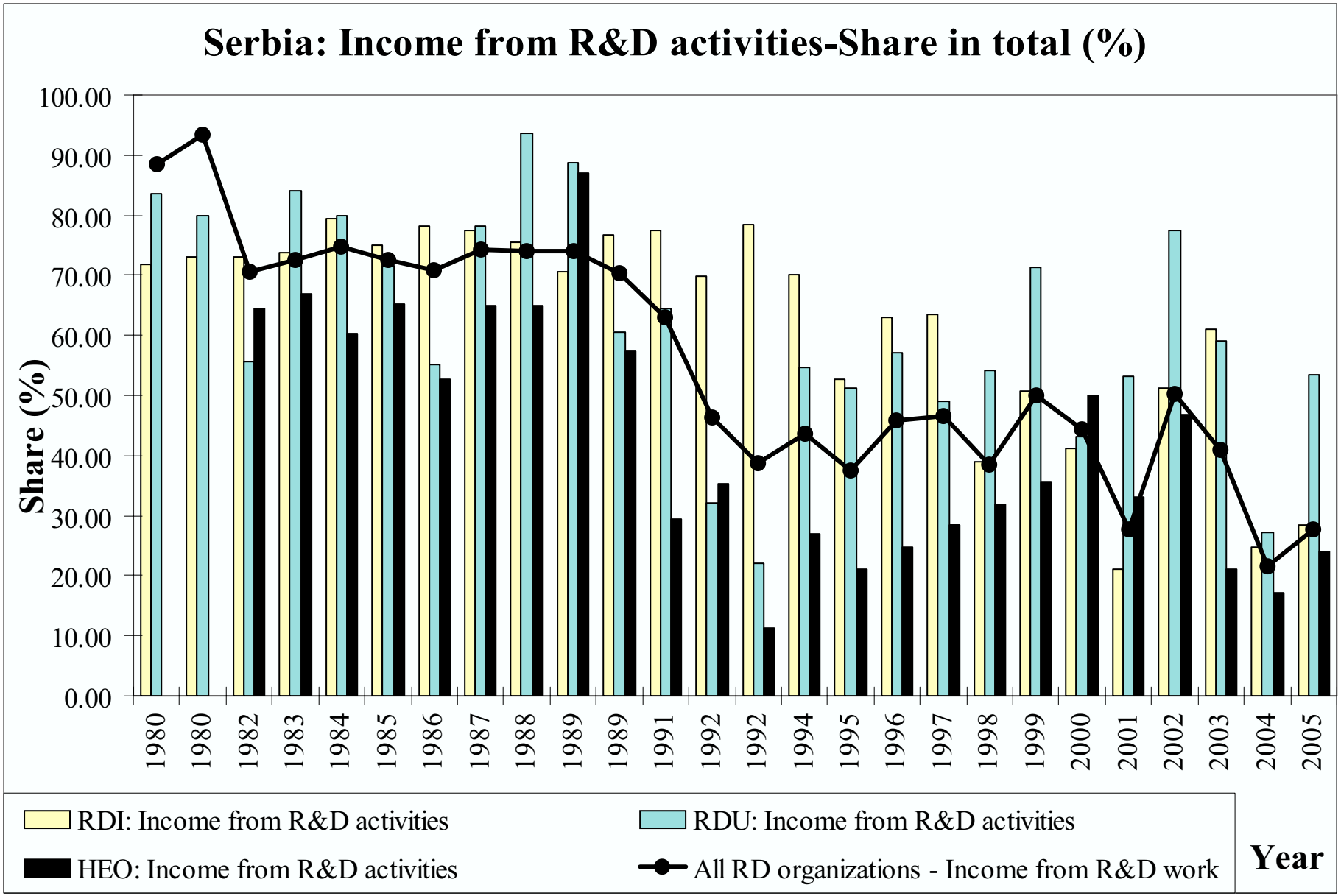

Serbia - R&D system
Number of researchers per 10000 employees
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year
Number of researchers per 1.000 employees
Number of researchers - FTE per 1.000 employees

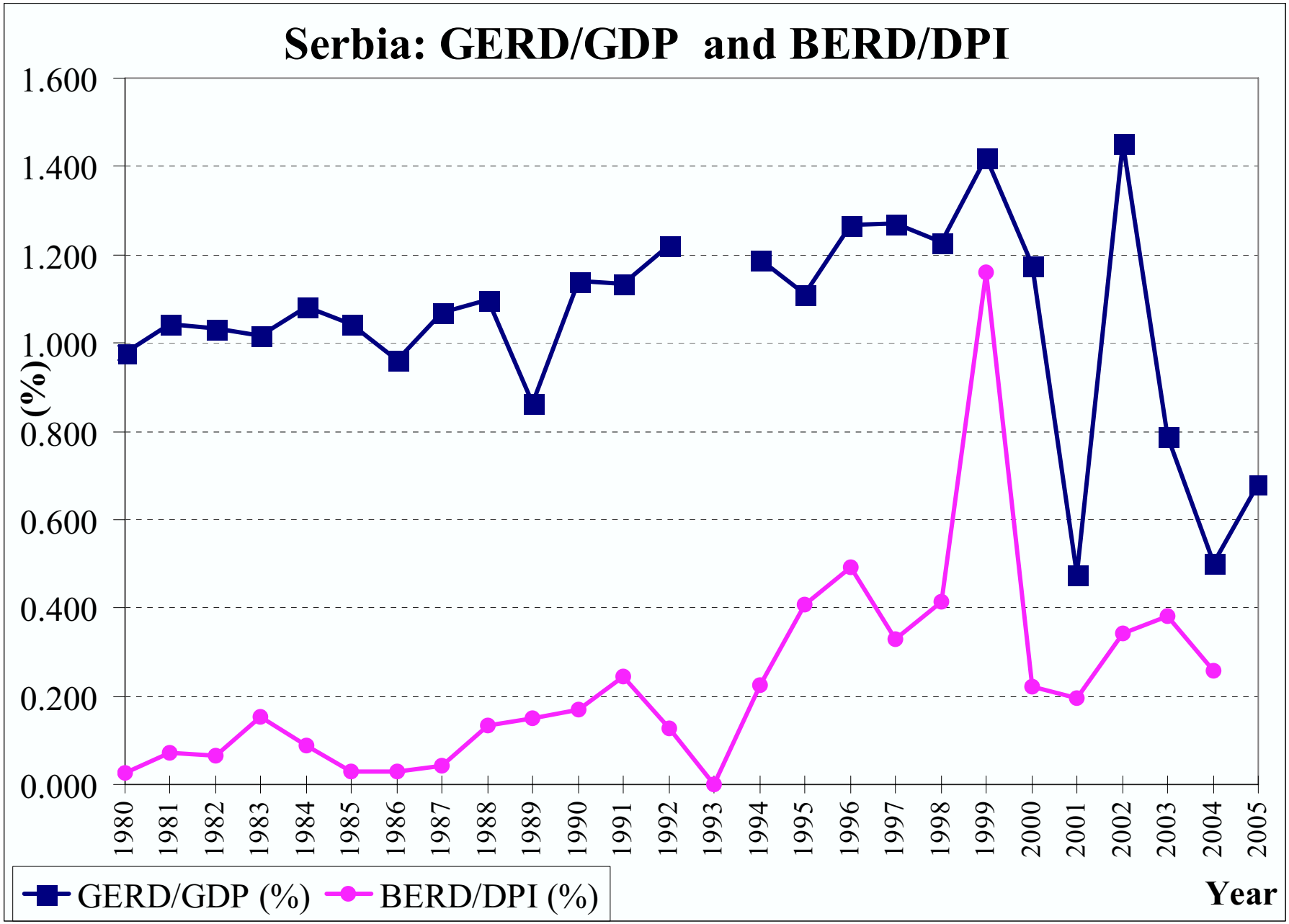

Serbia - R&D system: Employees, Researchers
Employees - share (%)
100%
80%
60%
40%
20%
0%
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Researchers
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year
Employees-total-RDU
Employees-total-RDI
Employees-total-HEO
Researchers-RDI
Researchers-RDU
Researchers-HEO


Employees in R&D system in Serbia
Share (%)
100%
80%
60%
40%
20%
0%
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005
Year
Researchers
Supporting staff - UG
Supporting staff - others
Administration
Others

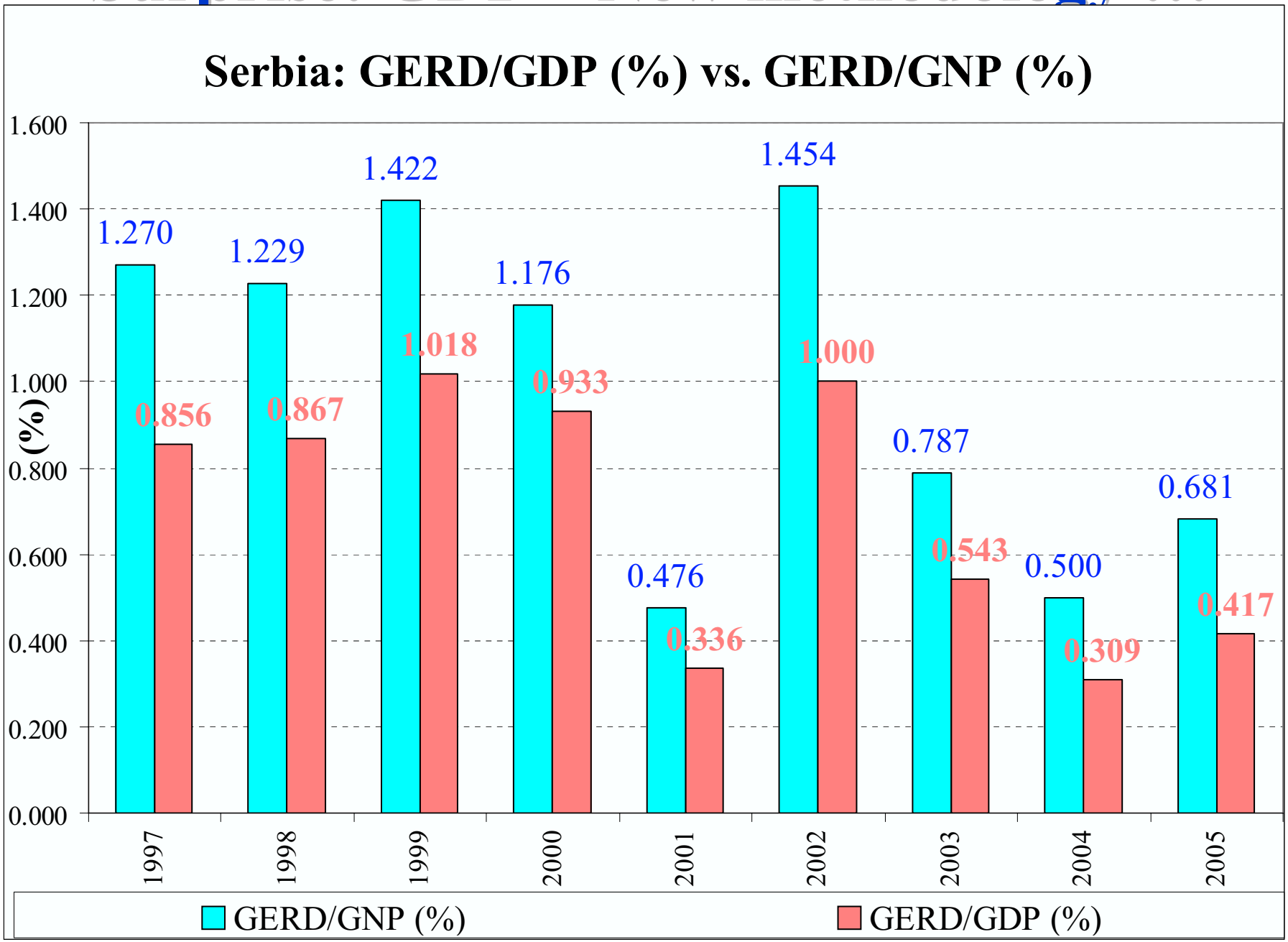

Serbia: Researchers by Field of Science
Researchers (FTE)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005
Year
RES-FTE -NS
RES-FTE - TS
RES-FTE - MS
RES-FTE - AS
RES-FTE - SS
RES-FTE - Hum
RES-FTE - Mult


Serbia: Researchers - Share by Field of Science
Share (%)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005
RES-FTE - NS
RES-FTE - TS
RES-FTE - MS
RES-FTE - AS
RES-FTE - SS
RES-FTE - Hum
RES-FTE - Mult


Serbia: Income from R&D activities-Share in total (%)
Share (%)
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
1980
1980
1982
1983
1984
1985
1986
1987
1988
1989
1989
1991
1992
1992
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
RDI: Income from R&D activities
RDU: Income from R&D activities
HEO: Income from R&D activities
All RD organizations - Income from R&D work
Year


Serbia: GERD/GDP and BERD/DPI
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
(%)
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year
GERD/GDP (%)
BERD/DPI (%)

Surprise: GDP – New methodology !!!



2.

Key challenges of science and innovation policies in Serbian' economy

Innovation capacity

"National innovative capacity is the ability of a country – as both a political and economic entity – to produce and commercialize a flow of new-to-the-world technologies over the long term" [Furman, Porter, Stern, 2002].

Building blocks for the concept of innovative capacity:

1. **Presence of a strong innovation infrastructure;**
2. **Specific innovation environments present in a country's industrial clusters;**
3. **Links between the common innovation infrastructure and specific clusters.**

Innovation capacity – second concept

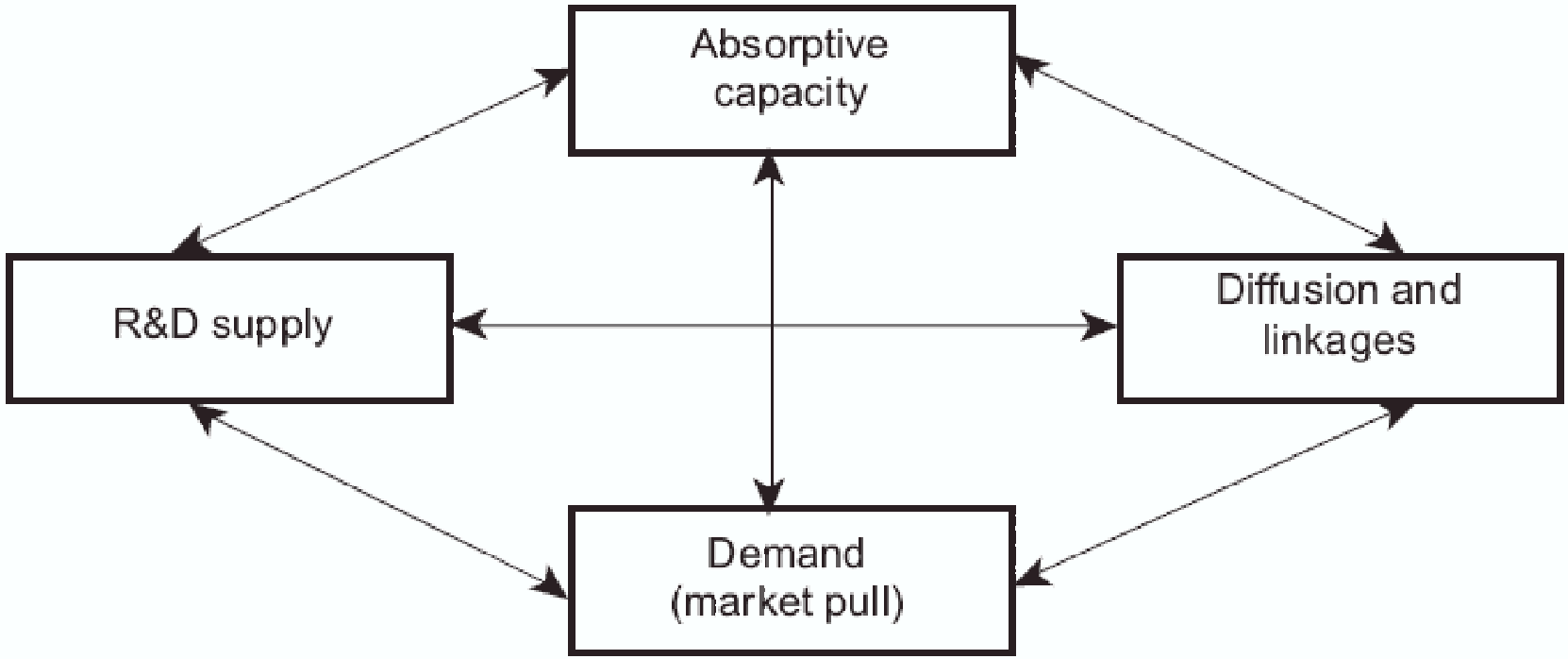
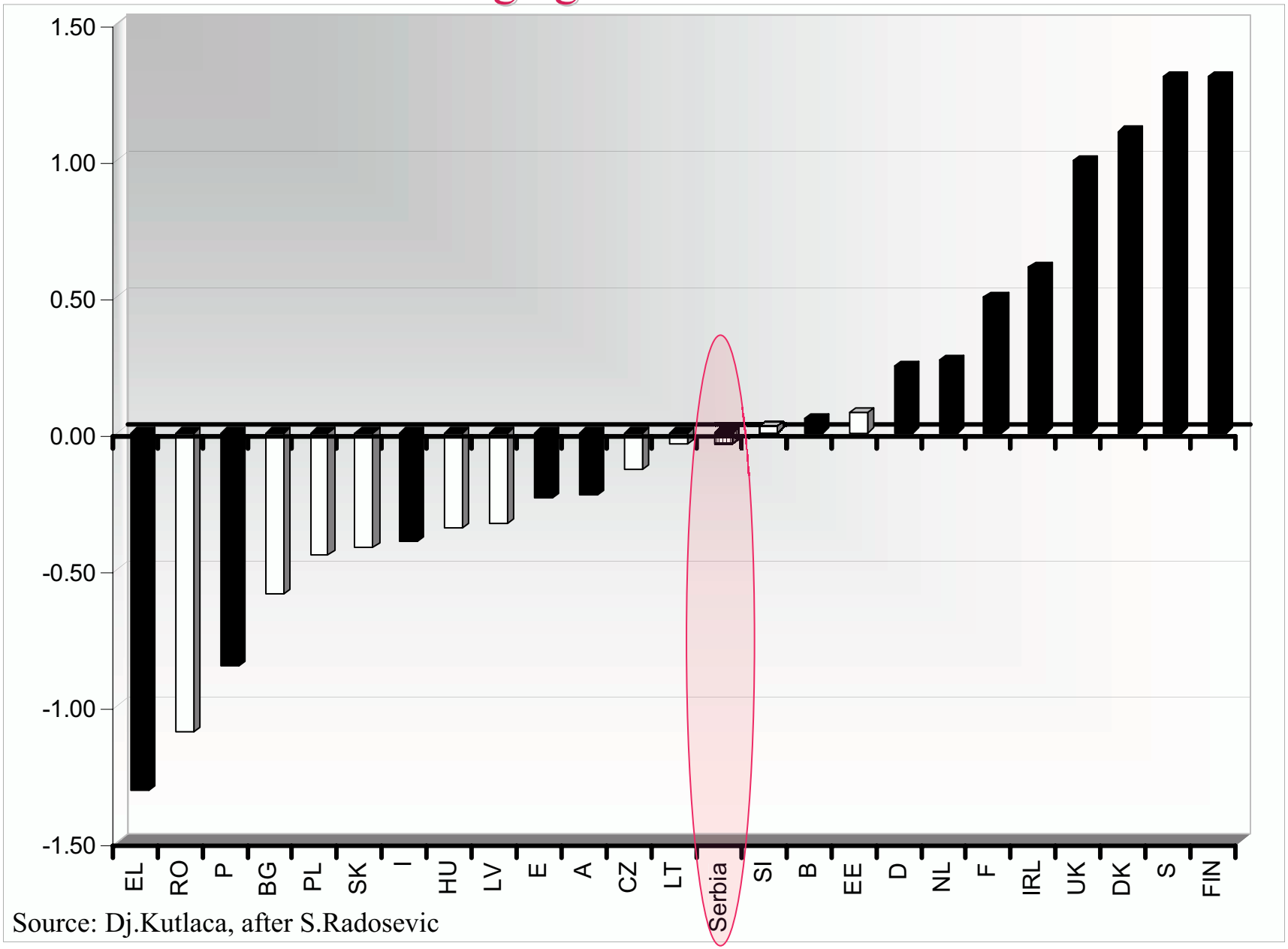


Figure 1: National Innovation Capacity Framework

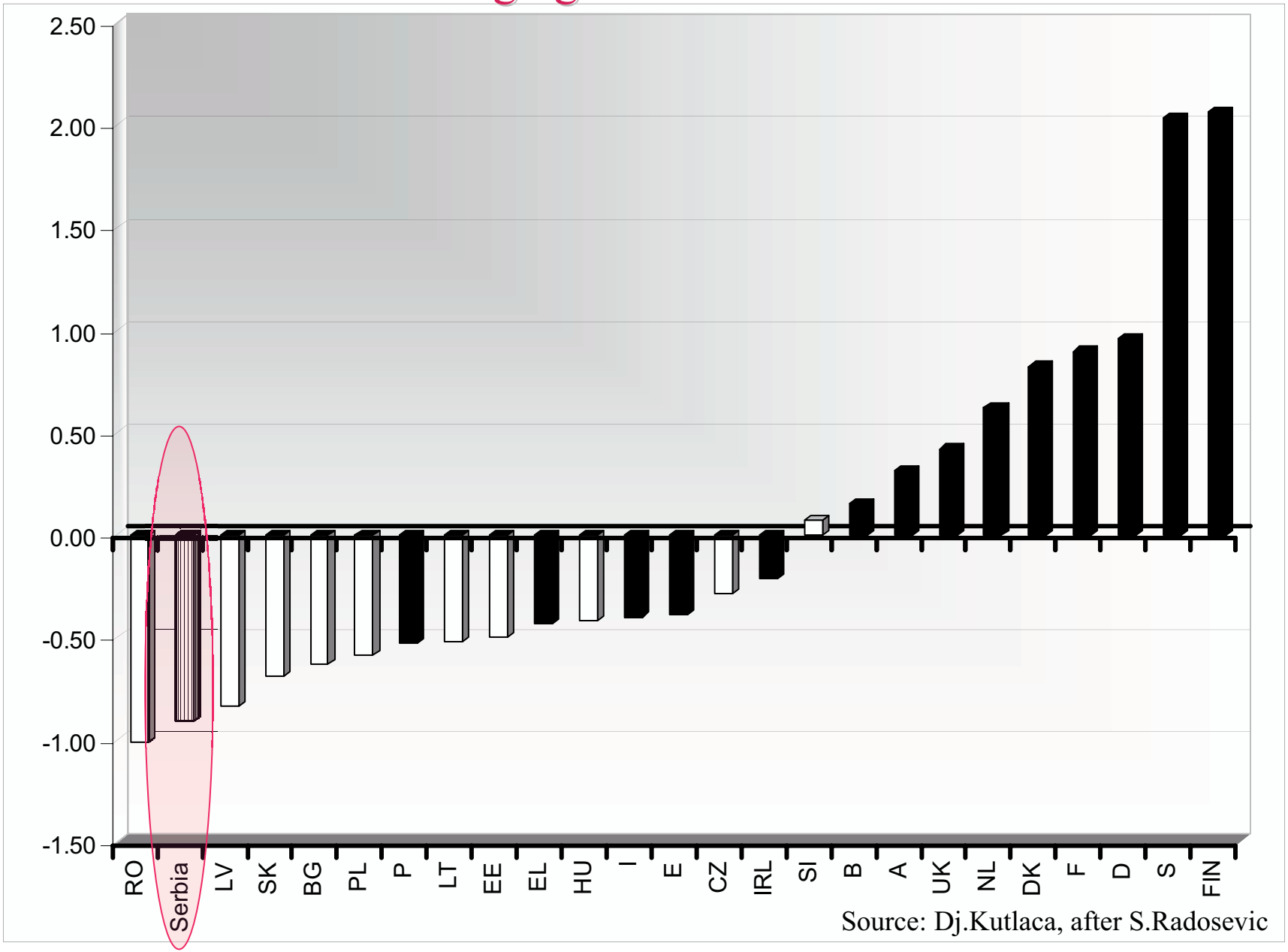
A Two-Tier or Multi-Tier Europe? Assessing the Innovation Capacities of Central and East European Countries in the Enlarged EU; SLAVO RADOSEVIC; School of Slavonic and East European Studies; JCMS 2004 Volume 42. Number 3. pp. 641–66

Absorptive Capacity:
Agregate Indicator

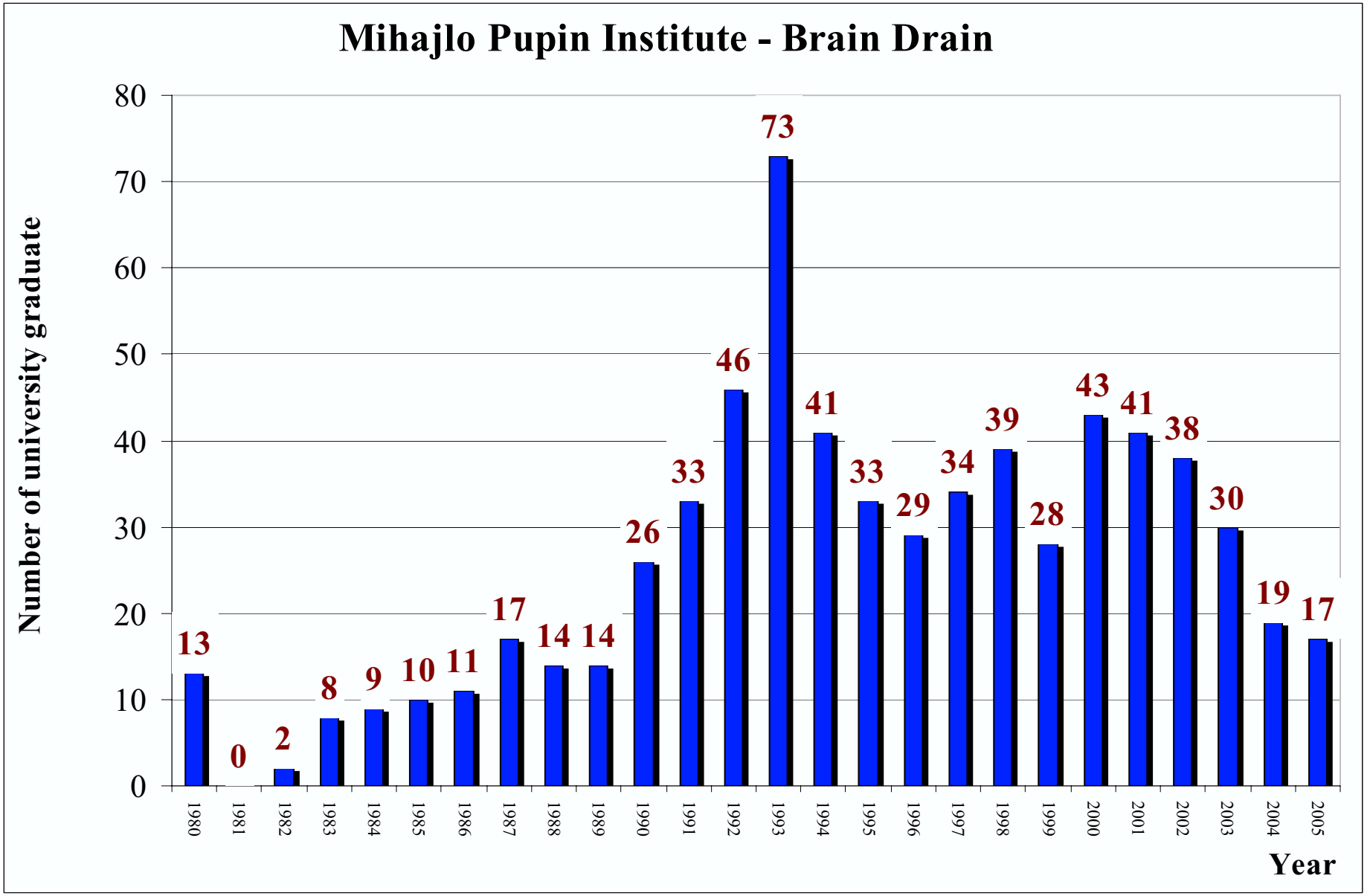


Source: Dj.Kutlaca, after S.Radosevic

R&D supply:
Agregate Indicator



Source: Dj.Kutlaca, after S.Radosevic


Mihajlo Pupin Institute - Brain Drain
Number of university graduate
Year
0
10
20
30
40
50
60
70
80
13
0
2
8
9
10
11
17
14
14
26
33
46
73
41
33
29
34
39
28
43
41
38
30
19
17
1980
1981
1982
1983
1984
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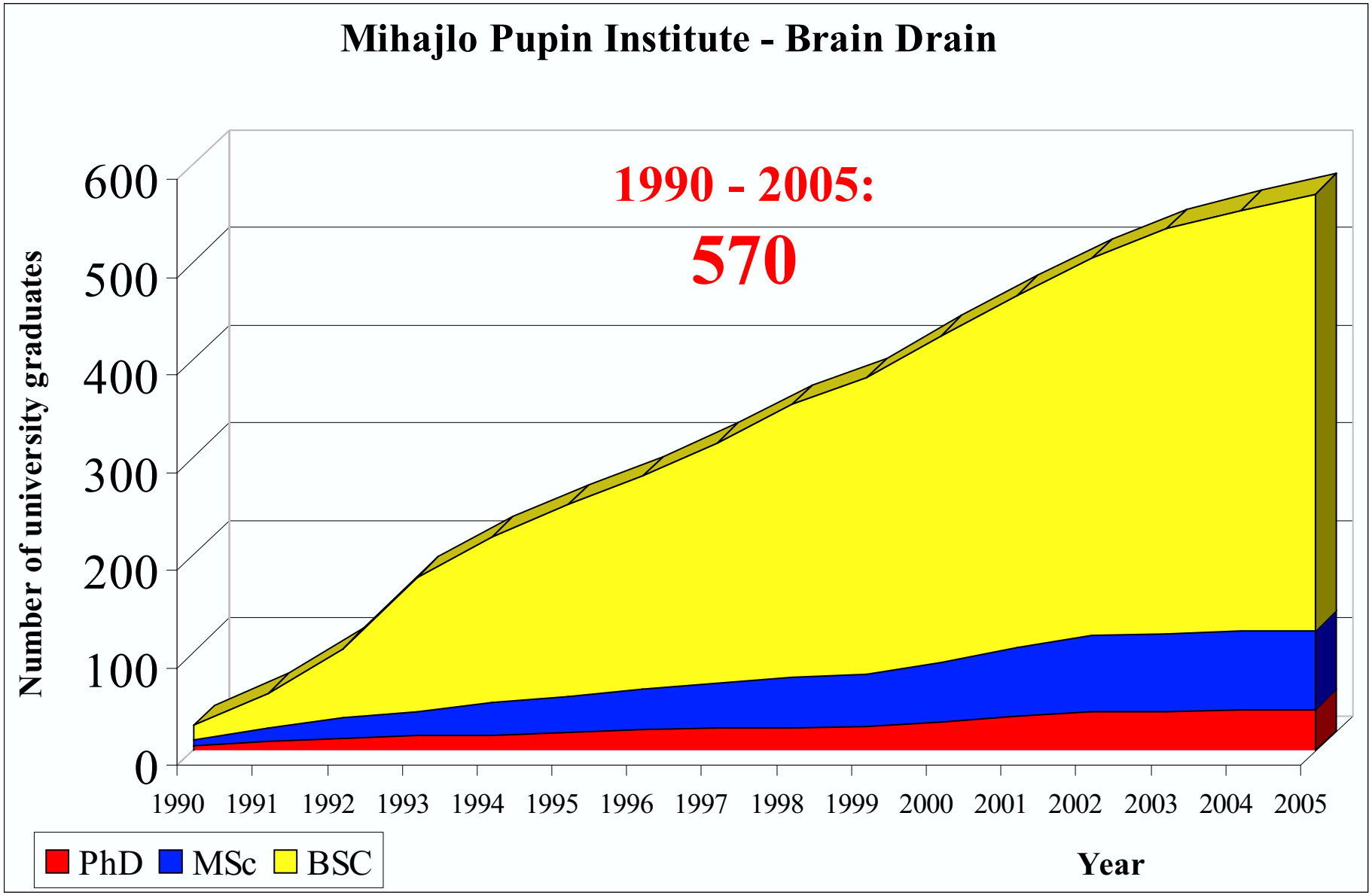
2003
2004
2005


Mihajlo Pupin Institute - Brain Drain
1990 - 2005:
570
Number of university graduates
600
500
400
300
200
100
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
PhD
MSc
BSC
Year

3.

S&T and innovation policy in Serbia: how far it is from the best practice models?

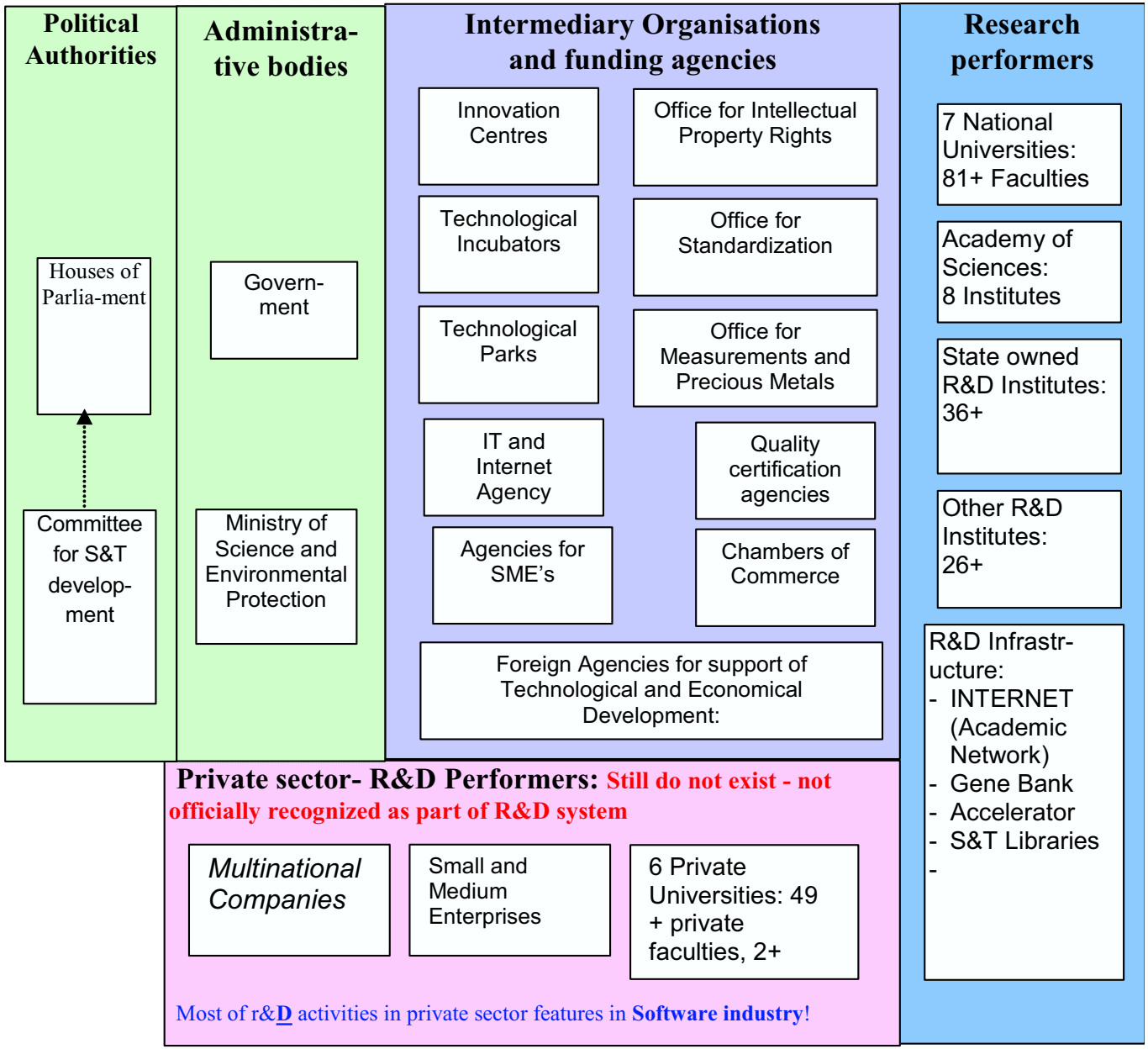


Figure 1: Structure of the STI system in Serbia

(model inspired by ENIP-PRIME NETWORK)

Institutions and Mechanism for Normative and Legislative Regulation and Administration of R&D Activities in Serbia

1. Science Law from 1993 last till 2005 !;
2. Science Law adopted in December 2005;
3. Innovation Law, adopted in December 2005.
4. Law on High Education, adopted in September 2005.

Institutions and Mechanism for Normative and Legislative Regulation and Administration of R&D Activities in Serbia .... cont.

Laws on IP Protection:

- **Patents Law**, published on July 2, 2004 in Official Gazette of the Serbia and Montenegro, No 32/20004
- **Copyrights and Related Rights Law**, published on December 24, 2004 in Official Gazette of the Serbia&Montenegro, No 61/2004
- **Trademark Law**, in power from January 1, 2005, published in Official Gazette of the Serbia&Montenegro, No 61/2004
- **Law on the Legal Protection of Designs**, published on December 24,2004 in Official Gazette of the Serbia&Montenegro, No 61/2004
- **Law on the Protection of Integrated Circuit Topographies**, published on December 24, 2004 in Official Gazette of the Serbia and Montenegro, No 61/2004

Comparison betwen Science Law – 1993 and Science and Innovation Laws – 2005:

→ *What is the Scope?*

Science Law-1993

Science Law & Innovation Law-2005

vs.

OECD – "Oslo Manual-2005":

Innovation activities are all scientific, technological, organisational, financial and commercial steps which actually, or are intended to, lead to the implementation of innovations. Some innovation activities are themselves innovative, others are not novel activities but are necessary for the implementation of innovations. Innovation activities also include R&D that is not directly related to the development of a specific innovation.

Comparison betwen Science Law – 1993 and Science and Innovation Laws – 2005:

→ *How Restrictive they are?*

Science Law-1993 vs.

Science Law & Innovation Law-2005

- → Eligibility to use public money for R&D
- → Eligibility to do R&D
- → Use of term ”Institute”
- → Privatization of R&D organization – govt. owned instutes must have govt. approval for privatization

Comparison betwen Science Law – 1993 and Science and Innovation Laws – 2005:

→ *How Detailed they are?*

Science Law-1993 vs.

Science Law & Innovation Law-2005

a) Strictly defined types of organizations eligible for R&D;

b) Strictly defined minimum of human resources for each type of organizations under (a) (number of researchers);

c) Strictly defined minimum of R&D capacities for all R&D and Innovative organizations (structure of researchers by scientific degree).

Researchers by sectors of performance, year 2001

	BES	**GS**	**HES**
OECD av.	64.60%	8.8%	26.30%
Serbia	6.37%	18.8%	74.83%

Outputs of R&D system in Serbia

Authors from Serbia – Production of R&D papers in international S&T journals

Year	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Number of scientific articles	1023	990	1011	1163	1410	1594
Number of technical papers	1177	1124	1298	1372	1782	2036
Total number of articles	**2200**	**2114**	**2309**	**2535**	**3192**	**3630**

Source: National Library of Serbia and *WOS – Web of Science*.

Outputs of R&D system in Serbia

Resident patenat applications in Serbia

Year	Number of patent applications:			Total
	Individuals	Companies	R&D organizations	
1999	219	10	6	**235**
2000	280	18	4	**302**
2001	331	15	3	**349**
2002	325	21	4	**350**
2003	330	15	8	**353**
2004	448	15	6	**469**
2005	351	14	4	**369**

Source: Intellectual property organization, Belgrade.

"R&D organization is alowed to perform, along with R&D, other acitivities directed to comercialization of R&D results, under condition that this activites will not imperil quality of R&D work [Science Law – 2005].

The Innovation Scoreboard, 2004 – part I

The Innovation Scoreboard Indicators, year 2004	Serbia	Bulgaria	Romania	EU25	EU15
Human resources					
Number of scientist per 1000 active population	3.2		2.1	5.8	
Employees in R&D sector as % of active population	6.3		3.4	10.2	
New S&E Graduates (‰ of 20-29 years age class)	6.7	11.7	5.8	11.5	12.5
Population with tertiary education (% of 25-64 years age classes)	17.3	21.3	9.6	21.2	21.8
Participation in life-long learning (% of 25-64 years olds)	4.1	1.4	1.3	9.0	9.7
Employment in medium-high and high-tech manufacturing (% of total workforce)	6.57	4.66	5.32	6.60	7.10
Employment in high-tech services (% of total workforce)	2.59	2.69	1.45	3.19	3.49

Source: [EC, 2005] and authors' calculation base on data from Statistical office of Serbia

The Innovation Scoreboard, 2004 – part II

The Innovation Scoreboard Indicators, year 2004	Serbia	Bulgaria	Romania	EU25	EU15
Knowledge creation					
Public R&D expenditures (GERD - BERD) (% GDP)	0.21	0.40	0.15	0.67	0.69
Business expenditure on R&D (BERD) (% GDP)	0.06	0.09	0.23	1.27	1.30
EPO high-tech patent applications (per million population)	0.00	0.6	0.2	26.0	30.9
USPTO high-tech patent applications per million population	0.00	0.1	0.0	9.4	11.2
EPO registered patents (per million population)	0.00	3.7	0.9	133.6	158.8
USPTO registered patents (per million population)	0.00	0.8	0.2	59.9	71.3

Source: [EC, 2005] and authors' calculation base on data from Statistical office of Serbia

The Innovation Scoreboard, 2004 – part III

The Innovation Scoreboard Indicators, year 2004	Serbia	Bulgaria	Romania	EU25	EU15
Transmission and application of knowledge					
SMEs innovating in-house (% of manufacturing SMEs)	–	–	–	31.7	32.1
Manufacturing SMEs involved in innovation co-operation	–	–	2.9	7.1	6.9
Innovation expenditures (% of all turnover in manufacturing)	–	–	1.32	2.15	2.17

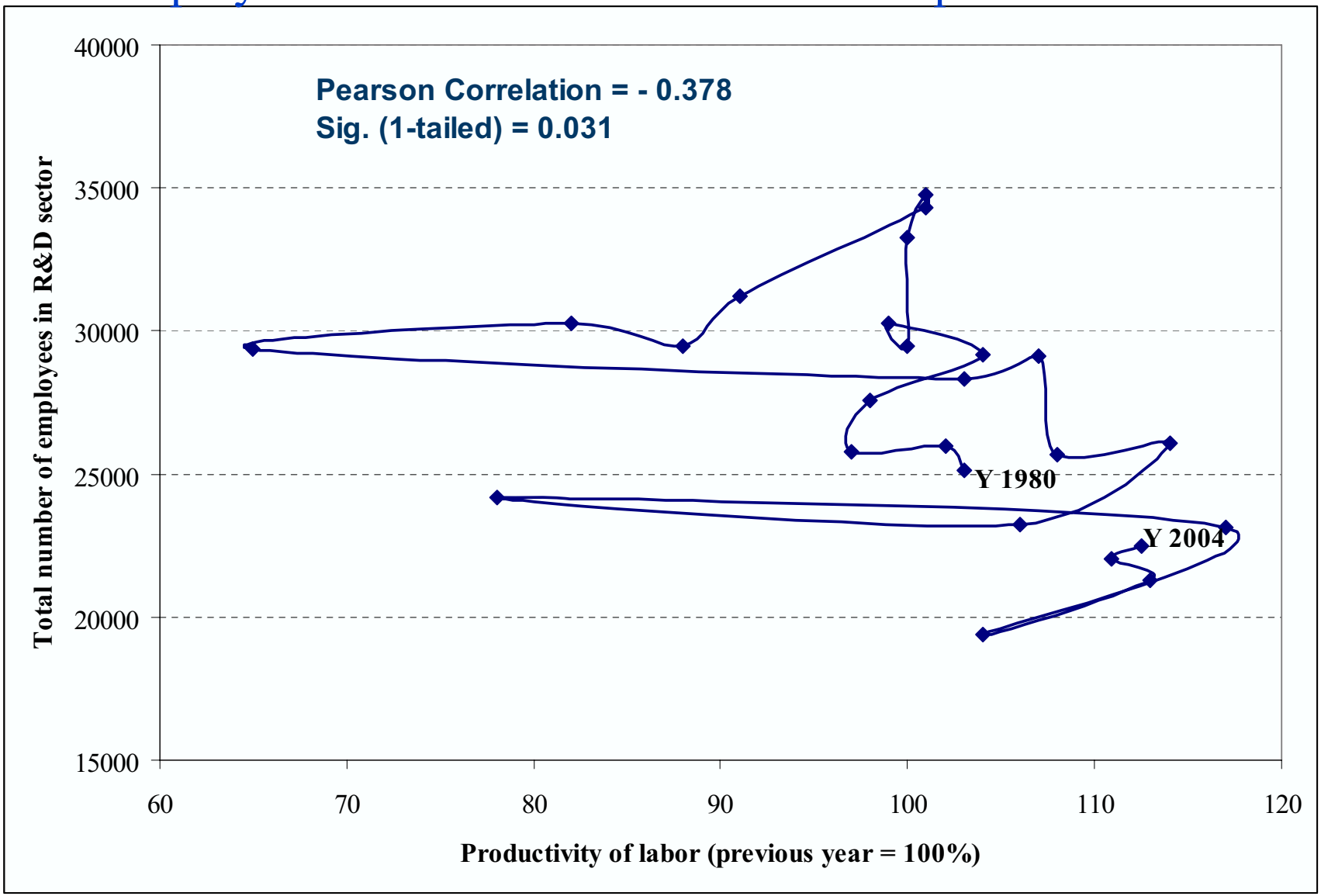
Source: [EC, 2005] and authors' calculation base on data from Statistical office of Serbia

The Innovation Scoreboard, 2004 – part IV

The Innovation Scoreboard Indicators, year 2004	Serbia	Bulgaria	Romania	EU25	EU15
Innovation finance, output and markets					
High-tech venture capital investment (% of GDP)	–	–	–	–	50.8
New capital raised on stock markets (% of GDP)	–	–	0.003	–	0.025
'New to market' products (% of sales by manufacturing firms)	–	–	7.8	5.9	5.9
Home internet access (% of all households)	–	–	–	–	0.57
ICT expenditures (% of GDP)	–	11.2	6.4	6.3	6.2
Percent of manufacturing value-added from high technology	1.31	–	–	12.7	14.1

Source: [EC, 2005] and authors' calculation base on data from Statistical office of Serbia

Scatter diagram for Labor productivity of economy and Total number of employees in R&D sector for 1980-2004 period in Serbia



Findings – I:

→ R&D system practically has no contributions to economic development of Serbia;

→ R&D system exists independently from needs and necessities of economy in Serbia.

Findings – II:

- → Number of R&D organizations has decreased from late 80's until 2004
- → Number of R&D organizations in BES permanently less than number of independent (govt.) institutes
- → Income from R&D activities has decreased – in 2004 this share is only 21,59% of R&D organizations' total income!
- → Total number of employees in R&D sector has decrease until 2000. Since than, this number is increasing every year!

Industrial R&D and Innovation activities in Serbia:

- First Innovation Survey: 1987-1991
- Second Innovation Survey: 1992-1995
- Metal processing, Chemical and Textile industries in Serbia and Montenegro
- Sample: 25% of employees
- 70% same firms in both surveys
- Methodology: OECD: - Frascati & Oslo Manual, EU harmonized questionnaire

- Third Innovation Survey: 2005-2006 – EAR!

S&T and innovation policy in Serbia: how far it is from the best practice models?

S: -Human Resources (?) -?	**W**: -R&D system: old, inefficient structure -Lack of knowledge and general acceptance of role of NIS? -No sufficient National Innovation capacities
O: -EU membership -National Investment Plan and other investments in economy; - Cheap outsourcing. -?	**T**: -"Wait and See" strategy - "No change please" - Mentality - Absence of Innovation culture

S&T&I SYSTEM IN SERBIA: research prospective – part II

Content – part II:

1. **Complementary information to UNESCO-BRESCE Report 'Strengthening Science Policy and Management in SEE'** ☺ ☹
2. **'S&T Statistics and Indicators systems' – Future plans** ☺ ☹
3. **Special projects / areas (of innovation) in the field of S&T statistics** ☺ ☹
4. **Reactions/comments concerning the tasks 3, 4, 5, 6 described in the Report** ☺ ☹

1.

Complementary information to UNESCO-BRESCE Report ‘Strengthening Science Policy and Management in SEE’

Serbia (Report: page 32)

The Ministry of Science and Environmental Protection has the main responsibilities regarding the formulation of S&T policy, with a new Law of Science in the process of being adopted. In its activities, the Ministry supports firstly basic research activities, to which the biggest share of its budget is allocated. Other areas of focus are technological development and technology transfer, international cooperation, human resources (for the first time post-doctoral fellowships are supported), and activities devoted to building the Information Society, with a focus on academic networking, IT infrastructure and e-government. The more recent interest in the development of innovation policies is reflected in the fact that a new Law of Innovation is being drafted, which will allow for the first time, for example, spin-off firms from research. The international cooperation activities have focused mostly on rebuilding bilateral agreements and on the participation in multilateral programmes, with particular attention being given to the EU Framework Programmes. One of the central drivers of change of the system has been the departure of a significant number of researchers, weakening the capabilities of the system and its innovation potential.

1. Science Law adopted in December 2005;

2. Innovation Law, adopted in December 2005.

2.

‘S&T Statistics and Indicators systems’ – Future plans

FP7 or UNESCO or ?

Optimistic scenario:

- 2007: **Capacity building** (Frascati, Oslo, ...)
- 2008: **Statistical surveys** (Innovation, R&D,...)
- 2009: **S&T&I Indicators**:

  Data collection and use in practice

⇒Innovation scoreboard for Serbia, ... WBC

3.

Special projects / areas (of innovation) in the field of S&T statistics

FORESIGHT

in Science, Economy and Society

in WBC:

1. **Phase I:**

   Identification of available resources for S&T development, as well as for development of economy and society!

⇒ Development of statistical system in S&T&I, compatible with OECD / EU / UNESCO standards!

4.

Reactions/comments concerning the tasks 3, 4, 5, 6 described in the Report

Although

"HOPE is not a Strategy"

but

we do hope that tasks 3, 4, 5 and 6 will be realized in near future!!!

Questions

&

Answers