



Republic of Serbia
Ministry of Science and
Technological Development

SCIENCE AND TECHNOLOGICAL
DEVELOPMENT STRATEGY
OF THE REPUBLIC OF SERBIA 2009 - 2014
“FOCUS AND PARTNER”



DRAFT VERSION
PREPARED FOR PUBLIC DEBATE



VISION OF SCIENCE AND TECHNOLOGICAL DEVELOPMENT OF SERBIA

Serbia as an innovative country where scientists reach European standards, contribute to the knowledge of the entire society and the technological development of the economy

KEY MESSAGES

1. Serbian science, despite improvements over the past few years, is still on an unsustainable path
2. Investing in science and technology is, for Serbia, the only way to create a sustainable economy and society
3. To become relevant in science and technology and become an innovative country, Serbia needs to **FOCUS** on a few national priorities
4. Implementation of the Strategy through system improvement and **PARTNERSHIP**, is as important as the Strategy itself
5. Increasing and diversifying R&D expenditure, as well as investing 300 million euros in infrastructure, are preconditions for the success of this strategy
6. A strict implementation tracking system will be established

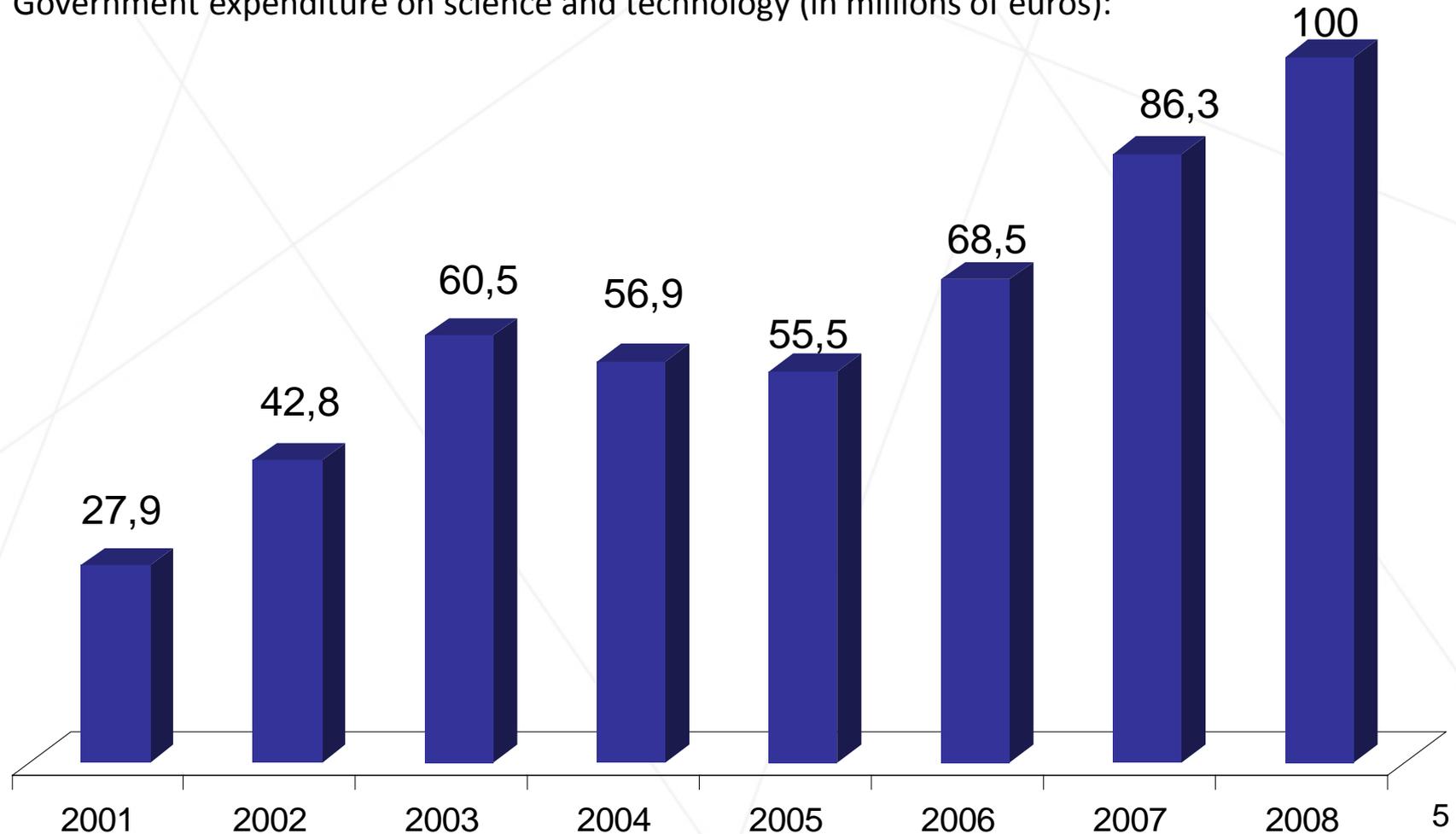


1. Serbian science, despite improvements over the past few years, is still on an unsustainable path



PUBLIC R&D EXPENDITURES HAVE BEEN RISING SINCE 2001

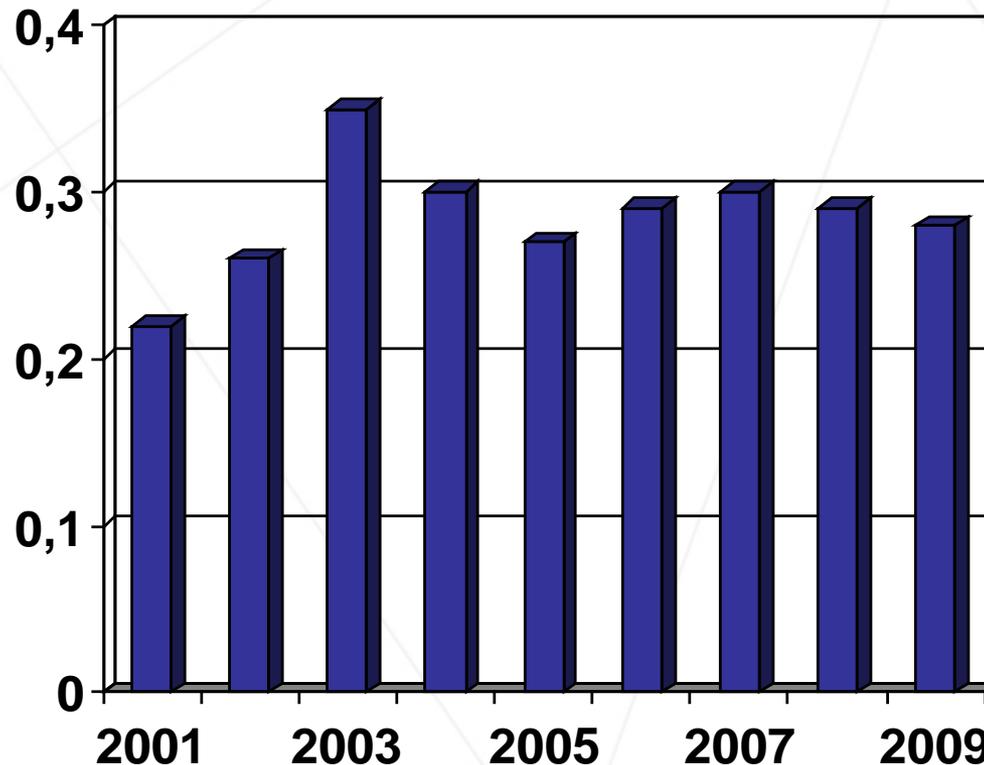
Government expenditure on science and technology (in millions of euros):





HOWEVER, IN % OF GDP, EXPENDITURES HAVE STAGNATED

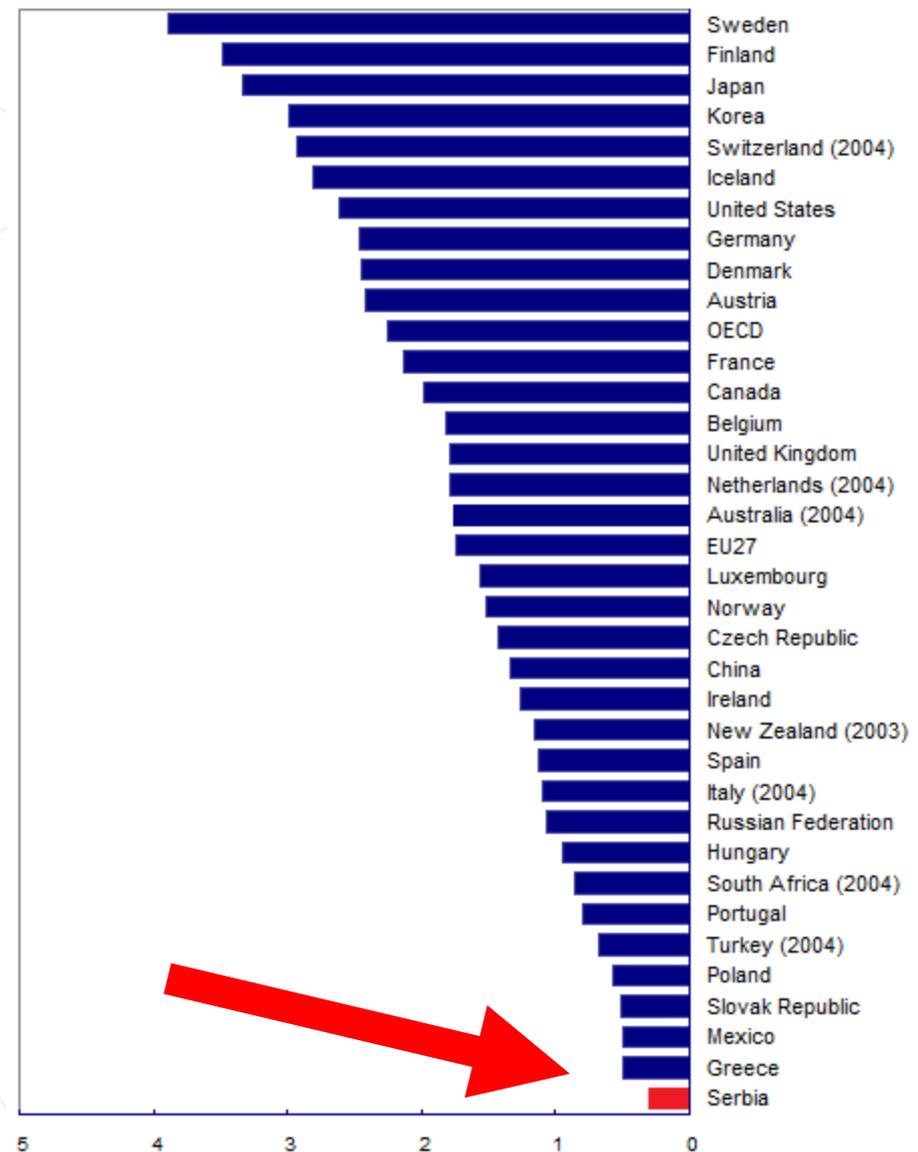
Budgetary R&D expenditures
(in % of GDP, not counting the National Investment Plan):



Source: Law on budget RS

R&D INVESTMENTS IN SERBIA ARE ONE OF THE LOWEST IN THE DEVELOPED WORLD

Gross domestic expenditure on R&D (as a percentage of GDP):



Source: OECD Science, Technology and Industry: Scoreboard 2007

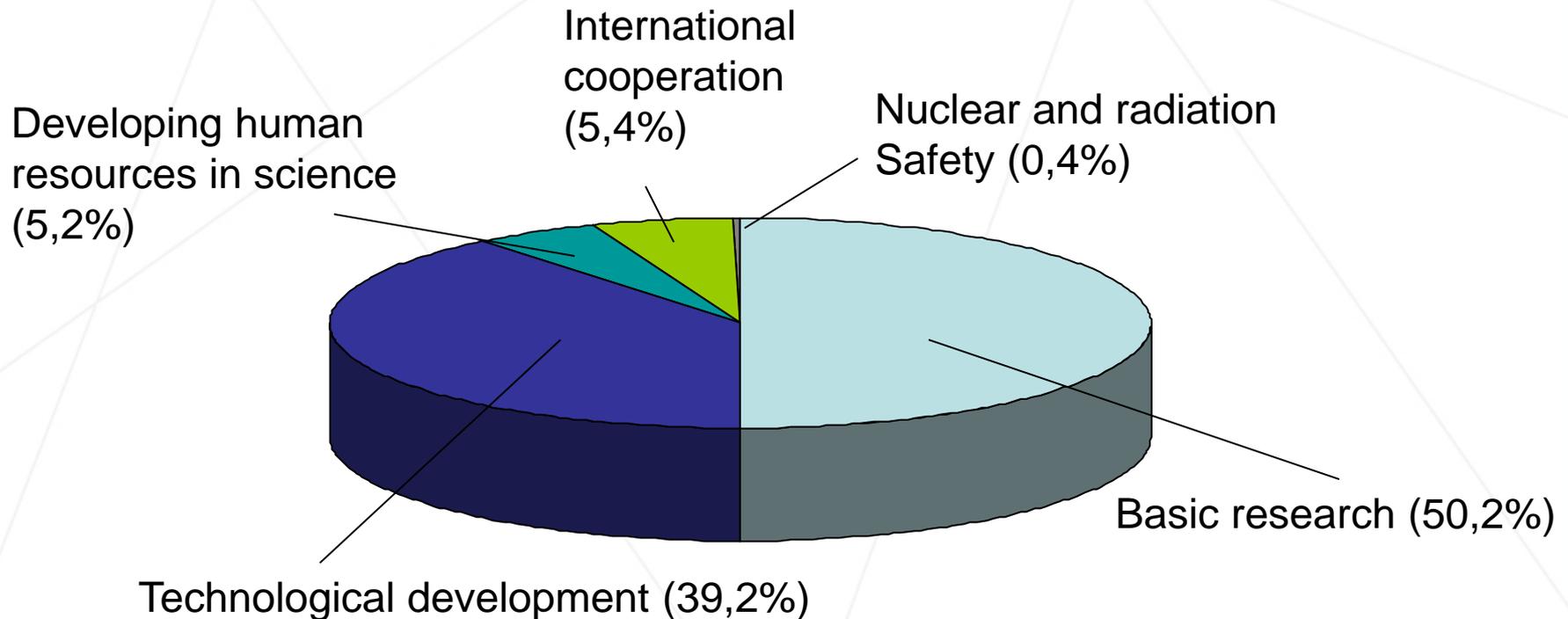


A COMPLETE PICTURE OF R&D FINANCING HAS TO TAKE INTO ACCOUNT OTHER SOURCES OF FINANCING AS WELL

- ▶ There are budgetary R&D expenditures in other ministries and other levels of government such as AP Vojvodina and municipalities
- ▶ Research institutes have income from collaborating with companies and through international projects (total estimate for non-budgetary income in 2008 is 12,5 billion dinars)
- ▶ Higher-education institutions received 23 billion dinars of budgetary financing in 2008 and earned about 12 billion apart from that, which makes up in total 1,3% of GDP

THE BUDGET IS PREDOMINANTLY SPENT ON BASIC RESEARCH

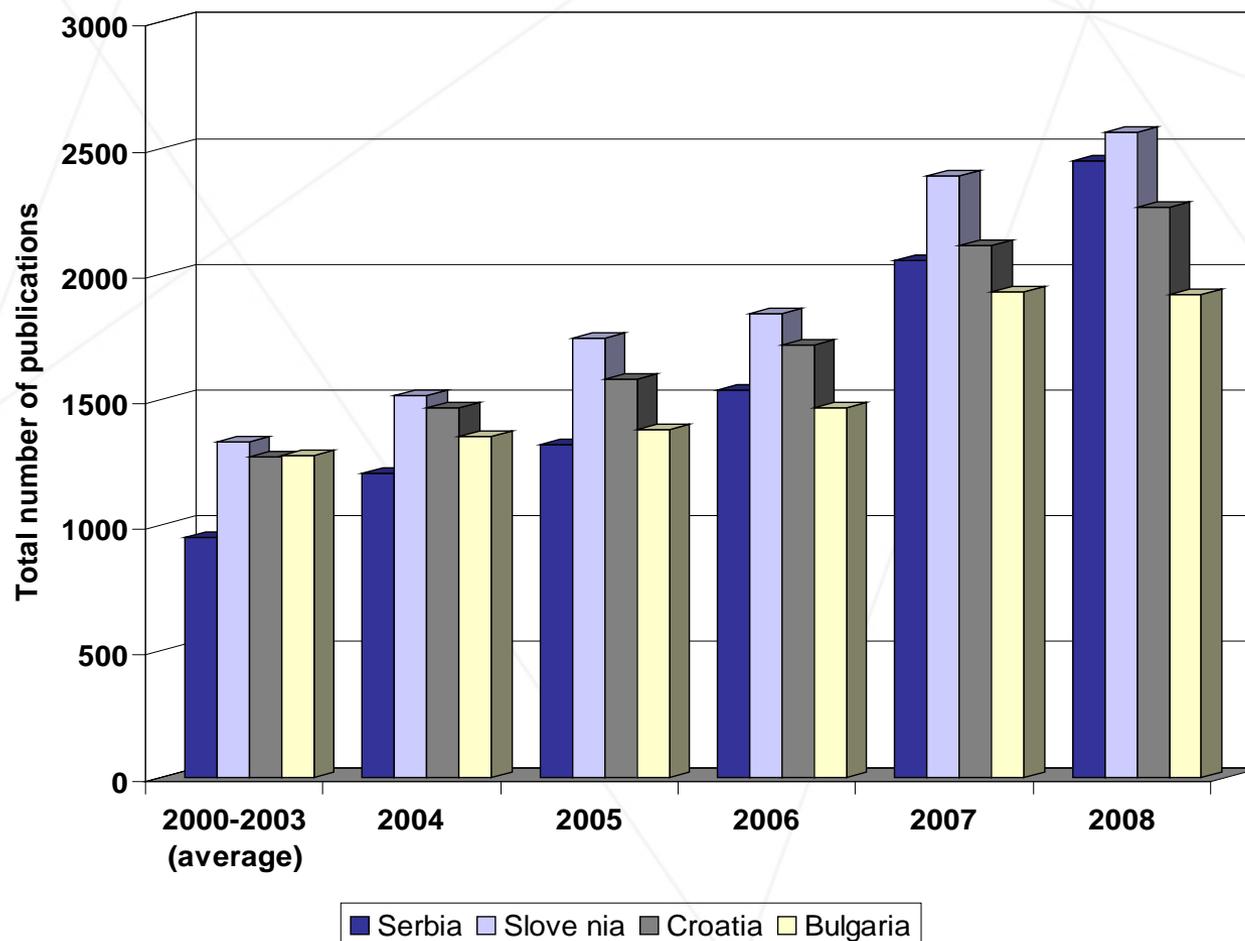
Distribution of budgetary funding for R&D (in percentages of total budget):





SERBIAN SCIENCE HAS CAUGHT UP WITH NEIGHBOURING COUNTRIES IN THE NUMBER OF PUBLICATIONS

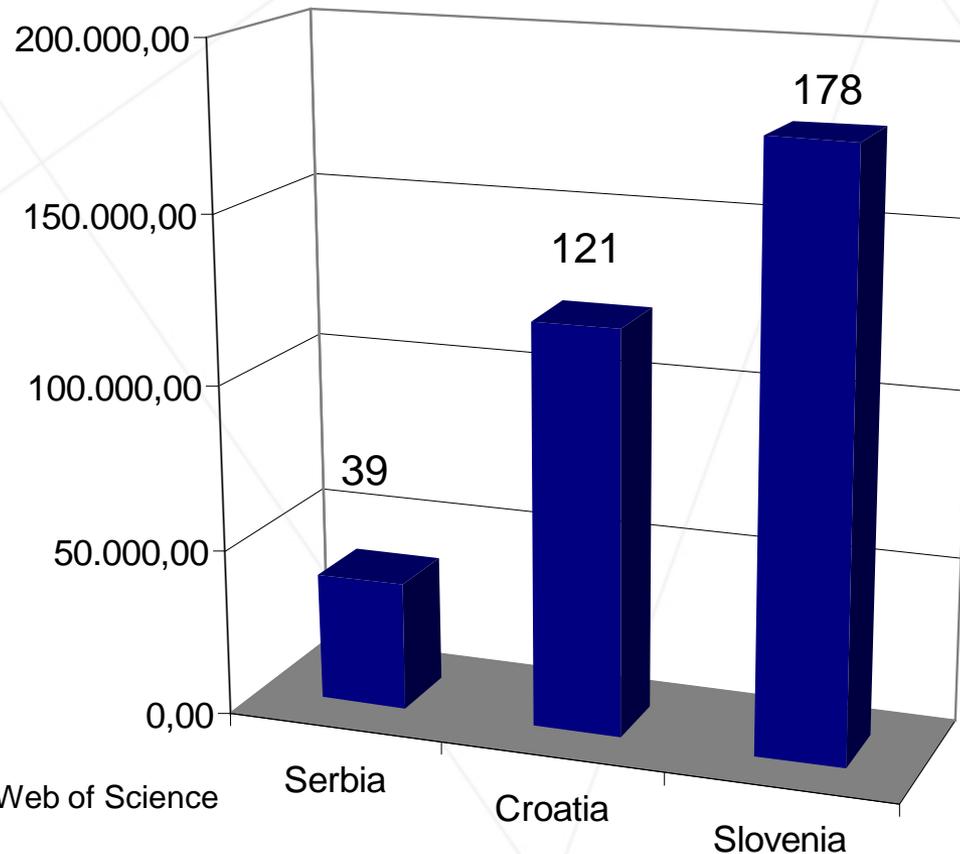
Number of publications in Serbia and countries in the region:





INVESTMENT PER PUBLISHED PAPER IS SIGNIFICANTLY LOWER IN SERBIA THAN IN NEIGHBOURING COUNTRIES

Investment per published paper (in thousands of euros):

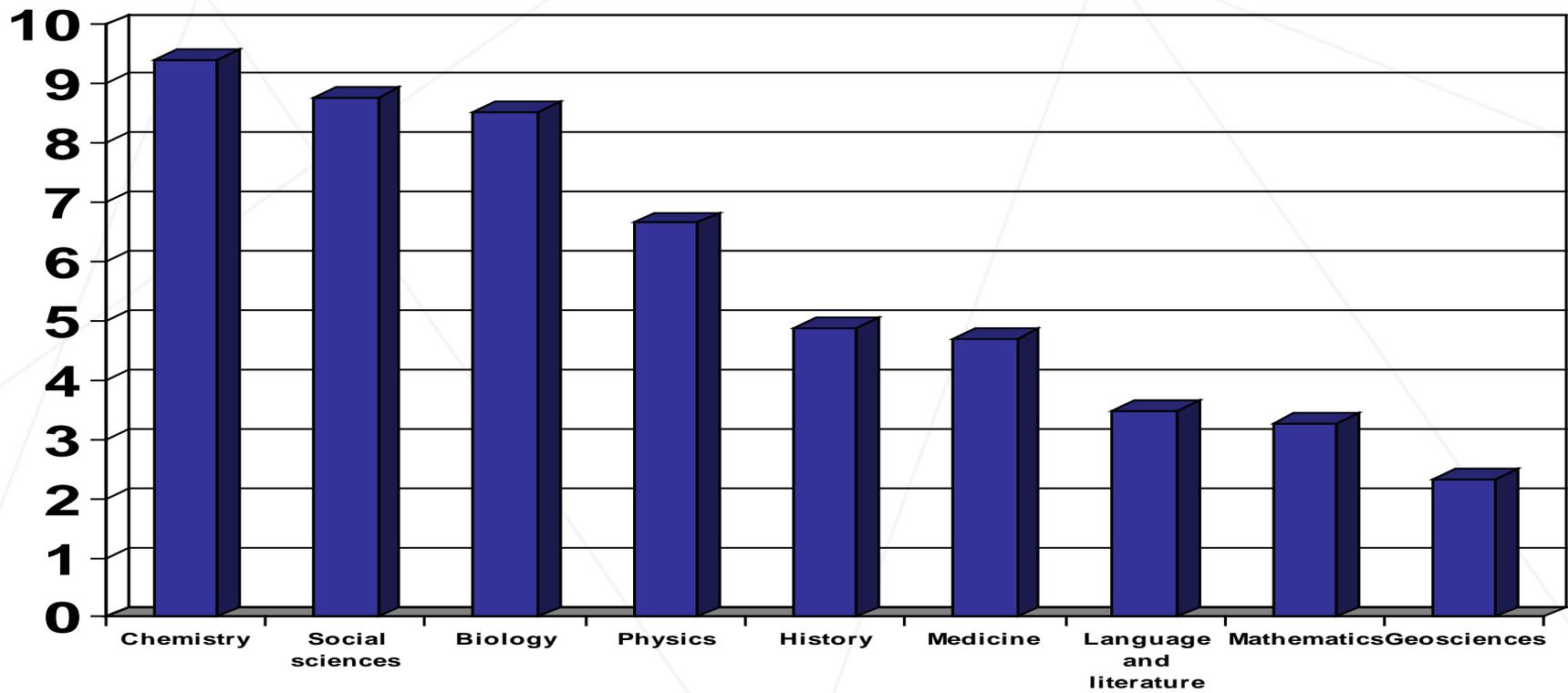


Source: Web of Science



THERE IS NOT A SINGLE BASIC RESEARCH FIELD WHERE SERBIA INVESTS MORE THAN 10 MILLION EUROS

Basic research funding by discipline in 2008 (in millions of euros)

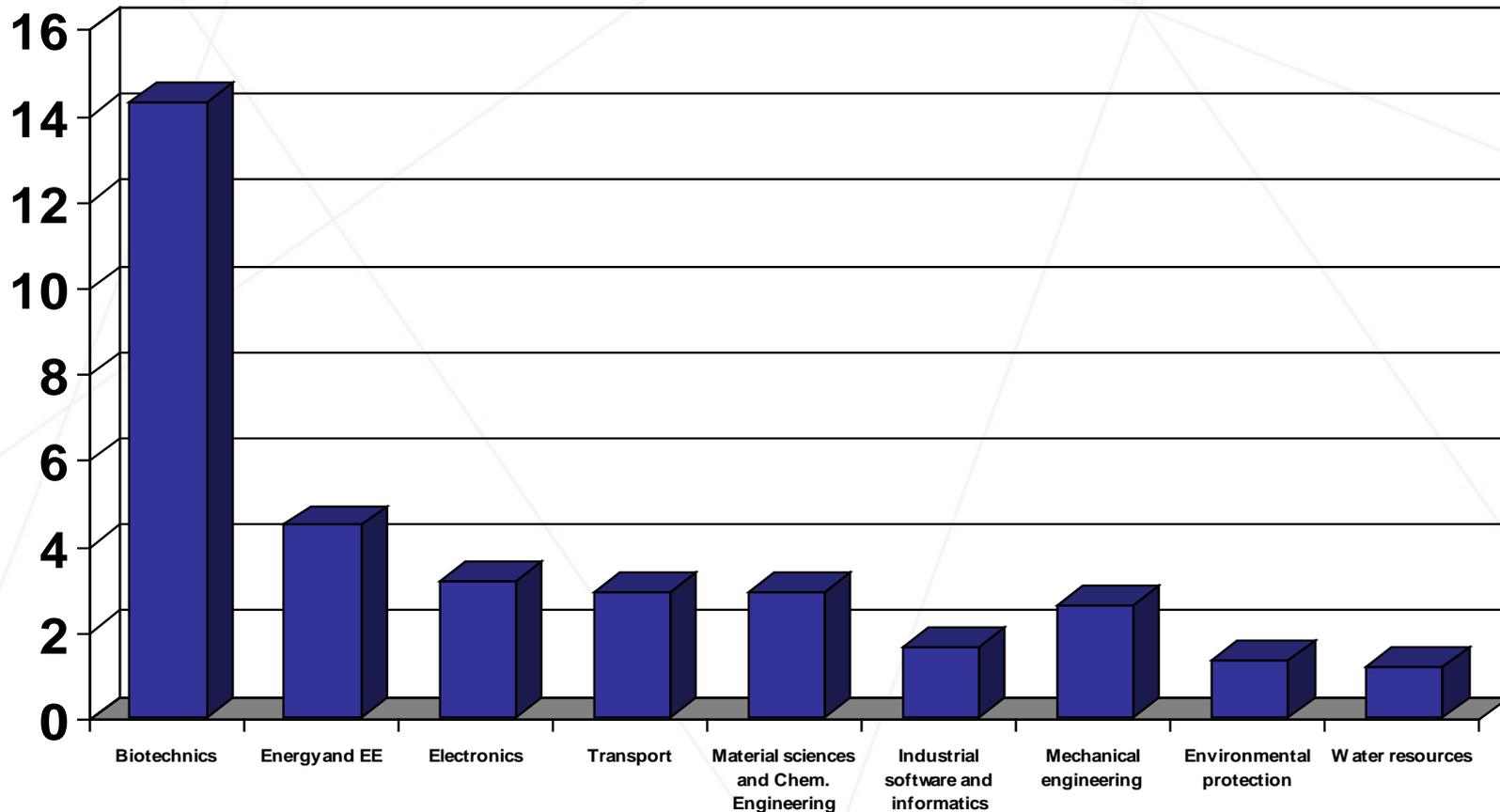


Source: Ministry of Science and Technological Development



WITH THE EXCEPTION OF AGRICULTURE, THERE IS NOT A SINGLE FIELD OF APPLIED SCIENCE WHERE SERBIA INVESTS MORE THAN 4 MILLION EUROS

Technological development funding by discipline in 2008 (in millions of euro):

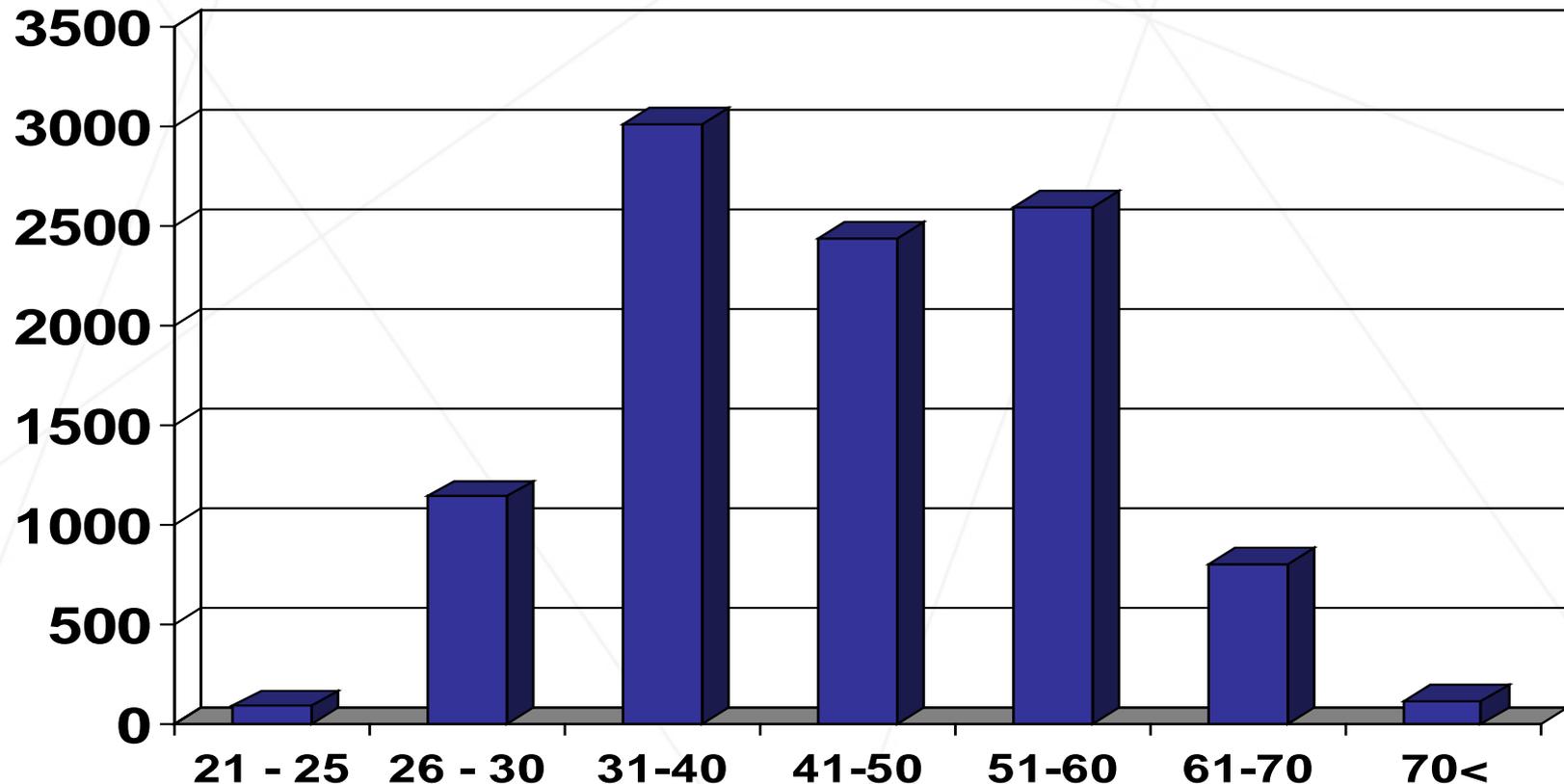


Source: Ministry of Science and Technological Development



THE AGE PYRAMID OF OUR SCIENTIFIC COMMUNITY IS WORRISOME: FEW YOUNG RESEARCHERS, MANY SOON TO RETIRE

Number of researchers in Serbia by age:

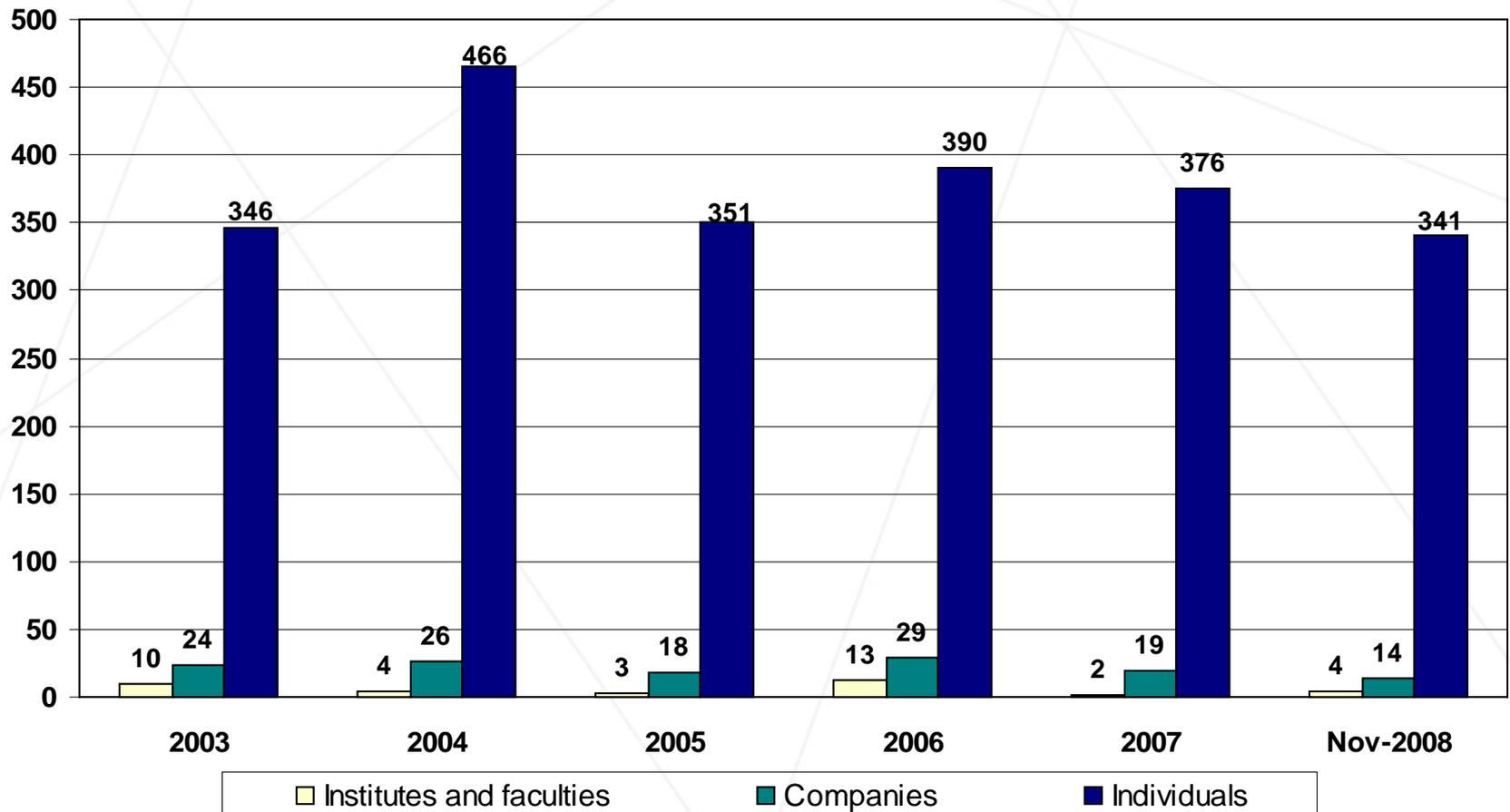


Source: Ministry of Science and Technological Development



IN SERBIA, INTELLECTUAL PROPERTY IS EITHER NOT BEING CREATED AND/OR NOT BEING PROTECTED

The structure of patent applications in Serbia:



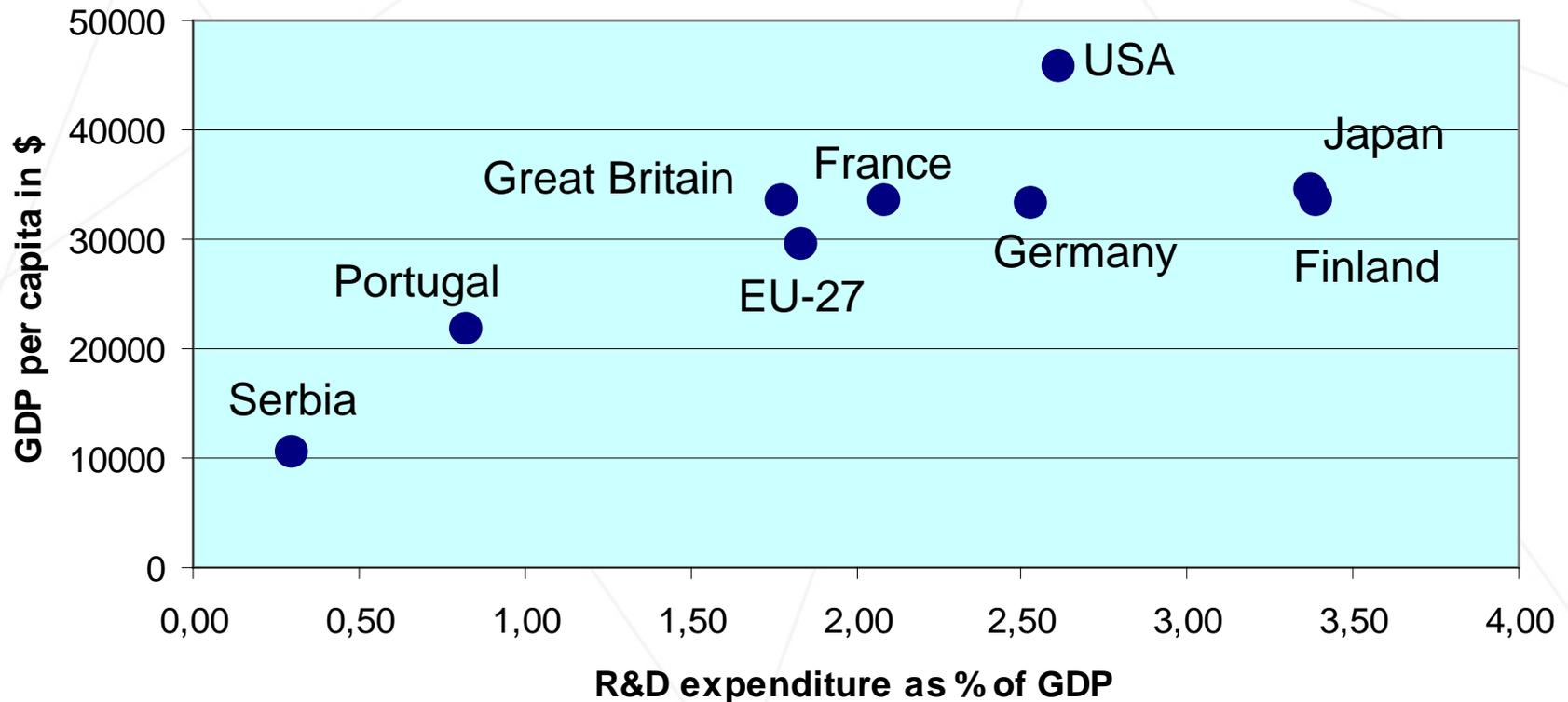
Source: Intellectual property office of Serbia



2. Investing in science and technology is, for Serbia, the only way to create a sustainable economy and society

INVESTING IN SCIENCE AND TECHNOLOGY IS A PRECONDITION FOR ECONOMIC DEVELOPMENT

Correlation between GDP per capita and R&D expenditure as percent of GDP (in 2007):



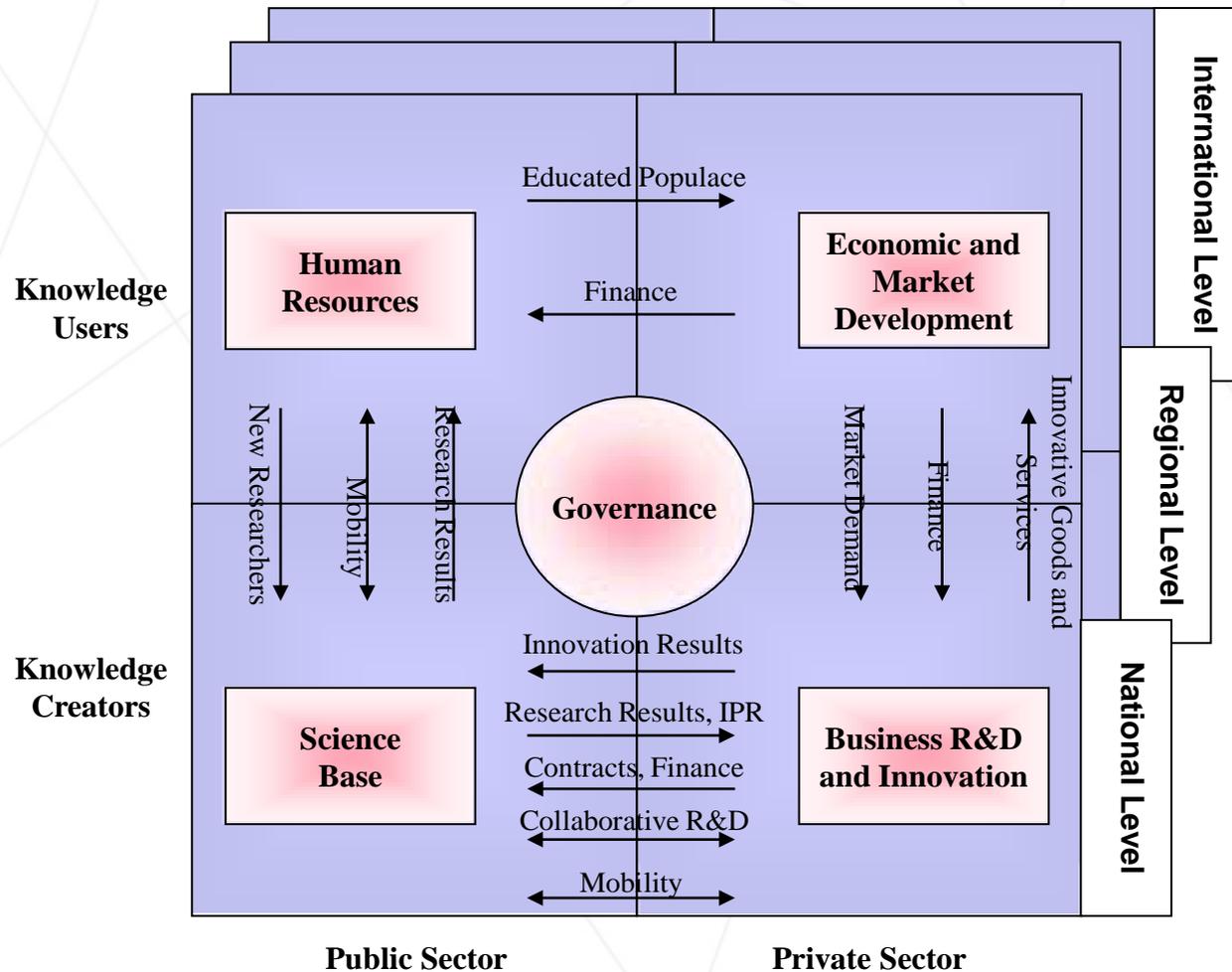
Source: World bank



INVESTING IN SCIENCE IS, FOR SERBIA, THE ONLY WAY TO CREATE A SUSTAINABLE ECONOMY AND SOCIETY

- ▶ Serbia does not have natural, but only human, resources to base its development on
- ▶ Globalization closes the option to continue growing by exporting raw goods and providing cheap labor
- ▶ The European Lisbon agenda places science and technology on top of Europe's priorities

THE ULTIMATE GOAL IS TO CREATE A NATIONAL INNOVATION SYSTEM





3. To become relevant in science and technology and become an innovative country, Serbia needs to **FOCUS** on a few national priorities



DOMESTIC CAPACITY IS THE FOUNDATION FOR INTERNATIONAL COOPERATION

- ▶ Investing in people and infrastructure
- ▶ Maintaining the existing level of basic research in all disciplines
- ▶ Increasing investment in applied and development research with a clear and measurable goal
- ▶ Defining national priorities
- ▶ Building a national innovation system
- ▶ Strongly connecting with domestic and foreign partners, public and private sector



FOCUS



EVEN THE MOST DEVELOPED COUNTRIES HAVE DEFINED A LIMITED SET OF NATIONAL PRIORITIES

Great Britain	Energy, e-Sciences, Genomics/Proteomics, Stem Cell Research, Brain research, Rural economy and land usage
France	Life sciences, biotech and health, Energy, Safety, Socio-economic studies and humanities, Environmental protection, Earth and space exploration
USA	Advanced defense systems, Health protection, Agriculture, Energy, Space exploration and exploitation, Basic research
EU	Health, Food, Agriculture, Fisheries and biotechnologies, Information and communication technologies, Nanosciences, Nanotechnologies, Materials and new manufacturing technologies, Energy, Environmental protection and climate change, Transport and aeronautics, Socio-economic and humanistic studies, Space, Safety
Japan	Life sciences, Information and communication technologies, Environment protection, Nanotechnologies and material science Secondary priorities: Energy, Manufacturing technologies, Social infrastructure
China	Energy, Water and Mineral Resources, Environmental protection, Agriculture, Manufacturing technologies, Transport, Information technologies, Health, Urban planning, Public safety



FOCUS THROUGH DEFINING A LIMITED SET OF NATIONAL R&D PRIORITIES

- ▶ **Criteria used for defining priorities:**
 - ▶ Being in line with other national strategies
 - ▶ Possibility of successful participation in the Lisbon agenda and alignment with EU research priorities
 - ▶ Number and quality of current human resources, in the country and abroad
 - ▶ Investments so far over the past seven years
 - ▶ Success of researchers up to now
 - ▶ Amount of future investments needed to have critical mass and be relevant
 - ▶ Applicability in industry, in Serbia and abroad
 - ▶ Current international collaboration and potential for improvement
 - ▶ Importance for policy making capacity and affirmation of national identity



SEVEN NATIONAL R&D PRIORITIES ARE PROPOSED

- ▶ Biomedicine and human health
- ▶ New materials and nanosciences
- ▶ Environment protection and climate change
- ▶ Agriculture and food
- ▶ Energy and energy efficiency
- ▶ Information and communication technologies
- ▶ Improvement of public policy making processes and affirmation of national identity



BIOMEDICINE (priority topics):

- ▶ Molecular base of genomic and extra genomic mechanisms induced by endogenous or exogenous factors in physiological and pathological processes
- ▶ Environment and adaptive mechanisms
- ▶ Molecular base for transduction of hormone signals
- ▶ Biochemical and cytogenetic effects of radiation
- ▶ Biomedical engineering
- ▶ Molecular foundations of monogenic, polygenic and multi factor diseases
- ▶ Improving the quality of prediction, prevention, diagnostic and therapeutic approaches in clinical application
- ▶ Pharmacogenomics, regulatory mechanisms and pharmacological modulations
- ▶ Nutrigenomics, nutrigenetics and preventive medicine



NEW MATERIALS AND NANOSCIENCES

(priority topics):

- ▶ Ceramics and metal materials
- ▶ Composites
- ▶ Biomaterials
- ▶ Carbon nanostructures and nanocapsules
- ▶ Materials for new and renewable energy sources
- ▶ Electronic and magnetic materials
- ▶ Polymers
- ▶ Optic and photonic materials
- ▶ Eco-materials



ENVIRONMENTAL PROTECTION AND CLIMATE CHANGE (priority topics):

- ▶ New environmental protection technologies
- ▶ Integrated control of the environment (quality of water, air and soil)
- ▶ Scientific ecosystem monitoring and protection of biodiversity
- ▶ Environmental hazards and ecosystem risk assessment
- ▶ Monitoring and predicting climate change and its effects on the environment



ENERGY AND ENERGY EFFICIENCY

(priority topics):

- ▶ Increasing the efficiency of energy production, distribution and usage, with special focus on the efficiency of buildings
- ▶ Developing new technologies in the exploitation of fossil fuels
- ▶ Developing new technologies in using renewable energy sources and clean technologies with zero emission, mostly hydro-power plants, co-generation and biomass
- ▶ Modern measuring techniques of energy usage, monitoring and optimal automatic control
- ▶ Efficient usage of current mines and research on new locations



AGRICULTURE AND FOOD (priority topics):

- ▶ New enzymes and microorganisms in bioprocesses, new products and biomass production
- ▶ Evaluation and usage of cultivated and natural genetic resources through conventional and molecular methods as a base for healthy, nutritional and safe food production
- ▶ Advancing knowledge in the field of sustainable management, production and usage of biological resources
- ▶ Developing new technologies and products in the food industry and technologies based on traditional products
- ▶ Bio-rational usage, fertility increase, remediation and protection of soil



INFORMATION AND COMMUNICATION TECHNOLOGIES (priority topics):

- ▶ Built-in electronic systems
- ▶ Intelligent sensor-actuators and multi-sensory systems
- ▶ Management and control of complex distributed systems
- ▶ Informatization and digitalization of libraries
- ▶ Telecommunication systems for digital transmission
- ▶ Radar and infrared identification and control systems
- ▶ Expert systems
- ▶ Data safety



IMPROVEMENT OF PUBLIC POLICY MAKING PROCESSES AND AFFIRMATION OF NATIONAL IDENTITY (priority topics):

- ▶ Affirmation of the role of social sciences in formulating public policies
- ▶ Support in integrative processes: entering the EU, relations with the region, Russian Federation, USA...
- ▶ Finishing major national projects: dictionary, atlas, grammar...
- ▶ Affirmation of the national historical and cultural heritage



A MESSAGE FOR THOSE WHO ARE NOT LISTED AS A NATIONAL PRIORITY:

- ▶ Support will not decline in any single field
- ▶ The unity of the research system will be maintained
- ▶ All researchers, teams and institutions will be judged based on the same criteria, independent on the level of priority
- ▶ Each field will define its own priority topics
- ▶ All fields will have equal access to infrastructure and equipment



4. Implementation of the Strategy through system improvement and PARTNERSHIP, is as important as the Strategy itself



IDENTIFICATION, DEVELOPMENT AND SUPPORT FOR TALENTED YOUNG RESEARCHERS IS OF CRUCIAL IMPORTANCE

- ▶ Identification and development of talent in schools and other educational institutions:
 - ▶ Science competitions (international Olympiads)
 - ▶ Petnica Science Center, finishing infrastructure project and stable financing
 - ▶ Mathematical High School, new campus in Belgrade and capacity increase

- ▶ Support:
 - ▶ Scholarships
 - ▶ Noncommercial housing, 1000 more flats for researchers
 - ▶ Legal changes to stabilize employment status
 - ▶ Doctoral studies: solving the problem of social and health insurance, more financial support



HIGHER EDUCATION AND SCIENCE WILL CLEARLY AND QUANTITATIVELY DETERMINE BY SCHOOL YEAR 2010-2011 A MID TERM PLAN FOR ENROLLMENT

- ▶ It is critical to increase the number of students studying natural sciences and engineering
- ▶ A 5 year exact plan for funding will be agreed upon
- ▶ The number of PhD students will be matched with priorities



PROJECT EVALUATION AND CAREER DEVELOPMENT WILL MATCH NATIONAL PRIORITIES

- ▶ The evaluation of scientists will continue to focus on the quality of publications but will be complemented with more qualitative measures
- ▶ Specific evaluation for technological innovations and social sciences and humanities
- ▶ Evaluation will encourage and reward collaboration between labs and institutions
- ▶ Extra rewards will be attached to publications in top international journals and international editorial positions
- ▶ Specific situations will be recognized: young researchers, those coming back from abroad, researchers returning from administrative positions



THE SYSTEM OF FINANCING WILL BE MORE FLEXIBLE AND WILL GRADUALLY REFLECT THE NATIONAL PRIORITIES

- ▶ Already half of our R&D capacity is estimated to be working on one of the seven national priorities
- ▶ Starting 2010, the Ministry will be announcing calls specifically for projects in the priority fields
- ▶ Multidisciplinary projects will be initiated, with one of the conditions being the engagement of researchers in different fields and institutions
- ▶ A part of the financing will be given to the industry to select partners in the research community for joint projects
- ▶ More flexibility will be introduced: deadlines, team size, project duration...
- ▶ Financing of project costs will be adapted to the specificities of different fields
- ▶ The system will support the initiative of individuals, teams and institutions

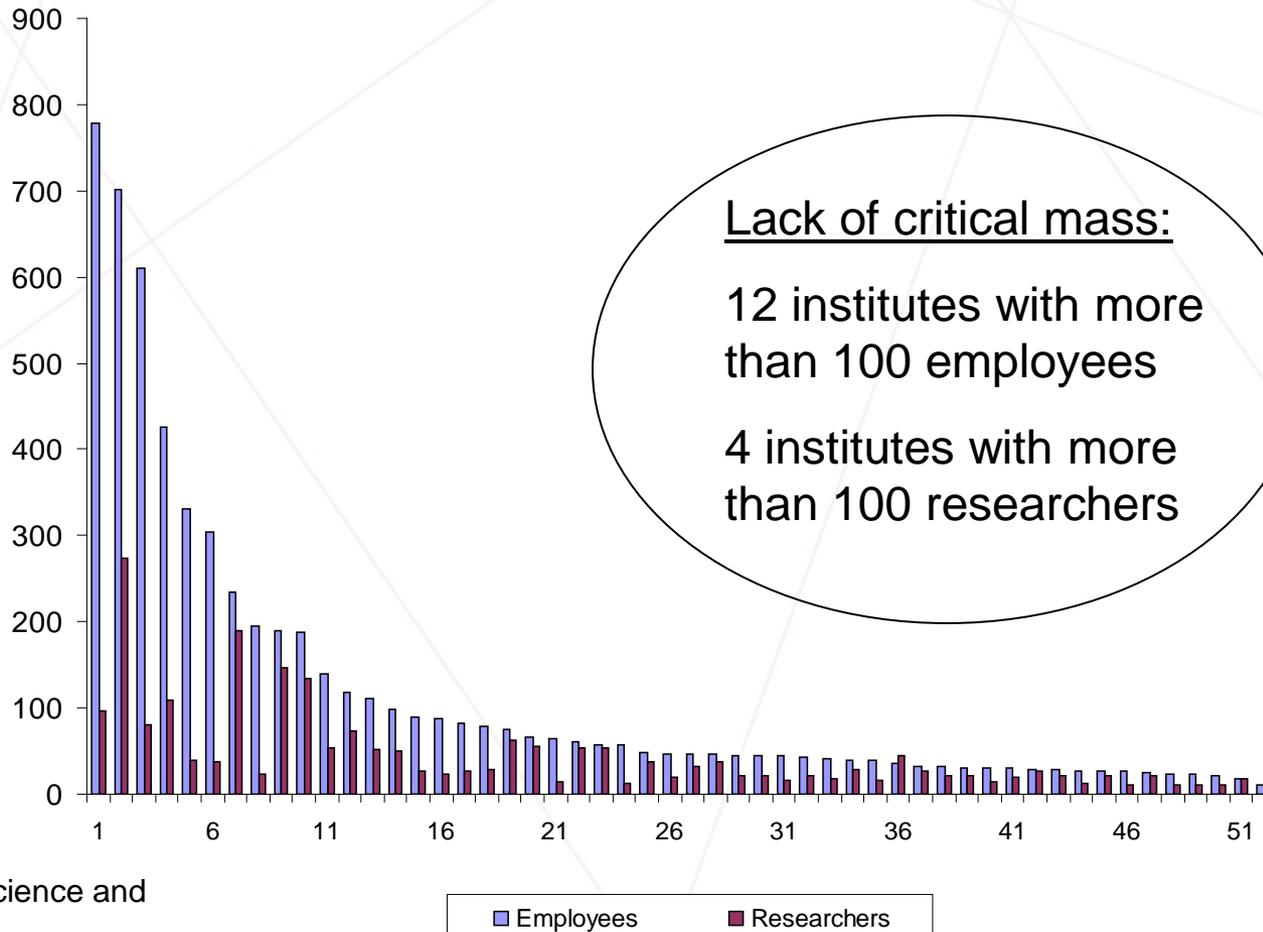


THE POSITION AND RESULTS OF SOCIAL SCIENCES AND HUMANITIES WILL BE IMPROVED

- ▶ An appropriate evaluation system will be introduced
- ▶ More financing for field work will be provided
- ▶ Better affirmation of domestic journals
- ▶ Development of a qualified network of referees
- ▶ Additional benefits for finalizing major national projects
- ▶ Rationalization of the social sciences institution network
- ▶ Investing in integral programs for the affirmation of the cultural and historical heritage

THE INSTITUTIONAL NETWORK WILL BE RATIONALIZED IN ORDER TO ACHIEVE CRITICAL MASS

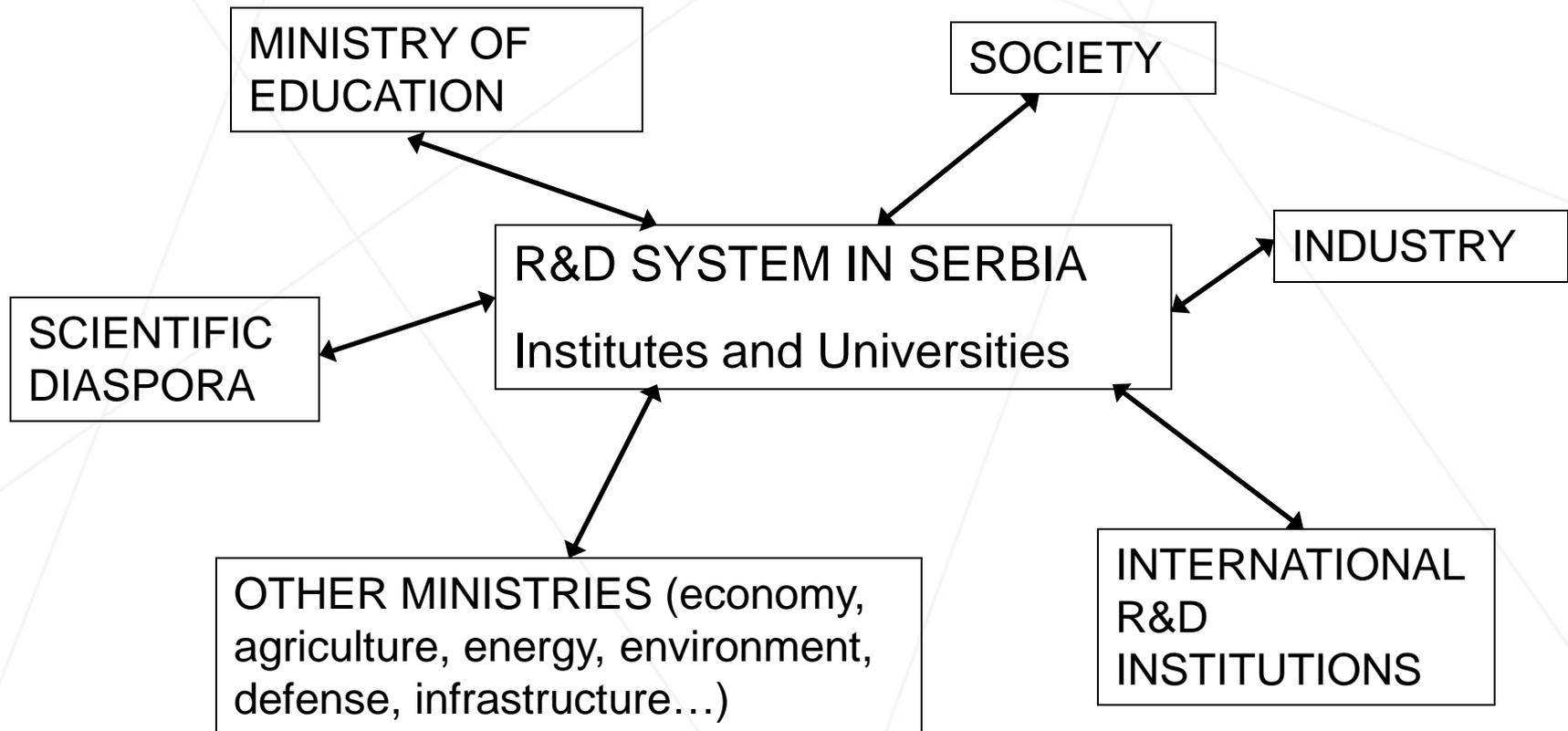
Number of employees and researchers in R&D institutes in Serbia in 2007



Source: center for science and technology development research



THROUGH PARTNERSHIP TOWARDS A NATIONAL INNOVATION SYSTEM





PARTNERSHIP WITHIN THE SYSTEM: CLOSE COLLABORATION OF INSTITUTES AND FACULTIES AND REASERCHER MOBILITY

- ▶ Joint work between the Ministry of education and Ministry of Science and Technological Development on optimizing the R&D system in Serbia
- ▶ Optimal usage of equipment through mandatory cooperation of connected institutes and faculties
- ▶ Researcher mobility- easier transition from institute to faculty and reverse, and between cities as well
- ▶ Fostering collaboration through joint projects
- ▶ An integrated database of researchers, publications, projects and institutions



PARTNERSHIP WITH SOCIETY THROUGH SCIENCE PROMOTION

- ▶ New **science center** will be built in Belgrade, with activities throughout Serbia
- ▶ Valorization of researchers involvement in science promotion
- ▶ Similarly to FP7, funds will be provided in each project for result dissemination
- ▶ Closer collaboration with media
- ▶ Continuing current activities: Science Festival, science promotion and popularization project call
- ▶ Social affirmation of scientists and innovators



PARTNERSHIP WITH INDUSTRY THROUGH A NEW SYSTEM ON INTELLECTUAL PROPERTY

- ▶ Law on intellectual property will include R&D based intellectual property
- ▶ Innovation belongs to the institution, royalty revenues regulated with contract and shared according to formula
 - ▶ At least 30% to the inventor and team members
 - ▶ At least 20% to the institution
- ▶ All financing contracts, where appropriate, will provide career and monetary incentives to deposit and register patents, as well as funding



PARTNERSHIP WITH COMPANIES THROUGH TAX INCENTIVES AND INNOVATION FINANCING

- ▶ Two year social contribution waived for MSc. and PhD's employed by private sector
- ▶ Tax break for money spent by SMEs and private companies on services of the Serbian scientific community
- ▶ Creation of an early seed venture capital fund with the European Investment Fund of EIB, public money with the aim of attracting public R&D and private players
- ▶ Attraction of international high-tech companies and their R&D capacities



PARTNERSHIP WITH THE SCIENTIFIC DIASPORA THROUGH JOINT PROJECTS

- ▶ Finalization of data base of Serbian researchers living and working abroad
- ▶ An international refereeing system will be established using the capacity of our research diaspora
- ▶ Possibilities will be opened up for researchers living abroad to be part of national projects
- ▶ A human resources program for the return of Serbian scientists living abroad will be conducted



PARTNERSHIP WITH INTERNATIONAL ORGANISATIONS THROUGH THE DEVELOPMENT OF DATABASES AND RELEVANT STATISTICAL METHODOLOGY

- ▶ Joint project with the Serbian Statistical Office to implement Eurostat and OECD reporting standards by 2012
- ▶ Joint projects and collaboration with relevant international organisations:
 - ▶ UNESCO
 - ▶ OECD
 - ▶ RCC
 - ▶ World Bank
 - ▶ JRC...



PARTNERSHIP WITH INTERNATIONAL COMMUNITY WILL BE DEVELOPED ACCORDING TO PRIORITIES

- ▶ Proactive deepening of links with institutions leading FP7 projects with Serbian participation
- ▶ Support for Serbian teams with FP7 coordinations
- ▶ Proposals to leading institutions in priority fields (joint postdoctoral studies, exchanges, joint projects)
- ▶ Becoming a CERN member State by 2011

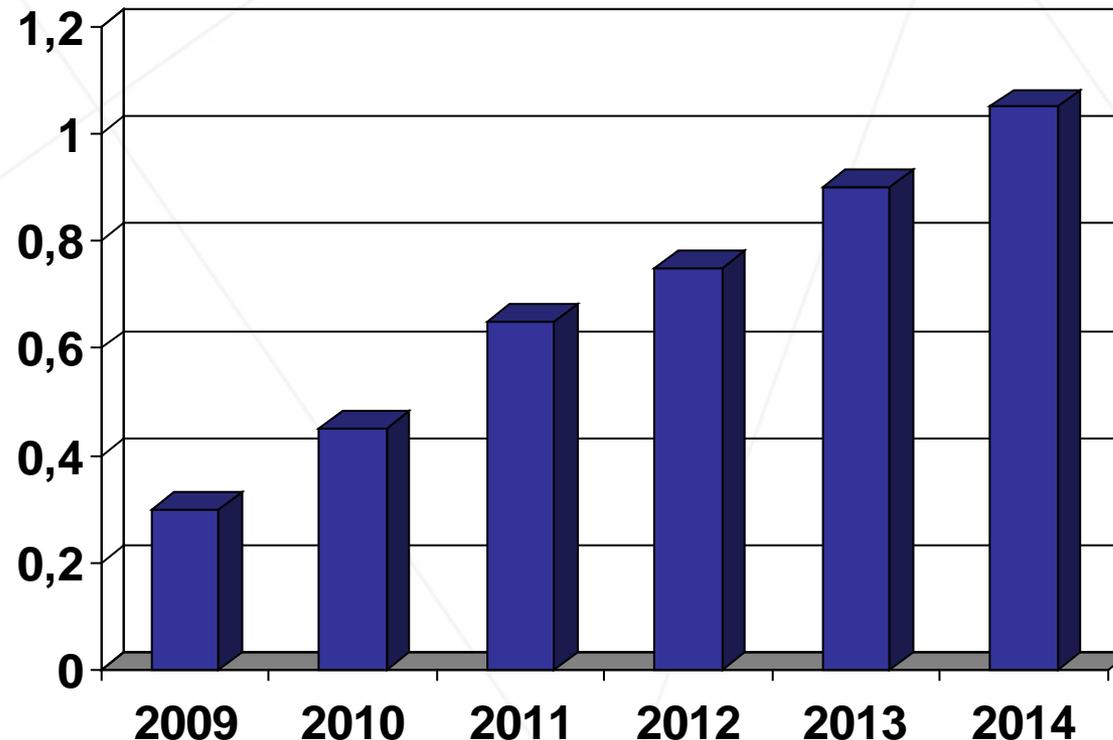


5. Increasing and diversifying R&D expenditure, as well as investing 300 million euros in infrastructure, are preconditions for the success of this strategy



THE GOAL IS TO REACH TOTAL BUDGETARY R&D EXPENDITURES OF 1% OF GDP BY 2014 (PREVIOUSLY AIMED AT IN 2007)

Expected growth of R&D expenditure over next five years (in % of GDP):



SERBIAN R&D INFRASTRUCTURE INVESTMENT INITIATIVE

- ▶ Through a joint loan with the European Investment Bank, World Bank and other international financial institutions and donations (IPA,...), a total of 300 million euros will be invested in several key infrastructure projects for science and technology in Serbia

1. Upgrading existing capacities (~ 70 million euros)

- 1.1 Adaptation of existing buildings and laboratories
- 1.2 New capital equipment for research

2. Development of human capital (~33 million euros)

- 2.1 Human resources program (bringing Serbian scientists from abroad back to Serbia)
- 2.2. Petnica Science Center
- 2.3. Mathematical High School Campus
- 2.4. New science center in Belgrade

Future view of the
Petnica Science
Center



INFRASTRUCTURE PROJECTS (continued):

Scientific
computing
laboratory at the
Institute of
Physics:



3. Development of centers of excellence and academic research centers (~60 million euros)

3.1 Centers of excellence in priority research fields

- 3.1.1. Energy and environment (National institute of energy and national laboratories for water, soil and air quality)
- 3.1.2. Material science (National Physics, Material Science and Nanotechnology Laboratory -using the current Institute of Physics infrastructure)
- 3.1.3. Agriculture and food (Center of excellence in Novi Sad using the capacities of the Institute for food technologies and Institute of field and vegetable crops)
- 3.1.4. Biomedicine and Biotechnology (campus located around the Institute for molecular genetics and genetic engineering, Institute “Torlak” and the Faculty of Pharmacy)

INFRASTRUCTURE PROJECTS (continued and end):

4. Development of information and communication technology infrastructure (50 to 80 million euros)

4.1. Campus for faculties of technical sciences in Belgrade

Option 1: Construction of new building in the courtyard between existing buildings of technical faculties

Option 2: Construction of new campus in Block 72 in New Belgrade

4.2. Infrastructure for supercomputing initiative “Blue Danube”

5. Creation of a knowledge based economy (~30 million euros)

5.1. Science and technology parks in Belgrade, Nis, Novi Sad and Kragujevac

6. Basic infrastructure projects (~80 million euros)

6.1 Apartment buildings for researchers in Belgrade, Nis, Novi Sad and Kragujevac

6.2. Infrastructure for the Ministry of Science and Technological Development

Housing for
researchers in
New Belgrade





6. A strict implementation tracking system will be established



IMPLEMENTATION TRACKING SYSTEM

- ▶ Implementation is led by ministry in charge of science with Ministry of education, Ministry of economy, representatives of other ministries, National council for science and technology, National council for higher education, Serbian academy of sciences and arts and foreign and domestic companies
- ▶ Implementation instruments:
 - ▶ Integral programs of research in priority fields
 - ▶ Technological development program
 - ▶ Program for support of innovation
 - ▶ Program for support of technology and knowledge transfer
- ▶ Metrics:
 - ▶ Applicable R&D programs
 - ▶ Improvement of higher education
 - ▶ More efficient allocation of R&D funding
 - ▶ Improvement and better application of new technologies
 - ▶ Development of innovation system and SMEs based on innovation

NEXT STEPS

- ▶ Public debate will take place until the end of September. Comments can be given through <http://forum.nauka.gov.rs> or strategija@nauka.gov.rs
- ▶ An action plan will be formulated by the end of the year
- ▶ By the end of 2009 a new legal framework will be adopted:
 - ▶ Changes to the Law on research
 - ▶ Law on innovation
 - ▶ Law on intellectual property
 - ▶ Law on Serbian Academy of Sciences and Arts
- ▶ Joint work with the Ministry of education on the new Law on higher education by the end of the year
- ▶ Detailed joint action plans with other ministries and industry
- ▶ Finalizing 2010 budget and negotiations with EIB in the last quarter of 2009
- ▶ Finished framework for new project cycle and adoption in the first quarter of 2010