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The Bulgarian Innovation
System in a Time
of Global Economic Crisis

EDITORS

Professor Marin Petrov, Chairman, Expert Council on Innovation, Applied Research and Communications Fund
Professor Teodora Georgieva, Senior Fellow, Applied Research and Communications Fund
Ruslan Stefanov, Coordinator, *Innovation.bg* Group, Applied Research and Communications Fund

WORKING GROUP *INNOVATION.BG*

Maria Alexandrova, Project Coordinator, Applied Research and Communications Fund
Dr. Georgi Angelov, Director, Center for the Study and History of Science
Professor Teodora Georgieva, Senior Fellow, Applied Research and Communications Fund
Zoya Damianova, Program Director, Applied Research and Communications Fund
Professor Tzvetan Davidkov, Sofia University
Valya Dobрева, Director of Certification, Moody International Ltd
Ilian Iliev, Founder and CEO, Cambridge IP, United Kingdom
Dr. Petkan Iliev, University for National and World Economy
Dr. Fani Koleva, University for National and World Economy
Angel Milev, Program Director, Applied Research and Communications Fund
Dr. Miglena Molhova, University for National and World Economy
Lora Pavlova, Senior Expert, Research Directorate, Ministry of Education and Science
Professor Marin Petrov, Chairman, Expert Council on Innovation, Applied Research and Communications Fund
Professor Kostadinka Simeonova, Chair of the Scientific Council, Center for Science Studies and History of Science, Bulgarian Academy of Sciences
Professor Milanka Slavova, University for National and World Economy
Ruslan Stefanov, Coordinator, *Innovation.bg* Group, Applied Research and Communications Fund
Marin Tinchev, Co-founder and CEO, Sinova Arvisors; PhD Candidate, Tsinghua University, China
Dr. Yordanka Tchobanova, Senior Expert, Applied Research and Communications Fund
Daniela Tchonkova, Program Coordinator, Applied Research and Communications Fund
Hristo Valev, Investment Manager, Advance Equity Holding
Dr. Benislav Vanev, Deputy Chairman, Automatics and Informatics Union
Dr. Albena Vutsova, Director, Research Directorate, Ministry of Education and Science
Todor Yalamov, Coordinator, IT Group, Applied Research and Communications Fund
Dr. Dessislava Yordanova, Sofia University

EXPERT COUNCIL ON INNOVATION AT THE APPLIED RESEARCH AND COMMUNICATIONS FUND

Dr. Eli Anavi, Director, Enterprise Policy Directorate, Ministry of Economy and Energy
Professor Ivan Georgiev, University for National and World Economy
Boyko Denchev, Federation of the Scientific and Technical Unions in Bulgaria
Hubanelia Dimitrova, ELTA-R Ltd
Zhenya Dinkova, Head, Coordination of Projects and Programs Department, Management of EU Funds Directorate, Ministry of Finance
Mario Hristov, Secretary General, Union of Inventors of Bulgaria
Dr. Nikola Kolev, Scientific Secretary, Agricultural Academy
Dr. Tzvetan Manchev, Deputy Governor, Bulgarian national Bank
Dr. Liliana Pavlova, Center for Science Studies and History of Science, Bulgarian Academy of Sciences
Lora Pavlova, Senior Expert, Research Directorate, Ministry of Education and Science
Petar Petrov, Manager, Point-L Ltd
Professor Georgi Popov, Faculty of Machine Technology, Technical University of Sofia
Professor Kostadinka Simeonova, Chair of the Scientific Council, Center for Science Studies and History Of Science, Bulgarian Academy of Sciences
Professor Milanka Slavova, University for National and World Economy
Hristo Traikov, Telematics Laboratory, Bulgarian Academy of Sciences
Dr. Benislav Vanev, Deputy Chairman, Automatics and Informatics Union



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LIST OF ABBREVIATIONS

ADCICT	– Agency for Development of Communications and Information and Communication Technologies	ME	– Ministry of Economy
AEAF	– Agency for Economic Analysis and Forecasting	MEE	– Ministry of Economy and Energy
AES	– Adult Education Survey	MES	– Ministry of Education and Science
ART	– Annual Roadworthiness Test	MSA	– Ministry of State Administration
BAS	– Bulgarian Academy of Sciences	MSAAR	– Ministry of State Administration and Administrative Reform
BCCI	– Bulgarian Chamber of Commerce and Industry	MTC	– Ministry of Transport and Communication
BG	– Bulgaria	NGO	– Non-Governmental Organization
BIA	– Bulgarian Industrial Association	NIF	– National Innovation Fund
BNB	– Bulgarian National Bank	NSF	– National Science Fund
BPO	– Bulgarian Patent Office	NSI	– National Statistical Institute
CAD/CAM	– Computer Aided Design/Computer Aided Manufacturing	OECD	– Organization for Economic Cooperation and Development
CCICMT	– Coordination Center for Information, Communication and Management Technologies	OECD	– Organization of Economic Co-operation and Development
CEE	– Central and Eastern Europe	OHSAS 18001:2002	– Occupational Health and Safety Systems
CEECs	– Central and Eastern European Countries	OP	– Operational Program
CIS	– Community Innovation Scoreboard	PHARE	– Poland and Hungary: Assistance for Restructuring Their Economies
CoM	– Council of Ministers	PIRLS	– Progress in International Reading Literacy
CRM	– Customer Relationship Management	PISA	– Program for International Student Assessment
DSL	– Digital Subscriber Line	R&D	– Research and Development
EBRD	– European Bank for Reconstruction and Development	RFID	– Radio Frequency Identification
EEA	– European Economic Area	RIS	– Regional Innovation Strategy
EEN	– Enterprise Europe Network	SAITC	– State Agency for Information Technologies and Communications
EIB	– European Investment Bank	SCI	– Science Citation Index
EIF	– European Investment Fund	SMEs	– Small and Medium Sized Enterprises
EPC	– European Patent Convention	SMS	– Short Message Service
EPO	– European Patent Office	SPICT	– Specific Purpose Information and Communication Technologies
ERP	– Enterprise Resource Planning	TFA	– Tangible Fixed Assets
EU	– European Union	TIMSS	– Trends in International Mathematics and Science Study
EC	– European Commission	UN	– United Nations
FP	– Framework Program	UNDP	– United Nation Development Program
GDP	– Gross Domestic Product	US	– United States
GIS	– Geographic Information System	USA	– United States of America
GPICIT	– General Purpose Information and Communication Technologies	USPTO	– US Patent and Trademark Office
GPS	– Global Positioning System	VAT	– Value Added Tax
GVA	– Gross Value Added	WEF	– World Economic Forum
HACCP	– Hazard Analysis and Critical Control Point		
ICTs	– Information and Communication Technologies		
IEA	– International Association for the Evaluation of Educational Achievement		
IMD	– International Institute for Management Development		
ISI	– The Institute for Scientific Information		
ISO 14001:1996	– Environmental Management Systems		
ISO 27001:2005	– Information Security Management Systems		
ISO 9001:2008	– Quality Management Standards		
IT	– Information Technologies		
JEREMIE	– Joint European Resources for Micro to Medium Enterprises		
KAM	– Knowledge Assessment Methodology		
LAN	– Local Area Network		

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INTRODUCTION

The current year marks a shift in the development of the global, European and Bulgarian economies. For the first time since its establishment in 1999, the Eurozone – the EU member states which use the euro as a common currency – has slumped into a recession. In 2009, the Bulgarian economy is expected to have no growth for the first time in eleven years. The world is facing the most serious economic crisis since the Great Depression. This situation calls for swift and bold measures by government and business leaders for turning the crisis into an opportunity and for economic recovery. Bulgaria needs to rethink its economic policy and **adopt an integrated strategy for economic growth based on innovation, technological development and science**. *Innovation.bg* aspires to provide a reference framework and recommendations for the implementation of such a strategy.

In 2009, Bulgaria marks its third year as an EU member, which should allow the country to make full use of the Community's instruments for economic development. Still, steady economic growth has not brought about improved innovation potential to the Bulgarian economy, which impairs its long-term sustainability. The country is not only **at the bottom of the Community's Innovation Scoreboard, productivity and GDP per person** but has also seen a decline in some aspects of innovation performance in the past year. The rapid GDP growth of the past few years has been primarily due to two factors (which fall under the category of 'extensive development' not associated with higher innovation intensity) – reduced unemployment, including by the entry of foreign workers, and the wide availability of financial resources in the form of foreign direct investment and easy credit. These factors are important when the country is catching up but quickly exhaust their potential and are not capable of ensuring long term competitiveness. They need to be complemented by other sources of growth such as technological renewal, integrating more knowledge into products, hiring of highly skilled employees and the promotion of the rapidly growing "green" sectors of the economy.

The financial crisis and the serious difficulties faced by the economy warrant the need for a rethinking of long-term priorities and the mobilization and re-

direction of efforts at the national and company level. In a time of economic recession, shrinking markets, and reduced investment activity, the Bulgarian government needs to establish an environment favorable to the development and deployment of innovation – this includes the upgrading of research infrastructure, promoting science and technology, and growing a high tech sector. The government should seek ways to optimize cooperation within the innovation system through an integrated innovation, technological and science policy. It is crucial that the highest level of government in Bulgaria undertakes the political commitment for the successful implementation of such a strategy: **the Prime Minister should, by way of a specialized body such as a ministry or an agency, preside over the decision making on the priorities of innovation development** if it is to make a difference. This should be done by supporting the innovation process and innovation activity of business (which support is currently decentralized and performed without proper coordination). The governments of all leading world economies are undertaking specific policy actions to that effect.

The *Innovation.bg* report provides a reliable annual assessment of the innovation potential of the Bulgarian economy and the conditions and opportunities for development of the Bulgarian innovation system. It makes recommendations for the improvement of public policy on innovation by drawing on the latest theoretical and empirical studies worldwide and adapting them to the specific economic, political, cultural and institutional framework of Bulgaria's innovation system.

The report **targets the decision-makers** – the people making the strategic choices in the public and private sectors of the country. The purpose of the current, 2009 edition of *Innovation.bg* is to discuss the innovation activity of the Bulgarian economy as compared to the rest of the EU member states and to suggest possible solutions for the development of Bulgaria's innovation policy. In keeping with the methodology established during the preceding four editions, *Innovation.bg 2009* analyzes the condition and opportunities for development of the Bulgarian innovation system based on **five groups of indicators**:

- gross innovation product;
- entrepreneurship and innovation networks;
- investment and financing of innovation;
- human capital for innovation;
- information and communication technologies.

Innovation 2009 updates the **Innovation Index of Bulgarian Enterprises**, which is constructed on the basis of the annual survey of innovation activity of Bulgarian enterprises carried out by the Applied Research and Communications Fund. As on previous occasions, the Expert Council on Innovation of the Applied Research and Communications Fund endorsed the report.

Methodologically the report is based on several existing models for measuring and comparing innovation systems: 1. The *European Innovation Scoreboard* of the European Commission; 2. OECD's *Science, Technology and Industry Scoreboard*; 3. The *National Innovation Initiative* of the US; and 4. The *Executive Index of the Massachusetts Innovation Economy*.

Detailed methodological notes and sources of information are presented in Appendix 1. *Innovation.bg: Innovation Potential of the Bulgarian Economy*, ARC Fund, 2005 contains the theoretical underpinning of the current report.



Research, Technological Development and Innovation Policies of the EU and Bulgaria in a Time of Global Economic Crisis

Bulgaria's membership in the EU presents an exceptional opportunity for the competitive and innovation-led development of the country. Being a small, open economy Bulgaria should make best use of its the access to a variety of technical aid and financial instruments of the Community to develop its own national policy on innovation, technological development and research in order to overcome its lagging behind the other member states and to deal with the effects of the global economic crisis.

European Research and Innovation Policy

The research and innovation policy of the EU is based on **bringing together the national, regional and European dimensions**.¹ The various editions of the founding treaties and the Lisbon Treaty envision complementarity between the common integration initiatives and the specific activities of the member states for scientific development and promotion of innovation.

The 2008 financial crisis and the entry of the global economy into a possibly long recession, require that **new sources of growth be identified**. The long term goal of building a European economy based on knowledge and innovation requires that measures for overcoming the financial crisis be linked to the Stability and Growth Pact, the Lisbon Strategy and the encouragement of free trade. Thus, enhanced competitiveness through innovation and higher productivity, and the creation of new products and services generating new jobs, remain top European priorities.

The European Economic Recovery Plan envisages coordinated efforts in the four areas of the Lisbon Strategy: people, business, infrastructure and energy, and research and innovation. European experience indicates that countries, which increase investment in research and education during a crisis, emerge out of it even more competitive. Therefore the plan recommends an increase of "planned investments in education and R&D (consistent with national R&D targets) to stimulate growth and productivity ... [and] increased private sector R&D investments, for example, by providing fiscal incentives, grants and/or subsidies. Member States should maintain investments to increase the quality of education."²

Support for research and innovation will continue to be pursued also

through other EU policies – education, development of the internal market, competition, regional policy and sustainable development, environmental protection and culture. To this end, both the European Economic Recovery Plan and the European Year of Creativity and Innovation 2009 include initiatives encouraging linkages of research and innovation with other areas of social and economic development of the EU member states.

servatory was established intended to assist policymakers at the regional and national level in the development of cluster policies;

- Access by companies to EU financial resources;
- Eco-innovations and innovations in the field of services and support for studies of the specific needs of the sector;
- Innovations generated by consumers (business consumers and

Box 1. EUROPEAN INITIATIVES FOR A "GREEN" ECONOMY

The European Economic Recovery Plan includes measures in support of innovation in manufacturing, in particular in the construction industry and the automobile sector which have recently seen demand plummet as a result of the crisis and which also face significant challenges in the transition to a green economy. In the automobile sector, a "European green cars initiative" will be implemented involving research on a broad range of technologies and smart energy infrastructures essential to achieve a breakthrough in the use of renewable and non-polluting energy sources, safety and traffic fluidity. In the construction sector, a "European energy-efficient buildings" initiative, to promote green technologies and the development of energy-efficient systems and materials in new and renovated buildings with a view to reducing radically their energy consumption and CO₂ emissions.

Source: European Economic Recovery Plan

The **European Year of Creativity and Innovation 2009** aims to raise awareness of their importance as key competencies for personal, social and economic development and to promote policy debate on methods of increasing the creative and innovation potential of the EU. Its initiatives will assist the implementation of the EU innovation strategy encouraging all types of innovations.

The main areas of EU support in the field of innovation will remain:

- Clusters and trans-border cluster initiatives. A European Cluster Ob-

end consumers) and the use of social networks for innovation; this will raise new problems for the innovation policy and intellectual property protection;

- Development and promotion of methods of innovation management which facilitate the evaluation of the innovation capacity of enterprises and assist strategy development, etc.;
- Launching the "European Innovation Platform for Knowledge Intensive Services."

In the field of research the main EU task is the development of the Eu-

¹ A detailed analysis of the financial instruments for the implementation of the innovation policy of the EU is available in the *Innovation.bg 2007* report of the Applied Research and Communications Fund.

² Communication from the Commission to the European Council, Brussels, 26.11.2008 COM(2008) 800 final.

European Research Area. Its priorities remain unchanged:

- promoting the fifth freedom – unhindered mobility for researchers, technology and knowledge;
- joint strategic programming of national research;
- favorable environment for all participants in the research and business sectors, including SMEs;
- access to a research infrastructure of the highest quality;
- attracting foreign researchers.

The free movement of researchers is of particular importance given the fact that even in case the Lisbon target of 3% R&D of GDP is reached, investments would not be as effective if they could not move freely in order to produce results where the research infrastructure is best. Increased communication produced by the European Research Area also addresses national research efforts which continue to duplicate each other through public financing as well as the high costs of patenting.

The common goals of the research and innovation policy of the EU allow the application of varying methods and means by the member states to implement functional policies in accordance with national traditions and in adherence to the subsidiarity principle. Countries should react according to the situation they find themselves in.

Challenges and Prospects For the Research and Innovation Policy of Bulgaria

The innovation and research policy of Bulgaria is developed in the context of the Lisbon Strategy and the Broad Innovation Strategy of the Community for the establishment of a knowledge-based society and integration of the European Research Area. Bulgaria needs to be **more active in participating in the design and implementation of European policies in the field of innovation and research** while at the same time clearly defining its interest and capacity to participate in the framework and operational programs of the EU.

Bulgaria has registered only modest progress in the field of innovation policy since the first publication of *Innovation.bg* four years ago. It was only during the last two years that policy makers recognized their commitment and the need for actions aimed at producing progress in the priority areas of the Lisbon Strategy. **Measures so far remain, however, ad hoc without any overall strategy and do not lead to a tangible improvement of the innovation poten-**

tial of the country.³ The approach applied to the design and delivery of policies (lack of appropriate public debate and dialogue among interested parties, lack of transparency and system of monitoring and control of results) does not allow a proper evaluation or the development of the innovation potential of the innovation system units, including cooperation among them. Innovation policy measures adopted by the Bulgarian government do not envisage measures aimed at overcoming underlying factors for the problems (due to the lack of comprehensive analysis and the mechanical adoption of foreign experience which are mostly aimed at their effects and not their causes) and are not consistently implemented. In 2008 for example, the **National Innovation Council held no meetings whatsoever** despite the apparent inadequacy of the goals and measures of the National

Innovation Strategy adopted in 2004 to the economic realities of today. At the same time, the drafting of a National Strategy for the Development of Research 2008-2018 was initiated although the previous National Strategy for Research 2005-2010 had not yet been adopted by the national parliament.

Bulgaria's **progress in research and innovation policy**, however, does not correspond to the potential of the national economy and **is not sufficient for arresting the effects of the deepening global recession in the country**. Critical mass is lacking in Bulgaria in that its research and educational infrastructure remain fragmented leading to a wasted research potential. Business is only marginally involved in the innovation process and the interaction between the components of the innovation system is ineffective. The country continues its relative decline on a number of indicators for measuring its innovation potential.⁴

There are **problem areas** as regards human resources, innovation culture and education, which bring about



³ Implementation of the Lisbon Strategy Structural Reforms in the Context of the European Economic Recovery Plan: Annual Country Assessment – a Detailed Overview of Progress Made with the Implementation of the Lisbon Strategy Reform in Member States in 2008, Commission of the European Communities, Brussels, 2009.

⁴ European Innovation Scoreboard 2008, Comparative Analyses of Innovation Performance, Inno Metrics, January 2009.

serious long term demographic, economic and social challenges for Bulgaria.

Demographic:

- ageing and shrinking population;
- declining share of the economically active population;

In education:

- deteriorating quality of the educational services both with time (compared to preceding periods) and with each subsequent educational degree. The dropout rate for school students without any qualification is more than 20%;
- a brain drain (currently in the form of university education abroad). The condition of the research and educational infrastructure and the financial stimulus make Bulgaria unattractive for young talents and leading researchers and do not contribute to a return of Bulgarian experts who have chosen a professional career abroad;
- declining qualifications – Bulgaria ranks last on the indicators for lifelong learning;
- discrepancies between the supply and demand on the labor market as regards qualification levels, professional experience, knowledge and skills among secondary and higher education graduates.

In research:

- Insufficient number of those employed in R&D and ineffective structure of sectoral employment.

As regards the share of R&D as a percentage of GDP (0.48% for Bulgaria compared to 1.83% for EU 27 and a 3% Lisbon Strategy target) Bulgaria is at the bottom of the European list for yet another year, while the downward trend of the last 10 years **threatens to make the country's lagging behind a lasting one leading to unsustainable growth.** Against this background, the National Research Strategy goal to increase R&D ex-

penditures to 1.8% by 2018 does not seem credible and substantiated, particularly considering that the country could not achieve even the modest targets of the National Innovation Strategy (2004).

Experience shows that R&D and innovation are the first expense items to go, when companies start looking for cuts in a time of crisis. In such **circumstances, public investment in R&D and innovation becomes all the more significant.** It is crucial to further clarify national priorities and address the strategic challenges (global warming, ageing population). The adoption of a transparent mechanism for accountability and oversight would be critical for the effective use of the resources of the Framework and Structural funds.

Political commitment is a critical factor for the innovation performance of the economy and the functioning of the national innovation system. Integrated economic, innovation, technological and research policies and specific steps for ensuring the administrative, personnel and financial support for their delivery are still not present in 2008-2009 in Bulgaria. Innovation, technological development and research have not been established as priorities for the Bulgarian government and as key factor for the competitiveness of the country's economy. The following conclusions and assessments, applicable during the past few years, are related to the establishment of an integrated innovation, technological and research policy and the mechanisms for its delivery⁵:

- **Research and innovation are not recognized as national priority.** There is no clear strategy and political will for reforming the national innovation system. **R&D investments in Bulgaria are decreasing relative to the**

growing costs of running the administration.

- **There is no focal point where political decisions are made** in order to provide coordination of national innovation, technological and research policies and commitment to the development of the innovation potential of the country.
- The national innovation system is still a chaotic set of public and private organizations, which **lack dialogue and interaction.** The institutional and organizational structure of the innovation system does not reflect market realities and the necessary reforms.

There is a pronounced divergence among Bulgarian regions as regards their innovation potential. The concentration of the research infrastructure and the financial and human resources mostly in the Southwest Planning Region is one of the reasons for the low levels of effectiveness of the entire national innovation system. This prevents the development of regional competitive advantages based on indigenous entrepreneurship and innovation.

In 2009, the challenges for maintaining financial and economic stability will be mounting, including as regards the mobilization of resources for a catching-up, innovation-led development. Advancing globalization and growing interdependence between countries and regions preclude the existence of islands of stability during a worldwide financial and economic crisis.

A small economy – such as that of Bulgaria – cannot escape the negative impact of trends and processes, for which it does not bear direct responsibility. It can, however, purposefully maintain and seek new attractiveness, and position itself strategically



⁵ A thorough analysis of the shortcomings of the process of development and implementation of the research, technological, and innovation policy in Bulgaria is provided in the 2006 and 2007 *Innovation.bg* reports.

on the international political and business stage. Small economies are more flexible and thus capable of shifting resources among priorities, sectors, regions and areas of influence and interest. Turning small size into an advantage requires the skill of identifying the micro-trends (the weak, minute signs of change, which set tomorrow's big trends) of upcoming changes (instead of ignoring them) and adapting correspondingly.

Bulgaria is an open economy, closely linked to the international markets both as regards access to resources, including capital, and as regards demand for its produce. Reacting post factum, after the event, however, is not an option when this kind of dependency exists. The government should embrace an effective counter-balance policy to the influence of external factors instead. Bulgaria needs to use the crisis as an opportunity to mobilize resources for change and revival on the basis of new sources of growth. To this end, the question that needs to be answered is – **What kind of economy does Bulgaria strive after?**

- **competitive** – in 2008, Bulgaria is still at the bottom, far behind the rest of the EU member states as regards its GDP (38.5% of the EU average) and productivity per employee (35.1% of the EU-27 average);
- **innovative** – with a share of innovative enterprises of 20% Bulgaria is last among EU member states;
- **sustainable and “green”** – there are no signs that the role of technologies in solving the problems of contemporary societies is being recognized to its full extent in this country.

All these goals are achievable only through innovation. It is no chance that large economies, while “bailing out” their financial sectors and other industries, do not cease to invest in R&D and innovation. This is evident

in the actions of many governments having invested in new technologies and innovation as a solution to previous economic crises.⁶

The effective use of the potential of science and technology in Bulgaria through the active involvement of all components of the innovation ecosystem requires resolute decisions for carrying out of at least the following **three main actions**:

1. The adoption of an integrated **national policy for research, technology and innovation** driven by a clear evaluation of the scientific and innovation potential of the country and based on a consensus on the directions for development, including in the context of Bulgaria's further integration in the European area for research and education.

The challenges of contemporary development require the Bulgarian government to hold a broad public debate involving all interested parties in the design of research, technology and innovation policy and to undertake tangible actions as opposed to the current mere declarations on innovation. At the European level such a debate is ongoing within the Lisbon Forum of the European Parliament. In 2009, it will be complemented by debates in the framework of the European Year of Creativity and Innovation.

Bulgaria needs an integrated strategy for research, technological development and innovation, which would protect the interests and enhance the competencies of all types of participants in the research and development of new knowledge. These would include research and educational institutions, technology brokers and intermediaries and business. One of the attempts at action in this direction in 2009 is the intended merging of the National Innovation Fund and the National Science Fund. Yet again,

however, this decision was made in a non-transparent way without debate, which incited institutional opposition and resistance rather than achieve unity and coordination of the various points of view. The government needs to clearly define the priorities and expected results – as well as appoint the institutions responsible for their attainment – for the manifold increase in the funding for the National Innovation Fund and the National Science Fund during the past two years. Higher effectiveness of public investments in innovation can only be achieved through a **clear plan for complementarity of the resources from the various national and European programs and instruments available in Bulgaria**. These include the two national funds, the Bulgarian Development Bank, the research budgets of all ministries, not just of the MES and MEE but also including defense, health care, environment, etc., the operational programs, the framework programs of the EU, the initiatives of the European Investment Bank, etc. For example, Bulgaria is still among the few EU member states, which **do not have an instrument for co-financing of projects awarded to national organizations under the Competitiveness and Innovation Framework Program of the EU**.

The absence of short-term benefits will not be the only result of the lack of coordinated national policy for research and innovation and a clear program for its implementation. It would exacerbate already serious problems, leading to further lagging behind the average European levels and it would raise the social and economic cost of their future resolution.

The development of an integrated research, technology and innovation policy should be based on a **clear**

⁶ Attacking the Recession, How Innovation Can Fight the Downturn, NESTA, Discussion Paper: December 2008.

choice of priority economic sectors that are seen as a source of growth and a platform for establishing new competitive advantages. To this end, there is considerable potential in the **network industries** (ICT, transport, energy) to provide horizontal technologies and an environment for the growth of the economy as a whole. These include **knowledge intensive services**, biotechnologies and renewable sources of energy. There are several advantages to making such a choice:

- in these sectors Bulgaria has established traditions, potential, and competencies in the form of advanced scientific knowledge, technological know-how and successful innovation practices;
- a sectoral prioritization could provide the setting and the platform for enhanced entrepreneurial and innovation activity;
- investing in the development of these sectors offsets the recession and contributes towards the solution of long term social and economic problems (generating higher productivity and employment in the knowledge intensive sectors; creating incentives for the qualification of highly skilled experts; leading to reduced energy intensiveness, higher energy efficiency and help overcome energy dependency; establishing a sustainable environment for growth).

Such a policy would match the innovation activity of the leading world economies and would be directly linked to the priorities at European level. Its implementation would contribute to overcoming the low technology profile of the country and to building of a knowledge-intensive economy.

2. The establishment of a center of responsibility over innovation policy decisions, which would coordinate the operation of the various public bodies of the national innovation system (direct participants or those who facilitate the

Box 2. BEST NATIONAL PRACTICES IN RESTRUCTURING AND FOCUSING OF THE POLITICAL RESPONSIBILITY FOR THE IMPLEMENTATION OF AN INTEGRATED RESEARCH AND INNOVATION POLICY

During the past years, the **Danish** national innovation system has been substantially restructured. For the first time, in order to improve coordination, the functions related to research and innovation policy were unified within a new ministry (2002) – Ministry of Science, Technology and Innovation, supported by a Council of Technology and Innovation. In 2005, the Danish government initiated the creation of a government committee chaired by the Prime Minister which governs the national innovation policy process and coordinates the national innovation system. The committee comprises of representatives of the ministries of economy, education and finance, and of science, technology and innovation. All structures function regularly, systematically and under a strict agenda.

Finland is the first country in Europe to start applying a national innovation system as a planning mechanism for the development of research, technology and innovation. The most important body responsible for R&D and innovation policy is the Science and Technology Policy Council of Finland, chaired by the Prime Minister. Established in 1960, the Council promotes a common vision of the knowledge economy, coordinates the other bodies and is the lead institution in the implementation of the new strategy.

As a response to globalization and technological change the government of **Catalunya, Spain** decided to create a regional Ministry of Innovation, Universities and Enterprise. The ministry is responsible for the better part of the strategic fields significant to the competitiveness of the economy and its transformation from one of industry to one of knowledge. The ministry aims to make Catalunya a driving force of the European economy, a magnet for talent from the Mediterranean and to contribute to a strong global role for the region by 2020. The ministry contributes to the improvement of the quality of university education within the European Higher Education Area and its closer linkages to business; helps attract foreign investment, encourage entrepreneurship and enhance the effectiveness of administrative procedures targeted at the needs of society and business.

There are similar examples of central and local government institutions in **Germany, United Kingdom, Ireland, Sweden, Canada and the US**.

implementation of the innovation process) and would take decisions on the design and delivery of the national research and innovation policy.

The currently fragmented and uncoordinated mechanism for the implementation of research and innovation policies in Bulgaria, involving various ministries, bodies and agencies warrants **a radical decision for the establishment of a strong structure, such as a ministry or an agency for research,**

technological development and innovation under the direct management of the Prime Minister. Successful practices at national and regional level in the European Union highlight the significance of having a single political focal point for decision making in the field of research, technological development and innovation.

3. The development of sustainable and effective interaction between the various agents of the national innovation system – re-

search and higher education institutions, innovative companies, intermediary organizations.

The interaction between the agents of the national innovation system for the creation, distribution, transfer and adoption of innovation products needs richer content, as well as improved mechanisms and modes of operation. This purpose can best be served by strengthening the network of intermediary and transfer organiza-

tions, and the expansion of an emerging new type of bodies: innovation centers, spin-off companies, research and innovation clusters, science parks, and social networks. The administrative capacity of national and regional authorities for the management of innovation development needs to be urgently enhanced. As clearly demonstrated by the Innovation Index of Bulgarian Enterprises in *Innovation.bg 2009*, Bulgarian public and private sector institutions **still make little and/or**

rare use of the potential of the international innovation networks and open innovation systems.

The adoption and implementation of an integrated strategy for research, technology and innovation, based on the above three action lines, is a precondition for Bulgaria's economy to enter a **new round of sustainable advanced growth** during the next decade.



INNOVATION INDEX OF BULGARIAN ENTERPRISES

The index provides a summary evaluation of the innovation activity at company level in Bulgaria. It was first calculated in *Innovation.bg 2007*. The index ranks the innovativeness of enterprises according to: (1) the existence and combination of product, process, organizational and marketing innovations in a given enterprise and (2) the degree of novelty of the product and process innovations introduced by the enterprise. The index, designed by the Applied Research and Communications Fund, relies on the annual Survey of the Innovation Activity of Enterprises in Bulgaria (INA) and its values range from 0 to 100, with 0 indicating that the enterprise does not innovate, while 100 meaning that the enterprise combines all four types of innovation at the highest degree of novelty. The innovation index provides a comprehensive evaluation of the innovation intensity of enterprises by measuring not only whether enterprises innovate, but also whether they combine different kinds of innovation, whether innovations are focused on one area or are comprehensive, as well as whether these are gradual or radical.

Range and Indicators of the Innovation Index

Innovation.bg applies a predominant-ly positivist approach to the design and application of public policy on innovation. Regardless of some limitations and drawbacks this approach is used in most developed countries and international institutions. It consists of:

- *First*, an effective capacity to measure accurately a number of objective indicators for the evaluation of the innovativeness of the economy and the application of generalized cause-and-effect models to existing data;
- *Second*, preliminary analysis carried out separately from and without influence on the innovation system;
- *Third*, neutral policy delivery both from institutions and considerations not belonging to the system, as well as from internal agents and relations.

Innovation.bg strives to mitigate the shortcomings of this approach by improving on the measurement and evaluation tools, by emphasizing certain aspects specific of the national business and innovation environment and through providing a number of constructive interpretations.

The main instrument developed by the Applied Research and Communications Fund to this end is the ***Innovation Index of Bulgarian Enterprises***. The index distinguishes between seven sub-types of innovation activity at company level of the four types applied by enterprises (product, process, organization and marketing innovation) and three degrees of novelty of the product and process innovations (new to the enterprise, new to the market or new to the world)⁷. It relies on an annual national survey of enterprises in Bulgaria. Its values range from 0 to 100,

with 0 indicating that the enterprise lacks innovation activity, while 100 meaning that the enterprise makes all types of innovation at the highest degree of novelty.

By introducing more levels of innovation performance measurement, the index overcomes a variety of problems stemming from the predominant separation of enterprises into two groups (product and process innovators), which either unjustifiably narrows the range of innovators or expands it to an extent where differences within the innovators' group are bigger than between them and those lacking innovation. An aggregate measure of innovation such as the one provided by the index allows, on the one hand, a more comprehensive analysis of factors influencing innovation, and, on the other, the design of better targeted policy responses in support of innovation tailored to the specific needs of each innovator group.

Some of the key considerations in constructing the innovation index have been the identity, number and type of *enterprises* surveyed and, correspondingly, what should the innovation policy targeted at them be. For example, Eurostat, traditionally excludes from its Community Innovation Surveys organizations not falling under the "Manufacturing" and

"Non-Financial Services" sectors or have less than 10 staff.⁸ Thus, Eurostat surveys do not cover innovation in the public sector or social services (non-governmental organizations, education and health care), which are significant to the overall innovation environment in the country. Applying Eurostat criteria to Bulgaria would cover 62 % of the gross value added in the economy and 94 % of the enterprises.⁹

The overall number of enterprises in Bulgaria is a fuzzy set and defining its boundaries is a key starting point for the designing of both the appropriate sample for the innovation survey and of any economic policy. According to the Bulstat register (the national commercial/company register), in 2007 there were 1 million "active" enterprises in Bulgaria, while according to the National Statistical Institute (NSI) their number at the end of 2006 had been 258,000, of which only 30,000 have staff of 10 or more; this is the set, within which Eurostat seeks the innovative companies. Also 30,000 is the number of enterprises which, although not necessarily the same as above, were involved in foreign trade, according to the Customs Agency. According to 2006 NSI data only 80,000 of the 258,000 are non-financial enterprises applying double-entry accounting.¹⁰ At the end of 2008, only 167,000¹¹ companies were



⁷ The types and kinds of innovation, as well as the degree of novelty criteria, have been coordinated with the definitions of the Frascati and Oslo manuals and the methodology of EU's Community Innovation Survey (CIS4) in order to allow for comparability of results.

⁸ For a more detailed description please refer to http://europa.eu.int/estatref/info/sdds/en/inn/inn_cis4_sm.htm#scope

⁹ The basis for the 2006 NSI and Eurostat data for the number of enterprises are non-financial enterprises which file declarations with the NSI.

¹⁰ Only sole traders and companies established under the Contracts and Obligations Act (COA) having a turnover above 50,000 and not liable for VAT registration are allowed to apply single-entry accounting. Usually, these are service companies or home production enterprises and in most cases involve self-employed persons and definitely do not qualify for the 10 or more staff criterion.

¹¹ These comprise all organizations, including state and municipal institutions, universities, NGOs, as well as sole-traders in tobacco and alcohol, which had to register for VAT purposes in 2008. Around 25,000 will be dropped from the VAT register when the latter requirement no longer applies. There are also natural persons having VAT registration. Thus, the actual number of active companies having sufficient turnover to qualify for the surveys of innovation is lower.

registered pursuant to the VAT law. Finding out the actual number of active, independent enterprises in Bulgaria is further complicated by the fact that an enterprise is often organized, for legal, accounting and other purposes, in several (three on average) registered companies. There are various reasons for this phenomenon – ranging from the opportunity to issue VAT-free invoices, through risk mitigation¹² (for example, it is customary in the construction sector to have each construction site serviced by a new company or a group of several already existing ones), to complicated ownership and control schemes. Companies active briefly for a specific project, public tender, privatization opportunity or financial fraud but not legally terminated afterwards (due to the cumbersome procedure) are not uncommon.

Further, of particular significance when studying the innovation potential of non-financial enterprises is to know their share of the value added or turnover in the economy, not just their number. For example, large enterprises with 250 or more employees generate 27% of the total turnover in the Bulgarian economy and 42% of the GDP (according to NSI data for 2006), while micro-enterprises (having 9 or less staff) make 88% of the total number of enterprises but produce only 14% of GDP. The top 200 enterprises by revenue generate 25% of the total revenue in the economy, while the first 2,700 generate 33% (for 2006, according to data from the rankings by Aktiv and own calculations).

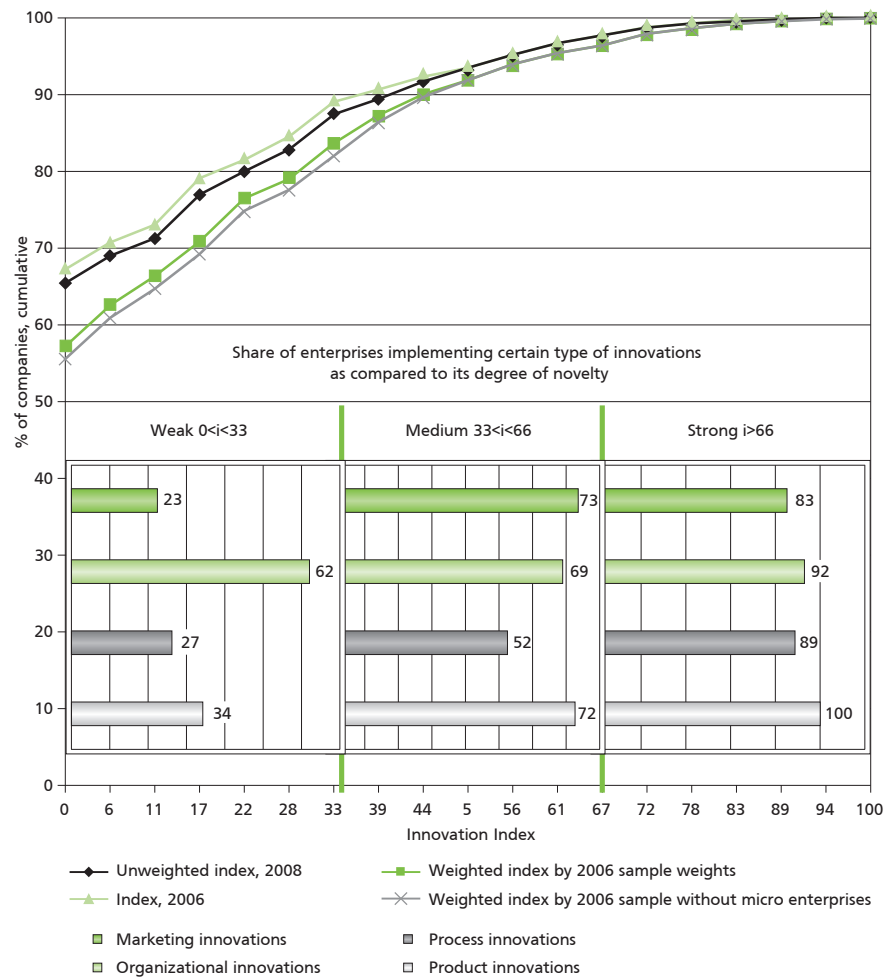
Based on the available statistics and its own calculations, the Applied Research and Communications Fund assumes that for the needs of the current innovation analysis the number of the active enterprises in the Bulgarian economy is around 120,000. Only about 22,000 – 25,000 companies in extraction, manufacturing, construction and transport and com-

TABLE 1. DISTRIBUTION OF ENTERPRISES ACCORDING TO THEIR SHARE IN SOME AGGREGATES

Aggregate	Micro (up to 9)	Small (10-49)	Medium sized (50-249)	Large (over 249)
Turnover	24	25	24	27
GDP	14	20	24	42
Number	88	9	2	1
INA-3	22	40	21	17

Source: Applied Research and Communications Fund, 2008.

FIGURE 1. INNOVATION INDEX OF BULGARIAN ENTERPRISES AND LEADING INNOVATIONS IN BULGARIA



Source: Applied Research and Communications Fund, 2008.

¹² What is mitigated against are not only financial and operational risks but also risk from inspections. No oversight institution has so far managed to conduct inspections of networks of enterprises. Such inspections could limit the opportunities to cover up violations of the law through fictitious contracts within the network.

munications have staff of 10 or more. Another 35,000 – 40,000 display characteristics of viable economic enterprises that could develop through innovation. The remaining (55,000 – 60,000) are a form of self-employment through sole-proprietorships and/or family businesses, which could be transformed into microenterprises through entrepreneurship, but which would most probably not resort to innovation.

The sample for the 2008 INA – the survey of the innovation activity of Bulgarian enterprises, presented in the current *Innovation.bg* report, is weighted with regard to the contribution of the various groups of enterprises to the overall turnover of enterprises in the economy, as well to their share GDP (mostly with respect to the three groups – microenterprises, small and medium sized considered together, and large firms). Despite small and medium sized enterprises having roughly the same share in the economy by these two criteria

– turnover and value added – small enterprises are boosted in the sample compared to the medium sized ones as regards the ratio of their numbers in the general population.

According to the Innovation Index of Bulgarian Enterprises, for the period 2006-2008 the overall number of enterprises engaged in innovation has increased by between 3 and 9 percentage points.¹³ At the same time, 5% of the enterprises (typically micro and small and medium sized) have made no innovation in 2008 since they claim they have introduced sufficient innovations in preceding years. According to the index, by now around a third of the Bulgarian companies (29-34%) innovate each year with 90 % of them having stable innovation budgets, and half having increased these levels in 2008 compared to 2007. Between 7% and 10 % of enterprises innovate only occasionally.

There is significant correlation ($r = 0.259$, $p < 0.01$) between enter-

prise size (natural logarithm of the number of staff employed) and its innovativeness as measured by the innovation index, i.e. typically larger enterprises are more innovative. This applies to all four types of innovation performed by enterprises but with lower correlation coefficients. In 2008 microenterprises performed worst in terms of the gap between their average index values and those of all enterprises in process innovations, while this gap among the small enterprises was biggest in product innovations. These two groups of enterprises were closest behind the averages as regards marketing innovations, while medium sized and large enterprises lead in product innovations. A micro or medium-sized enterprise is capable of being highly innovative in the Bulgarian environment only if it operates in a high-tech sector, in which knowledge (intellectual capital) is the biggest ingredient and only insignificant investment in long-term tangible assets is needed.

Factors and Types of Innovation Activity

Organizational and product innovations are most prevalent among Bulgarian enterprises. Seventy percent of the innovative companies introduce more than one type of innovation at a time, while 18% perform all – product, process, organizational and marketing innovations simultaneously. The predominant type of innovation evolves with the change in the value of the innovation index (level of innovativeness) of the enterprises. For example, for companies with weak innovation activity ($0 < i < 33$) organizational innovations are the most frequent ones, while marketing innovations

are typical for those in the middle of the innovation pack ($33 \leq i < 66$). As the level of innovation activity goes up ($i \geq 66$), process innovations become leading.

This dynamic in the type of the predominant innovation performed by the Bulgarian enterprises captures the typical development path of an enterprise from low into high innovation activity and could serve as a reference model for the design of

policies in support of innovation. Initially, the enterprise emphasizes organizational innovation (as they can produce substantially efficiency gains at relatively small cost) and enhances the range of its products – product innovations (mostly new for the enterprise for a limited market segment). Next comes a focus on marketing in order for the enterprise to expand its share in existing and new markets, which then inevitably requires a diversification of its product portfolio and an optimization of the business processes and production technologies through process innovations. At the last stage, product renewal at the most innovative en-

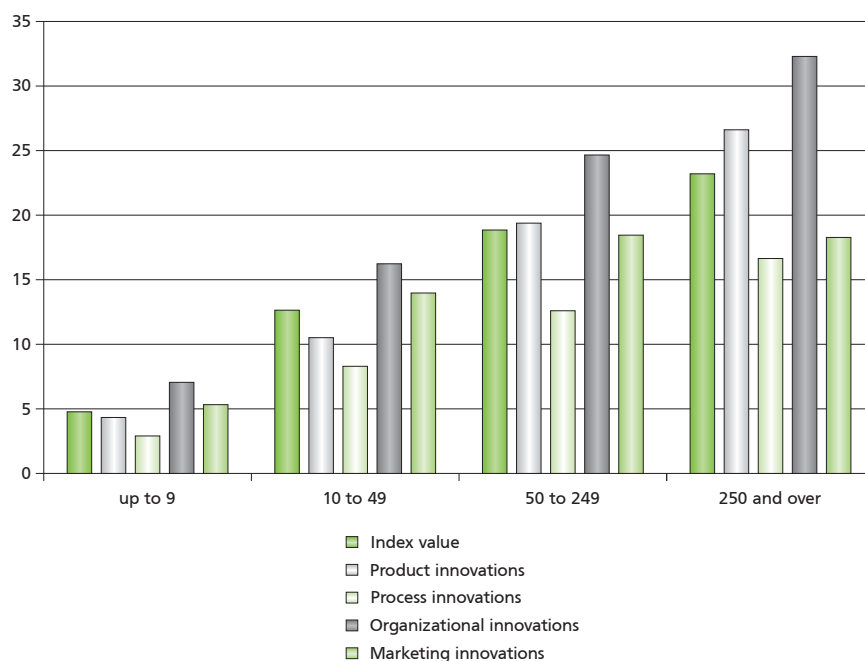
¹³ The difference in the numbers derives from the calculation methodology. They refer to an increase in the number of innovative enterprises in the weighted sample with weights for the micro, small and medium sized and large enterprises and in the unweighted sample, respectively.

terprises has become so routine that there are even operational targets for new products for each year. Comparative advantages for the companies derive from process innovations and business model innovations. Although it is possible for enterprises to introduce all these innovation stages in a very short period thus skipping some steps, this involves radical innovation, which can rarely be planned or receive project funding from the state. Government policy should therefore aim at supporting gradual innovation at the appropriate stages of development at company level.

The innovativeness of enterprises is determined by a number of endogenous factors (related to the enterprise; factors which it could influence or are the result of its development) and exogenous factors (which cannot be influenced by the enterprise and are characteristic of the environment in which it operates). There are significant correlations between the value of the innovation index and the type of market, in which the enterprise operates (local, regional, national, European, international), as well as its: export profile (share of exports in its overall turnover), size (logarithm of the number of employed staff), age (logarithm of the number of years the company has existed in the Bulgarian market), planning horizon, the quality standard systems it employs, the ERP characteristics of its IT systems, the quality of its website, R&D spending dynamics and the share of employees with university degree.

The type of market and the intensity of competition, which an enterprise faces, are the strongest factors influencing its innovativeness. The more closed the market (geographically and in terms of market participants), the less innovative the enterprises. Reaching the international markets requires more effort and capacity from the enterprise and is more exerting on the product, which needs

FIGURE 2. LEVEL OF INNOVATIVENESS OF THE ENTERPRISES BY SIZE (NUMBER OF PERSONS EMPLOYED)



Source: Applied Research and Communications Fund, 2008.

to meet more requirements and to be in demand on markets with tougher competition and sophisticated consumption. Only a quarter of the enterprises operating on the local markets (within 30 km of the enterprise premises) are innovative, compared with 40% of those selling to the regional market (within 100 km of the enterprise base) and 60% of those operating at national, European or international markets. The average innovation index for enterprises operating mostly in international markets is three times higher than that of the enterprises at local markets and twice higher than that of regional market enterprises. Exporting enterprises (particularly to more developed economies from the point of view of innovation) have access to advanced technological knowledge, which they could absorb, adjust to their needs and develop. This leads to a specific type of learning of enterprises – *learning through export*, by way of which external markets influence the enterprises' innovativeness.

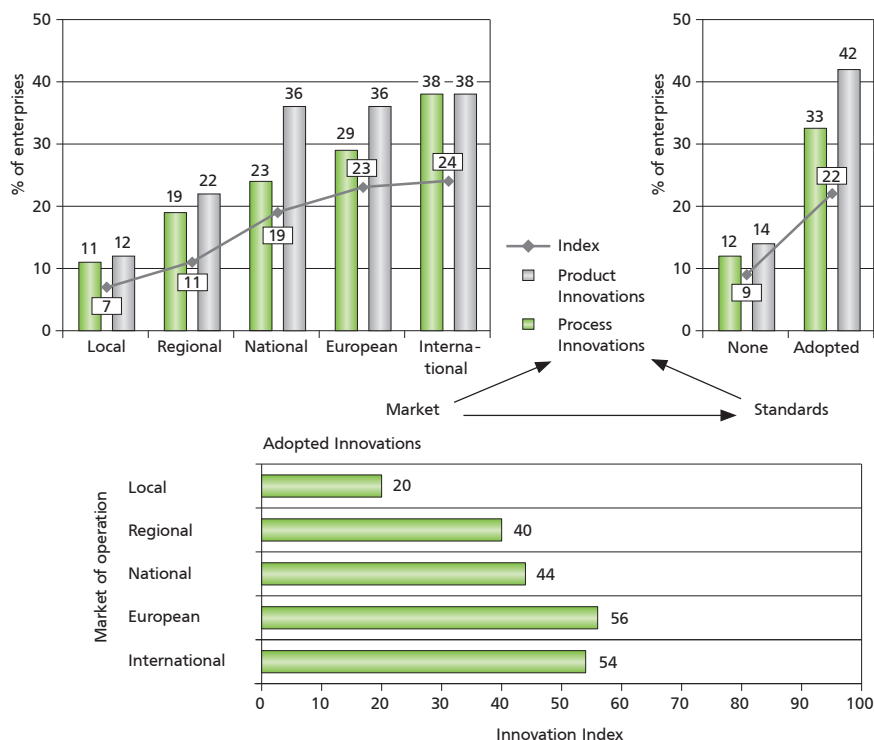
This provides the government with an extra reason to support the development of the export capacity of Bulgarian enterprises since it would contribute to both higher short-term economic growth and sustainable positive effect on the innovativeness of enterprises. The potential beneficiaries of such support would be a limited number of enterprises (less than 10,000) mostly of foreign ownership which have already been integrated in international value adding networks. Still, such a policy could support product innovations leading to the development of networks of local suppliers, partnerships with leading local researchers or enterprises whose services add significant value at some stage of the innovation cycle (R&D, prototyping, marketing). This would lead to a further learning effect of export for a wider group of Bulgarian enterprises, which could in turn develop their own innovations and new export lines.

The impact of competitors on the innovation activity of enterprises has

been evaluated through the main competitor type – whether its strategy emphasizes cost leadership or product differentiation. As could be expected, enterprises which have competitors with high product recognition are generally more innovative and in particular prioritize product over process innovations, both as regards their numbers and their degree of novelty. The cost leadership strategy requires a stronger focus on process and organizational innovations leading to optimal costs. The impact of competitors on specific innovation decisions, as well as linkages between the innovation activities of an enterprise and its use of ICTs, are analyzed in chapter 5 of this report.

The application or development of quality standards of the ISO, OH-SAS, etc, type is an additional factor regarding markets and competition. The application of international standards requires constant effort at all management levels and involves considerable cost. These are applied when the enterprise competes in very competitive markets which have quality standards as an entry requirement. The development of a Quality Management System (QMS) is an organizational innovation and could itself lead to product or process innovations. Thus, the application of such standards indicates an established or emerging culture of innovation. Enterprises which apply international standards are generally twice as innovative as those which do not. This difference is particularly pronounced for product and process innovations with the average values of the respective index components in these cases being three times as large. International standards have been introduced also to enterprises competing only on the national market. Partly (e.g. for industry) this is due to regulatory requirements but also to their use as an entry barrier in some public procurement tenders in the serv-

FIGURE 3. IMPACT OF MARKET AND INTERNATIONAL STANDARDS ON THE INNOVATION ACTIVITY OF BULGARIAN ENTERPRISES



Source: Applied Research and Communications Fund

ice sector where their application is not mandatory¹⁴. The application of a QMS is a long term investment and requires a longer planning horizon, which also stimulates innovative thinking and action.

Innovations are a long-term commitment and require a certain attitude, which is not developed over a year or a few months – the range of operational planning. The average innovativeness of enterprises whose planning horizon is three years is 50% higher than that of enterprises whose planning horizon is just one year, rising to 150% for those with 5 year planning span. On the other hand, enterprises which plan for the long-term usually foresee and set microtrends leading to significant shifts in consumer demand and radical product and process innovations. Globally, leading enterprises develop

long term scenarios for 10-20, even 50 years for their sectors, markets and key technologies. These scenarios serve as basis for the design of conceptual models for new products or strategies for operation in an uncertain environment, which are then translated into short term R&D and lab tasks. In Bulgaria, the planning horizon impacts the most process innovations, and the least – organizational ones.

At the same time, assumptions about a stable and significant correlation between the innovativeness of enterprises (as indicated by the value of their innovation index) and capital investments (logarithm of the investment outlays and their ratio to turnover), the share of employees with post-graduate degrees, as well as the share of employees trained over the last year, were not confirmed.

¹⁴ For example, for population surveys and business analyses.

Capital investments which can be used to finance, if needed, innovation projects are an indicator of the financial potential of the enterprise. A linkage between innovation activity and capital investments could also be expected in the case of intensive enterprise growth where the development of new production processes and products necessitates an increase in tangible assets. The lack of such linkage in the surveyed enterprises could be explained by the mostly extensive growth pattern of enterprises in Bulgaria. In other words, this results from the expansion of their tangible assets as part of an ongoing process or structural change which are not related to the introduction of any novelty. An additional contributing factor in this regard was the fact that during the past few years Bulgarian industrial enterprises went into the real estate business lured by sky-rocketing returns, as well as that enterprises already operating on the retail market, mostly in garments, shoes and household equipment made considerable investment into an expansion of retail outlets in 2007-2008.

It is a common assumption in innovation literature that enterprises with larger human capital pool have a higher degree of innovation activity. The number of persons with higher education (completed bachelor's or master's degree), with post-graduate degree (which would lead to the assumption that their R&D would

be of higher quality) and the level of continued education within the enterprise (share of the staff undergoing additional training) seem like to naturally stimulate innovation. Although there is a strong correlation between the index and the share of persons with higher education in the overall number of employees, neither those with doctoral degrees nor the continually educated have any tangible innovation activity impact. While a more detailed study is required to identify the influence of the level of education of the staff on the innovation activity of the enterprises, on the basis of available data it could be concluded that the presence of doctoral degrees do not guarantee an innovative effect on the host institution. This could be partly attributed to input and output problems (applicants and graduates from PhD studies are not usually the ones with the highest innovation potential), and partly to the fact that the type of job assigned to those with doctoral degrees rarely matches their skills. This may also result from the fact that the enterprise does not expect and does not require innovation from its PhDs. Because of the economic crisis and the expected return of around 200,000 people to Bulgaria during the next two years, a sizeable share of them (possibly around 5%, or 10,000) could be expected to be Bulgarians holding PhD degrees who have had problems on the job markets of the US and Europe. The education re-

ceived in foreign universities could lead to boosting the human capacity at company level in Bulgaria in the subsequent upturn.

The lack of noteworthy correlation between innovation index values and the staff that had undergone training in 2008 could be explained by the prevalent type of training available for the Bulgarian market, which is mostly in soft skills or specialized administrative education (e.g. of accountants on legislative amendments). This, however, only peripherally leads to new technical competencies.

Of the factors described above, the enterprise's market, its adoption of quality standards and long term planning and the number of ERP characteristics of its IT systems are the ones that most comprehensively account for the innovativeness of an enterprise. Another possible combination of factors explaining an enterprise's innovativeness, includes the market on which the enterprise operates, its relative size (staff) and the share of employed persons with higher education, the presence of quality standards and the planning horizon. In both cases, however, the rather low coefficients of determination between the models and the data ($R^2 = 0.214$ in the former case and $R^2 = 0.199$ in the latter) indicate that additional factors explaining the innovativeness of the enterprises are needed to explain current trends.



1. Gross Innovation Product

The gross innovation product of an economy or its innovativeness is assessed by the new products and services introduced, new technologies created and new scientific results achieved. It consists of and results from the interaction of innovation, technological and scientific products of the country. It is a major benchmark for innovation policy because it makes it possible to compare the outcomes of the innovation system in temporal and geographical aspects and to estimate the needs for changes in organizational and input resources in the innovation process.

Innovation Product

Innovation product encompasses innovation activity in the form of new and significantly improved processes, products and services based on created new and/or adapted existing knowledge and know-how. It is determined by the innovation activity of enterprises in the country and is the most important indicator for assessing the operation of the national innovation system. The key features of this indicator, its market orientation and the fact that it represents the final stage of the innovation process, predetermines the business's leading role (especially enterprises' innovation activity) for its realization.

Innovative Enterprises and High-Tech Exports

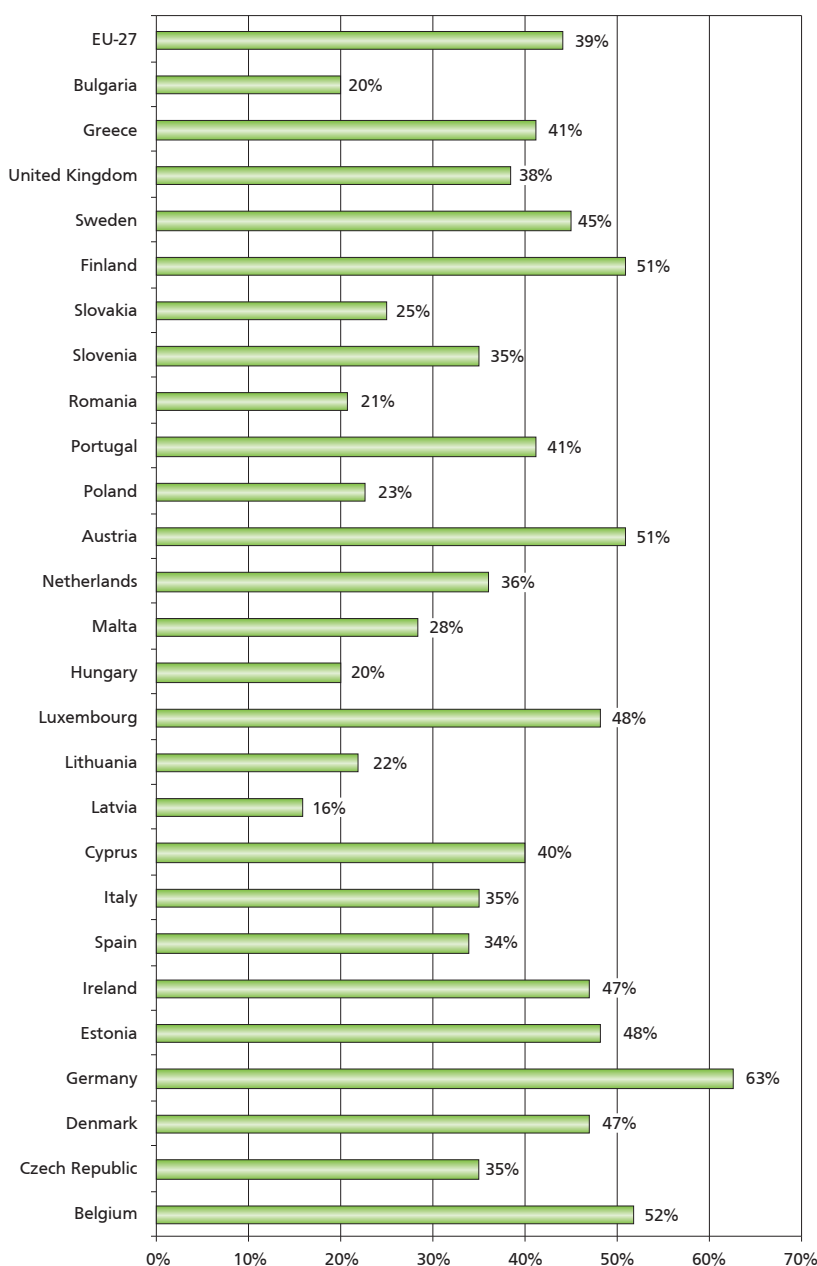
According to the Fifth Community Innovation Survey 2006, published in 2008 based on data for the period 2004-2006, the share of innovative firms¹⁵ in Bulgaria is 20% of all industrial and service enterprises¹⁶. Therefore, Bulgaria lags substantially behind the average level of the EU-27. For comparison, the share of innovative enterprises in EU-27 is 39%, which means that Bulgaria has almost half of the innovative companies than the EU average level. However, in Bulgaria there is positive growth in the share of innovative companies, with a 25% increase over the 2002-2004 period, while the share of innovative enterprises in EU-27 has decreased by 1%.

One can look for reasons for the increased innovative activity of Bulgarian enterprises in entrepreneurs' relatively higher awareness of the effect which innovative products and processes bring to a company; increased opportunities for funding, including European programs and funds; and effective cooperation with foreign companies. Among the EU-27 member states Germany (63%) keeps its leading position regarding the indicator of innovative enterprises share (despite the registered drop of 2 percentage points compared to 2004),

¹⁵ According to the Eurostat definition an innovative firm is the one that has introduced a new or improved product, service or process for the period being analyzed.

¹⁶ Enterprises with fewer than 10 employees are not studied.

FIGURE 4. INNOVATIVE ENTERPRISES, SHARE OF ALL ENTERPRISES IN INDUSTRY AND SERVICES



Source: Eurostat 2008, New Cronos, CIS2006.

followed by Belgium (52%), Austria and Finland (51%). Latvia (16%), Bulgaria and Hungary (20% each) and Romania (21%) have the weakest innovation activity.

A general feature of European economies is the presence of the strongest innovation activity in large enterprises (with over 250 employees). The situation with small and medium-sized enterprises is a bit different. While in Bulgaria only 17% of the small and 26% of the medium-sized enterprises are innovative, their shares are respectively 34% and 52% in EU-27. Over 40% of the small and 50% of the medium-sized enterprises in Sweden and Finland invest in innovative activities. As a whole, the segment of small and medium-sized enterprises (SMEs) in Bulgaria has low labor productivity and insufficient innovation activity. A large part of these enterprises operate on the local market where customers are not very demanding.

In a world financial crisis government efforts are focused on maintaining a stable macroeconomic policy. The increase of innovation activity, however, has a significant role in a long-term plan and in this context investments in company competitiveness have to be guaranteed. Well functioning enterprises are the key to economic recovery.

At the same time, the opportunities for funding SMEs are becoming more and more limited, and the situation could get worse because financial institutions are becoming more cautious when granting credits. The demand on the market shrinks and this is a prerequisite for companies to limit their investments, including in innovation projects, which generally are more risky. In this situation access to financing is of great importance, especially for start-up enterprises and SMEs.

The analysis of innovative enterprises in Bulgaria and EU-27 by industry reveals that the relative lagging behind

Box 3. NEW INITIATIVES OF EC FOR FINANCING OF INNOVATION

The European Commission and European Innovation Fund (EIF) offer active use of JEREMIE Initiative (Joint European Resources for Micro to Medium Enterprises) to create new enterprises and expand existing ones¹⁷. The Commission pays more and more attention to the important role of micro-enterprises and mechanisms for financing, adapted to their specific needs. On September 10, 2008 the Commission and the EIB Group launched the mechanism JASMINE (Joint Action to Support Micro-finance Institutions in Europe). The main objective is to channel different types of technical and financial aid and to support non-banking institutions for microcrediting in their efforts to improve the quality of services offered and to expand by simultaneously providing greater stability.

Source: Ministry of Economy and Energy.

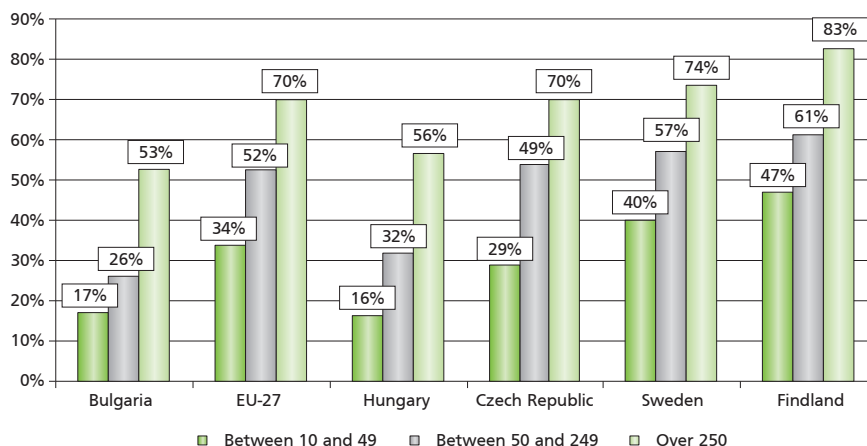
of a country centers on the transport, storage and communications sectors (37.03% of European level) and wholesaling and trade intermediation (46.1%). Computer technologies (80% of European level) and extractive industry (87.5%) are the most innovative sectors. The enterprises of the service sector continue to lag behind the average European levels significantly, but a change is observed towards the decreasing of differences.

Compared to 2002-2004, there is significant growth of over 5.8% in innovative enterprises, dealing with

computer technologies, 6.7% growth in the extracting industry and 5.8% growth for companies involved in production and distribution of electrical and thermal energy, gaseous fuels and water. The rise in the number of innovative enterprises in the above mentioned sectors is due to a great extent to the significant direct foreign investments over the period 2005-2006. Another great part of the direct foreign investments aid the development of Real Estate Operations and Construction sectors.

Financial intermediation is a sector with relatively good positions with

FIGURE 5. SHARE OF INNOVATIVE FIRMS BY SIZE (NUMBER OF EMPLOYEES)



Source: Eurostat 2008, New Cronos, CIS 2006.



¹⁷ National and regional authorities of Member States can apply to participate in JEREMIE. Small and medium enterprises are not granted direct funding.

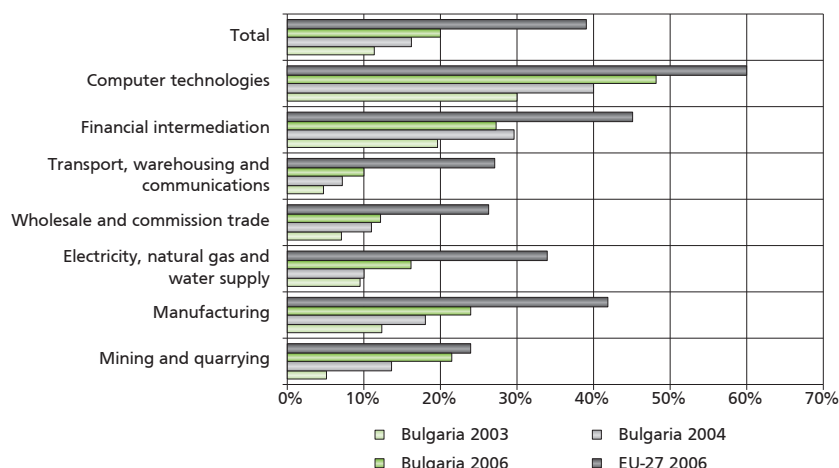
60% share of innovative enterprises, compared to the EU-27 average level (despite the drop of 2% compared to the former studied period).

According to the type of innovations, the analysis of innovative enterprises in Bulgaria over the period 2004-2006 shows the preservation of the share of 7% of companies introducing new products. The share of those introducing new production processes increases fourfold (from 1% to 4%). Nevertheless, by this indicator Bulgaria is among the countries with the lowest share of companies introducing process innovations, along with Romania and Hungary. About 8% of all Bulgarian enterprises introduce parallel product and process innovations at an average level of 16% for EU-27 (an increase of 1% in comparison to the former period). Cyprus (29%), Germany (27%) and Austria (25%) are the leading countries in Europe by share of companies with mixed innovations, followed by Estonia and Luxembourg (23% each) and Finland and Belgium (22% each). Germany with 19% of all enterprises is a leader in product innovations in EU-27, while Portugal has the greatest share of enterprises with process innovations (16%).

It is important to find out to what extent process innovations support and supplement product ones. A number of studies show that process innovations can be carried out without being directly connected to product innovation. In traditional industries, for example, process innovations are usually introduced for cutting labor costs or production rationalization.

In the sectors of computer technologies, R&D, architecture and engineering Bulgaria has twice as many product innovations (20% of enterprises) compared to the EU average level of 14%. In the sector of trade and trade intermediation in the EU-27 and Bulgaria, the share of product innovations is close (6% and 5% respective-

FIGURE 6. SHARE OF INNOVATIVE ENTERPRISES IN BULGARIA AND EU-27 BY SECTOR, %



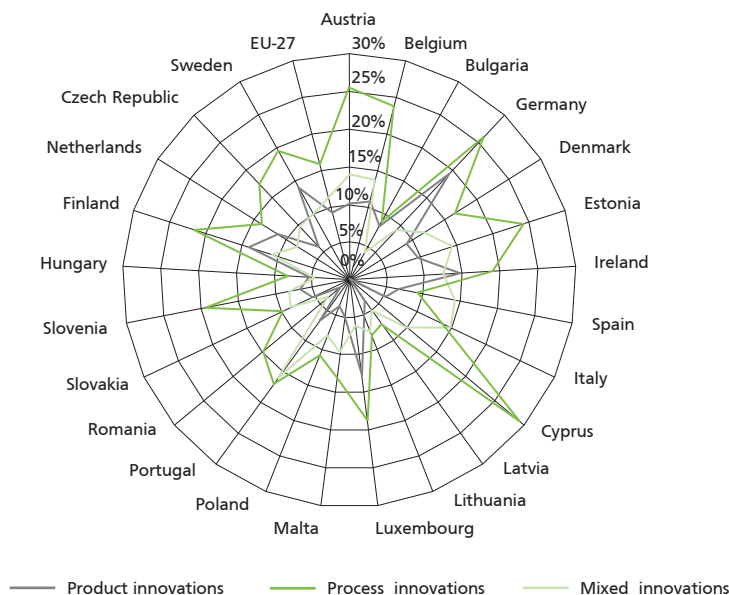
Note: The names of the sectors are shortened for clarity.

Source: Eurostat 2008, New Cronos, CIS 2006.

ly). As far as process innovations in this sector are concerned, however, there are still significant differences. In spite of the threefold increase of companies introducing new methods of distribution of goods and

services, the values for Bulgaria are only 4% of the EU average level of 12%¹⁸. In view of the difficult situation in which the construction sector is at the moment, a drop of product innovations can be expected next

FIGURE 7. SHARE OF ENTERPRISES DEVELOPING PRODUCT, PROCESS AND MIXED INNOVATIONS BY COUNTRY



Note: There are no data about the United Kingdom and France.

Source: Eurostat 2008, New Cronos, CIS 2006.

¹⁸ It is possible that the values for EU-27 are higher than 12%, as there are no data about Germany, France, Sweden, Ireland, Latvia, Estonia.

year in architecture and engineering which are related to this sector.

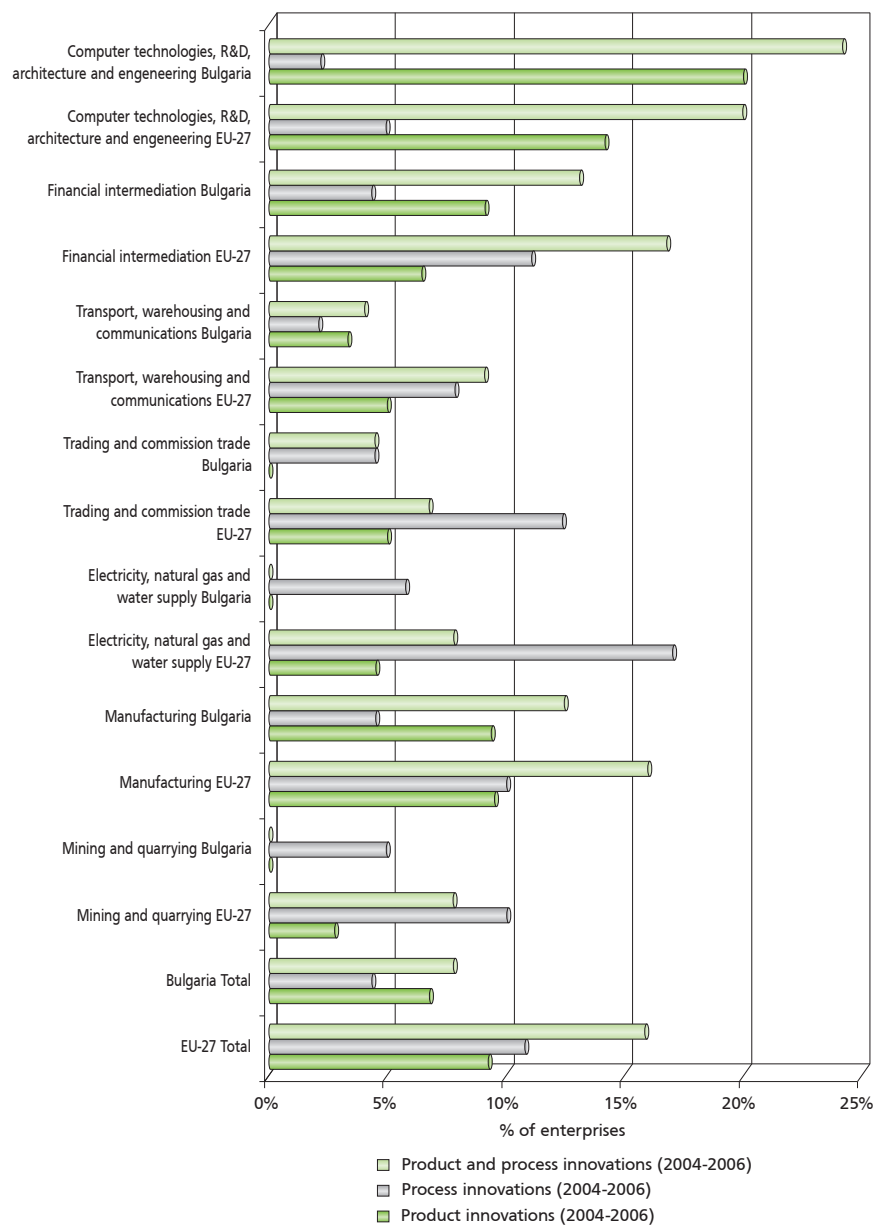
Research shows again that financial reasons are among the main factors hindering firms in carrying out innovation activities. The high costs of innovation are given as a basic reason for lack of innovation by 24% of Bulgarian companies and the percentage is the same with the EU-27 countries.

An impeding factor next in importance is the lack of spare funds in the enterprise itself. The insufficiency of in-house financial resources is a result of high expenses which businesses have to have to maintain the necessary equipment because of both old production equipment and the poor conditions of premises. An essential problem is the huge inter-corporate indebtedness of enterprises.

A third reason underlined by 15% of the innovation firms in Bulgaria, is the lack of proper sources of financing. About 18% of European entrepreneurs give the same argument. Compared to the former period, this indicator is relatively less important. There is an interesting phenomenon – the percentage of firms which have difficulties in finding highly-qualified personnel is on the rise. This trend has been in existence in Bulgaria for several years and continues to intensify. Having in mind the Eurostat data, it is clear why the personnel problem exists and is becoming more and more serious – only 29% of enterprises' innovation activity is directed to training (in the EU countries it reaches 52%).

An important aspect in the analysis of companies' innovation activity is studying their information sources. While for the period 2004-2006, enterprises rely only on their own research and analyses, in 2008 clients and consumers are a main source of information for 36% of them. Companies carrying out innovation activ-

FIGURE 8. STRUCTURE OF INNOVATIVE ENTERPRISES IN EU-27 BY TYPE OF INNOVATIONS OVER THE PERIOD 2004-2006



Note: The names of the sectors are shortened for clarity.

Source: Eurostat 2008, New Cronos, CIS 2006.

ity appreciate the role of end consumers in the market success of new or improved products.

A similar orientation of innovation activity to consumers' needs and requirements is in unison with the opportunities for process and product renovation of modern companies under the conditions of financial and economic crisis. The limited financial resources do not allow carrying out

large innovation projects connected with the development and adoption of entirely new products, application of new technological knowledge and the creation of new needs. Most innovations are limited to different stages of perfecting products and improving technical and economic characteristics of the production process (mainly in the direction of looking for opportunities to cut expenses). In this sense, knowing mar-

ket trends minimizes the risk of their investment.

Suppliers form part of the technological chain and are, in many respects, a limiting factor in the organization of a production process. They remain an important source of information and ideas for directing a company's innovative activity. Besides, firms demonstrate a widening horizon when it comes to new knowledge access channels. Conferences, trade fairs and expositions, scientific magazines and technical publications are used more intensely, which shows that they are seeking closer linkages to the achievements in the respective scientific and technological fields as a basis of product and process innovation.

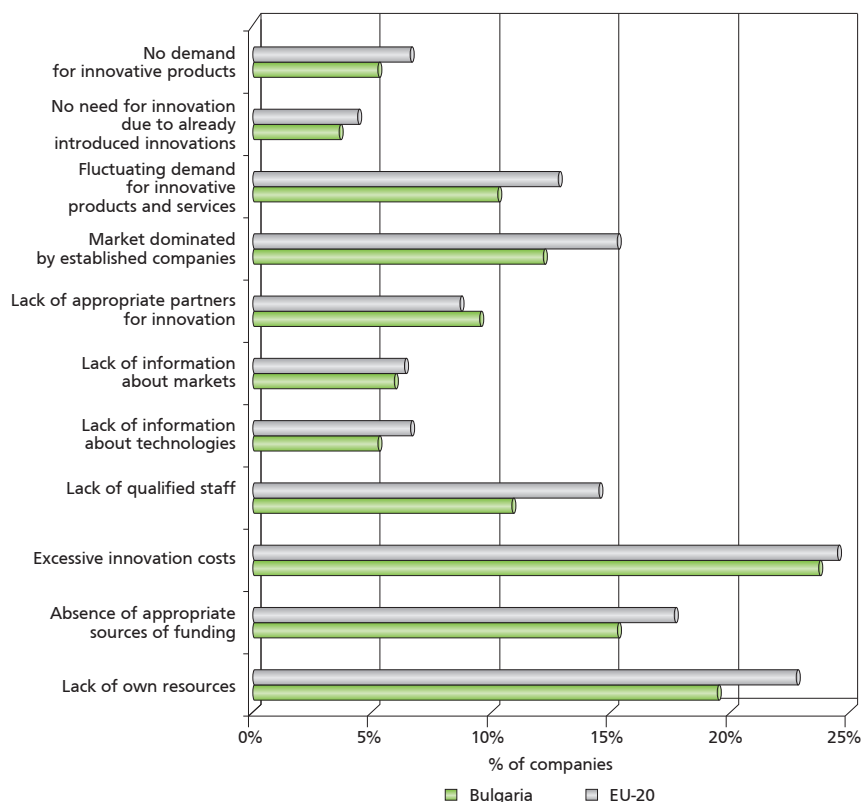
What is worrying is the fact that only 4% of the firms rely on universities and 1% work with state and public institutions to obtain information about new trends in their fields. There is only higher activity concerning the use of services of consulting companies – 11% of the firms regard them as a reliable source of information.

The type of specialization of the Bulgarian economy is best represented by the share of high-tech export in the aggregate commodity export of the country. These statistics reveals the low technological profile of the Bulgarian economy, in spite of the positive trend. The conclusion is that the Bulgarian innovation system is not directed at creating products with high added value content, unlike, for example, Hungary, which since the beginning of 1990 has pursued results-oriented policy in this direction.

Characteristics of the Innovation Activity in Bulgarian Companies

For the period from 2004-2006 the highest percentage of innovative Bulgarian companies (73%) recog-

FIGURE 9. FACTORS IMPEDING COMPANIES' INNOVATION ACTIVITIES



Note: Data about 7 Member States are missing or confidential.

Source: Eurostat 2008, New Cronos, CIS 2006.

nize machinery acquisition, equipment and software as the main innovation activities; 29% believe staff training to be a leading factor and

22% attribute innovation to the introduction of products and services to the market.

TABLE 2. MAIN SOURCES AND CHANNELS OF INFORMATION, % OF INNOVATIVE ENTERPRISES

	Bulgaria 2004-2006	Bulgaria 2008
Enterprise or group to which it belongs	32%	23%
Suppliers	28%	27%
Clients or consumers	28%	36%
Competitors	17%	8%
Consultants, trade laboratories, private research institutes	7%	11%
Universities	5%	4%
State or public research institutes	3%	1%
Conferences, fairs, expositions	17%	31%
Scientific magazines and/or technical publications	14%	25%

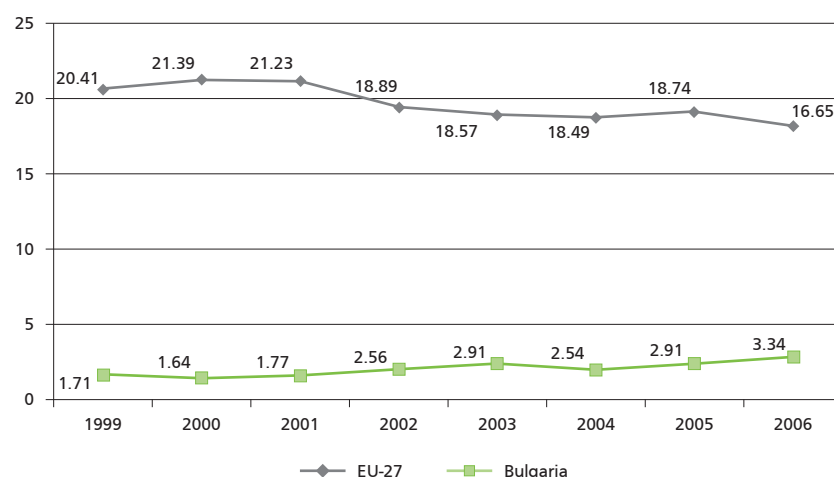
Source: Eurostat 2008, New Cronos, CIS 2006, Vitosha Research 2008.

The proportion of companies which conduct R&D (13%) or get studies and research from research institutes, universities and private labs (9%) is strikingly low. This shows the relatively low level of scientific and technological novelty of the accomplished innovation projects. While in Europe 28% of the enterprises conduct R&D (which is a precondition for the presence of research labs and skilled workers) hardly 2% of the innovative Bulgarian companies can afford such an investment¹⁹. In 2008, there was an additional drop in these indicators.

By investing in innovation activity, Bulgarian companies are striving both to perfect the quality of their products and services (48%) and for a wider range of goods (33%). The next most important reasons include compliance with internationally acknowledged standards (31%) and entering new markets (29%). In terms of the new regulations of the European market related to ensuring stable growth, there is an increase in the share of innovative projects that are oriented either to environmental topics or to providing safe work conditions. It is an invariable trend which is to remain in the coming years and is directly connected with Bulgarian membership in the EU.

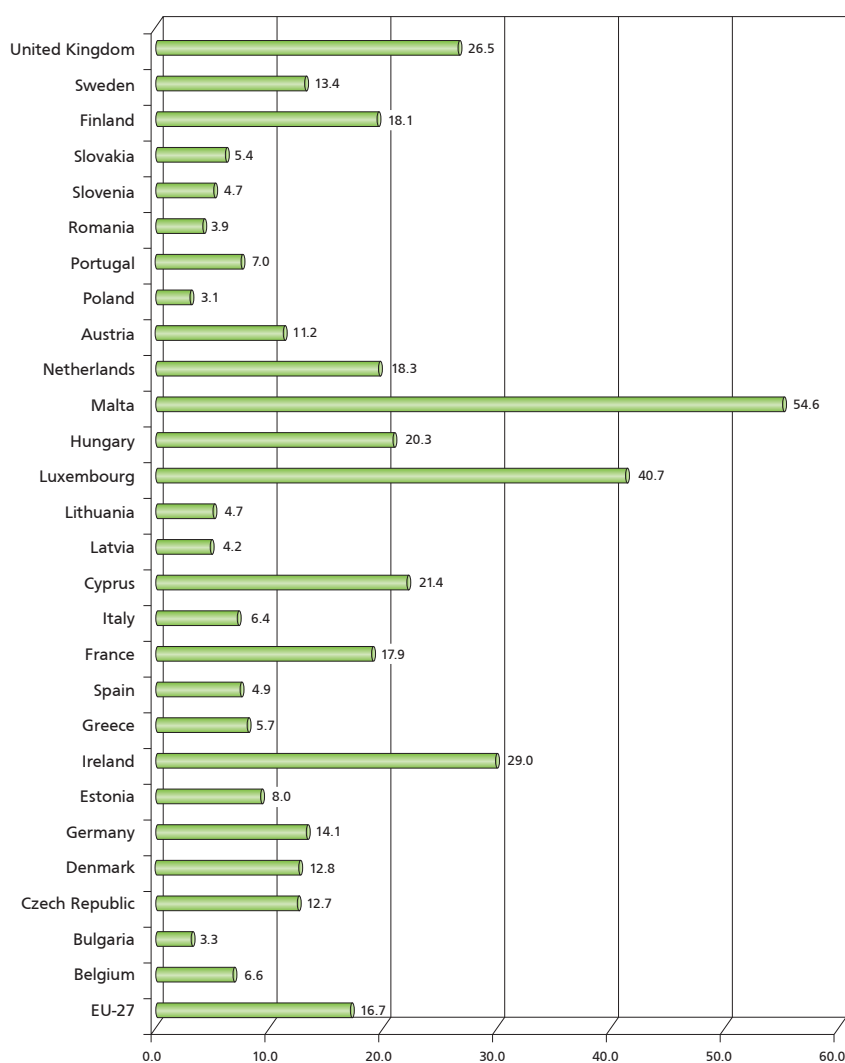
The lack of adequate and appropriate sources of financing is still one of the main obstacles to company innovation activity. This problem is to intensify due to the financial crisis. The government's efforts in the field of research and innovation might turn into a challenge in the present credit crisis and corresponding public funding decrease. Nevertheless, mechanisms should be found for guaranteeing a stable investment environment, including the goals of product and process renewal.

FIGURE 10. DYNAMICS OF EXPORT OF HIGH-TECH RPRODUCTS (SHARE OF TOTAL EXPORTS)



Source: Eurostat 2007.

FIGURE 11. EXPORT OF HIGH-TECH PRODUCTS (SHARE OF TOTAL EXPORTS)



Source: Eurostat, 2008.

¹⁹ *Accelerating Bulgaria's Convergence: the Challenge of Raising Productivity*; Report N 38570; World Bank; July 2007; p. 129.

Management Systems and Innovation

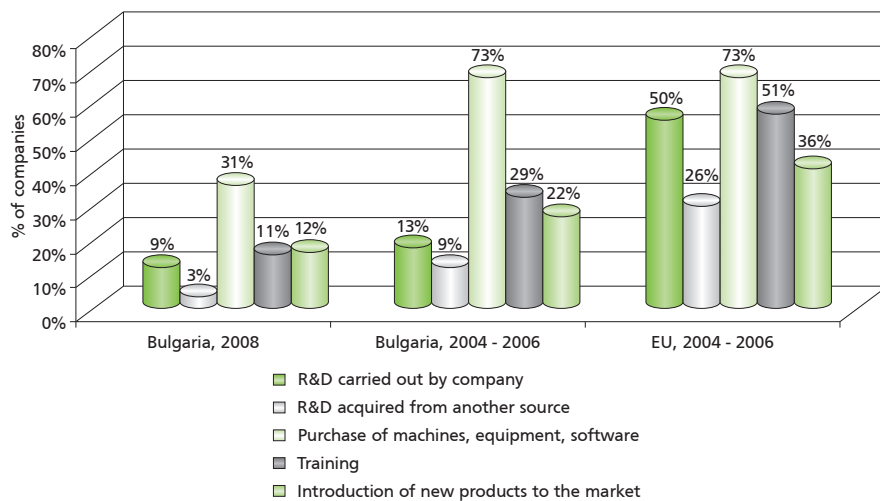
The logic of international standards for management systems²⁰ is in working out rules which, besides controlling processes and product quality, provide continuous improvement of these processes, products and services. Management systems can be viewed as a minimum requirement for creating sustainable internal environment for work and management which preserves the established positive practices and at the same time encourages innovation. Thus, certification, besides being a form of organizational innovation, can be viewed as an investment in management improvement and control which provides motivational factors and incentives for creating a sustainable innovation environment.

Certification is still used as an instrument of "legitimizing" good managerial practices in transition economies and in developing countries, which have the highest rates of such practices. In developed European economies and the US, the market is comparatively saturated and there is no such growth there. National governments have a different attitude towards certification and in many countries the imposing of certification as a requirement is a strong external incentive for investments in this sphere.

It is interesting to note the correlation between the number of quality certificates and environment certificates issued. It is indicative of priorities which businesses (and in some cases indirectly, the government through regulations) set regarding management. While in Japan for every 4 quality certificates granted

²⁰ Such are: ISO 9001:2008 – Quality management systems; ISO 14001:1996 – Environment management systems; OHSAS 18001:202 – Occupational health and safety management systems; ISO 27001:2005 – Security information management systems; HACCP – Food safety management system, etc.

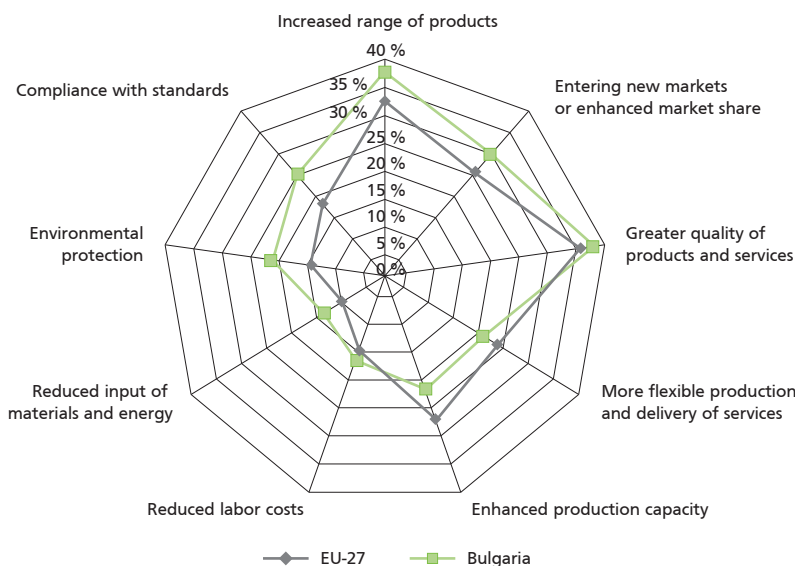
FIGURE 12. SUBSTANCE OF THE INNOVATION ACTIVITY OF BULGARIAN ENTERPRISES AND EU ENTERPRISES



Note: Eurostat 2008, New Cronos, CIS 2006.

Source: In the CIS2006 database the data about United Kingdom, Finland, Latvia and France are missing or confidential.

FIGURE 13. RADAR OF INNOVATION ACTIVITY EFFECTS OF INNOVATIVE ENTERPRISES IN BULGARIA AND EU-27 (2004-2006) (% OF COMPANIES)



Source: Eurostat 2008, New Cronos, CIS 2006.

there is one environment management certificate, in the developed European economies the ratio is 10:1, and in Bulgaria it is 20:1.

The average annual rate of growth of certificates granted in Bulgaria is 30-40%. It is possible that the expect-

tation for this rate to remain stable into 2009 will not occur because of the global financial crisis. The data for the distribution of certificates by sectors and standards outline a couple of main trends:

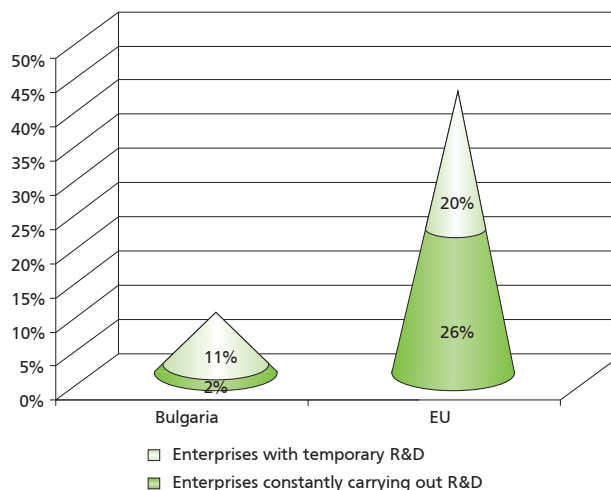
- Bulgaria is not an exception from the world trend of SMEs using

certification as an instrument of “legitimizing” their managerial practices and creating confidence in their clients and partners. Nearly 80% of the organizations certified in Bulgaria fall in the category of small and medium enterprises, most of them manufacturing products or offering services on the local market.

- Certification is undertaken mainly in organizations for which the requirement was introduced by regulations or which participate in public tenders. According to the distribution of certificates by sectors, the construction sector and sectors related to it are among the first in certifying by types of standards – quality, environment and occupational health and safety. This can be explained by the high risk associated with their work, as well as with the requirement for such certificates in almost all tenders for public orders. Thus, practically, for this sector these certificates are “voluntarily compulsory” – they are an explicit condition for the operation of businesses and getting new contracts.
- Another large group of economic agents operate in sectors where market leaders are certified and this makes the other enterprises also aspire to provide competitiveness through certification. In our country this is characteristic mainly of enterprises which compete on the Bulgarian market in the sectors of construction, transport, real estate, hotels, communications, information technologies and the food industry.

Separate attention should be paid to the introduction of certification in the structures of state administration and local authorities. In Club 9000’s register as of December 31, 2008 a total of 98 organizations are registered under the title “Public Administration”. 100 communal

FIGURE 14. ENTERPRISES ENGAGED IN R&D (SHARE OF INNOVATIVE ENTERPRISES)



Source: Eurostat 2008, New Cronos, CIS2006.

TABLE 3. EFFECTS OF THE INNOVATION ACTIVITIES OF BULGARIAN COMPANIES

	Bulgaria (2002 – 2004)	Bulgaria (2004 – 2006)	Bulgaria 2008
Increasing the range of goods	38%	43%	33%
Entering new markets or increased market share	30%	33%	29%
Improving the quality of goods and services	39%	46%	42%
Improving flexibility of production and supply of services	21%	23%	21%
Increasing production capacity	22%	23%	22%
Cutting labor costs	16%	19%	16%
Reducing materials and energy	13%	17%	11%
Environment protection	21%	21%	25%
Ensuring compliance with standards	25%	27%	31%

Note: Data about 7 Member States are missing.

Source: Eurostat 2008, CIS 2006, Vitosha Research, 2008.

administrations are expected to join them, which will take Bulgaria’s state administration to one of the leading places by number of received certificates.

This comparatively “mass” certification in the public administration

sector is in a way a Bulgarian phenomenon. Except in Japan, where almost all structures of local and state authorities are certified, in most European countries as well as in other parts of the world, certification in this sector is chosen by some administrations to demonstrate involve-

ment in quality management. The main driving force of this process in Bulgaria country is the pursuit of "legitimizing" of organizational and institutional capacity mostly for the European partners and the administration's "clients".

Certification, and the good management practices related to it, should be voluntary. They are really effective and bring real benefit for organizations only when they result from a confidence and maturity level achieved in development. The imposing of these voluntary requirements by administrative regulation is usually connected with resistance to the "extra" expenditures needed, and gives rise to doubts about the involvement of lobbyist interests and leads to formal compliance with requirements, without increasing effectiveness, efficiency or a real improvement of product or service quality.

In the European Union such practices are rare. In most cases enterprises are stimulated to introduce management systems and to get certified by granting various reliefs with certification.²²

In Bulgaria, the reasons for introducing management and certification systems are still mainly external – pressure from clients, competition and regulations. The foundations have been laid, but in the following years the building of a competitive economy will inevitably require development of another type of managerial culture, which – under the influence of market forces – will be based on the fundamental principles for good management and philosophy of continuous improvement.

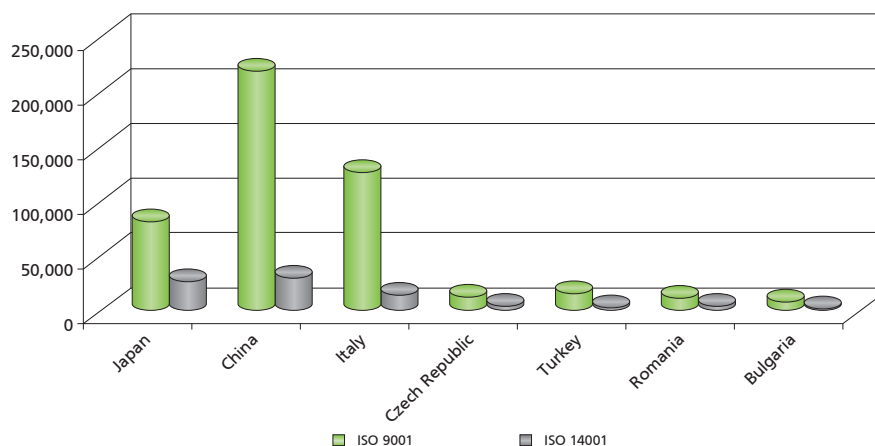
Bulgaria must refrain from imposing explicit requirements for certification but must find mechanisms for motivating enterprises in their choices towards certification by providing them with various stimuli and

TABLE 4. RATIO OF THE NUMBER OF VALID CERTIFICATES TO GDP BY COUNTRIES²¹

	Japan	China	Italy	Czech Republic	Turkey	Romania	Bulgaria
Number of ISO 9001 Certificates	73,176	210,773	115,359	10,458	12,802	9,633	4,663
GDP (million) USD	4,283,529	7,055,079	1,777,353	239,689	922,189	245,508	86,339
	58.54	33.47	15.41	22.92	72.03	25.49	18.52

Source: World Development Indicators Database, World Bank, as of October 17, 2008.

FIGURE 15. RATIO BETWEEN QUALITY (ISO 9001) AND ENVIRONMENT (ISO 14001) CERTIFICATES GRANTED



Source: Annual study of ISO (www.iso.org), as of December 31, 2007 and own calculations.

Box 4. EUROPEAN AND GOVERNMENT SUPPORT FOR INTRODUCING INTERNATIONALLY RECOGNIZED STANDARDS

Under the PHARE program in 2006-2007 and now under the Operational Program Development of the Competitiveness of the Bulgarian Economy the country provided grants to SMEs to develop and introduce management systems of international standards, their certification and investment in equipment and software related to the implemented systems. The projects come up to a total of €30 million for the first three years of operation of the Operational Program and contribute significantly to the increase of certificates granted in the field of export-oriented enterprises, processing enterprises and some kinds of services (information technologies, real estate, tourism, etc.).

Source: Ministry of Economy and Energy.

²¹ The data register the valid certificates as of December 31, 2007. Certificates are issued for a period of three years, some organizations do not renew them, some give them up, and some are deprived of them. These data are the only available formal information, which is gathered in a structured way. The voluntary principle of reporting and participation in the ISO study doesn't guarantee complete data.

²² In Denmark all enterprises, certified under OHSAS 18001 (Occupational health and safety management systems), are exempt from being checked by the Labor Inspection Agency. In many European countries this certification allows for reliefs in insurance contracts, access to credit resources, etc.

reliefs for the investments made and engagements undertaken. On the other hand, Bulgarian enterprises are still lagging behind world levels in the sphere of introducing management and certification systems. The country must continue with its efforts to popularize these practices and assist them.

It is important for businesses when introducing systems and certification to regard it as an inner necessity and a serious engagement for complying with requirements, not as a formality. Only then would this investment be profitable and provide sustainability and competitiveness. Special attention during crisis situations should be paid to investments when developing risk management systems and actions to provide business continuity.

Box 5. INTERNATIONAL STANDARDS AS A REQUIREMENT FOR THE OPERATION OF BUSINESSES

With the amendment to the Regulation of Periodical Technical Inspection of Motor Vehicles of August 08, 2007 the Ministry of Transport introduced an accredited certificate of conformity to ISO 9001:2000 as part of the compulsory requirements for granting license to carry out Annual Roadworthiness Tests (ART). A one-year period was set which the ART stations had to comply with. The ministry explained the change in the Regulation with the need of harmonization of national and European requirements, although the EU doesn't have compulsory certification in this sector. In our country this measure was imposed and gave rise to a controversy because companies in this sector weren't ready for such an action and didn't have a plan for investments in such an activity. The systems developed meet the requirements formally, but how effective they are and to what extent they will contribute to guarantee service's quality are subject to check.

Another similar measure came about in November 2008 with the introduction of Regulation of Common Requirements for Operative Compatibility and Information Security to Electronic Management Act. All administrations and their contractors were required to be certified under ISO 27001:2005 (Information Security Management Systems) within 18 months of the publication of the Regulation.

Source: Moody International, Ltd.

Technological Product

Technological product is a result of the creative activity of various participants in the innovation process. It has unique characteristics and economic significance, which makes it attractive as an object of transfer. The most frequent form of protection of technological products as intellectual property is their registration as inventions and utility models. The analysis of applicant and patent activity regarding inventions and utility models in the country as well as the attitudes of Bulgarian and foreign persons in this field make it possible to assess an essential aspect of the innovation system operation and to find ways for improving it.

Two main issues need to be highlighted in relation to applicant and patent activity when registering inventions and utility models within the territory of the country in the last few years. The first one is connected to changes in the European Patent Legislation (e.g. about biotechnological inventions) which had to be adopted in Bulgaria by mid-2000. The second one relates to Bulgaria's membership in the EU, which led to other legislative changes becoming effective (e.g.

protection of medicinal products). This analysis, therefore, studies the trends in the protection of technology products on a broader scale, covering the period of 2000 to 2008. Special attention is paid to the activities of firms, individuals and research institutions creating technological innovations from 2006-2008, compared to the values of indicators studied during the pre-accession period and the years of membership. The main information sources of the study are the

publications of applications and patent licenses in the Bulletin of the Bulgarian Patent Office (BPO), as well as BPO's annual reports and statistics.

Applications Submitted for Protection of Inventions and Utility Models

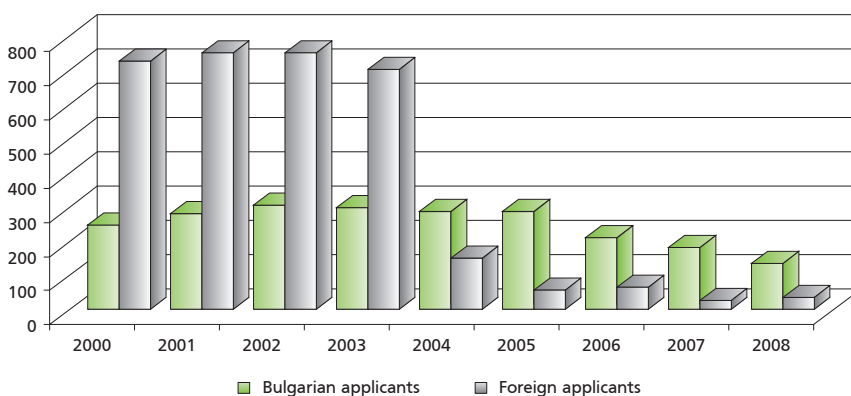
Data show relatively stable applicant activity regarding Bulgarian applicants' inventions for the whole peri-

od 2000-2008 and significant changes in foreigners' interest in patenting in Bulgaria. In 2004, the number of patent applications, submitted by foreign persons, fell sharply below the level of applications submitted by locals (having in mind that in the former period foreign applications were much more than Bulgarians'). To a great extent this is due to the fact that in 2002 the country joined the European Patent Convention (EPC). As a result of this, many foreign applicants applied for protection of their technological products through the European Patent Office, instead of submitting national applications to the BPO.

The influence of the country's EU membership on the trends of patenting in Bulgaria is of great interest in terms of innovation and technological development of the country. 256 patent applications for inventions were submitted in Bulgaria in 2006, 184 in 2007 and 169 in 2008. The data of the relative share of the applications of Bulgarian and foreign citizens and the jointly submitted applications show that our country's membership in the EU required a certain adaptation period for applicants. This is especially true for the first year of membership when the number of patent applications for inventions, submitted by all studied categories of applicants, dropped.

Regarding utility models, data show relatively stable activity by Bulgarian applicants before 2006 and drastic changes in 2007. The interest of foreigners in the protection of technical solutions as utility models is lower compared to their interest in patenting them as inventions both as relative share and in absolute terms. This is due to the fact that not all legislation envisages registration of utility models, i.e. they are not a familiar form of protection for all foreign persons. Therefore, the conclusions made about the changes in applicant activity of foreign persons regarding

FIGURE 16. NUMBER OF SUBMITTED PATENT APPLICATIONS FOR INVENTIONS FOR THE PERIOD 2000-2008 BY NATIONALITY OF APPLICANTS



Source: Bulgarian Patent Office, 2008.

inventions after 2002 are not confirmed in the utility models.

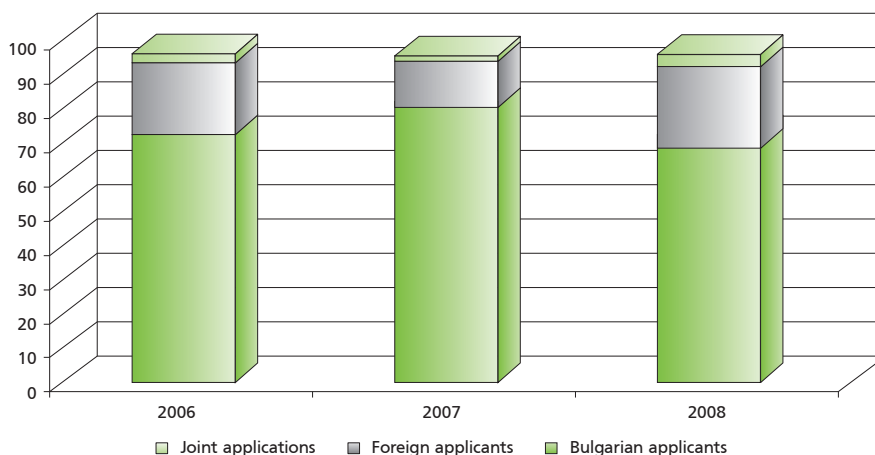
The drastic changes in Bulgarian applicants' activity regarding utility models in 2007 can be explained by the changes in patent legislation made in 2006, part of which seriously changed the regulation of property protection of these kinds of technological products.

In Bulgaria, utility models are not subject to patenting but to registration. Correspondingly, their protection document is called a certificate and is issued after a formal inspection

of application documents. It is valid for four years after an application submission with the possibility to be extended twice for a three-year period each time. Shortened registration terms are stipulated as long as no inspection is made concerning a technical solution (it is possible to examine the state of equipment at the concerned person's request).

The aim of these changes is to stimulate the protection of technical solutions of a lower technological level as utility models. There are three registration criteria for a utility model

FIGURE 17. SUBMITTED PATENT APPLICATIONS FOR INVENTIONS IN BULGARIA'S PATENT OFFICE BY NATIONALITY OF APPLICANTS



Source: Bulgarian Patent Office, 2008.

and a requirement for an invention step is added to novelty and industrial applications (both novelty and invention steps are assessed at lower requirements compared to criteria of the same name in inventions. The new and more favorable regulation of utility models is one of the reasons for the drop in applicants' activity in inventions.

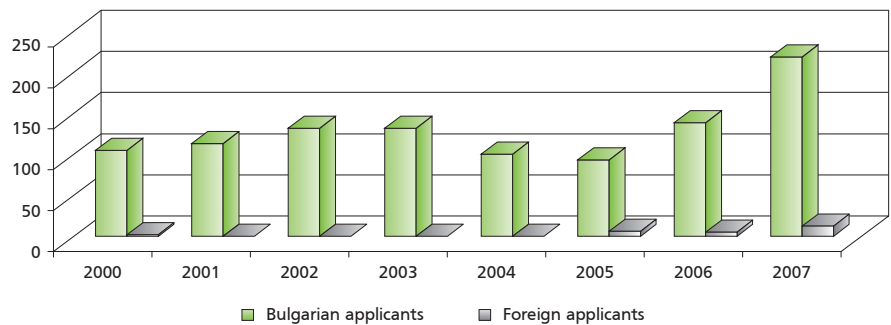
It is interesting to note that in almost all categories of Bulgarian applications, the downward trend is confirmed. Jointly submitted applications, enjoying an upturn, are an exception. It is obvious that potential applicants look for partners with whom to carry out joint research and patenting (respectively to share the associated risks).

A great part of research institutions create inventions and apply for patenting together with their employees, often for financial reasons (employees are also involved in the financial provision for these processes with their own or borrowed funds). In these cases, because the institution doesn't have financial resources, employees get permission to apply on their behalf regardless of the fact that the technological product had been created as part of their employment obligations.

Throughout the whole studied period, individuals show the greatest interest about protection of technological products like utility models. Unlike the trends in inventions, firms show comparable activity in utility models. Research institutions also show considerably smaller interest. It must be noted that the applications submitted by individuals and companies for the period mark a trend of increase unlike those in inventions.

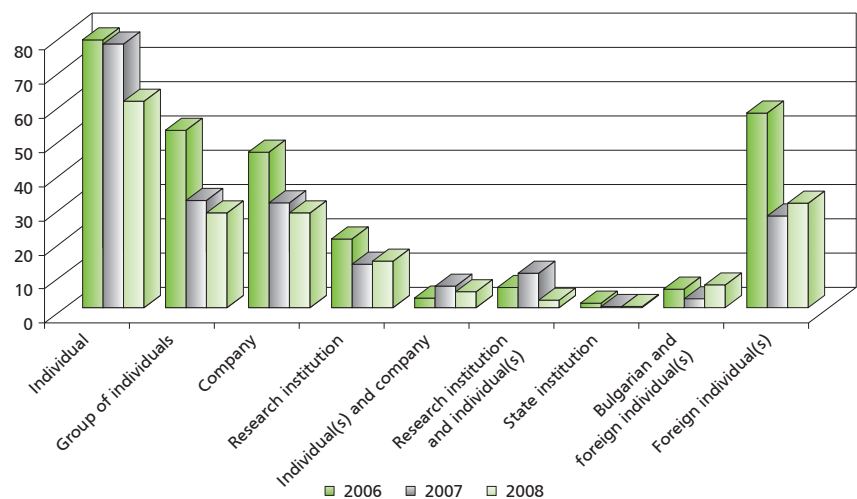
The share of applications submitted by Bulgarian individuals is higher compared to that in inventions applications – over 60%. Given the higher relative share of applications submit-

FIGURE 18. NUMBER OF SUBMITTED PATENT APPLICATIONS FOR PROTECTION OF UTILITY MODELS FOR THE PERIOD 2000-2007 BY NATIONALITY OF APPLICANTS



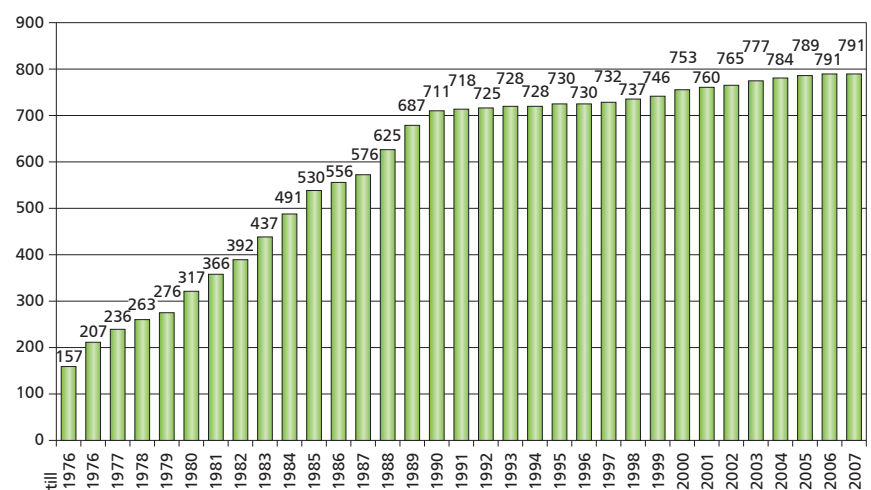
Source: Bulgarian Patent Office, 2008.

FIGURE 19. NUMBER OF SUBMITTED PATENT APPLICATIONS IN BULGARIA BY TYPE OF APPLICANT



Source: Bulgarian Patent Office, 2008.

FIGURE 20. DISTRIBUTION OF BULGARIAN ACADEMY OF SCIENCES PATENTS, CUMULATIVE NUMBER BY YEAR OF APPLICATION



Source: Cambridge IP based on data of the Bulgarian Patent Office.

ted by Bulgarian firms compared to that in inventions, it could be concluded that companies appreciate the lower criteria for protection and protection expenses connected with utility models. This is yet another reason for stimulating the creation and adoption of technological products.²³

A comprehensive analysis of the Bulgarian innovation system requires studying the foreign persons' activity for the period after Bulgaria's EU accession, as they increasingly come to be:

- competitors to Bulgarian persons who are innovatively-oriented;
- potential suppliers of technological products for adoption by Bulgarian entrepreneurs;
- potential partners of Bulgarian entrepreneurs as regards carrying out joint research.

What is more, patent protection of technological products by foreign persons influences the technological level in the respective sector and on the respective market – on one hand, it puts a limit on the technologies which can be used legally by Bulgarian persons, and on the other, it poses challenge to reach and surpass this technological level.

In terms of potential impact of the EU membership on applications by foreign persons, it can be noted that during its second year the number of patent applications in Bulgaria, submitted by foreign persons rose. Besides, the number of jointly submitted applications also rose in 2008. These data can be considered as an indication both for the increasing attractiveness of the Bulgarian market and for the increasing confidence in our country as an EU member state.

Foreign persons submitting patent applications in our country are usually legal entities (mainly companies). By years, their share as applicants in the overall number of applications,

Box 6. JOINT APPLICATIONS

Between 2 and 5 applications are submitted jointly by Bulgarian companies and physical persons annually. The companies with such patent applications for inventions are *Daflorn Ltd.*, *Vera Light Ltd.*, *Herti Ltd.*, *VIK Ltd.*, *Fento Technology Ltd.*, *Keit Ltd.*, *Security BG Mark Ltd.* and *BMM plc.*

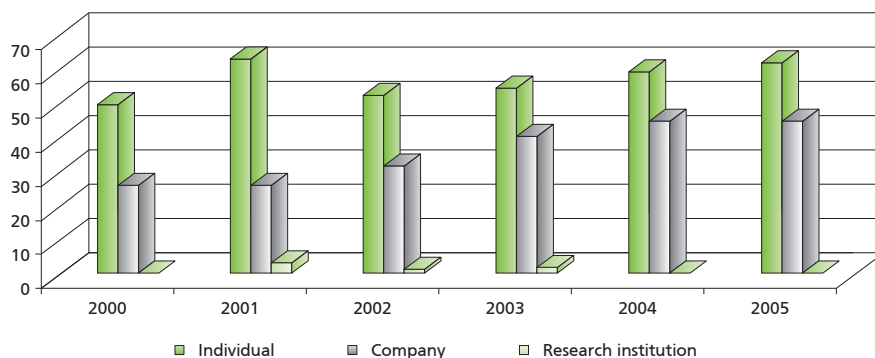
There are between 2 and 8 applications submitted jointly by Bulgarian research institutions (universities, research institutes) and individuals annually. This category includes Higher School of Civil Engineering "Lyuben Karavelov"(2), Space Research Institute, Institute of Microbiology, Institute of Organic Chemistry (3), Institute of Chemical Engineering, Ruse University (3), Institute of Polymers and Technical College, Yambol.

One joint application was "registered" for the studied period – a research institute and a firm (Institute of Metal Science and Kam Ltd.).

There is one case of patent application for an invention from a state institution – the Ministry of Defense.

Source: Bulgarian Patent Office.

FIGURE 21. NUMBER OF SUBMITTED APPLICATIONS FOR PROTECTION OF UTILITY MODELS BY MAIN TYPE OF BULGARIAN APPLICANTS FOR THE PERIOD 2000-2005



Source: Bulgarian Patent Office, 2008.

submitted by foreign persons, varies between 86% and 92%. This is quite logical, having in mind that patenting abroad is associated with high expenses and it is usually only justified after serious planning and organization, which sometimes are beyond the capacity of individuals.

The data for submitted patent applications show that applicants' activity

is extremely variable in terms of technological fields (261 fields processed to a group of the International Patent Classification). The technological fields which attract greatest interest are "Preparations for medical, dental or cosmetic purposes" – 15%, "Heterocyclic compounds" – 5% and "Therapeutic effect of chemical components or medical preparations" – 4%, the rest in the group are of 2%

²³ The only jointly submitted application by an individual and a company is that of "Remotext" EAD. One application is submitted by a research institution – National Centre of Radiobiology and Radiation Protection.

or less. It is obvious that applicants' interest is not very concentrated.

Protection Documents Granted for Inventions and Utility Models

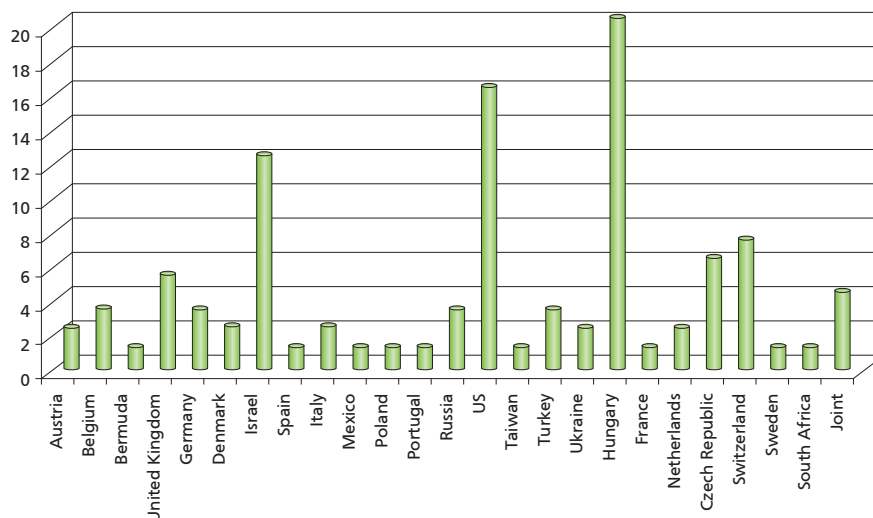
There is a trend toward decrease of inventions patents granted according to national regulations for the period 2000-2007. In 2008, there was an increase in the number of patents granted to Bulgarian persons. As this is the last year of the studied period, it is difficult to determine whether this increase is the beginning of a positive trend or it is accidental. Applicants' activity and decreasing number of patents granted to foreign persons could be due to our country's accession to the European Patent System.

For the whole period 2000-2008, the data about utility models show relative stability in the number of protection documents issued according to national regulations in favor of both Bulgarian applicants and foreign ones. Only in 2008 was there an increase in their number.

The protection documents for inventions and utility models according to national regulations in 2006 are 386, in 2007 – 300, and in 2008 – 455. The comparison of data for submitted applications and patents issued show that Bulgarian applicants are more often rejected invention patents than foreign applicants.

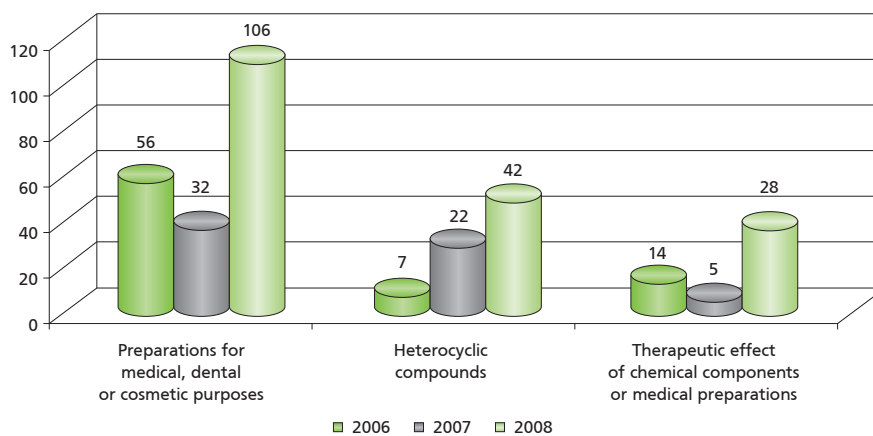
As far as inventions are concerned, a smaller part of documents are owned by local persons (below 30%). Among Bulgarian holders, individuals have the greatest share (68%). Technological products protected by individuals are often created with resources of the organizations for which they work. Since organizations are often not interested in protecting new knowledge, individuals apply independently and get protec-

FIGURE 22. SUBMITTED PATENT APPLICATIONS FOR INVENTIONS IN BULGARIA BY FOREIGN PERSONS BY NATIONALITY OF APPLICANT FOR THE PERIOD 2006-2008 (NUMBER OF APPLICATIONS)



Source: Bulgarian Patent Office, 2008.

FIGURE 23. NUMBER OF INVENTIONS SUBMITTED FOR PATENTING FOR THE PERIOD 2006 – 2008 BY YEARS BY NUMBER OF APPLICATIONS FOR THE LEADING TECHNOLOGICAL FIELDS FOR THE PERIOD



Source: Bulgarian Patent Office, 2008.

tion documents. Companies' patents are respectively 24% and research institutions' – 5%.

There are single cases of patents issued jointly to a physical person and company (Herti Ltd.), to a physical person and research institute (Space Research Institute) and to a company and research institute (NPS Kozlodui EAD and Institute of Metal Science).

The data for utility models show a greater relative share of Bulgarians – 96%, the same being the case with applications. Of them 60% are owned by individuals and 36% – by companies. Research institutions holding protection documents for utility models are very rare. The same applies to the only variant of jointly held certificates for utility model by individuals and companies (Daflorn Ltd, Furnace Building and Insulations – Mounting

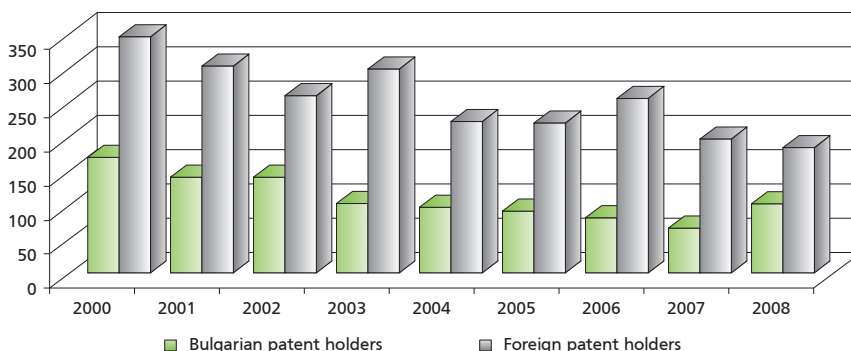
Plc, BMM Plc, and Vega – Vasil Vasilev ET). The reasons why Bulgarian persons seek protection for their utility models could be the following:

- Protection of utility models is more accessible in terms of the protection procedure (much shorter than for inventions) and financing by the applicant (charges for utility models protection are much lower than charges for invention protection).
- Bulgarian applicants seek protection of their technological products through utility models, because the criterion for the invention step is determined at a lower level compared to inventions and this enables even technical solutions of an average technological level to get protection, which undoubtedly poses questions about the quality of technological product created in our country.

For the period 2006-2008, a total of 185 individuals became holders of protection documents for inventions and utility models, 106 companies received patents/certificates for protection of their technical solutions. Much fewer were those who had more than one patent. Research institutes are represented only in 16 documents.

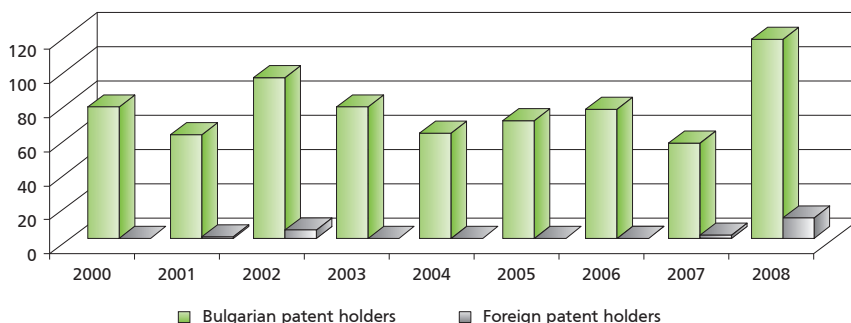
Of foreign persons, those who show the greatest interest in the Bulgarian market are physical persons and mainly legal entities from USA (23%); Germany (20%); France (8%); United Kingdom (5%) and Belgium (5%). The trend for the period 2006-2008 is mainly towards a decreasing of patent activity of foreign firms on the Bulgarian market. There is a certain discrepancy between the most active applicants and patent holders in terms of origin. This could be accounted for by both the inspection expertise system in inventions and possible disparity in the quality of technological products created in different countries.

FIGURE 24. NUMBER OF INVENTION PATENTS GRANTED FOR THE PERIOD 2000-2008 BY NATIONALITY OF HOLDER



Source: Bulgarian Patent Office, 2008.

FIGURE 25. NUMBER OF PATENTS/CERTIFICATES GRANTED FOR UTILITY MODELS FOR THE PERIOD 2000-2008 BY NATIONALITY OF HOLDER



Source: Bulgarian Patent Office, 2008.

Aventis Pharmaceuticals (US), Janssen Pharmaceutica N. V (BE), Pfizer Products Inc. (US), Schering Aktiengesellschaft (DE), Aventis Cropscience S. A. (FR) are among the most active foreign patent holders.

The protection documents owned by people of different countries are 15. These are most often co-holders that are representatives of the US, United Kingdom, Switzerland and Japan.

Results of the Functioning of the Patent System

The technical level of knowledge created by Bulgarian persons can be assessed in terms of applications and granted patents. Data show that Bul-

garian applicants are more frequently denied protection documents compared to foreign ones, which undoubtedly poses the question of the quality of technological products created in this country. The reasons are complex and could be sought in the financial, technological and innovation policies of the country as well as in the specific policies of creating technological products by Bulgarian companies and research institutes. On the one hand, even if the country defines priority fields in research and development and grants the necessary funding on a project basis, there are no clear indicators for tracing the quality of the technological product created and whether it meets the high standards set in that technological field by other countries.

On the other hand, Bulgarian physical persons and legal entities often create technological products without a clear policy regarding their market realization (in response to specific market needs, present or future). Research to identify the technological level in a certain field, to create products of high quality and unique parameters is rarely done. Patent information is often ignored as a source of ideas for creating a specific technological product, which, in turn, leads to greater cost of time and funds.

An interesting indicator of the rate of adoption of protected technological products in practice is the termination of the validity of protection documents for not paying annual support fees. In 2006, the validity of 368 patents for innovation and utility models was terminated for this reason, and in 2007 – 287. In 2006, the total number of national patents and utility models in force was 2137 and in 2007 – 2228 (as of December 31 of the corresponding year). Comparing the number of terminated protection documents in the corresponding year with the number of all valid documents for the year shows that there is a loss of economic interest of about 15% (2006) and 11% for 2007 respectively in the protected technological products.

In addition, Bulgarian persons do not avail themselves intensively enough of the opportunities for international submission of patent applications for inventions. In 2006, Bulgarian applicants filed 12 applications for European patents. Throughout the year Bulgarian applicants were granted 4 European patents. In 2007, the situation remained almost unchanged – Bulgarian applicants filed 12 applications for European patents and protection documents were granted for 6 inventions²⁵.

As far as the interest of foreign persons is concerned, it is higher – 618

TABLE 5. COMPANIES WITH THE HIGHEST NUMBER OF PROTECTION DOCUMENTS GRANTED FOR INVENTIONS AND UTILITY MODELS FOR THE PERIOD 2006 – 2008²⁴

Firm	Number of protection documents
Sopharma Plc	21
Arsenal Plc	19
Balkancar record Plc	3
Biovet Plc	3
Daflorn Ltd	3
Microprocessing devices and transport systems Plc	3

Source: Bulgarian Patent Office, 2008.

TABLE 6. PROTECTION DOCUMENTS FOR INVENTIONS AND UTILITY MODELS ISSUED TO RESEARCH INSTITUTIONS FOR THE PERIOD 2006-2008

Research institution	Number of patents/certificates
Space Research Institute within BAS	3
Welding Institute Plc	1
Institute of Chemical Engineering within BAS	2
Institute of Metal Science within BAS	3
Institute of Oceanology within BAS	1
Institute of Fish Resources – Varna	1
Institute of Solid State Physics within BAS	2
Institute of Soil Science	1
National Centre of Radiobiology and Radiation Protection	1
Agricultural Academy	1

Source: Bulgarian Patent Office, 2008.

people obtained protection through European patents on the territory of Bulgaria in 2006 and 1027 in 2007, which is 66% more protection documents granted for one year. Correspondingly, the number of European patents operating in the territory of Bulgaria in 2006 was 808 and in 2007 – 1795 (as of December 31 of the corresponding year) which is proof of the increase of foreign per-

sons' interest in the Bulgarian market with view to our country's EU membership.

Should we compare data about Bulgarian persons' interest in patenting and economic realization of the technological products created by them for European countries with that for another important market – USA, the trend is not very different. In 2006,

²⁴ Besides those shown in the table there are more companies with two patents: Avko Ltd, Apex 11 EOOD, VMZ Co, Kintex EAD, Laktina Ltd, Leslav Ltd, Mawer, Locking Systems Ltd, Meloplam EOOD, Opticoelectron Group Plc, Orgachim Plc, Saira – Zagore Ltd, SKGT – Electrotransport Plc, Solid – 55 Ltd, Hyundai Heavy Industries Co. Bulgaria Plc.

²⁵ European Patent Office, 2006, 2007.

Bulgarian persons filed 47 patent applications, and in 2007 – 55. The patents granted to Bulgarian persons in 2006 were 4 and in 2007 – 7. For comparison, there were years in which Bulgarian persons filed applications and “received” patents several times more than now. It must be noted, however, that the persons to whom patents were granted were individual inventors and not organizations²⁶. This definitely puts in doubt the way the innovation system operates in Bulgaria, and puts forward the need of stimuli in creating, introducing and using technological products by companies. The data of the European Patent Office and the United States Patent and Trademark Office make it clear that Bulgarian persons need schemes to aid them in patenting on foreign markets.

According to the International Property Rights Index Bulgaria has improved intellectual property protection on its territory.

Transfer of technological products is an important channel for the adequate use of their potential. The survey by the Applied Research and Communications Fund of the innovation activity of Bulgarian enterprises INA-3 confirms the results of previous analyses that Bulgarian companies are not familiar with the opportunities and variety of forms of purchasing and selling intellectual property objects and refrain from participating in them.

Nearly 40% of respondents believe that the lack of reliable intellectual property protection has a negative impact on innovation activity, despite the fact that Bulgarian legislation is

TABLE 7. INDEX OF THE DEGREE OF INTELLECTUAL PROPERTY PROTECTION FOR SOME COUNTRIES OF CENTRAL AND EASTERN EUROPE

Country	2006	2007
Hungary	6.0	6.2
Czech Republic	5.6	5.8
Romania	3.4	5.0
Bulgaria	3.5	4.9

Source: International property rights index 2006, 2007.

TABLE 8. INDEX OF THE DEGREE OF INTELLECTUAL PROPERTY PROTECTION FOR BULGARIA AND THE REGIONS OF CENTRAL AND EASTERN EUROPE AND RUSSIA, AND WESTERN EUROPE

Country/ region	2006	2007
Bulgaria	3.5	4.9
Eastern Europe and Russia	4.4	3.9
Western Europe	7.6	7.5

Source: International Property Rights Index 2006, 2007.

almost completely harmonized with the international standards in the field of intellectual property. Another aspect of the problem is that the effective intellectual property protection requires modern legislation and regulations as well as effective enforcement, including a well functioning judiciary. This part of the system for intellectual property protection in Bulgaria faces some problems and does not sufficiently guarantee the interests of rights holders. The need of improving the functioning of the judiciary is not new, and one of the ways to do this is to create specialized courts or judicial panels on intellectual property.

Bulgarian companies offer for sale the rights of their intellectual prod-

ucts only as an exception. The insignificant number of transactions for buying licenses and trademarks is their only participation in the market of technological knowledge as buyers. Thus the lack of well-developed research units within the business sector does not allow the creation of their own sources of technical innovation. Besides, by abstaining from technological transfer the firms have no access to technologies already created and introduced. This makes the discrepancy between Bulgaria’s technological level and that of the developed economies practically insurmountable.

²⁶ USPTO, 2009.

Research Product

An important precondition for raising the country's innovation activity is the new knowledge created by its scientific organizations and scientists. An analysis of the dynamics and structure of this process reveals Bulgaria's potential to enter successfully the world's research networks, the country's relative advantages in different spheres of knowledge and its ability to compete successfully on the market of intellectual products. Regional and European comparisons are particularly important with a view to Bulgaria's participation in the European Research Area along with the other EU member states.

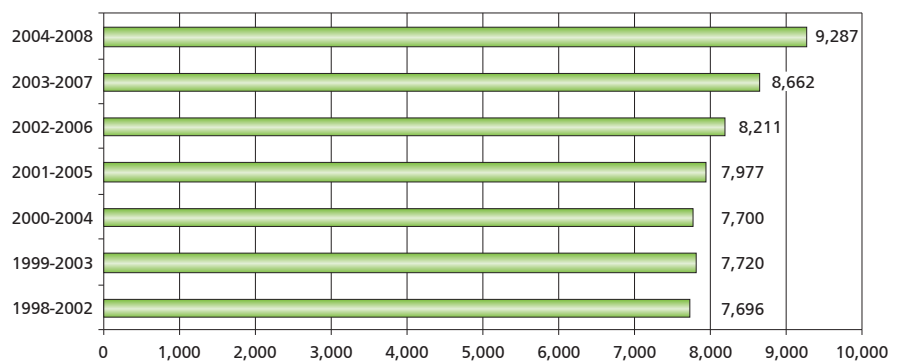
Publication Activity

The tendency for increasing publication activity in the country, displayed after 2001, continued in the past year. Over the period 1998 – August 31, 2008 the scientific magazines referenced by Thomson Reuters published 18,015 scientific publications involving Bulgarian scientists (ranking 47th out of 147 countries)²⁷. The number of scientific publications in the referenced magazines is increasing.

This equals to 2,346 scientific publications per one million inhabitants, estimated per one million inhabitants over a period of ten years, as is the practice of Science and Engineering Indicators. Over the last five years (2004-2008) the number of research publications involving Bulgarian authors has increased by 21% compared to their number for the previous five years (2000-2004).

Over these two periods the scientific areas with the highest growth rate are the so called multidisciplinary articles with Bulgarian authors – from 3 to 140, the biggest growth rate being in 2006 and 2007. This is due to the fact that the *Proceedings of BAS* journal, a multidisciplinary one, is referred to again in ISI Web of Science. The publication activity has not only quantitative dimensions. In November's issue "Rising Stars" of Science Watch, supported by Thomson Reuters which presents researchers, institutions, countries and journals that register the highest growth in

FIGURE 26. NUMBER OF ARTICLES INVOLVING BULGARIAN AUTHORS IN MAGAZINES REFERENCED BY SCI



Source: Essential Science Indicators, 2008.

the citation rate for the last included two-month period, Bulgaria was pointed out among these countries in the area of immunology.

As regards structure, the highest number of scientific articles with Bulgarian participation is in areas such as chemistry, physics, science of materials, biology and bio-chemistry and engineering sciences. The results from these areas are essential for the emergence of innovative products and processes. Leading here are the fundamental natural sciences in which Bulgarian scientists have many years of traditions, many world achievements and scientific schools.

The publication activity on a world-wide scale, though, has quite a different structure by scientific areas.

Such differences and scientific specialization are characteristic not only for Bulgaria but also for the other Eastern and Central European countries which have their historical justification in the previous decades of development of their scientific research.

Clinical medicine is leading by publication activity on a world-wide scale while in Bulgaria it is only in the sixth place. At the same time, the science of materials, being in the seventh place on a world-wide scale, is in the third place in Bulgaria. The publication activity in the area of mathematics is relatively higher in our country (7th place, 14th on a world-wide scale). It is not clear whether these facts point to some relative advantages or disadvantages but it is obvious that among

²⁷ According to the database "Essential Science Indicators" which is part of the ISI Web of Knowledge bases.

the examined scientific areas there are such in which Bulgarian potential for scientific research and results is considerable.

Impact of the Research Product

The impact of scientific publications can be judged by the number of citations of an article. Unlike volume indicators (number of publications and number of citations), which depend greatly on the scale of the respective national research community and on the representation of their magazines in the database, this relative index gives more accurate notion of the influence of scientific publications in their areas. Over the last ten-year period the average number of citations per article is 5.27 (102nd place in the world ranking list out of 147 countries).

According to this index Bulgaria is in the first half of the ranking in the areas of psychiatry/psychology, agricultural sciences, engineering sciences, physics and mathematics.

This index highlights scientific areas that are different from the ones of the index of number of publications. This could be attributed to the very active citation-behavior, widely mentioned in the literature, of researchers in the sciences about humans, as well as the relatively low number of articles with Bulgarian participation in these areas (except clinical medicine). At the same time, it is important that such publications in the more active areas as physics and chemistry get a high number of citations per article – comparable to the world’s values of the index. The areas of molecular biology and genetics are also in a leading position on a world-wide scale by this index.

The journey of new knowledge, comprised in scientific publications, towards successful application is ambig-

TABLE 9. AVERAGE NUMBER OF CITATIONS OF AN ARTICLE, 1998-2008

Country	Average number of citations
Hungary	8.17
Estonia	7.98
Greece	6.80
Czech Republic	6.46
Latvia	6.00
Slovenia	5.83
Poland	5.82
Slovakia	5.28
BULGARIA	5.27
Croatia	4.74
Lithuania	4.64
Moldova	4.16
Russia	4.10
Romania	4.08
Belarus	3.62
Ukraine	3.44

Source: Essential Science Indicators, 2008 and calculations of the author.

uous and is difficult to predict. On the one hand, this is due to the fact that the time lag between a scientific discovery and its application as a successful product on the market is a continuous process of gradual transformation of scientific knowledge into technological. Fundamental differences and mutual influences between these two kinds of knowledge predetermine the participation in this transformational process of heterogeneous players in the innovation system.

The relative quality of the research product of Bulgarian scientists can also be judged by the place which Bulgaria occupies among the other countries according to the indicators for influence of publications on the development of scientific knowledge. According to the values of the two indexes adopted in scientometrics for quality of scientific articles – total

number of citations and number of citations of an article, Bulgaria is in the first half among the countries in the following areas (out of 22 monitored by Essential Science Indicators):

It can be seen that three of the research areas in which the country has years of scientific traditions and which have a relation to the current technological innovations – engineering sciences, physics and chemistry – are in the first half of the ranking by both indicators. The publications of the Bulgarian researchers also have a considerable influence on the area of agricultural sciences, which is indicative of their scientific potential as a source of innovations in agriculture.

73 scientific publications involving Bulgarian researchers are in the list with the most frequently cited articles²⁹ over the last ten years. They



²⁸ Dosi, G., Llerena, P., & Labini, M. S., *The relationships between science, technologies and their industrial exploitation: An illustration through the myths and realities of the so-called 'European Paradox'*. Research Policy, 35(10), 2006.

²⁹ The citation threshold allowing a certain article to enter this list varies by research area.

are spread in 15 out of 22 observed scientific areas, the greatest number of such articles having the areas of physics (23), clinical medicine (16), engineering sciences (8), chemistry (8) and botany and zoology (6). Physics, chemistry and engineering sciences are again in the foreground, including clinical medicine, which is a leader by total number of citations on a world-wide scale. It must be noted, that the predominant number of frequently cited articles is a result of international cooperation. Still, 13 of them are mainly the work of Bulgarian scientists, 4 of them in the engineering sciences and 3 in chemistry.

Joint Authorship in Creating a Research Product

International cooperation in the creation of a research product, measured by means of the number of joint authorship publications, is an important indicator of the participation of the country in research networks and joint projects. On the one hand, it reveals the geography of research activity and makes it possible to determine prospective partnerships in the creation of research products. On the other hand, it provides an opportunity for evaluating the effect of the policies for encouraging international cooperation and integration in the area of research.

The data from the different international databases on which this analysis is based confirm that over the period 1996-2007 Bulgaria considerably increased its international cooperation in the creation of its research product. Thus, according to Scopus, their relative share increased from 32.4% in 1996 to 53.9% in 2007. This is a result of a considerable international cooperation of Bulgarian scientists in research projects, especially their integration in the European Research Area. Over the last four

TABLE 10. AREAS OF PUBLICATION ACTIVITY OF BULGARIAN AUTHORS

Areas in which Bulgarian publications are in the first half among the countries according to the total number of citations	
1	Biology and Bio-Chemistry
2	Physics
3	Chemistry
4	Earth Sciences
5	Engineering Sciences
6	Botany and Zoology
7	Pharmacology and Toxicology
8	Mathematics
9	Sciences of Materials
Areas in which Bulgarian publications are in the first half among the countries according to the number of citations per article	
1	Psychiatry/Psychology
2	Agricultural Sciences
3	Engineering Sciences
4	Physics
5	Mathematics
6	Chemistry

Note: The areas are listed in the order of their ranking.

Source: Essential Science Indicators, 2008 and own calculations.

years this share exceeded half of all publications in Bulgaria.

In 2007, in the Web of Science base, Bulgaria was presented with 2,728 documents (1,599 of which were research articles and 765 materials from congresses, conferences and other scientific forums), and scientists from Bulgaria carried out joint authorship publications with 77 countries.

Comparison with previous years according to the same database shows that in 2007 there were no substantial changes in the structure of joint authorship publications in the country. As in 2006, the developed West European countries and the US retained their leading position. The United Kingdom moved forward and occupied 3rd place, moving ahead of France and Italy. Russia dropped from 6th to 9th place. This is also confirmed by the data in the Science Citation Index.

Bulgaria's membership in the EU has a positive effect on the cooperation with the new EU member-states, as they have about 14% of the joint authorship publications of the country. In 2007, there was an increase in the relative share of joint publications of Bulgaria and Romania, Poland (which moved forward compared to previous years), the Czech Republic, Slovenia, Slovakia and Hungary. As regards joint authorship publications with Bulgaria, Poland retained the highest relative share (4.84%), while Slovenia occupied the last place (0.24%) of the new member states in 2007. The co-authorship with Romania increased, which ranked 16th in the joint authorship publications of Bulgaria (in 2006 it occupied 25th place). The cooperation with Latvia, Lithuania and Estonia is not active. Taken together, they have only 0.84 % of the total number of joint authorship publications in Bulgaria.

The data for the cooperation with other countries in Southeast Europe, especially Turkey and Greece, show that Greece is the second active partner of Bulgaria with 2.68 % of joint authorship publications. Turkey is in the 23rd place with 1% of joint authorship publications.

With a view to the stability of the cooperation in the creation of research products, it is important to find out to what extent Bulgaria is a significant partner for the respective countries and what place it takes in the joint authorship publications of these countries.

The data of Web of Science for 2007 shows that among the 12 new EU member states Bulgaria is a significant partner in joint authorship cooperation only for two of them – Romania and Slovakia. For Slovakia the relative share increased from 1.02% in 2005 to 1.30 % in 2006. However, as regards Romania, although the relative share increased, the number of joint publications decreased from 36 in 2006 to 24 in 2007. Bulgaria ranks 35th to 53rd in the cooperation of the EU leading countries, US and Japan.

Some research areas which have a considerable potential in developing the innovation activity of Bulgaria are especially interesting as regards cooperation. The data in the Scopus base show that in the priority areas of research activity, the publications which result from the international cooperation of Bulgaria in the period after 2000 are constantly increasing their relative share. In 2007, it was highest in the areas of 'Energy' and 'Engineering Sciences'. This confirms the ever increasing international integration of scientific research in the country over the last years and a presence of potential in these areas which is why our scientists are sought as partners. In some areas, such as 'Energy', an important factor for cooperation is the increasing expenses for research which can hardly be af-

TABLE 11. JOINT AUTHORSHIP PUBLICATIONS IN BULGARIA IN 2007*(N=2,728)

Country	Number of joint publications	% of the total number
Germany	382	14.00
US	211	7.73
France	196	7.18
United Kingdom**	195	7.15
Italy	176	6.45
Poland	132	4.84
Spain	115	4.22
Belgium	113	4.14
Russia	98	3.59
Switzerland	87	3.19
Greece	73	2.68
Czech Republic	68	2.49
Japan	63	2.31
Slovakia	61	2.24
Sweden	55	2.02
Romania	53	1.94
Netherlands	52	1.91
Hungary	51	1.87
Canada	42	1.54
Austria	38	1.39
Finland	36	1.32
Turkey	27	1.00

* the marginal value is 1% of the total number of documents. All documents are included. The scientific articles and materials from conferences comprise 86.66% of the total number of documents; 9.38 % are summaries of reports.

** England, Scotland, Wales and Northern Ireland are presented separately in the database.

Source: Web of Science, 2007.

forded by individual countries. The role of the country's research policy is also important. Bulgaria's membership in the European Organization for Nuclear Research since 1999 provides new opportunities for participation in international projects and mobility of Bulgarian nuclear physicists.

Institutional Aspects of the Creation of a Research Product

The data of Web of Science for 2007 show that the irregular participation of Bulgaria's research organizations

in creating a research product, stated in the previous *Innovation.bg* report, remained unchanged. The Bulgarian Academy of Sciences and Sofia University create the bulk of Bulgaria's scientific publications (52.5% and 15.03% respectively for 2007).

This situation is also confirmed by the analysis of scientific product usability. Research of the citation rate reveal that the ten most cited scientific articles from Bulgaria over the period 2005-2008, defined within 9,038 articles in Web of Science (Science Citation Index, Social Sciences Citation Index, Art&Humanities Ci-

tation Index), are distributed in the following way: BAS – 50%, Sofia University – 20%, and Medical University – Sofia, Plovdiv University and Tsaritsa Yoanna Hospital – 10% each. This picture calls for a critical examination of the accreditation practice of the country's universities, as well as the capacity of a number of universities to train specialists in conformity with current achievements of science³⁰.

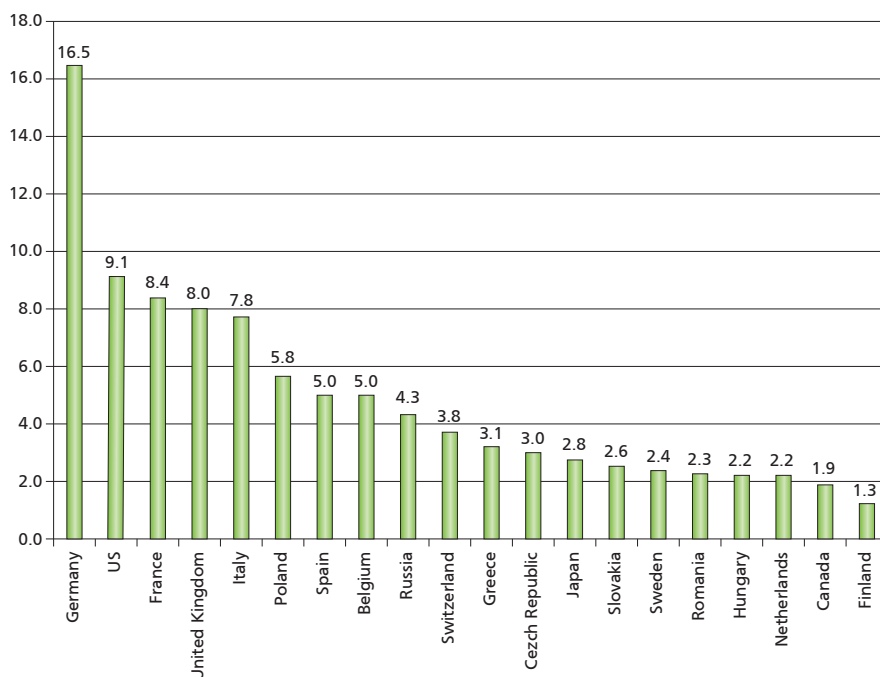
Channels for Research Product Distribution

The various channels for scientific product distribution contribute differently to its international visibility; because of this, the choice of a channel is of strategic importance both for scientists and scientific organizations.

On the whole, over the past years a positive development has been observed in the structure of the communication channels for distribution of Bulgaria's research product. The second inclusion of the *Proceedings of BAS* journal ("Compte Rendus de l'Academy Bulgare des Sciences") in the list of the referenced editions of the Web of Science base has a positive effect on the number of publications from Bulgaria in it. In 2007, 6.31% of the Bulgarian publications (172 in total) came from this journal³¹. Journals published in the country worth mentioning are *Biotechnology and Biotechnological Equipment and the Bulgarian Journal of Agricultural Science*, with 3.53 % and 1.66% respectively, of the total number of Bulgaria's publications.

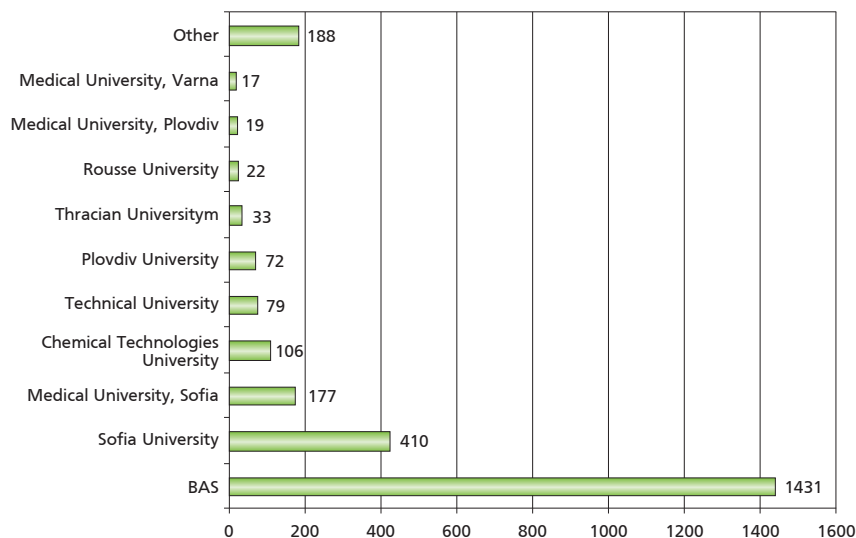
Over the last years the dynamics in the main international information bases has been of great importance for the country's publication policy. In 2006 a considerable expansion of the Web of Science was carried out as regards the referenced journals and 700 of the so called regional journals which meet Thomson Reuters's³²

FIGURE 27. RELATIVE SHARE OF JOINT AUTHORSHIP PUBLICATIONS OF BULGARIA, 2007



Source: Science Citation Index, 2007.

FIGURE 28. NUMBER OF PUBLICATIONS BY SCIENTIFIC ORGANIZATION, 2007



Source: Web of Science, 2007.



³⁰ The observed irregularity is characteristic not only of Bulgaria. In relation to this, some authors pose the question of EU-regulated typologizing and differentiating of research universities and universities for exclusively educational purposes (Dosi, G., Llerena, P., & Labini, M. S. (2006), *The relationships between science, technologies and their industrial exploitation: An illustration through the myths and realities of the so-called 'European Paradox'*, Research Policy, 35(10), 1450-1464).

³¹ The journal was excluded from the list of referenced magazines of Web of Science base in the mid-90s because it was published irregularly.

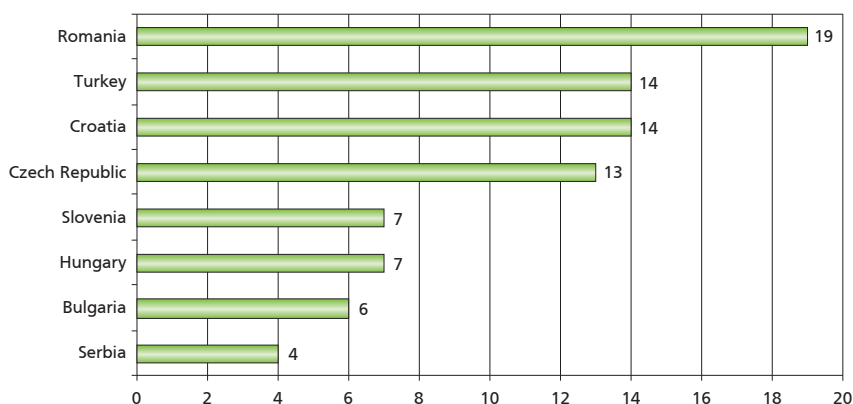
³² This development can be related to a greater extent to the emergence and competition of Scopus, which references 16,000 magazines against about 9,000 by ISI Web of Knowledge.

selection criteria. A basic argument in favor of this expansion is the increased importance of the regional problems and the role of science in solving them. The new journals completely integrated with the existing database. 386 new magazines from Europe were included. Bulgaria has 6 new magazines, considerably fewer compared to other countries, such as Croatia, Romania, and Slovenia, which is comparable to it in a number of indicators of their potential. This expansion provided better visibility for magazines in the area of social and humanitarian sciences. Unfortunately, Bulgarian magazines in these areas are not included, unlike Croatia (6), the Czech Republic (4), Hungary (4) and Romania (1).

The country's research product presented at scientific forums (conferences, congresses, seminars) should be evaluated with a view to the advantages of this communication channel: its efficiency, opportunity for direct communication, inclusion in networks and expansion of cooperation. Although in this case the annual dynamics of publications by areas is generally dependent on the regularity of respective forums, the participation of Bulgarian scientists in them indirectly reveals their activity and capacity for research.

The greatest number of publications is received by the participation of

FIGURE 29. REGIONAL JOURNALS INCLUDED IN THE WEB OF SCIENCE DATABASE IN 2006 (NUMBER)



Source: http://isiwebofknowledge.com/currentuser_wokhome/wos_jnlexpansion/eu

our scientists in conferences, schools and seminars in the areas of: condensed matter physics, plasma physics, laser physics, numerical methods and applications, current methods of calculation, and nanotechnologies³³. In 2008, Bulgarian participation was registered in 383 conferences, as the publications from the participation of Bulgarian scientists in scientific conferences in the area of medical sciences (cardiovascular diseases, allergology, and neurology), solar-earth influences, oceanology research, telecommunications and space technologies had a high relative share.

The data about the research product over the last years show that Bulgar-

ia keeps its position in world science thanks to its active international scientific cooperation, expressed not only in the total number of published papers but also in joint authorship publications. This is also due to the considerable enlargement of the main databases on research publication activity on a world-wide scale. Publishing in renowned international journals retains its paramount role as a communication channel. Significant opportunities also exist for national publications which face the task of raising their quality in conformity with international criteria.

³³ Web of Science, 2007.



2. Entrepreneurship and Innovation Networks

Entrepreneurship and innovation networks are the main linking elements in the national innovation system. Entrepreneurship is embodied by start-ups and initiatives undertaken to expand business and implement innovation projects. Innovation networks are the channels and forms of interaction and exchange of information among the stakeholders in the innovation system. Entrepreneurship and innovation networks determine the viability, adaptability and flexibility of the national innovation system. The creation of an entrepreneurial spirit and stable innovation networks inside and outside the country should be among the main goals of the national innovation policy.

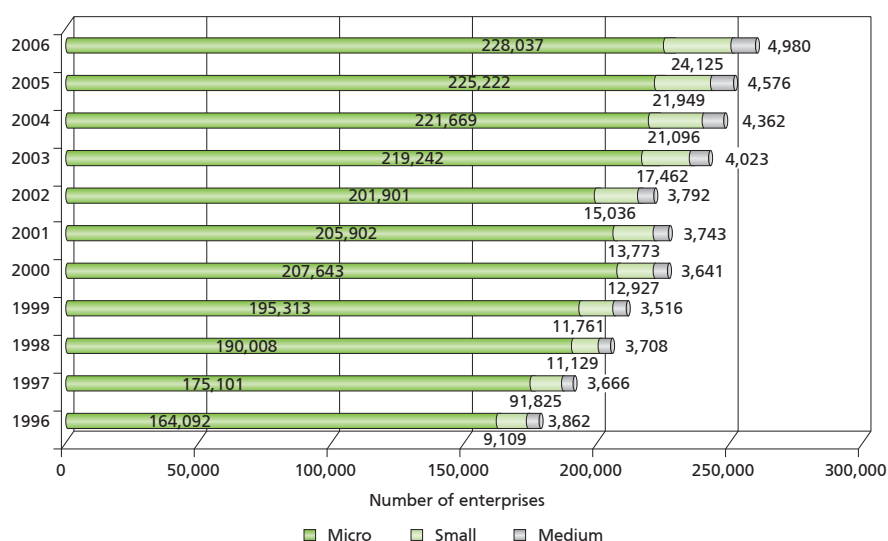
be restricted only to the creation of favorable environment for business. State institutions should actively influence the factors that lead to the formation of positive entrepreneurial attitudes, intentions and behavior³⁶ among the population in Bulgaria, especially among young people.

In the conditions of a world economic crisis, new and small companies are the most vulnerable economic agents. The main risks that these companies face are:

- reduced access to financing by banks, leasing companies and other financial institutions. This will hamper investments in new equipment, new projects and activities;
- lower demand on the internal European market and a drop in prices of some products and services. This can endanger the survival of companies whose export is bound by shrinking markets;
- slump in some sectors of the economy such as real estate transactions, construction, etc. This will have a serious effect on new and small companies in these sectors of the economy as well as on networks of suppliers and subcontractors, including mainly small companies;
- higher risk profile of the Bulgarian economy for outside investors that may lead to reduced foreign investments and outside financing.

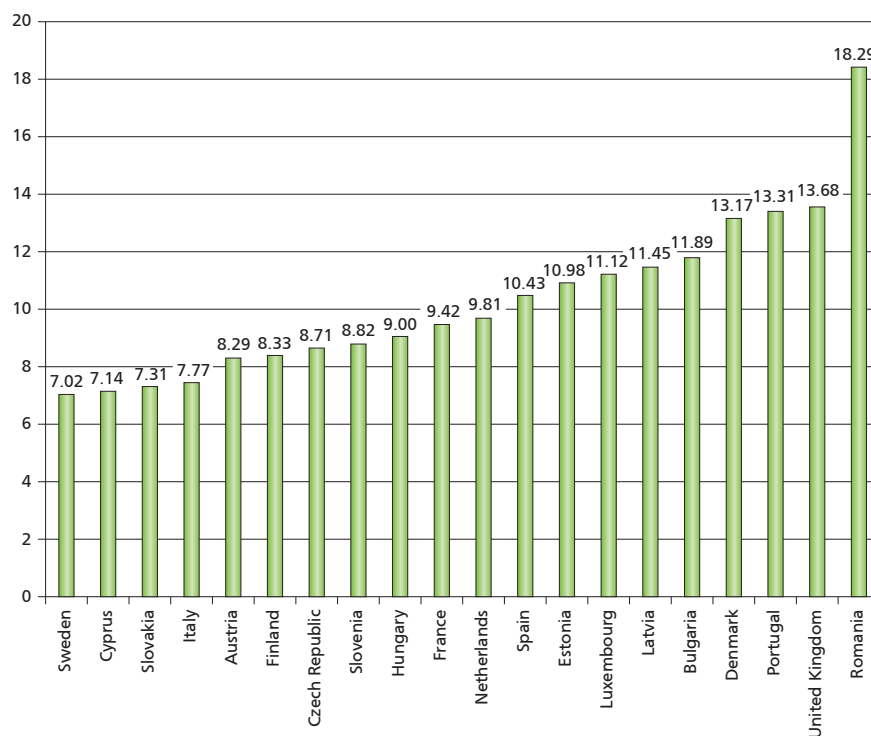
The country has to adopt a much more active attitude towards assisting the survival of new and small Bulgarian companies. The possible measures in this direction include providing easily accessible financial resources for SMEs; directing state expenditures to the most affected sectors of the economy; making the access of new and small companies to public procurement tenders easier; and providing more information and advice regarding the opportunities for participation in European projects and programs.

FIGURE 31. STRUCTURE OF SMALL AND MEDIUM-SIZED ENTERPRISES IN BULGARIA (1996-2006)



Source: NSI, Report on small and medium-sized enterprises in Bulgaria (2003).

FIGURE 32 SHARE OF ENTERPRISES LAUNCHED IN 2005



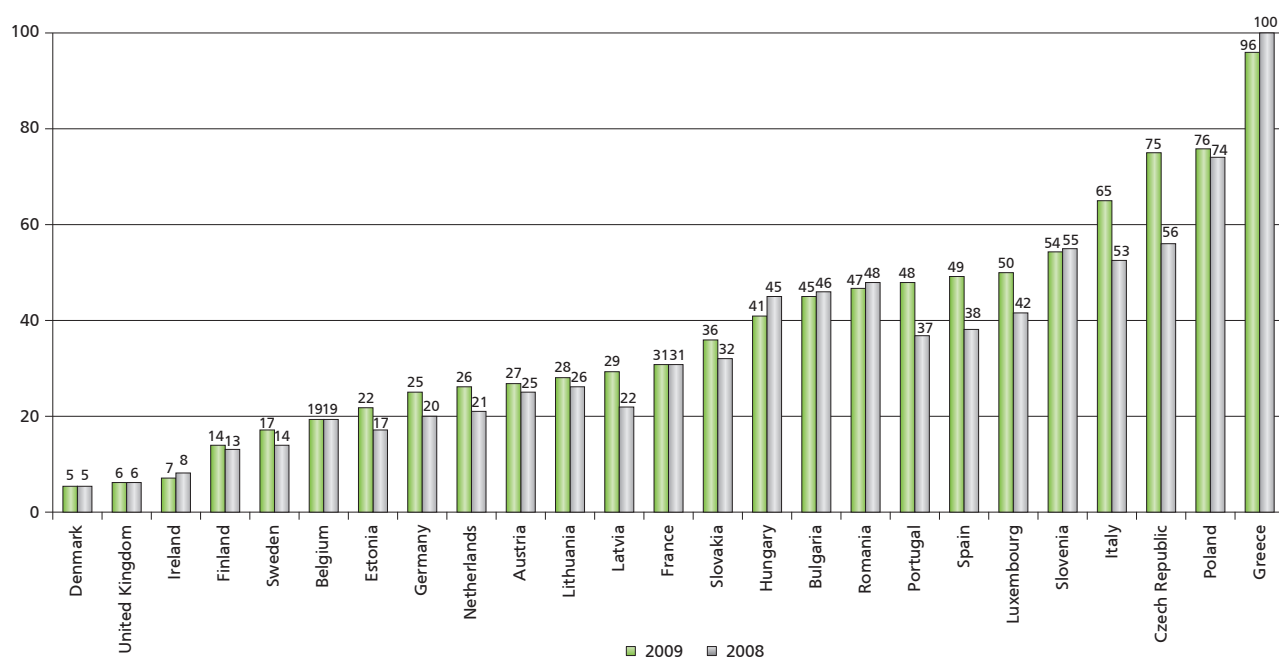
Source: Structural Business Statistics, Eurostat, 2009.



³⁵ *Doing Business in Small Island Developing States 2009*, The World Bank, <http://www.doingbusiness.org>

³⁶ A number of theoretical models and empirical studies show that the presence of positive entrepreneurial attitudes and intentions are the main prerequisite for entrepreneurial behavior.

FIGURE 33. DEGREE OF DIFFICULTY OF DOING BUSINESS IN THE EU MEMBER STATES IN 2008 AND 2009



Note: Cyprus and Malta are not included in the study.

Source: Doing Business 2009, 2008, World Bank.

Innovation Networks and Information Sources

Innovation networks include the channels and forms of interaction and information exchange among participants in the innovation system. The intensity and the instruments for information exchange within the network determine the capacity for implementing innovation projects on behalf of individual participants and the innovation system as a whole.

The participants in the innovation system in Bulgaria are not able to coordinate their efforts in defining priorities and implementing the innovation policy measures. The result is limited innovative activity of the individual units within the system and unused innovation potential of the national economy. The link between universities, the Bulgarian Academy of Sciences and business is unstable and weak, which in turn hampers the introduction of new knowledge, created in the country, and adequate participation in the transfer of already existing knowledge.

Bulgarian companies are comparatively poorly integrated in the global production chains. In 2007, the direct foreign investments in Bulgaria reached their peak – 22.6% of GDP. Despite this trend, the economy of the country remains poorly integrated in the global economy. An explanation could be sought in the fact that this growth is due mainly to the sectors “Real estate transactions”, “Construction” and “Financial intermediation”. According to the Index of Globalization, which is a synthesis of the economic, social and political globalization of the coun-

tries, Bulgaria ranks 44th among the globalized countries and 42nd regarding economic globalization³⁷.

A comparison between the results of surveys of innovation activity of Bulgarian enterprises conducted by ARC Fund in 2005 and 2008 shows that when developing innovative products and processes Bulgarian business relies more on its own efforts than cooperation with other

³⁷ Data for the Index of Globalization is available on the internet site of KOF (the Swiss Institute of Economics): <http://globalization.kof.ethz.ch/>

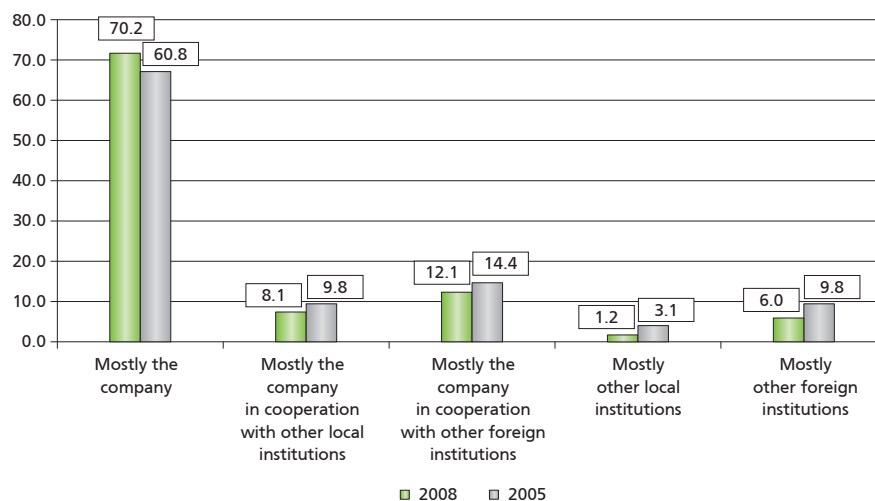
organizations. The share of innovative enterprises developing product innovations on their own increased by about 10% in 2008. As far as process innovations are concerned, the share of enterprises which rely primarily on their own efforts increased by about 6%.

In 2008, the cooperation between Bulgarian enterprises and foreign and local organizations in the process of developing innovation products and processes decreased for both joint developments and the commissioning of innovation activity (2% and 1.7% respectively). Regarding process innovations, there is a decrease by more than 8% in companies that work together with foreign partner organizations and by almost 4% in those that cooperate with local organizations.

The share of economic agents that assign development activity to foreign organizations is decreasing by 3.8% for innovation products and by 2.7% for the innovation processes. The share of companies that commission development for innovation products to other local organizations is decreasing by about 2%. Regarding the development of innovation processes, this decrease is even bigger – 2.8%. Only 19.9% of the organizations interviewed have cooperation agreements for innovation activities with local companies and 17.3% with international ones.

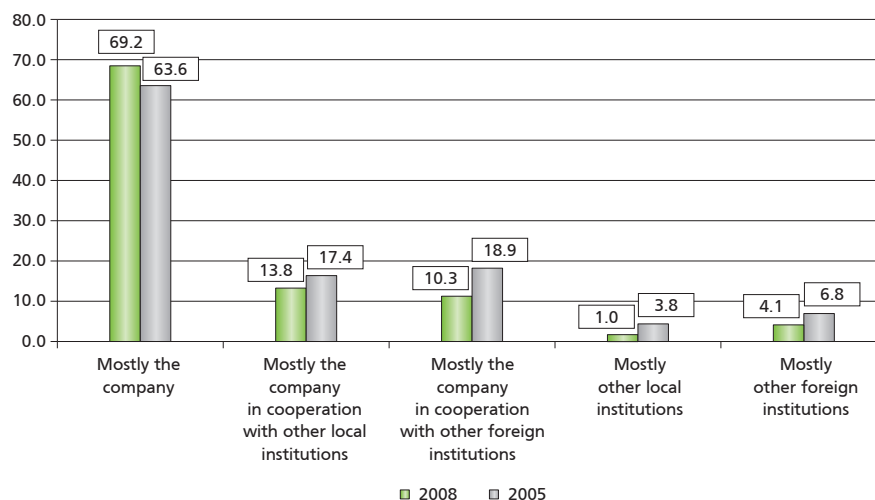
The reasons for the decrease in trust in partner organizations in implementing innovation activities are different for each particular case. Some companies avoid joint work in order to benefit alone from the results obtained. Most of the companies, however, do not appreciate the advantages connected with their participation in innovation networks. Some would like to participate but cannot find suitable partners and thus they are forced to develop innovative products and processes on

FIGURE 34. TYPOLOGY OF PARTNERSHIPS IN THE DEVELOPMENT OF INNOVATION PRODUCTS IN THE BULGARIAN INNOVATIVE ENTERPRISES IN 2005 AND 2008 (%)



Source: INA-1 and INA-3.

FIGURE 35. TYPOLOGY OF PARTNERSHIP IN THE DEVELOPMENT OF INNOVATION PROCESSES IN THE BULGARIAN INNOVATIVE ENTERPRISES IN 2005 AND 2008 (%)



Source: INA-1 and INA-3.

their own. Nearly 12% of the companies interviewed admit that the lack of partners hampers their innovation activity. Insufficient cooperation in the implementation of innovation projects might be full of dangers related to the unilateral acceptance of the risk connected with innovations; the impossibility to create considerably new products and processes; the limited access to specific competences or foreign technologies.

Since 2003, there has been a tendency for the innovation cooperation in Bulgarian enterprises to be rather market oriented than technologically oriented. Dominating are the companies indicating that their clients (35.1%) and suppliers of equipment, materials, components and software (32.4) have decisive significance for their joint innovation activity. A number of the organizations interviewed (23.3%) regard other enter-

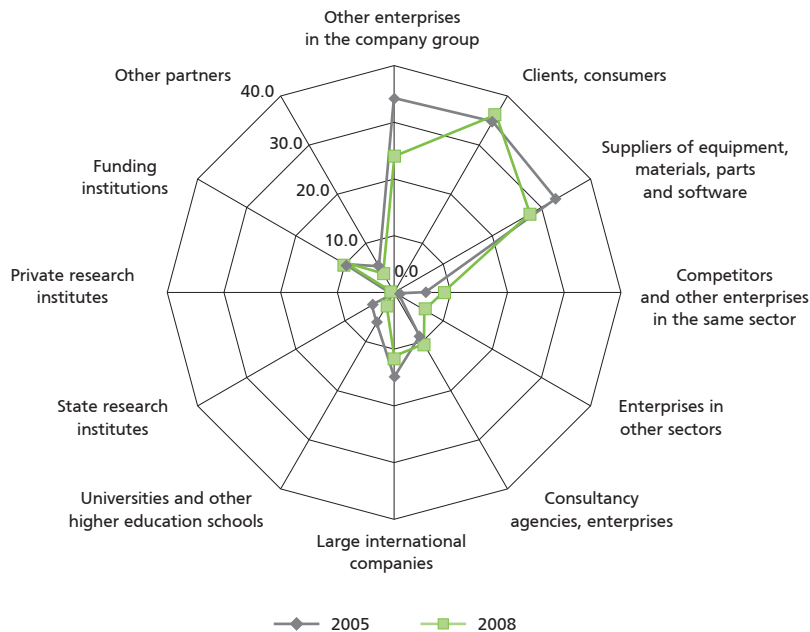
prises within the same company group as a significant partner. The share of Bulgarian enterprises that assess their competitors, private research institutes and consulting organizations as important partners has increased in comparison to the share in 2005.

At the same time, the number of companies that appreciate the importance of universities, state research institutes and big international companies for the implementation of joint innovation projects is considerably decreasing. It is necessary to improve the cooperation between the research sector and SMEs, which as a whole implement or assign research and development work more rarely than large companies. This could be achieved through the creation of special market-oriented groups in universities and state research institutes, which would communicate with the enterprises and analyze their specific needs and demands. Such structures would facilitate the mutual access and communication between enterprises and scientific organizations and would assist the universities and research institutes to realize their scientific product on the market more successfully.

As a number of surveys reveal, Bulgaria has traditions of conducting high quality research, developing a good scientific product at prices lower than the average prices in EU and there are some examples of partnership between business and publicly financed research organizations in some industries and regions³⁸. The participation of educational institutions (universities and the Bulgarian Academy of Sciences mainly) in the innovation activity has been improving (stimulated by the National Science Fund and the National Innovation Fund), but is still at a level far lower than their potential.

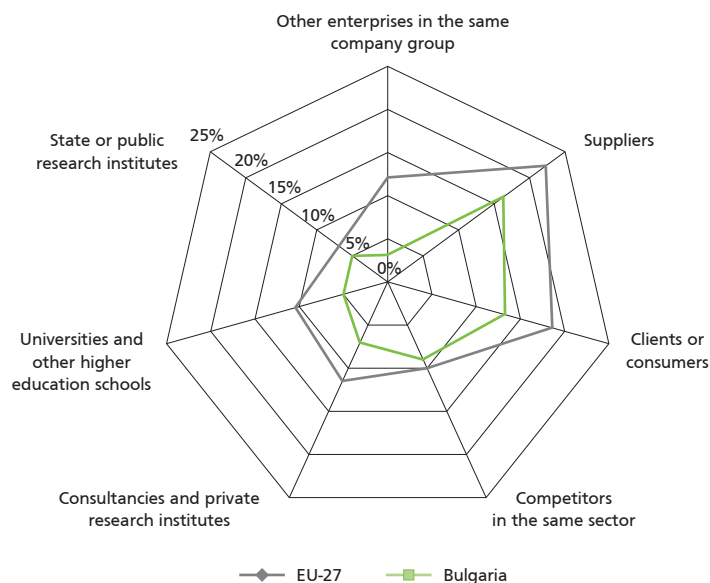
Bulgarian entrepreneurs still tend to use mainly market sources of information to implement their innovation projects. More than 40% of

FIGURE 36. SHARE OF THE INNOVATIVE ENTERPRISES IN BULGARIA WHICH INDICATED THAT THE CHOICE OF PARTNERS FOR THE IMPLEMENTATION OF JOINT INNOVATION PROJECTS IS IMPORTANT (%)



Source: INA-1 and INA-3.

FIGURE 37. COOPERATION BETWEEN INNOVATIVE COMPANIES AND OTHER ORGANIZATIONS IN CREATING INNOVATIVE PRODUCTS/PROCESSES FOR THE PERIOD 2004-2006 (%)



Note: The values are calculated for 24 member states only, because the CIS 2006 database does not have available data for three of the member states – Italy, France, and Germany.

Source: Eurostat 2008, CIS 2006.

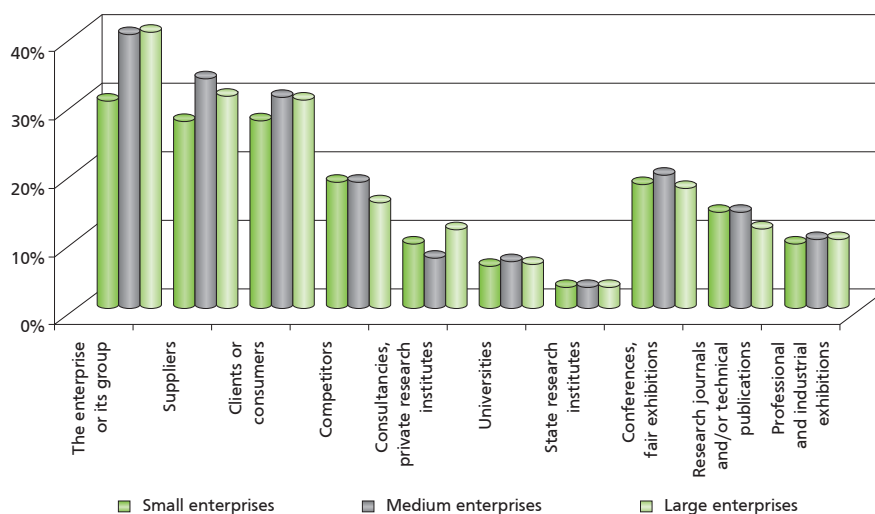


³⁸ For more information see *Annual report on the state and development of the national policy in the sphere of innovations, 2007*, Ministry of Economy and Energy.

the enterprises studied point out that their customers and consumers are an important source of information for their innovation activity and nearly a fourth of the companies define their suppliers or competitors as such a source. The importance of the other enterprises within the same group or the parent company has significantly decreased in comparison to 2005. There has been a tendency of a decrease in the share of Bulgarian enterprises that point out universities, colleges, research institutes and private research/technological centers as significant sources of information for their investment projects. Almost 70% of the Bulgarian enterprises haven't used these organizations as a source of information for the implementation of innovation projects, and companies that assess them as significant represent less than 3% of all enterprises.

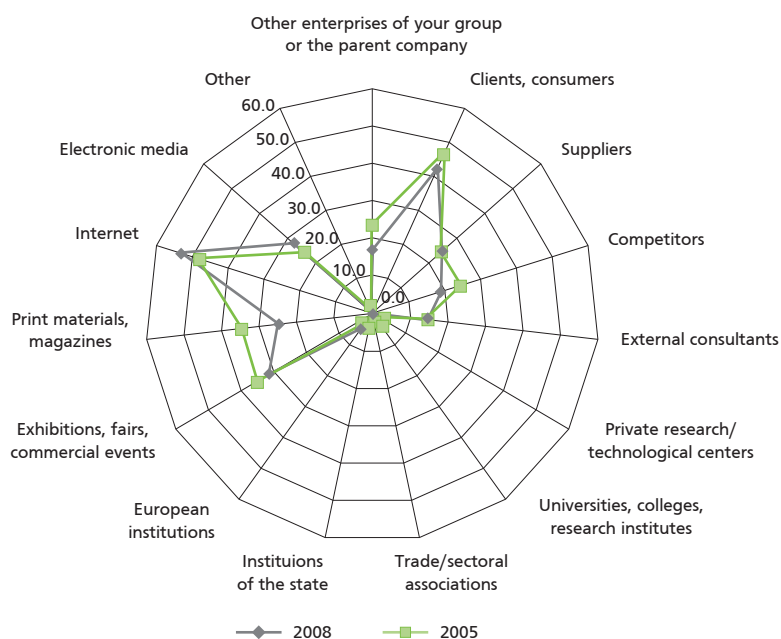
These facts show that the link between research organizations and business in Bulgaria is very weak. The lack of market orientation among research organizations reflects unfavorably on the nature and quality of the innovation activity in Bulgarian enterprises (mainly routine innovations, oriented towards the local market). The importance of some information channels has partially changed in comparison to 2005: in a comparative aspect the share of internet and electronic media is increasing; the importance of printed materials and journals, exhibitions, fairs, and trade events is decreasing. The internet is still the main media information channel. The access to the global network is of great significance for over 53% of the Bulgarian enterprises. The relative importance of the European institutions is increasing. At the same time the importance of the state institutions as a source of information is slightly decreasing. However, about 60 % of the organizations interviewed stated that they haven't used these sources of information.

FIGURE 38. MAIN SOURCES OF INFORMATION FOR BULGARIAN INNOVATIVE ENTERPRISES



Source: INA-3.

FIGURE 39. SHARE OF INNOVATIVE ENTERPRISES IN BULGARIA WHICH SPECIFY THE LISTED SOURCES AND CHANNELS OF INFORMATION AS VERY IMPORTANT FOR THE IMPLEMENTATION OF THEIR INNOVATION PROJECTS (%)



Source: INA-1 and INA-3.

The experience of the OECD countries shows that the government policy could play a key role for improvement of the country's innovative performance by creating favorable framework conditions and adopting policies for overcoming the specific market or

system shortcomings. In this context Bulgaria should try to use adequately the opportunities given to the country through increased EU funds for research and innovations for the period until 2013.

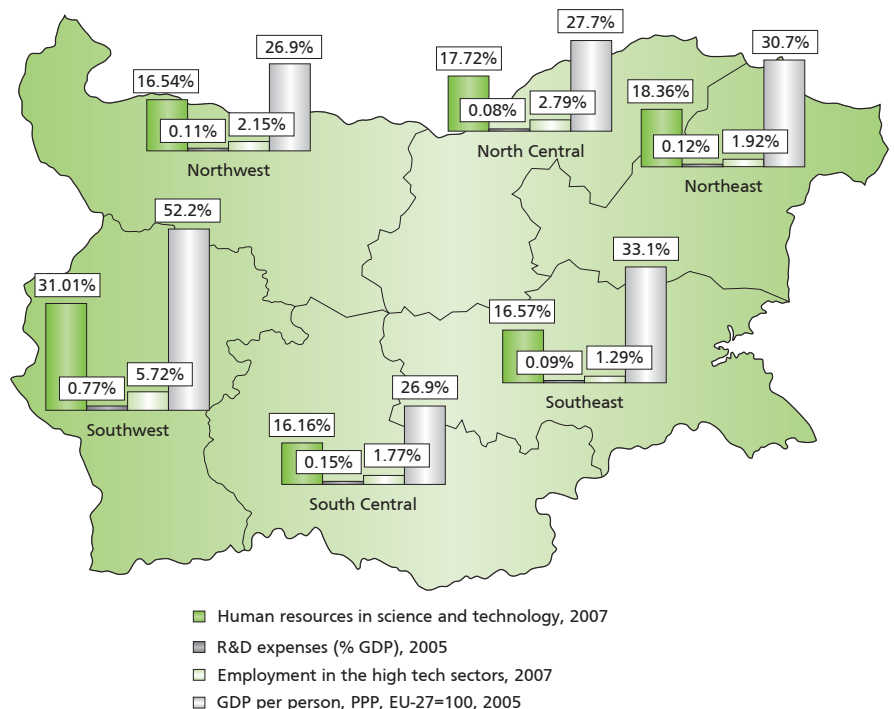
Geography of Research and Innovation Activity in Bulgaria

Bulgaria has a small economy and can strive for competitiveness only in certain priority fields of science and technology. High levels of regional divergence are observed in the country – a well-developed region around the capital city Sofia (Southwest Planning Region), and lower growth rates in the other planning regions. Regional differences are still considerable despite progress in institutional modernization, investment in regional development and economic growth. To a great extent this result is due to the geographic concentration of foreign direct investments.

The analysis of economic, social and research aspects shows considerable differences between the regions. The Southwest Planning Region (especially the capital city) plays a disproportionately important political and economic role that is expressed in a high share of GDP per capita, employment in high-tech sectors and expenditures for R&D. GDP per capita and the budget expenditures for R&D are 1.5 times higher than the average for the country. The Southwest region is distinguished for high concentration of universities and colleges.

In that sense, Bulgaria can be viewed as a scale model of the EU regarding the asymmetrical distribution of welfare. The unbalanced development between advanced and underdeveloped regions limits the EU competitiveness. The same problem and the same consequences are reported in Bulgaria as well. This fact, to a great extent, explains not only the low percentage of innovative companies, but also the weak link between individual innovation partners. Without polycentricism (at least one well-developed city per region that can be regarded as a power of attraction for investors) it would

FIGURE 40. CONCENTRATION OF INNOVATION CAPACITY (GDP, R&D, EMPLOYMENT IN HIGH-TECH SECTORS) BY PLANNING REGION



Source: NSI, 2008.

be difficult to achieve steady prosperity. What is meant in this case is not simply redirecting funds to poorer regions, which is an approach for resource redistribution, but a focused state policy based on the recently developed **Regional Innovation Strategies** by regions of planning and state investments in innovation infrastructure – universities, innovative SMEs and dynamic start-ups.

Regions need focused guidance of interaction between industries, research institutes and universities located on their territory. The pure administrative approach should be applied in combination with traditionally developed unique regional advantages as is the case of border regions of Bulgaria, Greece and Romania. The current difficulties (lack

of unification of educational systems, non-recognition of diplomas, administrative problems, and difficult communication) are not insurmountable and all border regions should combine their efforts to achieve the EU goals for a Europe without borders and developing of knowledge-based economies.

The Baden – Württemberg initiative suggests opportunities for cooperation for the creation of a Danube alliance, similar to the Mediterranean alliance and the North dimension (for the countries in the Baltic Sea region). This initiative aims to improve transnational and interregional partnership among the ten countries located along the river, improving the infrastructure and preserving the natural diversity. The Danube River

strategy has important political and economic consequences because it opens up broad vistas for European grants in aid of the region. In this context there are serious opportunities for Bulgaria to receive funds for the riverside region and cooperation of the business and universities with partner countries located along the Danube.

European programs and initiatives which presently encourage trans-border and transnational partnerships in the sphere of science and innovation include Interreg, the program for the Southeast of Europe, Espon and the RegioStars awards initiative. Participation of Bulgarian partners in these programs should increase in order to make the most of the knowledge exchange at European level.

Achieving the aims of the Lisbon Strategy imposes hard research work and effective trans-border coopera-

Box 7. TRANSNATIONAL AND TRANS-BORDER COOPERATION IN RESEARCH AND EDUCATION

Michael Stammering, Managing Director of the Oresund Committee (Denmark/Sweden) at an annual meeting of the European trans-border regions held in Plauen, Germany emphasizes that the Oresund region is famous for its human capital. Twelve establishments of higher education work together in the so called Oresund University without any preliminary government decisions. 'Do not ask, just be active', says Mr. Stammering. The university represents volunteered cooperation of scientific and educational institutions from the two countries. The aim is to create a powerful information centre to increase the quality of education offered and perform joint research and other university activities. Students and lecturers have access to the common library funds; there are conditions for mobility between different educational institutions and joint European projects. Regarding the concentration of knowledge, measured by the number of publications, Oresund region ranks seventh in Europe.

Source: Association of European Trans-Border Regions.

tion within the range of the joint influence of regional and research policies. In this respect the potential of clusters³⁹ remains unused. Bulgarian authorities should do more to target research and assess the po-

tential of particular regions (with giving special focus on trans-border regions) with a view to identify the common resources (scientific and material) and create long-term partnerships.

³⁹ Steven Hermans, DG Research, European Commission, Annual meeting of the European trans-border regions Association, Plauen, Germany, 2008.



3. Investment and Financing for Innovation

Investments in innovation are the funds spent on creating (or adapting) the innovation, technological and/or research product in the country. They are mainly used to cover the expenses for research and development activity (R&D). Investment in innovation depends on the functioning of the whole innovation system, yet they are most closely related to the presence of various funding mechanisms and tools, including venture capital. The government's direct financial commitments to R&D make this field an important pillar in the national innovation policy.

Public Financing for Research and Innovation

R&D and innovation funding in Bulgaria is implemented by direct budget subsidies, indirect budget support, financial schemes within the Cohesion and Structural Funds, financing under EU programs and private funding on the part of banks and businesses.

Direct budget subsidies include institutional financing for the Bulgarian Academy of Sciences and the universities, transfers to those ministries in which structures there are scientific organizations, program-oriented financing for the National Science Fund and project financing for the National Innovation Fund.

The indirect budget support is in the form of membership fees in different international programs such as the Seventh Framework Program (FP7) of the EU for scientific research and technological development, and the Competitiveness and Innovation Framework Program (CIP). For 2007-2013, financial support from the Cohesion and Structural Funds for advancing science and innovations is available under Operational Programs "Human Resources Development" and "Development of the Competitiveness of the Bulgarian Economy".

Public funds for science and innovation continue to be the main source of financing in the country. Businesses have a very small share in supporting research and innovative projects, which places Bulgaria at one of the bottom positions among EU member states according to this indicator.

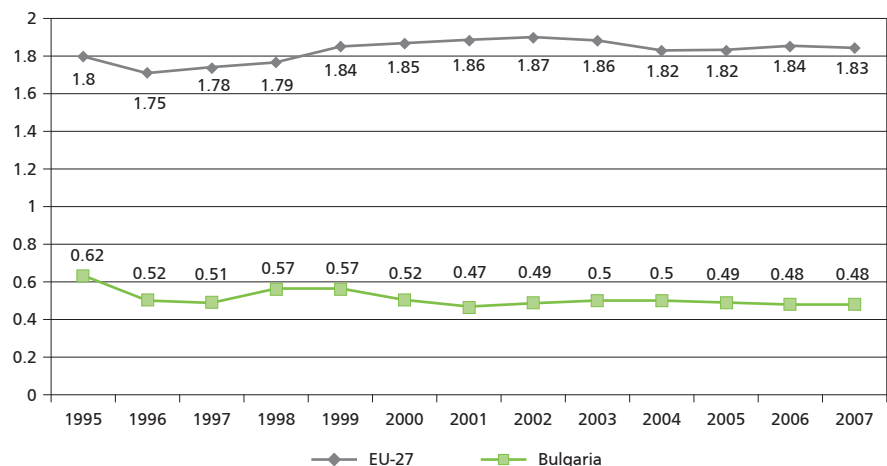
Europe remains far behind the objectives of the Lisbon Strategy related to funding research and development activities. The share of investment in R&D at 1.83% of GDP is significantly below the planned 3%. The member states with the highest intensity of R&D expenditure are the Scandinavian countries with over 3% of GDP, and they keep a leading position in the European rank list (Sweden – 3.63%, Finland – 3.38% in 2008) followed by Denmark (2.54%), Germany (2.53%) and Austria (2.64% in 2008).

Among the new member states, the fastest increase of funds allocated for R&D is registered in Slovenia and the Czech Republic, reaching respectively 1.53% and 1.54% of GDP in 2007, which brings them the closest to the average EU level by this indicator. Cyprus, Bulgaria and Slovakia spend less than 0.5% of GDP on R&D.

In the period 1998 – 2007, R&D expenditure of EU-27 increased by 2.2%. The change for Bulgaria is nearly 16% downward.

Germany, France and the UK form two thirds of the R&D investments in ab-

FIGURE 41. INVESTMENT IN R&D (% OF GDP)



Source: Eurostat 2009.

solute amounts at average growth of the annual basis by approximately 2%. Romania and Estonia mark the biggest increase in the absolute amount of the spent funds (more than 20%), which is reflected in their percentage within their GDP (up to 0.54% for Romania and up to 1.19% for Estonia in 2008). The figures are indicative of the effort the two countries are making to catch up with the average EU levels and meet the Lisbon objectives.

Another major part of the efforts of the EU member states is connected to a change in the structure of R&D spending by institutional sectors. In 2005, 54.5% of the total financing for R&D was provided by businesses, which is below the projected two thirds in the Lisbon Strategy.

At the bottom of the 2006 list are Cyprus (15.9%), Lithuania (24.5%), Romania (30.4%, which goes down

to 26.9% in 2007), Bulgaria (30.6%) and Greece (31.1%) with the lowest degree of participation of the businesses in R&D funding.

For the EU-27, higher education is the second most important sector viewed as a source of investments in R&D after businesses. In a number of countries, among which are Bulgaria, Romania, Hungary, Poland, Slovenia, Slovakia, Russia and China, a leading sector with R&D financing remains the state, mostly due to the interventionist traditions in implementing state policy, including the R&D field.

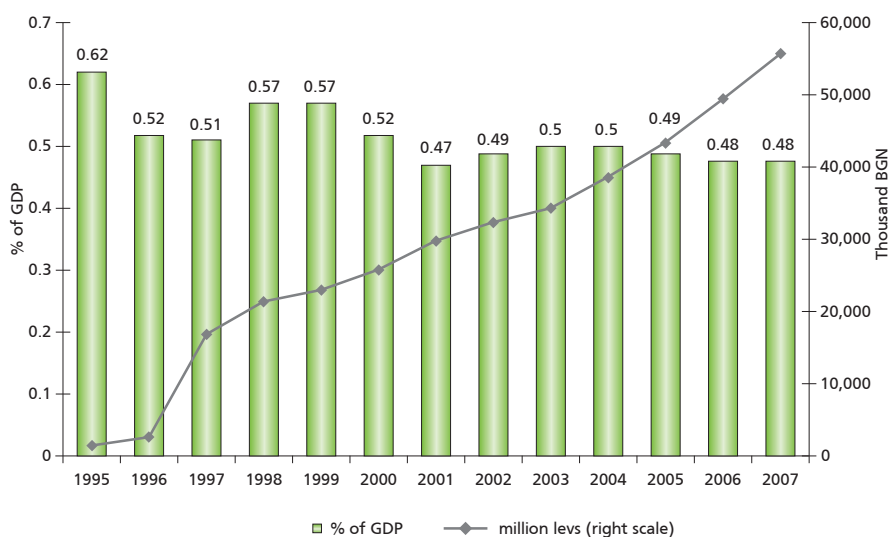
Outside of the EU, businesses remain the most involved in creating new knowledge and applying it further. In Japan, 76% of all R&D activities are financed by business, while in the US the percentage is 64. China registers levels close to those in the developed countries (67%).

In Bulgaria, the structure of expenditures by economic elements in 2006 remained unfavorable despite the small improvement over the past ten-year period. Current expenditures amount to 88.7% of the total expenditures for R&D, while only 11.1% are allocated for the acquisition of tangible fixed assets (a 1% decrease compared to the previous year).

National Science Fund (NSF)

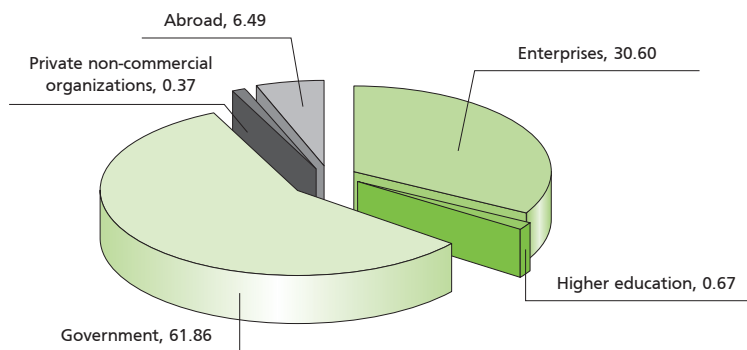
The tendency toward increasing project financing at the expense of institutional financing in Bulgaria is accompanied by a increase in the amount of public funds for science. The NSF budget for 2008 was 60 million leva, which is nearly four times more than the previous year (15.9m for 2007). The aim for the R&D expenses as a share of the GDP is to increase each year by minimum 0.1 percentage point of the GDP, in comparison to the prior year's amount, until they reach 1% of GDP in 2013. The

FIGURE 42. R&D EXPENDITURE IN BULGARIA



Source: National Statistical Institute 2008, Eurostat 2009.

FIGURE 43. STRUCTURE OF R&D EXPENDITURE BY INSTITUTIONAL SECTORS (IN % FOR 2006)



Source: Eurostat 2009.

allocated funds for the NSF for 2009 are 100 million leva. In 2008, the ratio between institutional and program financing reached 35 to 65% (having been at 90 to 10 in 2004).

In Bulgaria, scientific research is conducted predominantly by public scientific organizations: the Bulgarian Academy of Sciences, the Academy of Agriculture and the universities. Their funding, for the most part, is institutional. Project financing as a share of these structures' resources is still insufficient. Despite the diversity

of research organizations and universities across the country, the funds allocated on a competitive basis through the NSF tend to be absorbed by few scientific organizations. These entities successfully combine different sources of financing, both public and private, on different levels – national, regional and European. The number of private structures conducting research is still small and those who use or demand scientific services are only a few.

National Innovation Fund (NIF)

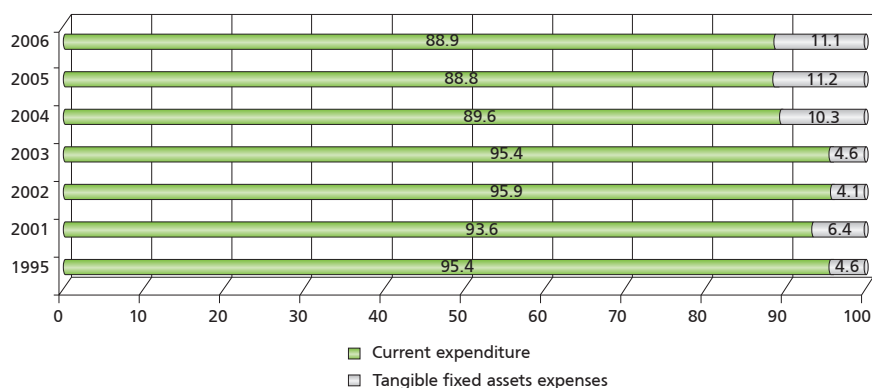
The National Innovation Fund has been created in pursuance of the Innovation Strategy of the Republic of Bulgaria. Potential beneficiaries of its financial support are all manufacturing companies which upgrade their product and technological structures and seek to strengthen and expand their existing market positions as well as enter new markets. 320 contracts were signed in the first four competition sessions in 2005. The negotiated subsidy amounts to more than 48 million levs. The NIF regulations require businesses to co-finance 50% of the total cost of the approved projects. This resulted in the Fund's support of investments of about 100 million levs for innovative activity.

NIF's fifth competition session is subject to the alterations in the competition rules introduced in April 2008, the most important of which are:

- The extra funding for small enterprises added to the basic intensity of 50% support for scientific and applied research projects reaches 20%, rising from 10% in the previous sessions.
- Within the technical-economic research areas two task types were introduced: industrial development and experimental development.
- Support for testing should increase from 50% to 75% for SMEs and to 65% for big enterprises.

The firms' growing interest in the competitions launched under 'Operational Program Development of the Competitiveness of the Bulgarian Economy', as well as the ill-timed notification on the part of the Bulgarian Small and Medium Enterprises Promotion Agency (BSMEPA) about the methods of drawing up the financial reports, resulted in the declining number of submitted projects in 2008 (123 projects participated,

FIGURE 44. STRUCTURE OF R&D EXPENDITURE BY ECONOMIC ELEMENTS



Source: National Institute of Statistics 2008.

Box 8. PROGRAM FIELDS AND INITIATIVES OF THE NATIONAL SCIENCE FUND IN 2008

The National Science Fund works on 16 competition schemes. 1,050 project proposals were submitted during the open procedures in 2008 (20% more compared to 2007), the applicants being the higher education schools, the institutes of the Bulgarian Academy of Sciences, non-profit-making organizations and companies. The forecasted average cost of the projects submitted in 2008 is around 200,000 levs. For the first time in 2008 a competition for centers of excellence was announced which aims to pool the research infrastructure and concentrate scientific potential in several big research institutions. Another development in the Fund's work is the first ever competition for integrated university research units for conducting complex activities, e.g. research, training, technological advancement and innovation activities. In 2008, there was a strong emphasis on human resource development in the research field. Six competitions were launched, all targeted at supporting young and proven scientists' career and qualifications in science. A new 2008 development is the "Ideas" competition which supports fundamental research and allows the stimulation of innovative and original research creating new opportunities for developing a given scientific field.

Source: Ministry of Education and Science.

i.e. 26.8% fewer than in 2007). 30 projects dropped out due to administrative noncompliance while another 32 projects dropped out due to discrepancies between the team capacity and the eligibility of the project idea. 61 projects scored more than 60 points (out of a 100) and were invited to sign contracts for financing by the Fund. Out of these 49 are in priority areas and are allocated as follows:

- Information and Communication Technology (ICT) – 21 projects
- Instrument-building – 4 projects
- Biotechnology, Pharmacy, Chemistry – 12 projects
- New materials and Nanotechnologies – 6 projects
- Eco Technologies and Waste Treatment – 3 projects
- Energy-saving Technologies and Renewable Energy Sources – 3 projects

The approved subsidies for these projects amount to 12.3 million levs which is 58.6% less than the year before. The average subsidy for one project is 201,600 levs, which is 23%

more compared to 2007, and is mainly due to the increased aid intensity supplements.

The National Innovation Fund was pronounced by the European Com-

mission to be one of the forty "good practices" for 2006 as an example of the state administration's support for enterprises. In the European Commission's Small Business Act of June 2008, NIF is pointed out as a

good practice to support SMEs' innovations and is the only Bulgarian project mentioned.⁴⁰

Bulgaria in the European Research Area

The accession of Bulgaria to the Framework Programs of the EC practically broke the existing implementation frame of research programs and opened new opportunities to work on scientific projects. It increased access to modern scientific equipment and transfer of knowledge, experience and intellectual potential. The framework programs ensure the establishing of science as a basis for boosting competitiveness. They are used as a basic instrument for building the European Research Area and are in essence a method of managing scientific research.

Bulgaria has gained experience with its participation in three framework programs: the Fifth, Sixth and the currently, the Seventh.

Fifth Framework Program (FP5)

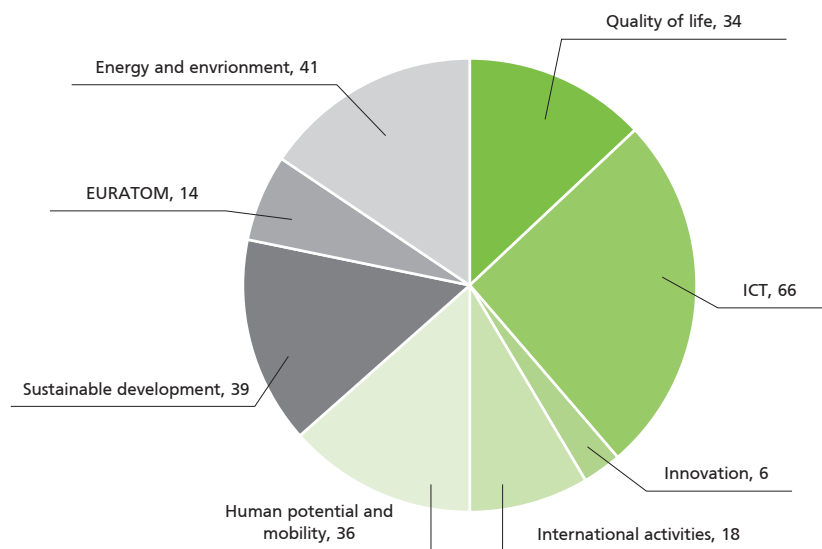
Bulgaria's profile in FP5 is characterized by the following:

- Participation in 254 funded projects with a €22-million contribution on the part of the EC;
- Highest project activity under the Sustainable Development Program, ICT, and Human Resources and Mobility Programs. A comparatively small number of projects have been submitted under horizontal programs like Innovations and International Activity;
- Balanced participation by institutional types. The Bulgarian Academy of Sciences has 90 financed projects, the higher education institutions have 80, and the private sector has 84 projects.

Sixth Framework Program (FP6)

FP6 aims to accomplish the tasks defined in Article 169 of the EC Treaty

FIGURE 45. PROJECTS WITH BULGARIAN PARTICIPATION IN FP5 (NUMBER)



Source: Ministry of Education and Science 2008.

signed in Amsterdam. It presumes the strengthening of the scientific-technological base of the Community economy and promotes modern scientific and technological research targeted at achieving competitive scientific products on the international market.

Being the chief instrument of building a European research area, the program is characterized by the following features:

- Concentrating the scientific efforts into a small number of strategic thematic fields;



⁴⁰ "Think Small First" Small Business Act in Europe, Brussels, June 25, 2008, IP/08/1003.

- Building a critical mass of research potential;
- Simplifying the assessment procedure.

The FP is built on three main blocks with specific measures:

Block One – the Community’s strategically oriented research and its integration through activities in seven priority areas: genomics, information and communication technologies, nanotechnologies and nano-materials, sustainable economic growth, aeronautics and space, food quality, civil society and governance.

Block Two – Structuring the European research space through activities in the fields of innovations, mobility of the potential scientific personnel, unique scientific infrastructure, society and science.

Block Three – Strengthening the foundations of the European research area through coordination and supplementary activities in the area of scientific research under scientific programs (national and transnational) and complementary measures.

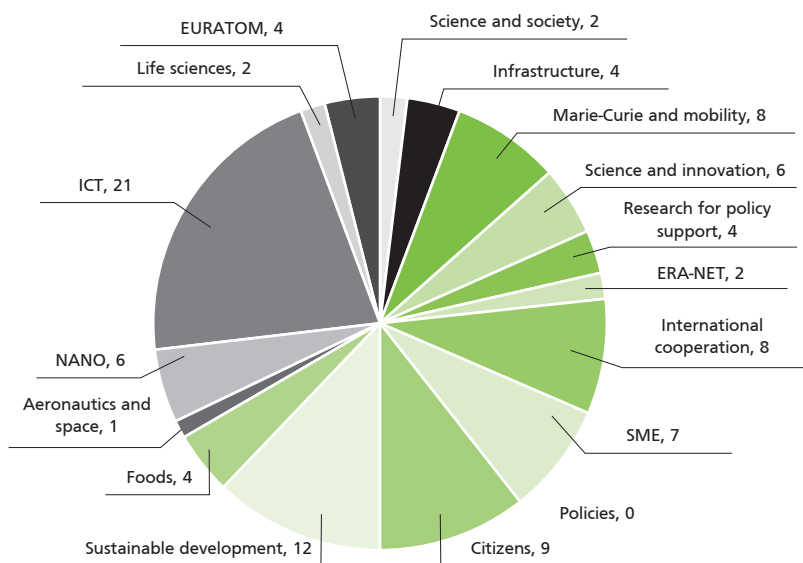
Universities and scientific units, SMEs, big companies, as well as non-profit organizations have access to the program. The activities involve not only research but also the dissemination of knowledge, analysis of the economic and social effectiveness following their implementation, including evaluation of the success factors.

Bulgaria took part in 341 projects with 451 Bulgarian entrants in the Sixth Framework Program. €39,320,355 has been received in the form of research project funding (with membership fees of €17 million for the same period).

The analysis of Bulgaria’s participation in FP6 outlines the following trends:

- After officially joining the program, substantial growth in the

FIGURE 46. BULGARIA’S PARTICIPATION IN FP6 BY PRIORITY AREA (NUMBER OF PROJECTS)



Source: Ministry of Education and Science 2008.

TABLE 12. FINANCING UNDER FP6 BY PLANNING REGIONS

Planning Region	Financing in percentage of the total funding under FP6
North-Central Region	1.65
North-East Region	6.00
North-West Region	0.63
South-East Region	2.67
South-West Region	85.95
South Central Region	3.10

Source: Ministry of Education and Science 2008.

amount of attracted funds was observed through the years (the participation fee is fully reimbursed).

- According to attracted financial resources, the distribution among the different institutions is comparatively balanced according to types of participating institutions: Bulgarian Academy of Sciences – 156 entries (a little over €15,000,000), universities – 123 projects (a little over €13,000,000), industries – 58 projects (approx. €6,000,000), other organizations (including the National Center

for Agrarian Studies, non-governmental sector, state institutions, municipalities) – 114 projects (over €7,000,000).

- Participation in the various thematic priorities is also balanced. The ICT field stands out as especially successful, with considerable quality potential, within which companies register the greatest number of successful projects. University and scientific structures perform well in “Environment and Sustainable Growth” and “Food Quality and Safety” thematic priorities.

With respect to participation and the funding received under FP6, a severe imbalance is observed on a regional level. Nearly 86% of all FP6 projects with Bulgarian coordination or participation (€27 million financing) are concentrated in the Southwest planning region.

Seventh Framework Program (FP7)

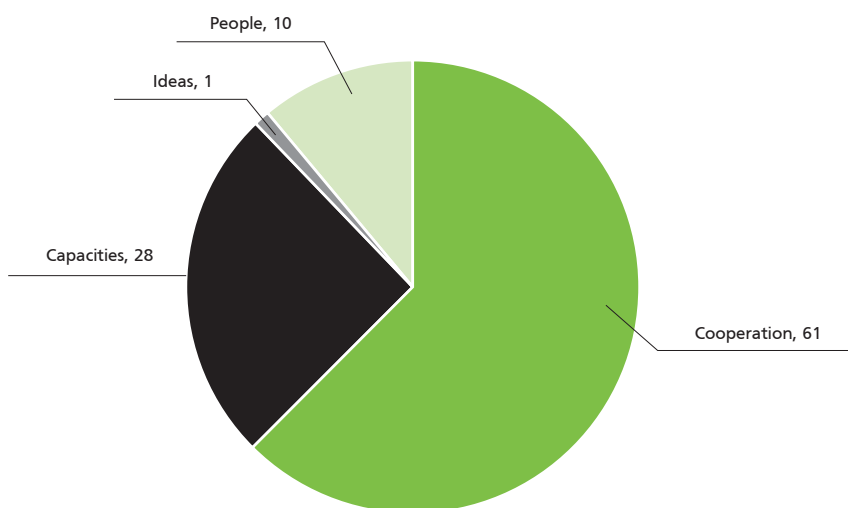
The EU Seventh Framework Program for research, technological development and demonstration activities promotes advanced scientific research in emerging areas of knowledge. This program is a means of promoting the involvement of science policy with the other Community policies such as employment, regional development, competitiveness and innovations in order to guarantee complementarity and synergy between them. The program is oriented toward building an integrated European research area and achieving lasting and sustainable economic growth, an objective realized within four specific sub-programs:

- Cooperation – conducting scientific research in priority areas;
- Ideas – research in new and/or emerging areas;
- People – human resource development;
- Capacities – building scientific potential in Europe.

The results from Bulgaria's participation in the first call for proposals session and the subsequent schemes can be summed up as follows:

- 950 participants from Bulgaria in about 350 submitted projects;
- Participation of Bulgarian organizations in 104 projects approved for financing worth over €16 million. The financed projects of the research organizations (of which 3 projects are for the Academy of Agriculture and 35 for the Bulgarian Academy of Sciences) amount to €4.5 million in total.

FIGURE 47. BULGARIAN PARTICIPATION IN THE SUBPROGRAMS OF FP7, NUMBER OF PROJECTS



Source: Ministry of Education and Science 2008.

The private sector participates with 32 projects worth approx. €5.2 million;

- According to preliminary data, at the end of 2008 the received funds exceeded €25 million for successful Bulgarian participation in 180 projects under FP7;
- Significant presence of the private sector including firms, specialized associations and non-governmental organizations, which is highly appreciated by the European Commission;
- Good presence in the thematic areas of "Information and Communication Technologies", "Social Sciences and Humanities", and "Energy and Health".

From the analysis of Bulgaria's participation in FP7, certain negative trends can be traced in comparison to the previous program schemes, with the stipulation that these conclusions are based on initial data insufficient for a quality evaluation of the country's performance.

What stands out is the very low participation percentage and minimal success of the human resource development programs. Possible reasons are include impeded access to the

"Ideas" program, the high admission criteria (especially for established scientists), the insufficient number of young people taking an interest in scientific careers and development, the small number of project proposals put forth by Bulgaria for a great part of the "People" program schemes and the lack of appropriate infrastructure to attract foreign researchers on medium-term visits. Up to now, there has been a relatively good representation in two scientific areas which are part of the "Cooperation" subprogram – Information and Communication Technologies (ICT) and Health.

Although the balance of active and effective participation is kept between universities and horizontal scientific organizations, a new element is the fast penetration of institutions outside the public research sector: SMEs, non-governmental organizations and regional and local authorities. This has been recognized as a positive trend by the European Commission, yet a major problem in from the point of view of Bulgaria remains the practical absence of new participants from public scientific institutions seeking to attract new financial resources to fund their research activity.

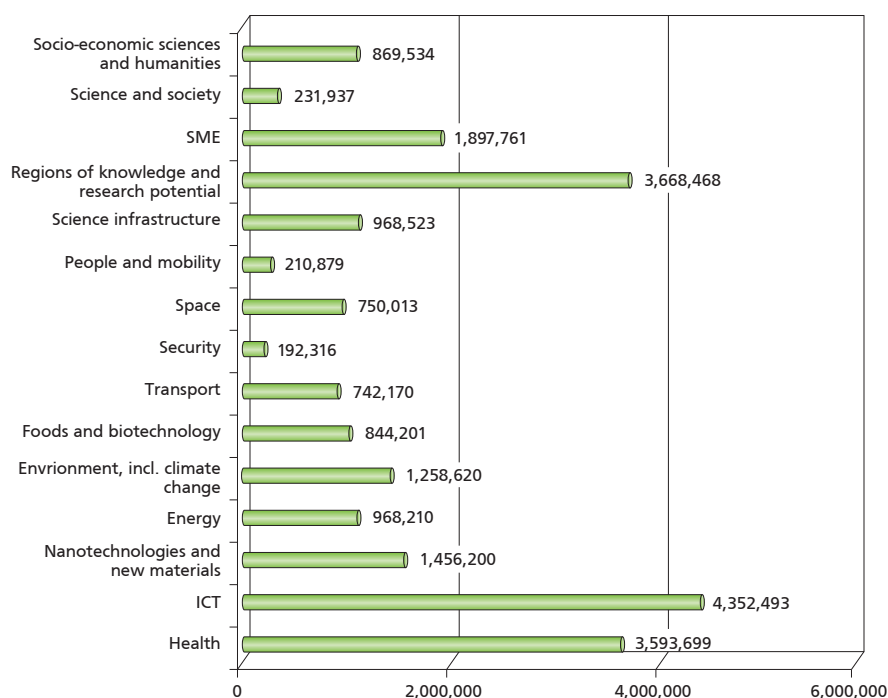
The parallel between the participants in FP6 and the first calls under FP7 shows a similarity regarding the participating and the financed institutions. Particularly active have been 7 institutes of the Bulgarian Academy of Sciences, 4 universities and 2 institutes of the Agricultural Academy. Possible reasons for the specific nature of the Bulgarian participation can be sought along several lines:

- The enlarged thematic areas and the interdisciplinarity of FP7 are not being utilized. A good practice of many member states is the binding of strictly scientific themes such as research in the area of the environment or nanotechnologies, with the horizontal program "Science in Society".
- Unconventional collaboration between institutions is not being created, such as scientific teams from very different scientific fields like ICT and health, or nanotechnologies and social studies.
- Contacts and cooperation with associated countries and third parties are not exploited intensively enough.
- The program components and administrative rules are not well known.

Along with the launch of FP7, the Ministry of Education and Science implemented two specific instruments for supporting the Bulgarian participation in FP7. Unfortunately, these schemes are not used effectively. On average, 30 proposals are presented annually originating from the calls for support for the development of project proposals for FP7. In addition, specific activities for building international consortiums are contemplated through the competition schemes of the Scientific Research Fund:

- Further actions for utilizing the results to prepare scientific projects under FP7 could be envisaged with bilateral cooperation.
- Using resources to build networks with foreign partners could

FIGURE 48. ALLOCATION OF FUNDING FOR THE BULGARIAN PARTICIPANTS BY PRIORITY AREAS (€)



Source: Ministry of Education and Science 2008.

be promoted within the thematic competitions and those targeted at aiding research in state-run higher education institutions.

EU Framework Program for Competitiveness and Innovation

This program is a new instrument of the EU for promoting innovations and entrepreneurship in order to encourage the competitiveness of European enterprises. The SMEs are the chief target group of the program. The program supports innovative activities, including eco-innovations, facilitates the access to funding and provides services in support of businesses in the European regions. The wider use of information and communication technologies is promoted, as well as

the development of the information society. The activities also aim at increasing the use of renewable energy sources and energy efficiency. The FP consists of three programs: "Entrepreneurship and Innovations", "ICT Policy Support", and "Intelligent Energy – Europe II" (IEE-II), and its implementation period is 2007-2013. With the financial support of the EU Framework Program "Competitiveness and Innovations" operates the Enterprise Europe Network – Bulgaria, which is an integrated information consulting network in support of businesses.⁴¹

New Instruments of the Ministry of Economy and Energy

The Ministry of Economy and Energy (MEE) and the United Nations Devel-

⁴¹ The network includes as full partners the Applied Research and Communications Fund (coordinator), Bulgarian Industrial Association (BIA), Centre for Innovations – Bulgarian Academy of Sciences (BAS), Business Information and Consulting Center (BICC) – Sandanski, Business Support Center for SMEs – Rousse, Chamber of Commerce and Industry (CCI) – Dobrich, CCI – Yambol, CCI – Stara Zagora, CCI – Vratsa, CCI – Plovdiv, GIS Transfer Center, Bulgarian Chamber of Commerce and Industry (BCCI) – Sofia.

opment Program (UNDP) announced a national program for promoting innovation activity of young people in Bulgaria known as the TECHNOS-TART Project. Under this program, undergraduate students or those who graduated in 2008 aged up to 29 and having no registered firms in their name can apply for grants. On the basis of approved business plans, the young people receive grants of 20,000 levs with mandatory co-financing on the part of the entrepreneurs-to-be amounting to 10%.

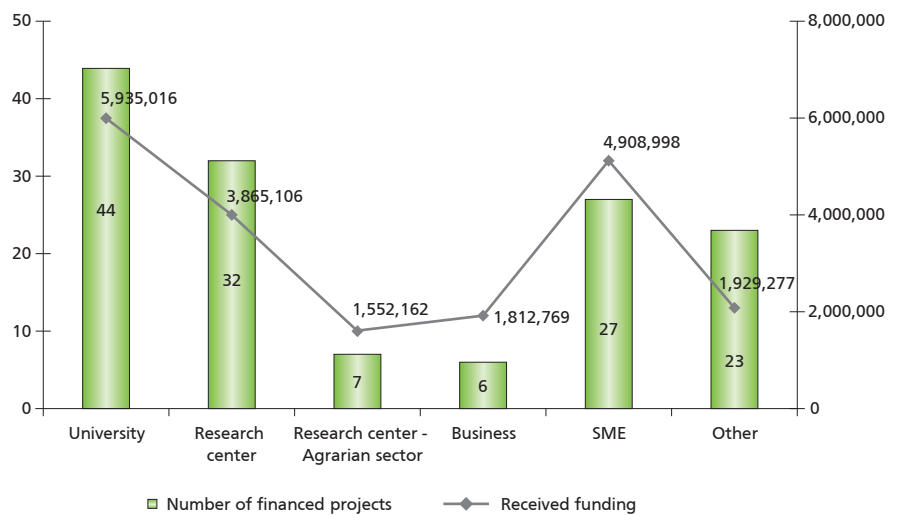
MEE also launched a support scheme for transferring knowledge to enterprises (voucher scheme) aiming at providing enterprises with technological knowledge from universities and scientific organizations (“knowledge providers”) for the purpose of stimulating the science-business relationship. Projects oriented towards solving problems of an applied nature by obtaining new knowledge, qualify for funding under this scheme. The scheme only finances the costs for consulting services rendered by the knowledge provider to the beneficiary enterprise. After closing the evaluation procedure for the applications, the initial list included 80 qualified applicants. The scheme’s budget for 2008 was 1 million levs.

OP Competitiveness

Operational Program “Development of the Competitiveness of the Bulgarian Economy 2007-2013” is funded by the European Regional Development Fund (ERDF) and by the national budget. The amount of public funds available is €1.1 billion.⁴²

The budget for the next four open procedures is directly oriented at improving the enterprises’ technological base and increasing their innovative activity (introducing innovative products, processes and providing innovative services, meeting internationally recognized standards, technological

FIGURE 49. FUNDING ALLOCATION OF THE NATIONAL SCIENCE FUND BY TYPE OF ORGANIZATION (€)



Source: Ministry of Education and Science 2008.

Box 9. APPROVED PROJECT FUNDING UNDER OP COMPETITIVENESS

The first contracts with beneficiaries under the open procedures worth a total of €66.5 million which were announced in October 2007, are for providing SMEs with grants under the following procedures:

- Technological modernization in the enterprises – 131 approved project proposals out of 306 submitted;
- Complying with internationally recognized standards – out of the 291 submitted project proposals 181 have been approved.

Source: Ministry of Economy and Energy.

modernization in SMEs and large enterprises). It increased by 88,012,350 levs and has reached 272,838,283 levs.

The difficulties in ensuring the financing of work on the contracted projects (providing the necessary co-financing, the non-eligibility of VAT expenses and the delays of grant payments during project implementation) forced the Managing Authority of OP Competitiveness, banks and leasing companies in the country to take a joint approach. The framework agreements signed with the

banks aim to aid the implementation of the firms’ investment projects by providing ad hoc investment credits at preferential interest rates and an accelerated funding approval procedure conforming to the requirements of OP Competitiveness. The banks have already opened special lines of credit conforming to the Framework agreement rules in response to the specific needs of innovative enterprises. These include the increased risk in financing innovative projects, slow returns on introducing a new product or start-ups, as well as a necessary co-financing of the



⁴² OP “Development of the Competitiveness of the Bulgarian Economy 2007-2013”, <http://www.eufunds.bg/>, <http://www.opcompetitiveness.bg/bg/index.html>

⁴³ In 2008, 23 commercial banks entered into an agreement to extend credits for projects financed under OP Competitiveness.

work on European programs and on the National Innovation Fund.⁴³

In spite of the measures taken, firms are still submitting few project proposals, which is the result of a lack of sufficient information and training seminars about project preparation and implementation under EU Programs. The cumbersome procedure for payment approvals also needs to be added to this list, as well as the delayed cash transfers to the recipients' bank accounts, which extremely impedes the activity of the smaller firms having no available spare re-

source to finance the initial phase of the projects.⁴⁴

OP Human Resources Development

The European Social Fund (ESF) supports the development of human potential in Bulgaria through the "Human Resources Development" Operational Program⁴⁵. After the first call under BG051PO001/07/3.3-02 "Development Support for PhD students, post-doctoral students, post-graduate students and young scientists" in 2007, 20 projects were approved.

The second call for project proposals under Priority Field 3 included, "Improving the Quality of Education in Accordance With the Labor Market Needs Toward Building a Knowledge-Based Economy", a major area of intervention and "Strengthening the Relations between Educational and Training Institutions, Research Sector and Businesses" by means of a grants scheme under BG051PO001-3.3.04 "Development Support for PhD students, post-doctoral students, post-graduate students and young scientists." This has now been completed.

Private Financing of Innovation

Public funds continue to be the main source of funding for research and innovation in Bulgaria. Business' share of support for research and innovation projects is insignificant, which places Bulgaria at the bottom of EU member states ranking by the indicator.

Financing of Innovation Projects by Businesses

The survey of the innovation activity of enterprises in Bulgaria conducted by the Applied Research and Communications Foundation in the last quarter of 2008 encompassed 1,004 businesses, 428 of which (42.6%) answered the question about the main sources of financing the companies' innovation projects. The enterprises ranked the significance of the various sources of financing of innovation as follows:

1. **Their own funds** – 61.2% of the respondents rely on their own means to implement innovation projects, which could, to some extent, be explained with the fact that company innovations (according to the answers of 248 businesses) are mostly developed by their employees.

2. **Bank loans** – 29.2% of the respondents point to bank financing as the second major source. As the bank products tailored to support businesses to operate with the instruments of the Structural Funds are relatively new, the answers apparently refer to the traditional investment crediting by banks.

3. **Financing from European programs (3.7%) and specialized national funds (3.5%)** appears as the third major source, although its share is insignificant compared to the own funds and the bank loans (according to the respondent 428 businesses).

These results to a great extent confirm the conclusions of a 2006 survey by Vitosha Research⁴⁶ about the main sources of financing businesses' innovative activity. For the most part businesses continue to rely on company funds for innovation project funding, regardless of the increasing number of financial instruments in support of innovations and the increased amount of funds in 2008 made available through the two national funds, NIF and NSF, as well as OP "Competitiveness".

Likely reasons are the lack of capacity for preparing proposals and implementing projects, as well as lack of awareness of the possibilities offered by the EU programs, the National Operational Programs and the two national funds. Considering the low-tech profile of the Bulgarian economy as a whole and the primary domestic market orientation of the businesses, it could be concluded that innovations are not yet a strategic priority for the businesses. Other possible reasons for



⁴⁴ The projects under operational programs are financed on the principle of reimbursement of approved expenses, there are no advance payments under the contracts, or if there are any, they are a small percentage of the total project budget.

⁴⁵ OP "Human Resources Development", <http://ef.mlsp.government.bg/bg/index.php>, <http://www.efunds.bg/>

⁴⁶ *Bulgarian Small and Medium-Sized Enterprises and Their Part in the Absorption of EU Structural Funds*, analytical report, July-August 2006.

the firms' poor participation in the European and national funds and programs are both the underdeveloped consulting services for project preparation and implementation and the discouraging participation terms, e.g. the absence of a financial instrument for co-financing the Bulgarian participation in the EU Framework Program "Competitiveness and Innovations". The application of the principle of reimbursement by the national operational programs, the delay in payment in the course of the project, and the large number of documents filed on applying, also creates challenges.

Conclusions could be drawn similar to the above concerning the holding companies and the companies joined in them from the interviews held with representatives of holding companies in the country:

- Due to the world financial crisis the projects with innovative orientation have been 'frozen'. Even applying for projects using the national funds and operational programs is not an attractive prospect for implementing innovative projects in 2009.
- The options offered through the operational programs, specifically OP Competitiveness, are known comparatively well. The main problem appears to be the absence of capacity to work with the instruments of the Structural Funds – there are no specialized teams that can prepare and implement projects.
- The opportunities provided by the programs at the EU level (Framework Program for Competitiveness and Innovations, FP7 for Scientific Research and Technological development, etc.) are practically not known.

Equity Financing

One of the affordable options in developed economies concerning the financing of innovative businesses and

Box 10. VENTURE CAPITAL THE BULGARIAN PRACTICE

"Advance Equity Holding AD" is one of the first Bulgarian company for equity financing analogous to the venture capital funds popular in the US and Western Europe. So far the company has invested in seven private companies in the following basic business areas: **High Technologies** (a System for Mobile Payments and Providing Internet services), **Power Engineering** (Renewable Energy Sources, Energy Efficiency and Compressed Natural Gas Deliveries), **Farming** (Cultivation of Agricultural Lands), **Real Estate** (Development of Industrial, Commercial and Logistic Areas).

Source: Applied Research and Communications Fund.

the introduction of modern technologies in existing enterprises are venture capital/private equity funds. A large number of successful companies have sprung into existence thanks to the support of equity investment funds. No fewer are those that have significantly improved their cost effectiveness as a result of a new technology or rationalization applied by managing to attract an investor.

The absence of high equity investment activity in Bulgaria is the result of several circumstances. First, there is the lack of fiscal incentives for the financial investors supporting innovative business start-ups. Because of their specific nature, the investments in new technologies, especially in newly set up companies, have a longer period of return and sometimes even fail. The opportunity for investors to use tax concessions, as well as receiving state guarantees for loans needed to finance innovative businesses are just part of the incentive instruments.

Second, yet equally important, is the absence of special legislation regulating the creation of Bulgarian equity investment funds. It is needed to regulate matters of principle concerning the raising of capital in specialized pools (Funds) with clear criteria for its investment and return after a certain period of time (10-12 years). Those investing their capital in similar funds would also normally enjoy tax relief for the period of their investment. Typical investors are the owners of a long-term resource. Among those are

pension funds and insurance companies. In Bulgaria, the legislation regulating the operation of pension funds and the insurance companies does not allow investments in instruments which do not bring fixed profitability or are not traded on a regulated market.

Currently, several foreign equity investment funds operate in Bulgaria. However, they focus on existing local medium-sized and large enterprises offering potential opportunities for financing in exchange for a share of the ownership. There is no typical venture capital fund among these funds which could invest in emerging or inexperienced companies developing an innovative business. In a global financial crisis the interest of other equity investors in the local market will certainly be limited, whereas the entrance of a venture capital fund into concrete projects in Bulgaria is not likely to happen. At the same time, Bulgarian pension funds constantly accumulate new resources when the alternatives to their investment in financial instruments traded in the stock exchange or in bank deposits are far from attractive or profitable. Ensuring, through a series of legislative changes, the conditions for creating local companies specializing in equity financing of innovative business projects and whose investment capital would be secured through clear regulations about the participation of Bulgarian institutional investors, seems a very real and completely justified alternative.

Prospects

The JEREMIE⁴⁷ Initiative

The measures supporting technological business start-ups are a priority of the innovation policy, not only at the EU level, but also at regional and national levels. A number of countries, including Bulgaria, still encounter difficulties in attaining that objective. Starting innovative SMEs is a serious problem, mostly because of the absence of sustainable processes of transferring technologies and know-how within the R&D institutions (universities, academies), poor entrepreneurial activity and difficulties in evaluating financial and business partners. The international practice shows that a starting point for creating an effective culture for knowledge exploitation and successful innovation project financing through venture capital, is the development and implementation of supportive measures for entrepreneurs before their business starts.

Priority Axis 3 "Financial Resources for Development of Enterprises" from OP "Competitiveness" is aimed at developing special financial instruments for stimulating the SMEs' investment activity and entrepreneurship. The foreseen interventions would offer new opportunities for SMEs to access venture capital in financial niches where there is no conventional bank financing or where it is insufficient.

The activities under this priority axis are structured in two areas of impact due to the different funding method:

- Improving the access to financing micro, small and medium enterprises by utilizing the instruments for financial engineering, mainly through revolving funds. The instruments for financial engineering shall be implemented

through the establishment of a Holding Fund according to Article 44 of Regulation 1083/2006. The European Investment Fund will be performing the function of Manager of the Holding Fund within the JEREMIE initiative.

- Support for creating or expanding the activity of networks of business angels in Bulgaria by making grants available.

The JEREMIE⁴⁸ Initiative is an initiative of European Commission's Directorate General for Regional Policy (DG Regio) and the EIB Group (the European Investment Fund and the European Investment Bank), aiming at improving the financing for SMEs.

The resources for JEREMIE are provided by the EU Structural Funds for the program period 2007-2013, while the funds are granted by the European Commission to the member states and their regions. The national and regional authorities of the member states can apply for entry, and they are the ones who make decisions on the JEREMIE terms and conditions, e.g. the investment strategy and the financial instruments associated with it, the volume of available funds or the choice of the financial institution managing the JEREMIE activities. The funds envisaged for the implementation of JEREMIE in Bulgaria are €200 million to support the activity of networks of business angels.

Traditionally, money from the EU Structural funds is spent mostly as subsidies in the form of one-off payments on a project basis. The JEREMIE

initiative provides new opportunities to the member states and regions for investment and reinvestment of money from the EU Structural Funds with the utilization of a set of financial tools instead of grant schemes. JEREMIE's financial instruments are based on the expertise of the EIB Group in financing SMEs, particularly with respect to the guarantees, venture capital, securitization⁴⁹ and crediting. JEREMIE's financial products work on a market basis by stimulating the involvement of both private and public financial institutions, which is of key importance. The JEREMIE funds are not granted directly to the small and medium enterprises (SMEs).

Bulgarian Development Bank

The Bulgarian Development Bank was established following the adoption of a special law by the National Assembly in April 2008. The financial institution is a successor of the Encouragement Bank. The mission of the Bulgarian Development Bank is to support the development of the Bulgarian economy by promoting export and supporting the implementation of the economic policy of the government in terms of micro, small and medium-sized enterprises. To implement its goals and tasks, the Bulgarian Development Bank has established a bank group of its own which includes the Bulgarian Development Bank (BDB), the National Guarantee Fund (NGF) and the Capital Investment Fund (CIF).

The operation of the Bulgarian Development Bank and its bank group is regulated by the Bulgarian Development Bank Act. The basic activities of BDB and the structures associated with it are:

1. Pre-export direct and indirect financing of Bulgarian micro, small



⁴⁷ OP "Development of the Competitiveness of the Bulgarian Economy 2007-2013", <http://www.eufunds.bg/>, <http://www.opcompetitiveness.bg/bg/index.html>

⁴⁸ Joint European Resources for Micro to Medium Enterprises, JEREMIE.

⁴⁹ Converting credits and other assets into liquid securities.

- and medium-sized enterprises geared toward their export transactions;
2. Guarantees through the establishment of a National Guarantee Fund and support for launching and development of the activity of micro, small and medium-sized enterprises in the country;
 3. Long term investment financing which the bank will perform directly or through the commercial banks in Bulgaria;
 4. Risk capital financing, which will be geared towards small and medium-sized enterprises registered in Bulgaria with a proven potential for development, are in good financial condition and have a stable, but not dominant, presence on the market;
 5. Attracting and management of medium and long-term local and foreign resources and grants intended for economic development.

National Guarantee Fund

The National Guarantee Fund was established in August 2008 as a subsidiary to the Bulgarian Development Bank. The guarantees issued by the Fund and by the BDB will support all micro, small and medium-sized enterprises registered in the Republic of Bulgaria that meeting the criteria of the Act on SMEs. The Fund will guarantee up to 50% of the loans to SMEs. The maximum amount of the guarantees to be used by one SME or group of related parties is up to 10% of the capital of the National Guarantee Fund and not more than €1,500,000, which will ensure compliance with the EU provisions for

maximum allowable state aid (the “De minimis” rule).

The term of the guarantee and the loan will be equal and the maximum term of the guarantee which is 10 years.

“National Guarantee Fund EAD” will grant individual guarantees to SMEs – clients of commercial banks, as well as portfolio guarantees with which it will share the commercial banks’ risk on extending credit to micro, small and medium-sized enterprises. All of this is happening under maximally simplified rules and procedures.

Capital Investment Fund

The Capital Investment Fund is a subsidiary of the Bulgarian Development Bank. Its establishment is projected for 2009. Its function will be to aid the development of Bulgarian small and medium-sized businesses by providing venture capital. The capital investment activity of the Fund will be governed by the bank priorities and will include:

- Participation in the capital of small and medium-sized enterprises;
- Provision of consultancy services regarding capital structure of local small and medium-sized enterprises, consultations and services related to transformation of enterprises;
- Investment advice;
- Advice related to the management of pools of securities of Bulgarian small and medium-sized enterprises.

Following Bulgaria’s accession to the EU, the number of financial instruments in support of research and innovations increased and public funds provided by the two national funds and OP Competitiveness grew substantially. At the same time a great number of businesses continue to rely on their own funds and investment credits for the financing of innovation projects, which means that the financial support from the national funds and programs has not been recognized as an alternative to own-funding sources and bank crediting.

The negative trend continued in 2008 – an upside down structure of the expenditures for science and innovations which show the predominance of public financing and an insignificant amount of expenditure on the part of businesses. The universities and research institutes continue to be the main participants in the EU programs for science and innovations. Practically, Bulgarian businesses are not aware of the advantages of participation in the European programs and funds, and therefore do not utilize them fully.

In order to increase the involvement of businesses in national and European funds and programs, there has to be a focus on capacity-building measures, the development of quality consulting services and a simplification of the application procedures (e.g. applying online to operational programs both for the EU Framework and Operational Programs, with signed and sealed documents to be required only on approval of a certain project and when starting negotiations).



4. Human Capital for Innovation

Human capital for innovation includes the accumulated knowledge and skills to create, transfer and implement new technological solutions. It is expressed through the quantity and quality of the educational product and employment in some specific sectors such as research and development, entrepreneurship and high-tech and medium-tech sectors. Human capital for innovation is related to the overall condition of the secondary and university education system which is supplemented by lifelong learning. Human capital determines the long-term capacity of the national innovation system but it is influenced by the current potentialities and restrictions which it creates. This makes it an important target of the national policy for innovation-based economic growth.

The crisis in the financial and real sector and the deepening worldwide recession has changed corporate plans towards restraining from expansion and has resulted in investment contractions. The sources of competitive advantages sought are mainly a result of cutting production costs rather than of pursuing diversification. The need to survive has shortened the horizon of planning, and the pursuit of higher effectiveness has become a driving force when managing a firm's resources.

There is a deepening of the negative effects of population ageing and brain drain which is extremely important for the European countries, including Bulgaria. The expected changes are connected with the decrease in the number of newly-opened workplaces, limitation of the funds for raising qualifications and developing professional skills and the change in the workforce ratio on the labor market.

Research Career, R&D and High-Tech Employment

The number and quality of those who successfully complete their PhD degree reflect the dynamics and ability of the national innovation system to generate new scientific and/or technological knowledge in the future. On the other hand, employment in R&D and high-tech sectors of the economy is an indicator of the current demand for human capital for innovation in the national innovation system.

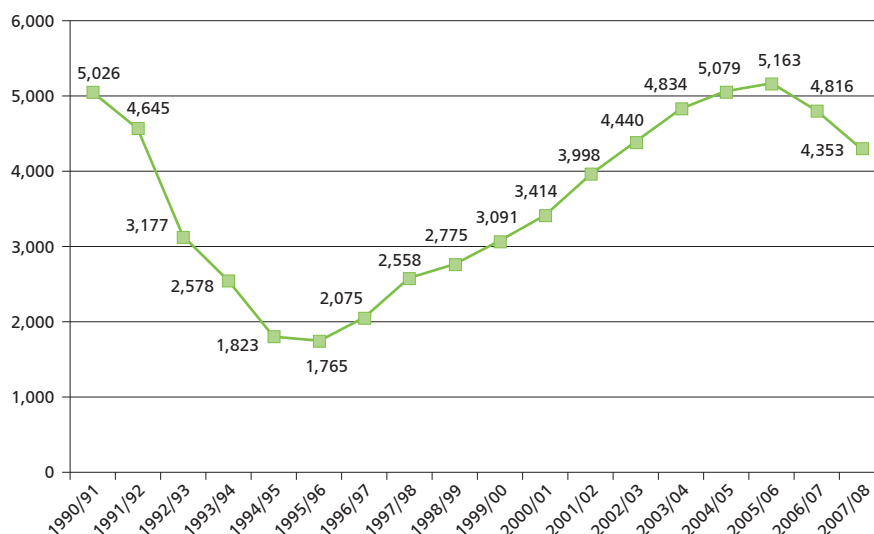
Training of Scientists

The PhD degree is the last stage in students' education and can be regarded as the first step in their research career. The PhD programs require doing original research based on acquired modern knowledge in the respective sphere. In this sense, the number of PhD students is an indication of affinity to research work and a declared interest in a future professional realization in the sphere of science and technology.

There are several reasons for the decrease in the number of PhD students in Bulgaria in the last couple of years. One of them is connected with the relatively rapid growth of the Bulgarian economy, the increasing economic activity, and, consequently the greater opportunities for a career of university graduates. Another reason is connected with measures undertaken to improve the quality of the educational product, including the PhD courses. The requirement introduced for covering the costs of education and dissertation defense by PhD students beyond the 3-year period provided by the law, discontinued the trend of applying for a PhD study solely as an alternative to entering the labor market.

During the 2008/2009 academic year the number of vacancies for PhD students in universities and research organizations has increased by 46% compared to the 2007/2008 academic year and reached 1,403 (1,049 full-time students and 354 extramural students).⁵⁰ The PhD scholarships nearly doubled – from 250 levs to

FIGURE 50. NUMBER OF PhD STUDENTS IN UNIVERSITIES AND RESEARCH INSTITUTES



Source: NSI, 2008.

450 levs with a premium of 1,000 levs when the PhD paper is defended within a year after submission. In 2007 and 2008, two calls were held under the Operational Program "Human Resources Development" grant scheme of "Support for the development of PhD students, post-PhD students, post-graduate students and young scientists" with a budget 3.912 million levs for the first year and 9.779 million levs for the second year respectively.

The financial stimulus is undoubtedly a necessary step for increasing the attractiveness of PhD study. In order to attract the attention of young researchers, however, including those who have received their higher education abroad, the Bulgarian universities have to offer diversified multi-disciplinary programs, reflecting the modern trends of scientific and tech-

nological development, and at the same time to train specialists for the R&D business sector.

There is not enough differentiation in Bulgaria regarding the positions held and the remuneration received between university graduate specialists and PhD specialists. According to the data from the INA-3 survey in 2008 only 2.8% of the companies surveyed have personnel with PhD degrees. The lack of proper motivation undermines the efforts of universities to make the tertiary stage of higher education more attractive. When carrying out its innovation policy, Bulgaria needs to support the efforts of the European countries oriented towards mobilization of the most

⁵⁰ Report on the activity of the Ministry of Education and Science, September 2005-August 2008.

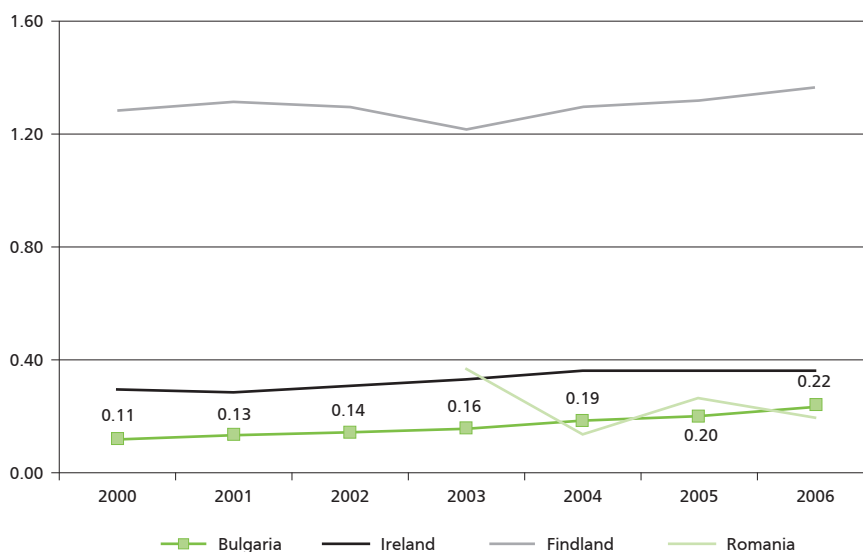
prepared and qualified part of the workforce, with the highest contribution to creation and dissemination of technological knowledge – the PhD students in the scientific and technological spheres of education.

The share of PhD students in the scientific-technological spheres of education in 2006 doubled compared to the level of 2000, and in this way Bulgaria managed to outstrip half of the new EU member states. The measures for increasing the attractiveness and quality of PhD study, supported by the government, make it possible for this trend to be preserved in the coming years.

The international mobility of PhD students is an indicator of internationalization of both higher education and the research system of a given country. It shows the degree of attractiveness of research programs offered and in certain cases opportunities for career growth of young researchers in the host country. During their education PhD students participate in research activities and thus contribute to the development of the research system. When they return they can apply their competences to solve certain research and business problems and become an important element of the international research network.

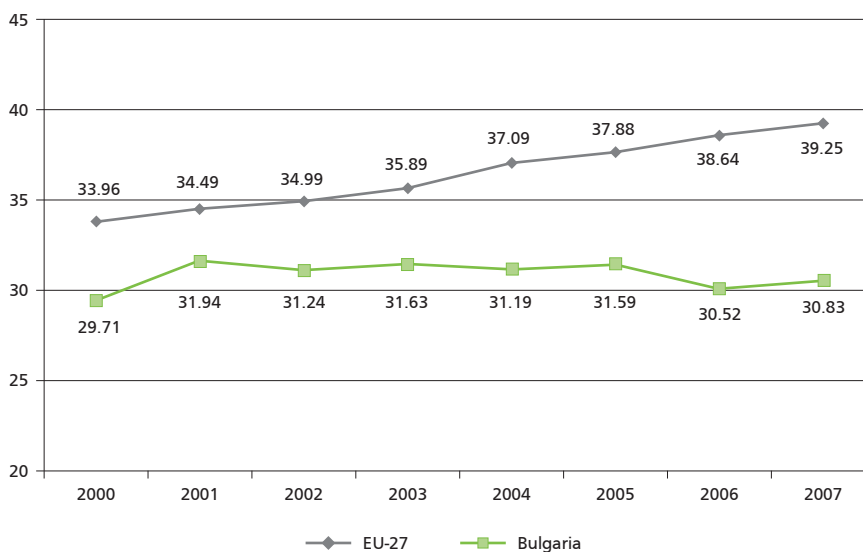
The most attractive research programs and terms for doing research are offered in Switzerland and the United Kingdom where the share of foreign PhD students educated by local universities is 40%. They are followed by Canada, Belgium and the US where foreign PhD students range between 20% and 35%. In absolute figures the leading country is the US (79,000 foreign PhD students in 2001), followed by United Kingdom (35,000 PhD students in 2004).

FIGURE 51. SHARE OF PhD STUDENTS IN SCIENTIFIC-TECHNOLOGICAL SPHERES OF EDUCATION⁵¹ IN THE 20-29 AGE BRACKET (%)



Source: Eurostat, 2008.

FIGURE 52. EMPLOYED IN SCIENCE AND TECHNOLOGY, % OF THE WORKFORCE AGED 25-64



Source: Eurostat, 2008.

Staff Employed in the Field of Science and Technology

Human resources in science and technology (HRST)⁵² constitute the

category of workforce which is most actively involved in implementing technological innovations and includes groups within the framework of general employment with the

⁵¹ Scientific-technological spheres of education in compliance with the International Standard Classification of Education (ISCED97) are: Natural Sciences (ISCED42); Physical Sciences (ISCED44); Mathematical Sciences and Statistics (ISCED46); Informatics (ISCED48); Technical and Engineering Sciences (ISCED52); Production and Processing Sciences; (ISCED54); Architecture and Construction (ISCED58).

⁵² The human resources in science and technology are measured according to the definition given in the Canberra Manual and include both people who have successfully finished higher education in science and technology and people without higher education qualification, but doing jobs which require such qualification.

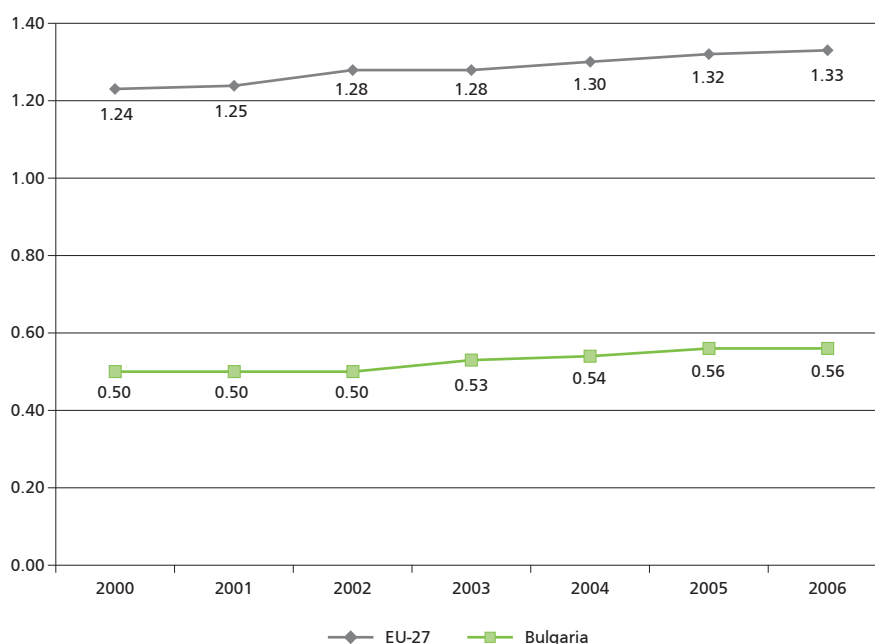
highest education and most developed professional skills. According to the definition of the National Classification of Occupations and Positions (International Standard Classification of Occupations, ISCO) this includes staff of class 2 "Analytical specialists" and class 3 "Technicians and other associate specialists" – categories which are regarded as a source of potential innovation activity and a base for building knowledge-based economies. In 2007, more than 1/3 of the workforce in the EU member states (39.25%) was employed in science and technology – a result of a permanent trend of growth in the last few years.

Bulgaria does not mirror this positive trend of change of the share of people employed in science and technology within general employment which is characteristic of the average European levels and, practically, of all member states. The value of the indicator from 30.83% for 2007 increased by less than 4% compared to 2000 and is a step backwards from the level reached during the greater part of the years of the period studied. The only countries lagging behind in the ranking of the member states for 2007 are Romania (22.97%) and Portugal (22.1%), but they show faster growth, 22.7% and 29.69% respectively which is constant, without the fluctuations observed in Bulgaria.

It is typical of most European countries to have a relatively large number of young people employed in the area of science and technology, compared to people employed in other fields of economic activity. Five countries, including Bulgaria, are an exception. The others are Croatia, Romania, Italy and Slovakia.

The personnel engaged in Research and Development, together with the funding of R&D, is one of the two major incoming flows that define the potential of the entire system of science, technology and innovation and

FIGURE 53. R&D PERSONNEL, % OF WORKFORCE



Source: Eurostat, NSI, 2008.

which allow it function effectively and competitively.

Bulgaria's comparatively low figures in that indicator (0.56% of the workforce for 2006, followed only by Romania) are complemented by an insufficient growth rate of a mere 12% at a base level, too low compared to that of Europe.

The people employed in the field of Research and Development – being a kind of innovation system input – directly influence application and patent activities⁵³. A survey within the European Union shows that despite the differentiation regarding the size and organisation of European economies, long-term trends show that large-scale investments in personnel employed in the field of science and technology lead to more significant results at the output end of the in-

novation system. This is manifested in newly created knowledge and know-how, including in the form of protectable intellectual property.

Despite the complex nature of the processes studied⁵⁴, the European countries with the highest innovation activity⁵⁵ report patent activity results which significantly exceed the average index of 101.3 (Finland – 223.2; Sweden – 152.0; Switzerland – 395.0; Austria – 180.0; Luxembourg – 189.0; Denmark – 155.6).

In Bulgaria, the opposite tendency is observed. The 12.74% increase in the number of people employed in R&D between 2002 and 2006 is almost entirely accounted for by the rise in general employment (11.09% for the same period). In this context, the positive change amounts to a mere 1.49%. The inadequate increase in



⁵³ Felix, B., *Patents and R&D personnel*, Eurostat, Statistics in focus, 107/2008.

⁵⁴ The personnel employed in the R&D field is heterogeneous and comprises categories that do not directly relate to the research activity carried out; part of the newly created knowledge is deliberately not subject to patent protection out of security considerations and in order to protect the areas of research interest.

⁵⁵ Share of the people employed in R&D in relation to general employment, as follows: Finland – 3.22; Sweden – 2.12; Switzerland – 2.12; Austria – 1.98; Luxembourg – 2.59; Denmark – 2.44 with a EU-27 index of 1.45.

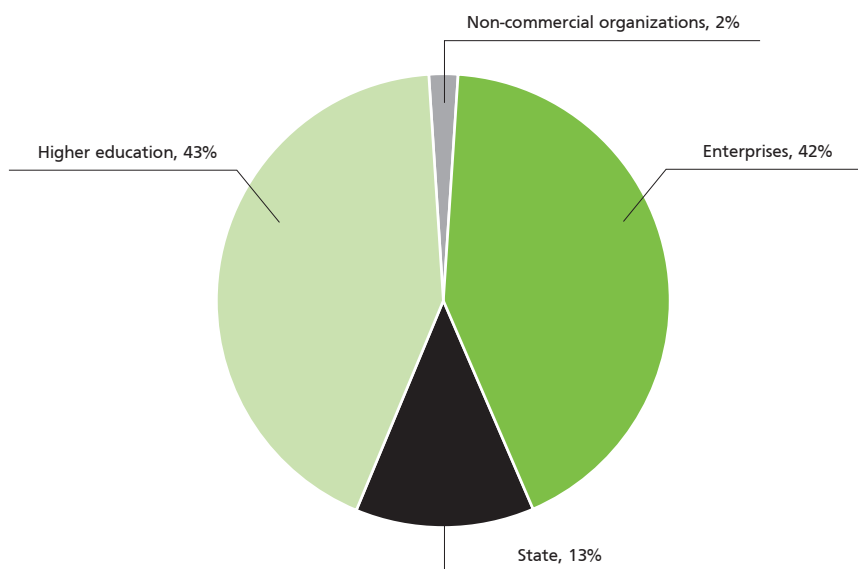
the number of employed people in the field of R&D, in relation to employment in general, however, does not lead to a corresponding, even minor, increase in applicant activity. The applications for invention protection in the Bulgarian Patent Office (BPO) filed by Bulgarian applicants in 2007 are only two-thirds of the number of the patent applications in 2002. Of course, the emergence of an invention is the result of research activity that does not automatically stem from hiring highly qualified personnel. Besides, a patent-acquisition procedure takes time. In this case, however, the reasons behind such a disparity should be sought elsewhere.

The analysis of the institutional structure of those employed in R&D provides an explanation for the peculiarities of the Bulgarian innovation system presented here. In the European countries, the R&D workforce is predominantly employed in private businesses and higher education sectors. This means that they are, to a greater degree, exposed to the influence of the market and are therefore geared towards production and quick return of the money invested in research.

In Bulgaria nearly 60% of the personnel engaged in carrying out scientific and research activities is in the state sector – funded by the budget and complying with primarily institutional financing principles and centrally oriented priorities of scientific and technological development.

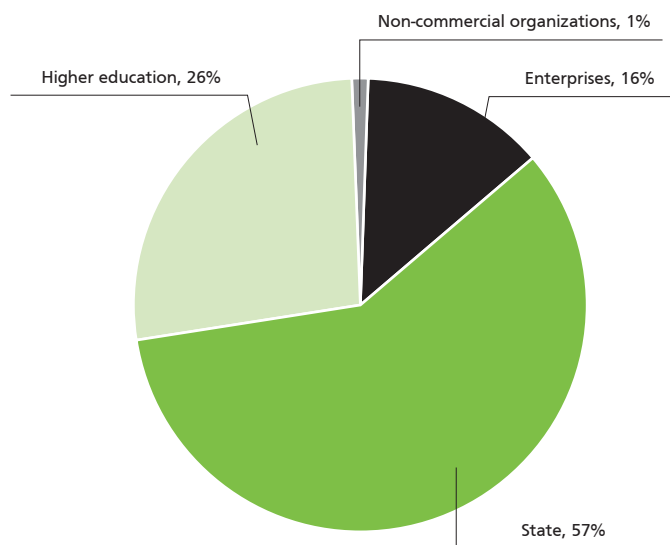
With a relative share of 12.4% of R&D employment in the business sector in relation to employment in general in 2005 (with only Latvia having a lower share of 9.6%), the companies in Bulgaria constitute 55.4% of the patent applications in the European Patent Office (EPO). Bulgaria has the highest relative share of R&D specialists in the state sector: 58.4% (according to the latest statistical data

FIGURE 54. R&D PERSONNEL BY SECTORS, EU-27, 2006



Source: Eurostat 2009.

FIGURE 55. R&D PERSONNEL BY SECTORS, BULGARIA, 2006



Source: Eurostat, 2009.

for 2006), a long way ahead of the next member state – Cyprus, with a 29.3% share.

A further challenge for the national innovation system and its human resources potential is the so-called 'fifth freedom' of the European Research Area, which aims at creating an environment for the free movement of researchers between the member

states. Regarding the state of the research equipment in the country and the financial resources allocated to R&D, Bulgaria can hardly compete with the developed economies. This is why the policy of attracting human resources in the field of science and technology needs to be more focused and comprehensive so as to prevent further brain drain.

People Employed in High-Tech Sectors

Investments in research activity (infrastructure, human resources and projects) find their natural continuation and effect in the development of high-tech sectors of the economy. Employment in high- and medium-high-tech productions and knowledge-intensive services is indicative of the implementation of innovation process, based on private scientific and technological basis. This is, in turn, is precondition for the distribution of new knowledge and technologies to traditional production sectors.

Regarding the employment in high-tech production sectors, Bulgaria followed the average decrease level in Europe until 2004. After that the country marked slight growth. In 2007, the share of people employed in sectors with high added value compared to general employment in the country approached 80% of the indicator level for EU-27.

The availability of a well-developed high-tech sector and human resources employed in R&D becomes significant for attracting direct foreign investments, including the opening of research units. This could successfully replace factors that have a temporarily attractive effect on foreign investors, such as geographical location and cheap labor. Some of the new EU member states (the Czech Republic, Slovakia, Slovenia, and Hungary) have made successful use of that approach and enjoy investors' interest in various fields.

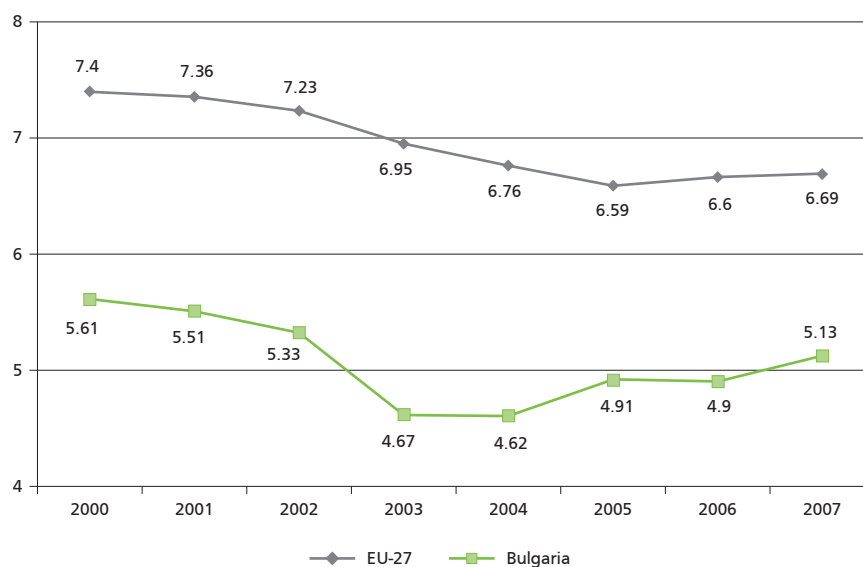
Knowledge-intensive services are oriented to satisfying end customers' needs and offer innovative decisions for their corporate clients' business development. In both cases they support the distribution of information and know-how as a basis for increasing the innovation activity of national economies and help (especially in the sphere of IT and

TABLE 13. RESEARCH AND PATENT ACTIVITY

	All Sectors (number)	According to sectors, %					
		Business	State	Higher education	Private non-profit organizations	Hospitals	Other
Personnel engaged in R&D, 2005:							
EU-27	3,047,825	42.9	13.1	42.8	1.1	-	-
Bulgaria	18,638	12.4	58.4	27.0	2.2	-	-
Patent applications in EPO, 2004:							
EC-27	52,968	79.6	1.2	1.5	1.6	0.1	16.0
Bulgaria	17	55.4	1.6	0.8	-	-	42.2

Source: Eurostat, 2009.

FIGURE 56. EMPLOYED IN HIGH- AND MEDIUM-HIGH TECHNOLOGICAL SECTORS OF INDUSTRY⁵⁶ (% OF TOTAL EMPLOYMENT)



Source: Eurostat, 2009.

communication technologies) to the effects achieved by the potential of social networks.

The reduction in the number of people employed in knowledge-intensive services is a disturbing trend bearing

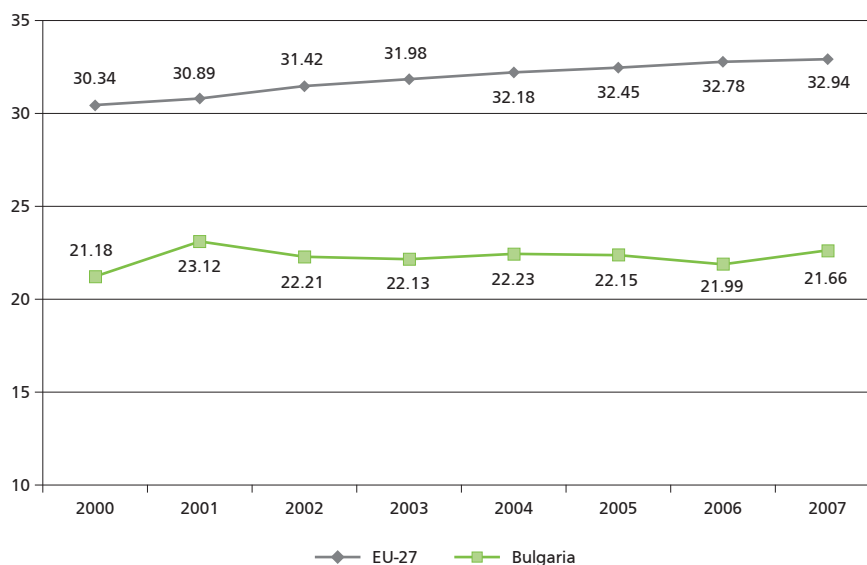
⁵⁶ High-tech sectors of industry include production of: medical preparations (NACE 24.4); office and electronic equipment (30), radio-, television and telecommunication equipment (32); aircraft and their engines (35.3). Medium high-tech sectors of industry include: chemical products (without medical preparations) (24); machines, equipment and household appliances (29); electrical machines and apparatuses, not classified elsewhere (31); medical, precision and optical apparatuses and instruments (33); automobiles, trailers, semi-trailers (34); locomotives, diesel trains and carriages (35.2), motorcycles and bicycles (35.4); vehicles not classified elsewhere (35.5).

in mind the increasing significance of this sphere of activity on forming the developed countries' GDP and the contribution to the Bulgarian State Standard. At the same time, this drop indicates decreasing effectiveness when spending funds on R&D and education (which are at a very low level). In European countries, knowledge-intensive services are the economic sector which is the biggest knowledge consumer and more than half of the people employed in knowledge-intensive services are university graduates in scientific and technological fields.

There is a worldwide growth trend in employment in the field of science and technology in comparison to general employment in the countries studied (average annual rate of 2.5% for USA and 3.3% for EU-15)⁵⁷. As far as staff employed in R&D is concerned, researchers have a higher growth rate than the rest of the categories.

In Bulgaria, the provision of research and high-tech business with the necessary human resources (number of employed in relation to structure) is still a challenge for the educational system and scientific and innovation policy. Within this framework, there should be a place for adequate supporting mechanisms.

FIGURE 57. EMPLOYED IN KNOWLEDGE-INTENSIVE SERVICES⁵⁸ (% OF TOTAL EMPLOYMENT)



Source: Eurostat, 2009.

Bulgaria's participation in European programs for researchers' mobility provides opportunities for overcoming the imbalance in the provision and effective use of human resources for technological and innovative development. Active partnership in the exchange of scientists and researchers, however, requires attractive offers for PhD degree programs and a career in scientific fields of priority.

A practice which is gaining popularity in European countries consists of giving grants on a competitive basis for doing research that is expected to have a considerable impact on the national economy. The fields envisaged are: nanotechnologies, molecular biology, and renewable energy resources in which Bulgarian scientists have strong international positions.

⁵⁷ OECD Science, Technology and Industry Outlook, 2008.

⁵⁸ **High-tech knowledge** services include: mail and telecommunications (NACE 64); activities in the sphere of computer technologies (72); R&D (73). **Knowledge-intensive market** services include: water transport (61); auxiliary transport activities and activities of travel agencies (62); real estate operations (70); leasing vehicles, machines and other equipment (71); other business services (74). **Knowledge-intensive financial** services include: financial intermediation (65), insurance (66), financial intermediation auxiliary activities (67). **Other knowledge-intensive** services include: education (80); healthcare and social activities (85); activities in the sphere of culture, sports and entertainment (92).

Level and Quality of Education. Lifelong Learning

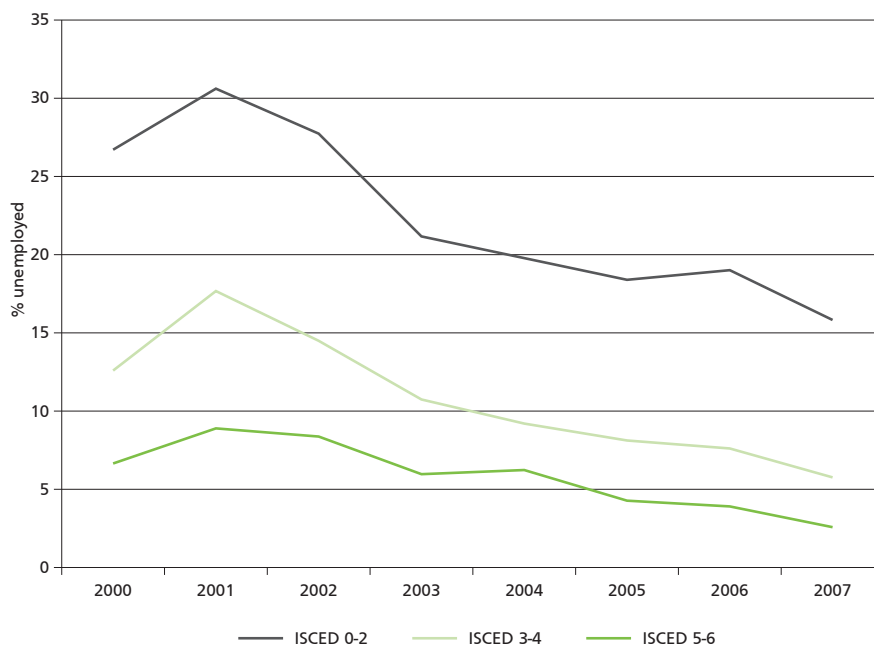
The quality of secondary and university education, including both bachelor and master degrees, is a major determining factor of the Bulgarian economy's capacity to generate and adopt innovation. The economy's ability to absorb the latest technological innovations is influenced by education in the areas of science and engineering. In addition, in the context of a dynamic modern global economy, the demand for new skills is ever-increasing: a fact that requires the development of new standards in the educational system for adequate employee lifelong learning.

The level of education and professional training is a major precondition for one's sense of personal accomplishment, for increased standards of living of the different social strata⁵⁹, and for the economy's potential for growth as a whole. In a crisis and during economic stagnation, it is the people with a lower level of education that are likely to remain unemployed more often and for longer periods of time. Social exclusion and the lack of access to information marginalize these people even further and thus, considerably more effort on behalf of society is needed for their reintegration into the group of the economically dynamic population.

The educational degree and the area of specialization affect one's social status and achievement opportunities. Within the EU-27, the share of unemployed science and technology specialists with a university degree, is a mere 3% (same figure applies to Bulgaria) compared to the 8% rate of unemployment of the same category of people without a degree (it is 9% in Bulgaria). The higher education factor is of the greatest significance in Sweden which has 1% unemployed university graduates and 14% unemployment of people without degrees.

The university graduates employment rate defines the potential of the market for innovation. Albeit not the only decisive factor, the increase in investment in education leads to a higher participation of the population in the educational process and hence, a rise in the share of university graduates.

FIGURE 58. UNEMPLOYMENT: DISTRIBUTION OF POPULATION (AGE GROUP 25-64) ACCORDING TO EDUCATIONAL LEVEL



Source: Eurostat, 2009.

The international standardized analyses offer a possibility for surveying the quality of education. The comparative results of Bulgaria's participation in research show a tendency of deterioration in pupils' training, regarding both different educational degrees (worse results at the end of pupils' secondary education compared to the level achieved upon primary school graduation), and dynamics (a lower absolute number of scores in tests and a tendency to lag

behind the rest of the countries in consecutive surveys).

PIRLS (Progress in International Reading Literacy) is a comparative study of literacy among pupils aged nine and ten, at the end of primary education level (4 years of schooling), carried out by the International Association for the Evaluation of Educational Achievement, IEA. Bulgaria is one of the 29 countries to have taken part in the two surveys,

⁵⁹ According to data of OECD there is a significant and increasing gap between the incomes of employed university graduates and secondary school graduates. The greatest discrepancy is observed in Hungary (217%), Czech Republic (182%), USA (172%), Switzerland (164%) and Poland (163%).

in 2001 and 2006. In 2001, Bulgaria ranked fourth, after Sweden (561), the Netherlands (554) and England (553)⁶⁰. The insignificant retreat in regard to the test scores in 2006 led to a comparative downward shift of nine places in the rankings.

TIMSS (Trends in International Mathematics and Science Study) is a study of the world trends in Mathematics and Natural Sciences, carried out by the International Association for the Evaluation of Educational Achievement, IEA. In 2007, in comparison with 1995, Bulgaria recorded the biggest drop in its achievements in the field of mathematics, compared to the rest of the countries participating in the two surveys. Seven countries (out of the 20 that took part in the studies) registered a positive shift in the areas of mathematics and sciences – Columbia, Lithuania, South Korea, the United States, England, Slovenia and Hong Kong.⁶¹

PISA (Programme for International Student Assessment) assesses the literacy of the fifteen-year-old students at the last stage of their compulsory education (8 years of schooling) and is carried out by the Organization for Economic Cooperation and Development (OECD). Three studies were done (in 2000, 2003 and 2006). Bulgaria participated for the first time in 2006 together with another 56 countries, 30 of which were members of OECD⁶². The results for mathematics (413 points) and sciences (434 points) ranked the country respectively 46th and 42nd.

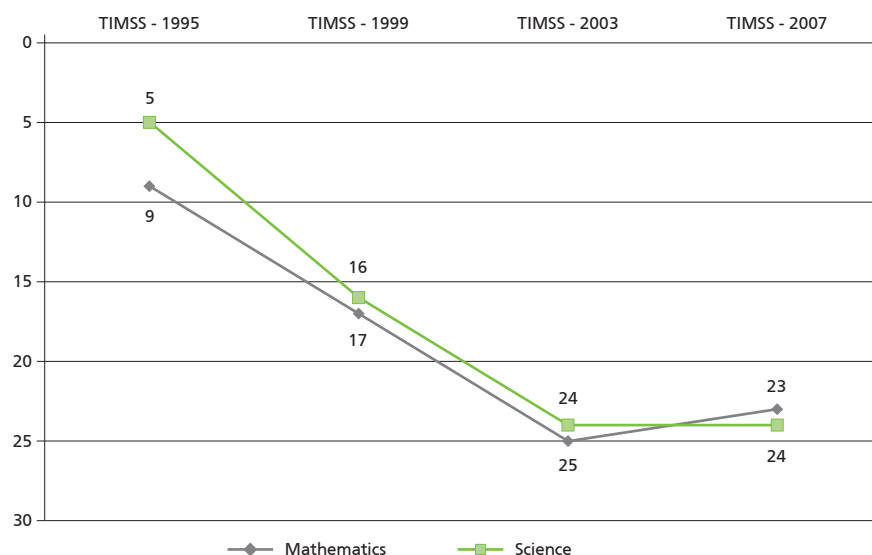
The deepening problem in Bulgaria is the high percentage of children of the compulsory school age who stay out of the education system or who later drop out. The lack of necessary knowledge and work skills threaten their integration into the labor market. While the data about the participation in the educational process in the country for the group aged 5-14 corresponds to the average levels

TABLE 14. PIRLS, RESULTS FROM BULGARIA'S PARTICIPATION

	PIRLS, 2001 45 countries	PIRLS, 2006 45 countries
Total Score	550	547
Ranking	4	13
Shift compared to 2001	-	-3

Source: <http://nces.ed.gov/surveys/pirls/>

FIGURE 59. TIMSS, RANKING OF BULGARIA



Source: <http://nces.ed.gov/timss/>

for the EU, the next age groups (15-19 and 20-29) lag behind regardless of the indicators from the previous years.

In the third age group the Scandinavian countries – Finland (40.4%), Sweden (34.5%), and Denmark (31.9%) have the best results for 2003. They are followed by Belgium and Poland (29.0%) while Luxembourg (6.5%), Slovakia (13.2%), and the Czech Republic (16.6%) are at the bottom of this ranking.

An indicator which measures the quality and the potential of human resources as a unique input stream for the so called knowledge-based economies is the percentage of the population from the age group of 20-24 years who have graduated at least from secondary school. For 2006, by this indicator Bulgaria is in a position which is above the average for the European countries with a result of 80.5 (at 77.8 for the EU-27). However, this result is below the average level of the greater part of the

⁶⁰ The Reading Literacy of U.S. Fourth-Grade Students in an International Context, Results from the 2001 and 2006 Progress in International Reading Literacy Study (PIRLS), November 2007.

⁶¹ Highlights from TIMSS 2007: Mathematics and Science Achievement of U.S. Fourth- and Eighth-Grade Students in an International Context, December 2008.

⁶² Highlights From PISA 2006: Performance of U.S. 15-Year-Old Students in Science and Mathematics Literacy in an International Context, Program for International Student Assessment, December 2007, <http://nces.ed.gov/pisa/>

new EU member states. The completion of secondary school is a necessary threshold for successful professional realization. This suggests that the graduates have skills and habits necessary for the development of acquired school knowledge through the system of higher education or various lifelong learning programs.

The higher education graduates are an indicator for measuring a country's potential for acquisition, development, and dissemination of contemporary knowledge. They supply the labor market with a highly qualified workforce. The percentage of the population with higher education within the active work age is a key indicator for the implementation of contemporary knowledge and the availability of capacity for its application. When this indicator is calculated there are no limitations to the knowledge fields taken into account since innovation is applied in all spheres of public life and it depends on the potential of the whole population of active working age.

The development of the scientific and technological spheres of education plays a fundamental role for the innovation activity of the national economy and the university graduates in sciences and engineering fields are an important element of human capital for innovations. On the basis of the acquired qualification and skills, these people introduce knowledge. They also successfully transfer technologies created outside the country to the practices of Bulgarian business. Bulgaria's lagging behind in these spheres is significant and they should attract future efforts for a reform of higher education.

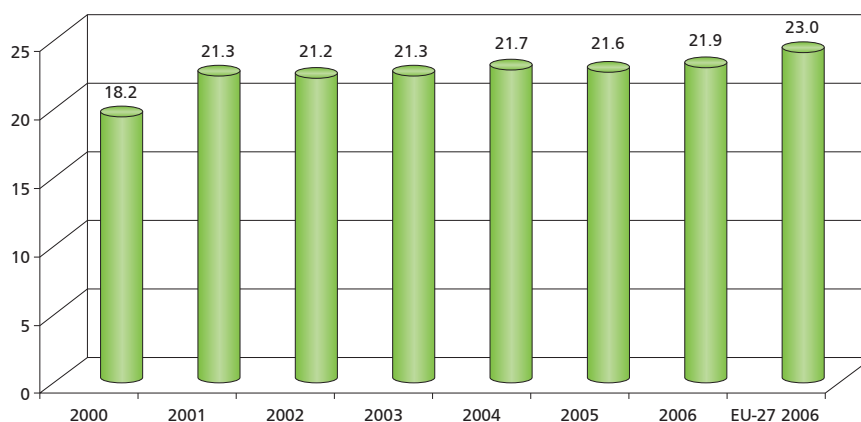
The distribution of the university graduates according to fields of knowledge and academic programs in Bulgaria retains national characteristics. As a trend of change for the period 1998-2006, some of the

TABLE 15. PARTICIPATION OF POPULATION IN THE EDUCATIONAL PROCESS, %

	2003	2004	2005	2006	Change, %
Students aged 5-14 as a percentage of the population aged 5-14	98.2	97.5	97.2	96.3	-1.9
Students aged 15-19 as a percentage of the population aged 15-19	74.2	74.9	75.8	76.0	2.4
Students aged 20-29 as a percentage of the population aged 20-29	15.4	16.6	17.2	18.7	21.4

Source: National Statistical Institute, 2007.

FIGURE 60. PERCENTAGE OF THE POPULATION AGED 24-64 WITH A HIGHER EDUCATION DEGREE



Source: European Innovation Scoreboard, 2007.

studied groups get closer to the average levels of the EU. The most distinct increase is in the field of natural science, mathematics and informatics graduates. The greatest deviation is in the number of graduates in social sciences and healthcare and this trend will continue to increase in the following years. The fact that the majority of the newly opened degree programs, including in the private higher education institutions, train students in the field of humanities, social and economic sciences, leads to an increase in their share and, to a great extent, is due to the low investments for the organization of the learning process in these fields.

With respect to the increasing internationalization of research and innovation activities together with the efforts for creating common European research and educational environment, foreign language skills has become a decisive factor for defining the potential of human resources. These are essential in the integration of different cultural environments and in the transfer of human knowledge. In accordance with this trend the number of people learning foreign languages has decreased to a minimum (0.1%). In contrast, the percentage of students learning two foreign languages at the compulsory school level has increased.

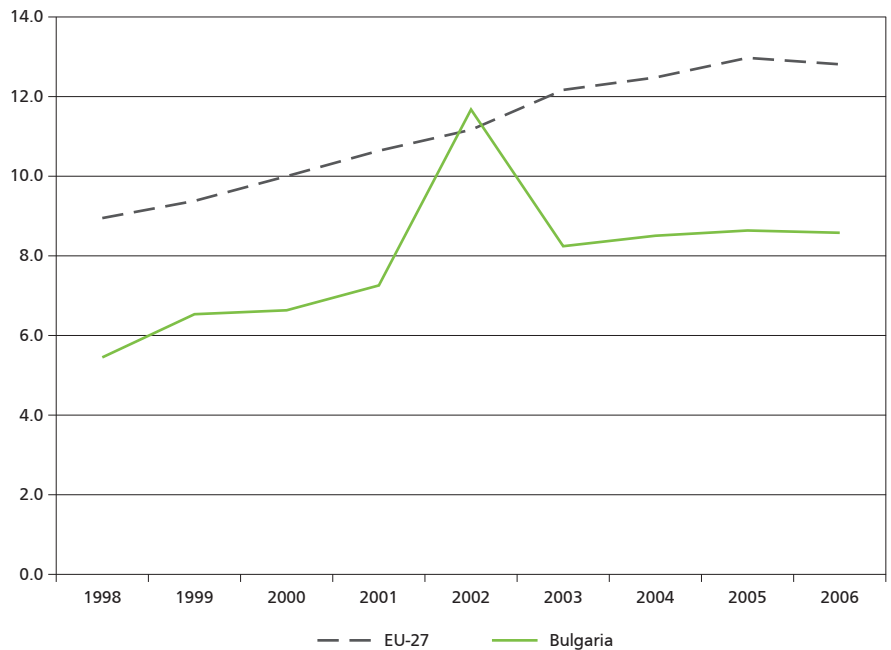
Student mobility is one of the main aspects of the Bologna Process. It is a manifestation of academic activity and a driving factor for the development of the European university environment. Bulgaria's participation in this process is a result of both previously existing and continued reforms and declared intentions for future changes in the context of the Bologna Process. Over the last years the number of newly accepted international students in Bulgarian universities steadily increased which led to a rise in total number of trained foreign citizens. Compared to the situation in the other European countries, student mobility in Bulgaria shows similar characteristics. The leaders in this trend are Germany, United Kingdom, and France, whose university programs have gained recognition and respect for the quality of the offered training.

Bulgaria has not become more attractive to international students (their percentage remains relatively unchanged). Nevertheless, it has not lost its position if only considering the fact that higher education in some other countries has become more popular.

As a percentage of the total number of students, the international students enrolling in the natural sciences and technical sciences programs have the biggest share. This fact is representative of the quality of the training offered in these programs. It also gives both students and lecturers valuable opportunities for participation in the transfer of new technological knowledge and know-how.

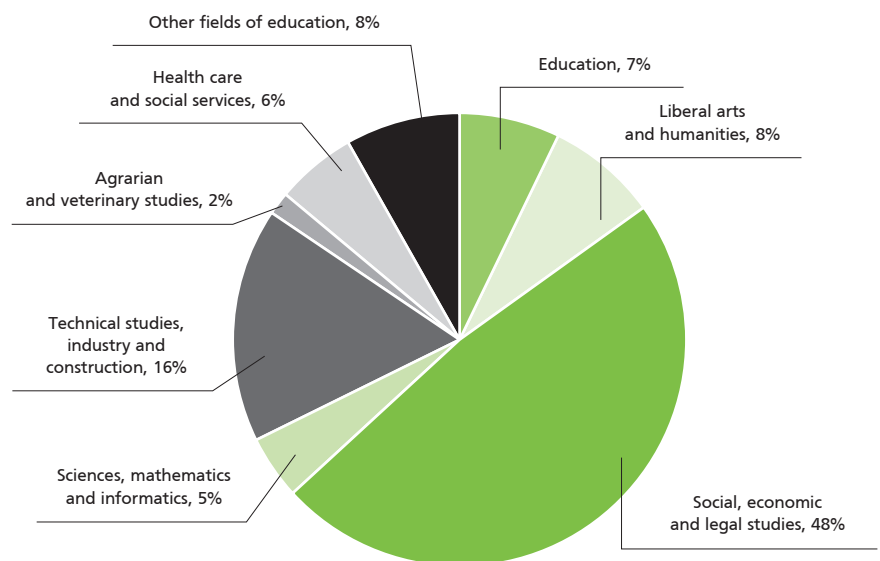
A fundamental characteristic of knowledge-based economies is that they have available potential for the adaptation of new technologies when solving problems through innovations. Innovation activity is based on the existing channels for information distribution and the readiness for accepting new ideas. The latter, in return, is a function of the readiness of the

FIGURE 61. UNIVERSITY GRADUATES IN SCIENCE AND ENGINEERING PROGRAMS⁶³ PER 1,000 PEOPLE OF THE POPULATION AGED 20-29



Source: Eurostat, 2009.

FIGURE 62. UNIVERSITY GRADUATES BY FIELDS OF EDUCATION AND TRAINING⁶⁴, BULGARIA, 2006, (%)



Source: Eurostat, 2009.

⁶³ Includes the number of all graduates with a Bachelor's degree (ISCED 5a) and higher according to the Classification of fields of education and training (KOO-2008): natural sciences (KOO42), physics and chemical sciences (KOO44), mathematics and statistics (KOO46), informatics (KOO48), technical sciences and technical jobs (KOO52), extraction and production technologies (KOO54), architecture and construction (KOO58).

⁶⁴ According to the Classification of fields of education and training (KOO-2008), National Statistical Institute, 2007.

population of active working age to acquire new knowledge and skills and apply them creatively.

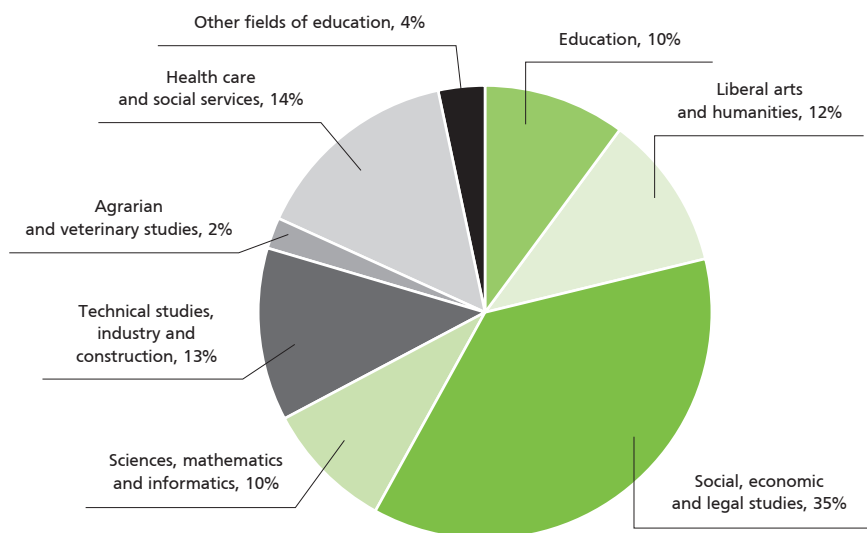
To provide definite knowledge about the world is neither the only nor the most important objective of the contemporary educational system. The dynamic pace of development of sciences and technologies change and interconnect the fields of human knowledge. They pose new requirements in regard to the professional realization of graduates. Thus, it is not important what young people know when they graduate from secondary school or university but what they are ready to learn after that through the various forms of lifelong learning.

Data about a country's participation in lifelong learning reveals the acquired skills for learning, adaptability and propensity for change. Using these criteria for assessment of the educational system, Bulgaria ranks last in Europe with a considerable lagging behind the majority of the member states and the candidate countries.

For 2006 the percentage of the population in the age group 25-64 that took part in formal and informal education was 1.3% compared to the average level of 9.6% for the EU-27⁶⁵. According to this indicator Bulgaria ranks last together with Romania and lags behind Croatia and Turkey which have results of 2.1% and 2.0% respectively. The countries with traditionally high results with respect to the technological potential and the innovation activity of their economies also occupy leading positions as far as this indicator is concerned (Denmark – 29.2; Sweden – 32.1; United Kingdom – 26.6; Finland – 23.1).

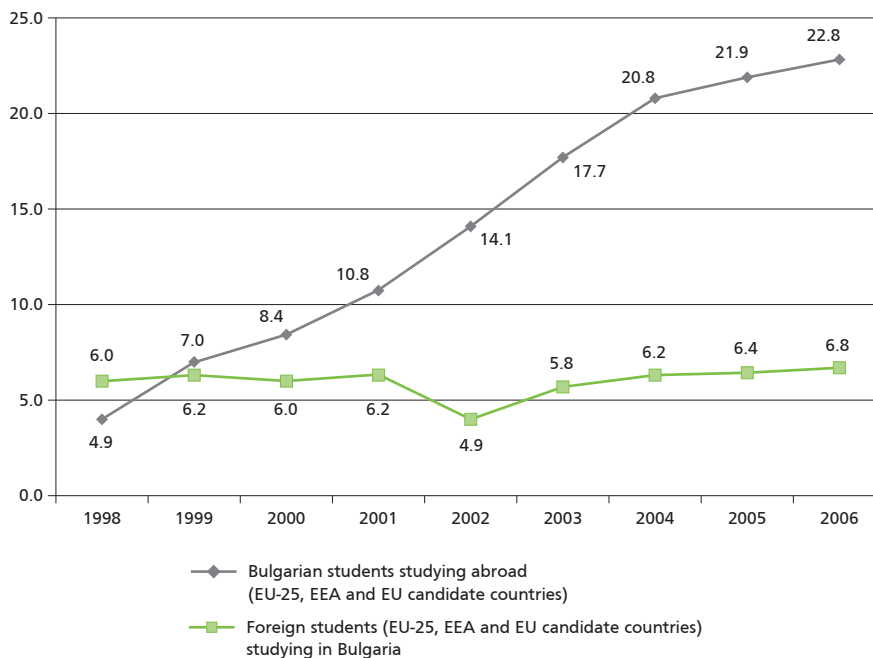
The Adult Education Survey – AES done for the first time by Eurostat as part of the Lifelong Learning Statistics confirms the results of the European Innovation Scoreboard. The analysis

FIGURE 63. UNIVERSITY GRADUATES BY FIELDS OF EDUCATION AND TRAINING, 2006 (%), EU-27



Source: Eurostat, 2009.

FIGURE 64. MOBILITY OF STUDENTS, BULGARIA (THOUSANDS OF PERSONS)



Source: Eurostat, 2008.

includes the countries from the EU plus Turkey, Croatia, Norway, and Switzerland⁶⁶. The study was carried

out during the period 2005 – 2008 but the data refer to 2007 and indicate the participation of adult popula-



⁶⁵ European Innovation Scoreboard, 2007.

⁶⁶ Results about some countries included in the survey will be published by the middle of 2009.

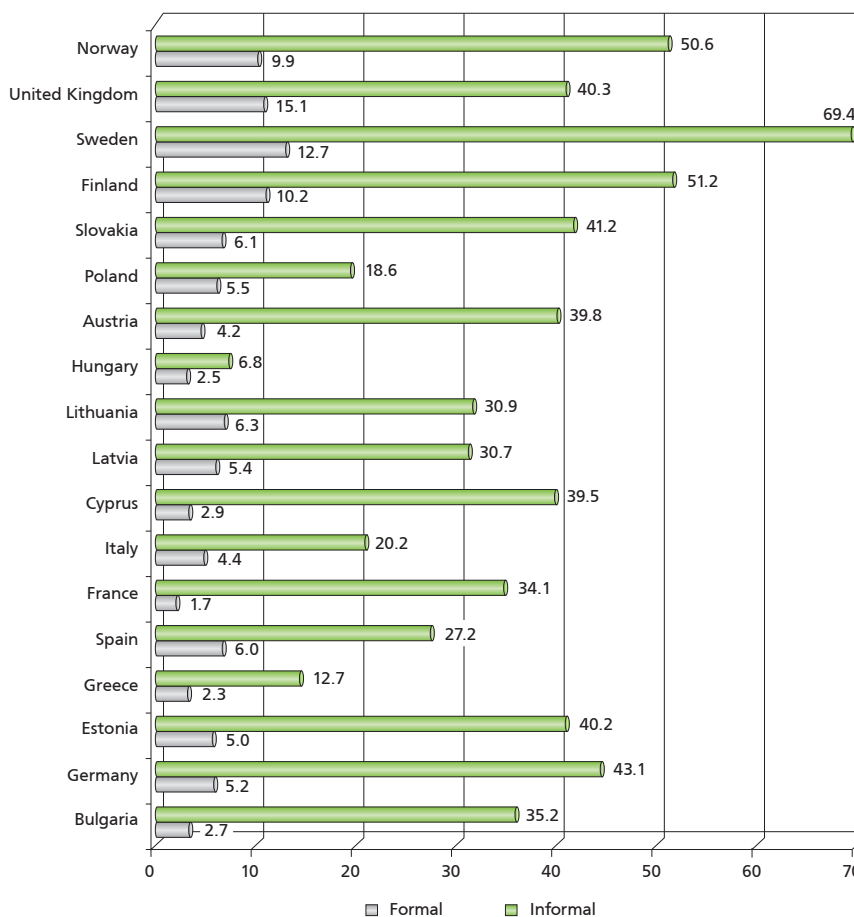
tion in the forms of formal, informal, and individual training⁶⁷ for a period of 12 months.

In all surveyed countries the population aged 25-64 participates more actively in the so called informal training which is done for shorter periods of time, requires a smaller amount of resources (both on behalf of employers and trainees) and is characterized to a lesser extent by leaving the work place. With regard to informal training, Bulgaria is in the middle of the ranking. The participation in formal training is relatively less common (2.7%) which positions us only before France (1.7%), Greece (2.3%), and Hungary (2.5%).

When this data is interpreted, the characteristics of the national educational systems should be taken into consideration. In general, in the Scandinavian countries the average age at which students enroll at universities is higher compared to that in the countries from South Europe – Iceland 26, Denmark – 25.5; Sweden – 25.3; Finland – 24.4. At the same time the data shows that the average age for Bulgaria is 21.5; for France – 20.7; and for Greece – 20.5. This means that in age group of 25 – 64, studied by Eurostat, the majority of students from the second group of countries have already completed their education. Actually, the continuation of the process of education in the different European countries varies but in years it can be from 2.3 for Finland, 19.9 for Sweden and Iceland to 16.7 for France and 15.6 for Bulgaria.

The analysis of participation in formal and informal training by age group shows the same trend – for each country the highest percentage of the enrolled trainees is for the group of young people aged 25-34. The percentage of trainees decreases for the next two age groups – between 35-54 and 55-64. In Bulgaria almost half of the respondents from

FIGURE 65. PARTICIPATION IN LIFELONG LEARNING, % OF THE POPULATION



Source: Eurostat, 2008.

the first group (44.7%) took part in training during the 12 months preceding the study. The values of this indicator for the next two groups are lower – 39.7% and 20.3% respectively. The lowest results are recorded for Hungary (15.8%-9.0%-2.5%) and Greece (22.7%-14.0%-5.1%).

In comparison the data about Sweden regarding the percentage of population from the respective age group is respectively 81.0%-76.4%-60.7%. The results for Finland, Great Britain and Norway are similar. It seems that the

reason why the population of the Scandinavian countries participates actively in lifelong learning cannot be found only in the characteristics of the educational systems of these countries. Rather, it could be explained by the desire for self-perfection and the priority for personal and social development of the Scandinavians.

Indicative of the predetermined attitudes regarding the knowledge and the usefulness of continuous education together with the degree

⁶⁷ The formal training is done at schools, colleges, universities, specialized higher schools or other educational institutions following a curriculum with respective number of classes which are approved in advance. As a result of this training students receive an educational degree. The informal training is done at courses, conferences, seminars, private tutoring, etc. regardless of the fact whether it is connected to the present or a possible future job of the trainee or is for private, social or household purposes. The individual training is organized without a lecturer and it carried outside the formal system of education. Its aim it to increase the knowledge and skills of the individual.

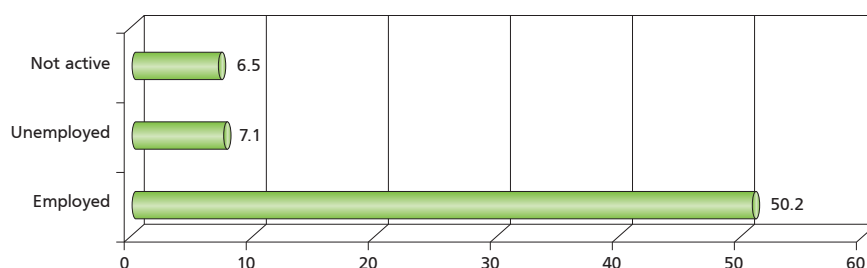
of satisfaction from participation in previous training is the data about the respondents' inclination to participate or not to participate in future training. In Bulgaria 58.2% of the respondents who have not taken part in trainings say that they do not want to be trained in the future (Sweden – 18.4%). Only 7.2% of the people who have undergone some kind of training say that they would like to participate in future trainings, too.

The allocation of population by participation in the continuous education indicator, according to employment status, shows that most active are the people who work. The lack of initiative in the unemployed and those who do not seek employment (inactive) is a factor that causes them to continuously remain in these groups.

The analysis of the reasons leading to participation in lifelong learning confirms the influence of the current job when making such decisions. The share of the respondents who participate in training because it is either obligatory or because the trainees are of losing their jobs is almost 15%. Almost 45% of the respondents look at the improvement of their qualification and the acquisition of new skills as a possibility for a career and personal development (including by receiving certificates). Only 0.6% of the surveyed people consider trainings to be a stepping stone on their way to starting up their own business.

Employers in Bulgaria do not cause significant problems to employees who want to participate in formal or informal trainings. Only 11.6% of the respondents say that they have had such problems. Another 24% have not managed to squeeze the training into their working schedules. For the majority of the European countries these reasons for non-participation in training are determined as much more serious. On the other hand, the employers in the country do not

FIGURE 66. PARTICIPATION IN LIFELONG LEARNING BY EMPLOYMENT STATUS, % OF RESPONDENTS IN THE RESPECTIVE GROUP, BULGARIA



Source: Eurostat, 2008.

express readiness for active support regarding the training of their employees. Almost 60% of the surveyed refused to participate in training because they lacked financial resources. This factor has the most negative impact in Bulgaria compared to the other countries included in the survey.

The launch of the Operational Program Human Resources is aimed at addressing exactly this problem. Nevertheless, the planned schemes for financial support can be easily transformed into yet another possibility for social security schemes. In order to avoid this problem, the grants for participation in training should be related to mechanisms for control and assessment of the effectiveness of training (including after their completion). The investment in the acquisition of new knowledge and skills do not always lead to immediate results. Thus the effect of their realization should be assessed in the long-term.

Most of the problems that higher education in Bulgaria faces are common for many of the European countries, including those with developed economies. Education is a fairly conservative system and it is very difficult to make reforms in this sphere. The dynamic changes at the beginning of 21st century, however, impose reconsideration of all issues related to the functioning of national educational systems and their priorities. Countries

in Europe work on approaches and mechanisms that are believed to be able to change the education into a more flexible, adaptive and effective working system. These approaches and mechanisms (priority for Bulgaria as well) concern the following:

- Curricula orientated towards the business requirements and demand in the labor market, development of entrepreneurial skills. Making the curricula more flexible and accessible to students through their right of choice will increase teachers' motivation to offer contemporary knowledge of high quality and at the same time it will make the respective subjects more attractive to young people. Acquiring knowledge about the essence and the importance of innovation through the curriculum or through participation in informal short term forms of training is an approach applicable to increase the entrepreneurial activity of young people as an alternative to their participation in the labor market at the exit of the secondary and high education system. This approach is regarded as an opportunity to overcome the problem of relative contraction of the economically active population at the expense of categories under and over the age of labor efficiency.
- Mobility and participation in networks. Bulgaria continues to lose valuable human capital in the

form of migration streams and students who continue their professional realization abroad. The only chance to actually attract their potential or as a channel of knowledge and experience transfer is for the educational system, research sector and business to become as open as possible for interaction, implementation of joint projects and exchange of good practices. Active and equal participation of Bulgarian institutions in the European educational and research area is an appropriate approach provided that all mechanisms included in them are used adequately.

- Funding. The lack of sufficient motivation (regarding payment as well as career development) still keeps young people far from universities. Regarding age structure, the system of higher education is a truncated pyramid resting on its small base. This base tends to become narrower and in such a position the pyramid is unstable and could easily overturn.

The crisis in the financial and real sector will undoubtedly have an impact on the level of training of human resources in Bulgaria. Trends that are already observed and that are expected to deepen are related to: freezing of

hiring, reducing costs for maintaining university equipment, and reducing public funding when it is redirected to save the real economy.

Nevertheless, it is necessary to mobilize resources to increase payment and grants, together with binding them to a well-grounded system of indicators to measure the long term effect of participation in the process of education. The experience of developed countries shows that applying such mechanisms is a way to improve the quality of the educational product and the effectiveness of educational system functioning as a whole.



5. Information and Communication Technologies

Information and communication technologies (ICT) are one of the most important engines for innovation in enterprises and growth of economies. ICT enter enterprises as general purpose technologies (GPT) which are integrated in the new production and management processes. ICT also change the organizational boundaries and transform the models for adding value, competitiveness, and consumption. The effects of their use include decreased relative transaction costs, shortened product life cycles and structural changes in markets (convergence, concentration and power of bargaining). The expenditure for Research and Development, patent activity and risk financing in the ICT sector exceed substantially that in the other sectors in the OECD⁶⁸ countries. R&D, focused on ICT, nanotechnologies and new materials, is among the most important driving forces leading to product innovations. The driving forces are connected to the health and leisure industries (including electronic games). The modern processes and marketing innovations cannot exist without ICT. The internet and web-based services have caused important social innovations, including such in the sphere of political processes and government. The ICT infrastructure is already considered an essential element of the critical infrastructure of each country, while the issues of digital security are of primary importance for the policy of each country or corporation.

⁶⁸ OECD, 2008, Information Technology Outlook 2008, p. 144.

Bulgaria was early adopter in terms of production of ICT and their use in other sectors in the 70s and the beginning of the 80s. Initially there were delays in the launch of new products after their world promotion. These delays were from several months (electronic calculators) to one or two years (discs) even under the conditions of relatively long technological and product life cycles. Gradually the delays increased⁶⁹ while the respective technological cycles decreased which resulted in Bulgaria being already behind in implementing ICT at the end of the 80s. The collapse happened during the first years of transition when there was no longer either access to know-how through industrial espionage or demand for ICT production for the enterprises under the conditions of energy, currency and trade crisis. The 90s were a period of serious technological lagging behind and decapitalization of enterprises. Nevertheless, some international research findings⁷⁰ defined Bulgaria as one of the potential technological leaders⁷¹ at the beginning of the millennium.

Despite the desire of its politicians, Bulgaria could not create technological champions like Korea, Finland

or the US but develops both niche technologies (mainly in the field of software) and production (hardware components). Bulgaria is already second after Ukraine in investments in ICT as a percentage of the GDP for 2006⁷² and among the 25th most fast-developing ICT markets in the world for the period 2003-2007. Bulgaria is ninth in the world regarding the growth in the production of electronics for the period 2005-2008, with the highest growth registered in the production of radio and radar equipment and data processing. Our export of electronics (as a percentage of the GDP) for 2007 is comparable to that of the US and the United Kingdom. It is also 2-3 times smaller than the export of Vietnam, Japan, Poland, and Germany and considerably bigger (4 to 9 times) than that of Russia, India, Brazil and Turkey⁷³.

When the ICT models of implementation and their role for the innovation in enterprises are analyzed, it is appropriate to divide ICT according to type of their purpose, namely general and specific⁷⁴. Despite the relativity and changeability of this division⁷⁵ it can be stated that the general purpose refers to technologies which are widely used in all sectors (including

end users) and facilitate the carrying out of various functions (mobile phones, e-mail, computers, networks, office packages, the internet, websites, etc.). The specific purpose, on the other hand, refers to applications in specific sectors or functions (production, marketing, or organizational). The decisions for implementation and the models of diffusion depend on the type of purpose of the technologies. The implementation of the general purpose technologies usually has a less powerful innovation impact and economic effect on the enterprises compared to the specific purpose technologies. Nevertheless, the former are often a prerequisite for the latter since they create a state of readiness for a quicker and easier implementation partially because the users are already partly trained how to use them. General technologies are extremely important for the innovative environment. They are the fundamental factors of the environment – if they do not exist, the enterprise will have serious problems. The specific technologies are usually implemented as a result of companies being aware of their necessity and have a direct measurable effect on the effectiveness of the organization.

⁶⁹ For example, IMCO-1 (acronym for the 1st Bulgarian Individual Micro-Computer) appeared in 1980, three years later than its prototype Apple II, while the first generation mobile phone technology came to Bulgaria nearly 14 years after it appeared in Japan in 1979 and in North Europe in 1981.

⁷⁰ UNDP, Human Development Report 2001: Making new technologies work for human development, Oxford University Press, 2001, p. 45.

⁷¹ The research puts the countries into four groups according to their index of technological achievement: leaders, potential leaders, dynamic implementers and marginalized ones. Among the other potential leaders are Spain, Italy, the Czech Republic, Hungary, Poland, Romania, Costa Rica, etc.

⁷² IMD World Competitiveness Yearbook, June 2008, IMD, Lausanne p. 429.

⁷³ OECD, 2008, Information Technology Outlook 2008, p. 114-115.

⁷⁴ Other classifications are also used – horizontal and vertical, mass and niche, etc.

⁷⁵ Some technologies change their purpose in the process of their dissemination. For example, the purpose of the personal computers in the 80s, the Internet in the 90s and the websites in the middle of the 90s would rather be described as specific and their usage as limited, while now they are considered to be general purpose technologies. In the 1940s the President of IBM expected that the world market for computers would not exceed 5 machines, while at the end of the 70s the President of DEC did not see any reasons why someone would like to have a computer at home.

General Purpose Information and Communication Technologies

The introduction of computers in enterprises (91%), connecting them to local networks (60% of the enterprises according to Eurostat and 78% according to Vitosha Research) and to the internet (83% of the enterprises and 79% of the computers) has reached its plateau in Bulgaria under the present structure of the economy⁷⁶. At the beginning of 2009, only 1% of enterprises do not have computers but believe they need some (between 1-3 computers). 20% of the enterprises that have computers estimate that they need more. Altogether the additional computers needed by businesses amount to 4% of the present number, which mirrors the natural rate of growth⁷⁷. In two thirds of the enterprises with more than one computer (and more than 10 employees) all available computers are connected in a network. The fact that very few employees regularly use computers at work (22%) is not due to the lack of computers but to the lack of operational necessity which is a result of the nature of the job. The failure of Bulgaria to keep abreast with the average level for the European Union (50%)⁷⁸ is a result of the country's specialization in low technology sectors characterized by less communication and data processing.

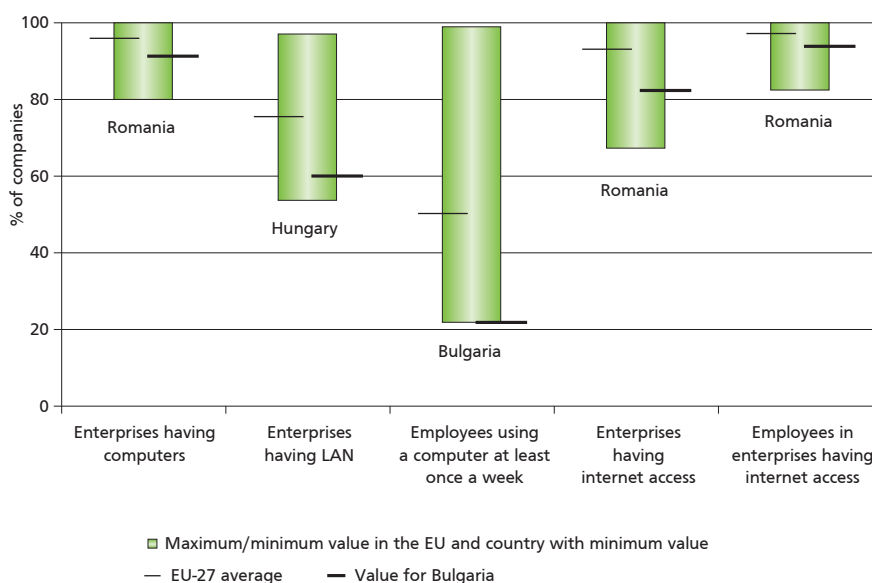
Because of their postponed and delayed introduction in enterprises, the General Purpose Information and Communication Technologies (GPICT) could not directly succeed in increasing the businesses' productivity and innovativeness (at least because it is difficult to isolate their effect in comparison with the other factors which influence the total productivity). Nevertheless, the firms which have computers are more innovative (an average index $i=15$) than those which do not have (an av-

erage index $i=1$) because the former are statistically significant ($p<0.01$). Even if we isolate the effect of the big firms and take into consideration only those with less than 10 employees, the statistical significance remains but the average index is $i=8$. There is a significant but very weak correlation ($r=11.5$, $p<0.01$) between the index of innovation and the number of computers per employee. This is, however, due to the fact that in the intensively innovative sectors there is a long-established practice

to use computers in comparison with those sectors which are less intensive concerning innovation. At the same time there is no correlation between the innovation of enterprises and the degree to which computers are connected in networks or to the internet. The companies which introduced GPICT early are more innovative compared to those which implemented them later.

Even after the introduction of GPICT, their functionalities⁷⁹ are rarely fully

FIGURE 67 INTRODUCTION OF COMPUTERS AND THE INTERNET IN BULGARIAN ENTERPRISES AND THE EUROPEAN UNION IN 2008



Source: Eurostat, 2009.

⁷⁶ The cited data comes from Eurostat. The percentage of connected computers is the average value of this indicator from a research done by Vitosha Research, December 2008. Data about the historical development of the processes of entering can be found in *Innovation.bg 2008* (p. 113-115).

⁷⁷ Data source: Vitosha Research, 2008. In a survey from 2006 using the same method the needed additional computers were 3.5% (see *Innovation.bg 2007*).

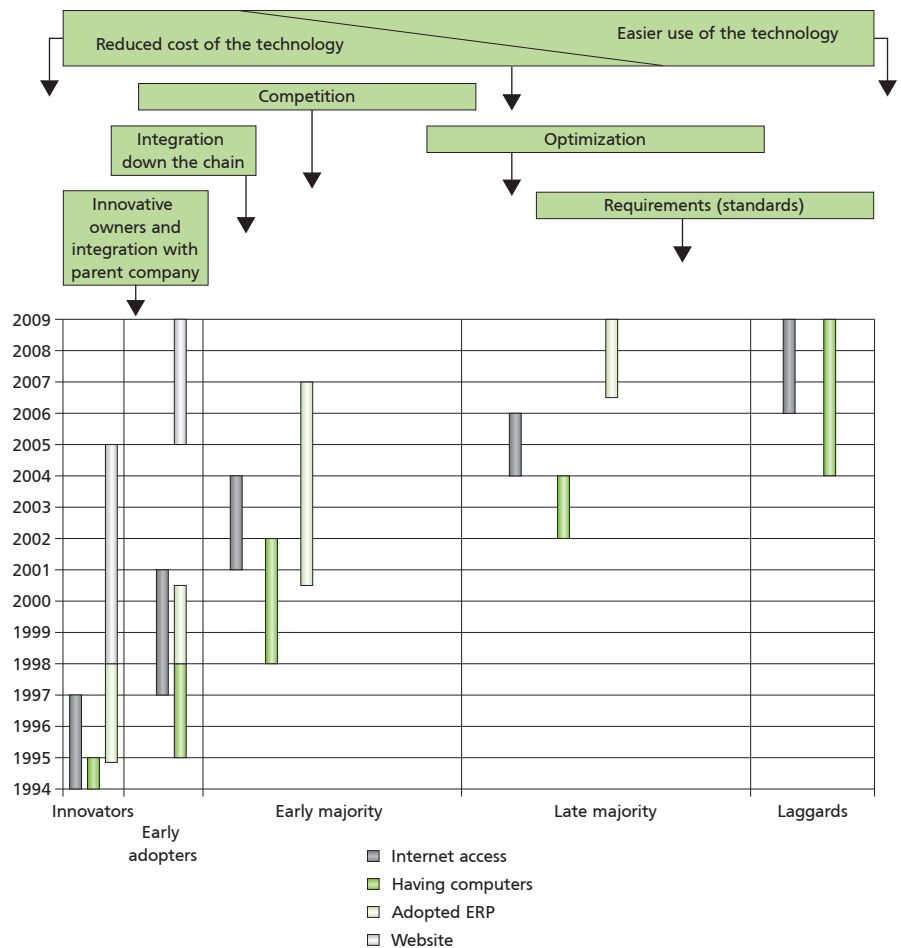
⁷⁸ The Eurostat data seriously overestimates the actual situation in some countries. For example, regarding this indicator in Croatia there is an inexplicable increase from under 40% to 99% for one year. Even for the most technologically developed countries a result according to which 99% of the employees use a computer at work, even if only once per week, is suspicious.

⁷⁹ The same tendency for not using a great number of the functionalities of mobile phones by users is described in *e-Bulgaria 2006* (WAP, GPRS, Bluetooth, e-mail, browser).

used, regardless of the fact that they directly lead to an increase in the effectiveness of enterprises. For example, the network features of office packages and e-mail programs are rarely used. The connection of computers in local networks is a result of the optimization of document printing⁸⁰ or access to common archive or information resources (files or programs). It is not due to specific technological needs or the manager's decision for collaborative work in real time with a particular software application using network facilities.

Most often the initial introduction of computers in a particular organization in Bulgaria⁸¹ is administratively motivated by the preparation of tenders bids, needs of communication, or bookkeeping considerations. Later their usage is gradually upgraded by the development of infrastructure (LAN and WLAN networks, servers) and the implementation of both additional functionalities (such as management of warehouse inventory, human resources, projects, etc.) and specific technologies which meet the particular needs of enterprises (CAD/CAM, ERP, CRM, platforms for e-learning, etc.). Nevertheless, there are rare occasions in which the enlargement of the computer base, local networks and the internet are a result of a particular organizational or process innovation which comes with embedded Specific Purpose Information and Communication Technologies (SPICT) which often require the availability and usage of general purpose ICT. Such examples include the implementation of computerized machines for production; systems for marking goods (barcodes), identification and tracking of stock

FIGURE 68. DYNAMICS OF THE ADOPTION OF MAJOR INFORMATION AND COMMUNICATION TECHNOLOGIES IN BULGARIA



Source: INA-3 and Applied Research and Communications Fund, 2008.

inventory in production and distribution processes and systems for the control of work hours.

When the diffusion of ICT in enterprises is studied⁸² the following three groups of factors are taken into consideration: external pressure (competition, partners, and regulatory changes); the organization's readiness and compatibility (financing, culture, work processes) and the management's ex-

pectations (connected with the process and result of ICT implementation). The *E-Bulgaria 2006* report defines the geographical remoteness from the big internal economic centers and the export orientation of the companies, as significant factors for the creation of a website. *Innovation.bg 2007*, on the other hand, states that the vertical and horizontal networks in which the enterprise participates have a stronger influence. These fac-

⁸⁰ This does not necessarily mean the use of a smaller amount of paper but an optimization of the number of printers and the printing time. International research shows that the consumption of paper increases after the introduction of the paperless office.

⁸¹ This conclusion is valid for the period after 1990. A large number of the implementations before that were rather production-oriented in nature. Of course, a small number of Pravets Computers were bought in enterprises as a status symbol of their managers and were primarily used by their children – a trend which remained stable well after the massive introduction of computers in households after 2000.

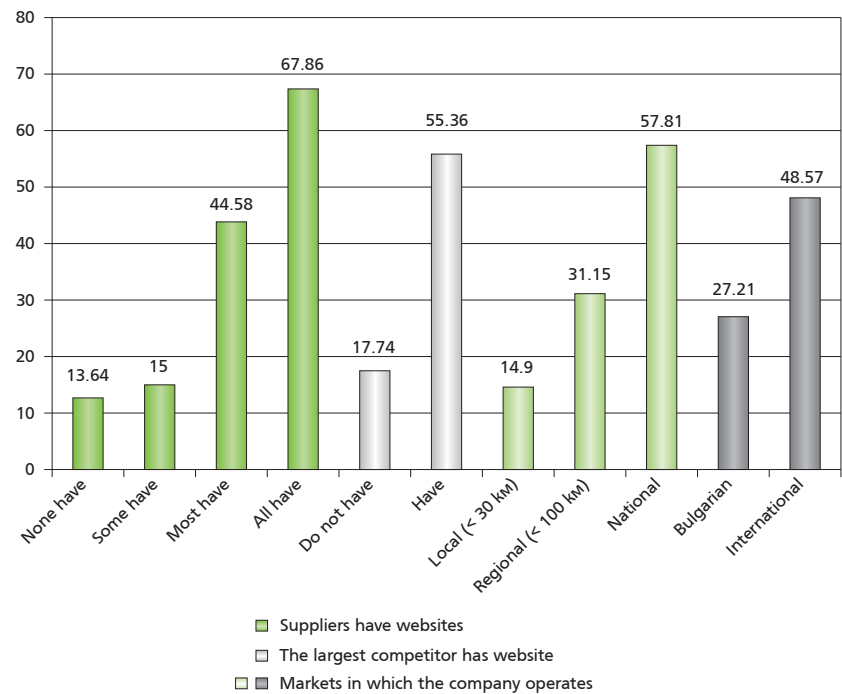
⁸² See for example Grandon, E. and Pearson, J. (2004) *Electronic commerce adoption: an empirical study of small and medium US businesses*, in "Information & Management," v42, pp 197-216. In Bulgaria the only formal modeling of the ICT diffusion using the Bas model has been done for the introduction of mobile telephony by Yordanov, R. (2008). Forecasting the diffusion of innovative products on the Bulgarian market (based on the example of mobile telephony) in Petrov, M. (editor) *Innovations: European, National, and Regional Policies*, Applied Research and Communications Fund, Sofia, 2008.

tors are even more important when SPICIT are introduced (e.g. ERP and e-business applications).

Statistically significant ($p < 0.01$) are the differences in the probability for a company to have a website depending on the percentage of its suppliers with websites, whether its main competitor has a website, the type of market it operates in, and the size of its market share. The fact that a bigger number of the companies operating in the domestic market have a website compared to those exporting their production is determined by two main factors. On one hand, there is a number of exporters who have long-term business contacts with a very few clients. These companies do not have the immediate objective to increase the number of their present contacts and they do not need to support a website to maintain them. On the other hand, the companies which operate in the domestic market have to serve much bigger number of customers (including end customers) and naturally have to compete with other companies for the clients' attention, money and loyalty.

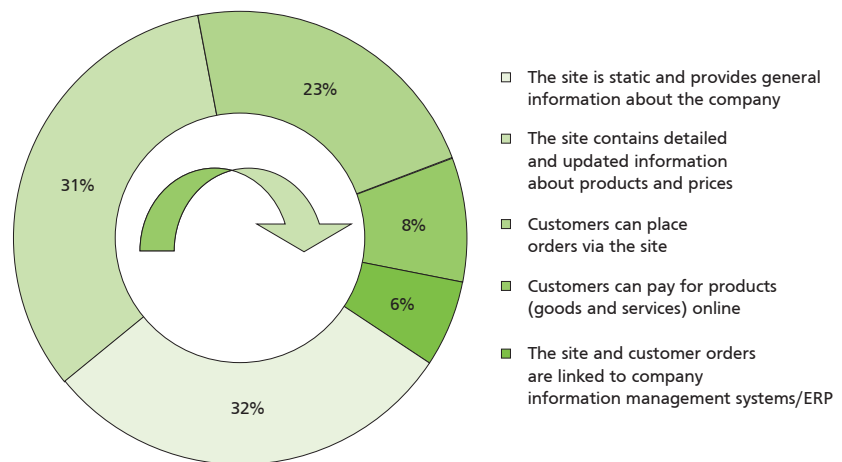
A little more than a third of the sites can take orders from clients, 14 % accept payment through their pages and 6% claim that customers' orders are directly connected to management information systems. Although the issue refers to ERP, here it is also a matter of partial functionalities connected with the management of orders and deliveries. The payments include both transactions with bank cards and text messaging with added value. In the country there are about 18-20 thousand traders who accept payments by POS terminals (this amounts to 11% of the VAT- registered companies) and approximately 500 traders who are registered in epay.bg. The slow adoption of the online payment reveals the lack of

FIGURE 69. PERCENTAGE OF COMPANIES HAVING WEBSITES IN RELATION TO KEY EXTERNAL FACTORS



Source: Vitoshka Research and Applied Research and Communications Fund 2007.

FIGURE 70. FUNCTIONALITIES OF THE WEBSITES OF BULGARIAN COMPANIES (% OF COMPANIES)



Source: INA-3.

trust between the contractors along the chain.

An interesting example of legislative innovation that has led to the quick

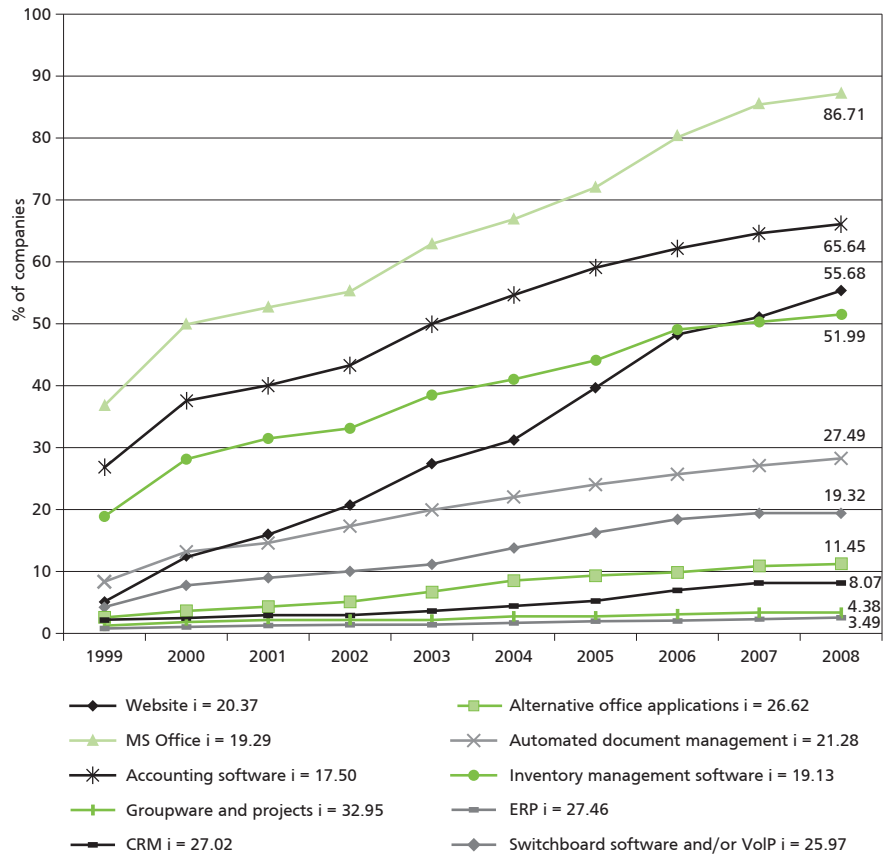
introduction of ICT is the Electronic Signature Law. At the end of 2008 Bulgaria is a leader in Europe with 40% introduction and use of electronic signatures with special protection.

Specific Purpose Information and Communication Technologies

The implementation of SPICT is a considerably more difficult task than the implementation of GPICT. The requirements for success encompass available human capital in the enterprise, technological compatibility and consultants who are experienced in the management of change and implementation of respective technologies. While GPICT actually start working immediately in a minimum mode, the process of implementation and tailoring of some systems may take a very long time (normally between four and six months, but often longer) and there is even a risk of terminating them.

The implementation of high class ERP systems⁸³ in Bulgaria started during the period 1996/1998 but the process then took more than a year to implement (for example Ideal Standard – Vidima Plc, Sevlievo). The Bulgarian subsidiaries of international companies are pioneers in the field because the implementation is an element of the global strategy and directly optimizes the relationship with the parent company (including the financial record keeping in dynamic markets which is of significant importance when the shares of the company are traded on the stock market). The choice of system is pre-determined in such cases; the unknown variable is only who will implement it. In the later years of the implementation process there were cases of importation of consultants from abroad when there was not enough expertise for the implementation of a particular system in Bulgaria. The number of used high-class ERP systems in Bulgaria is estimated at between 500 and 700. Regardless of the fact that there are mini ERP systems available intended for small and medium enterprises that can be implemented in three to four weeks,

FIGURE 71. DYNAMICS OF THE INTRODUCTION OF ICT IN ENTERPRISES IN BULGARIA (1999-2008) AS A PERCENTAGE OF THE COMPANIES AND THEIR AVERAGE INNOVATION INDEX FOR 2008 (i)



Source: INA-3.

the evolutionary development of Bulgarian accounting and inventory tracking systems which resemble the mini ERP systems after adding some modules and functionalities, is below 4%. The expectations that, with the help of the Operational Program "Competitiveness," a considerable number of firms will manage to introduce such systems following the experience of Greece were not met. In addition, the gas crisis will shrink the plans for investments in such systems in 2009.

The problems concerning the implementation of systems with more modules are often due to inadequate planning and are related to factors such as lack of knowledge about the business processes in the enterprise, lack of attitude to change in the employees, the turnover of key staff working for the host company or for the company implementing the technology. Taking into consideration these factors, the market for business process modeling developed in the first years after 2000. The additional

⁸³ The first systems for resource management in business appeared in the 60s. Their main focus was on raw materials, stock inventory, orders and the logistics but they gradually developed so that they included real time management of all business process based on Services Oriented Architecture (SOA). The term ERP was introduced by Gartner in 1990.

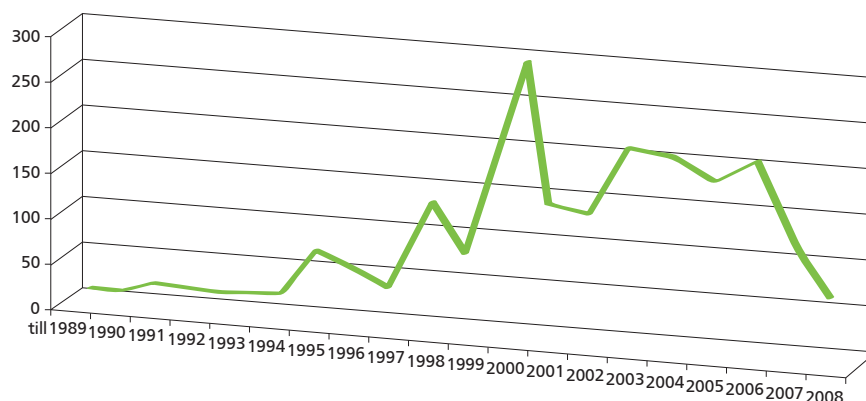
factors that contributed to its growth were the adoption of a number of regulations and quality standards. For example, the software and the consultant services for business process modeling concerning the preparation of documentation and/or the implementation and maintenance of the ISO standards were considerably cheaper than the classical type of consultants from the mid-90s. The requirements of the companies from electricity, telecommunications, and water supply sectors were also a serious incentive for the implementation of business process management facilitated by SPICT.

The introduction of groupware systems and the process of project management are similar to and slightly ahead of the ERP systems (with about 20-30%) and are, to a great extent, due to a projects management. The groupware systems have also been implemented in companies that do not need ERP systems (small, virtual and knowledge-intensive companies).

A considerably bigger number of companies use SPICT for stock inventory management (half of them), document circulation (more that one quarter), project management and groupware systems which are usually different modules or functionalities within the high-class ERP systems. During the last two years there is a trend towards a decrease in the growth in the use of these systems which is a sign that, to a certain extent, the companies which needed them have already implemented them.

There is a similar trend as far as the total number of implementations is concerned. They also include websites, telephone switchboards, and office packages. This means that in the coming years, the priority of ICT policy will be the integration of the existing systems and the increase in the effectiveness and use of available functionalities rather than the

FIGURE 72. NUMBER OF ADOPTIONS OF 10 SELECTED ICTS IN DYNAMICS PER 1,000 ENTERPRISES



Source: INA-3.

investment in brand new implementations. This conclusion is further substantiated by the allocation of funds in the expected IT budgets for 2009 where the highest percentage (45%) is for IT maintenance services and internet⁸⁴, while 39% are planned for upgrading the equipment (computers and networks) and only 16% are for investments in the implementation of new software and IT systems. A bigger percentage for new implementations from the total IT budget is planned by the more innovative companies (correlation $r=0.192$, $p<0.01$).

Although the companies have systems that cover three or four functionalities⁸⁵, they rarely (only 2-3%) claim they have ERP systems. Only when the companies have all of the five functionalities, the majority of them (80%) say they have ERP systems. This indicates once again the lack of integration of these systems. The reasons are usually in the fact that the systems were installed at different periods by different implementers and are used by different employees whose coordination is achieved through classical methods (meetings or e-mail) and it is

necessary to input data from one system into another.

The use of systems which offer most of the typical ERP functionalities is associated with a higher innovativeness of enterprises and this correlation is statistically significant. Most innovative are the companies (with an average index $i=33$) which use groupware systems and project management, followed by the ones which use ERP and CRM systems (with an average index $i=27$). The companies with the average lowest innovation index (close to the average for the study) according to the 10 selected ICT are the companies which use accounting software ($i=18$), stock inventory software ($i=19$), and Microsoft office packages ($i=19$).

Very often users and implementers of ERP emphasize the more innovative character of the system by pointing out that ERP is based on international management experience and in this way the company receives for free part of the know-how of the best in the sector. Training and application of practices from other industries is an additional positive factor and it is



⁸⁴ The introduction of the internet in enterprises is discussed in details in *Innovation.bg 2008*. Actually, all enterprises use broadband access (including, as an alternative, in the house of the manager of the SOHO segment).

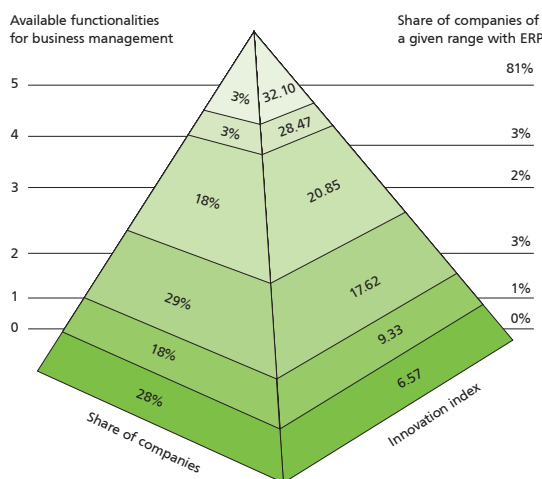
⁸⁵ Accounting, stock inventory, document circulation, customer relationship management (CRM) and systems for project management and collaborative work.

learning. The demand for this type of service is created by enterprises that are involved in very intensive training activities, for example the pharmaceutical industry. The government turned out to be another serious client. The managers, looking for optimization of expenses for compulsory trainings turn to e-learning providers and realize considerable economic benefits – not only of money but of the time of their employees. This market is also closely connected to the market for electronic tests⁹⁰ for the needs of human resources management departments. These tests not only save time and money but also create possibilities for more complex agreements and cooperation between companies. It will not be long before corporate training, team building and personnel recruitment are done (at least partially) in 3D environments⁹¹.

In each sector there are specific information technologies which directly increase the effectiveness of certain functions or the overall productivity of enterprises (CAD/CAM in textiles, GIS/GPS in transport and logistics). These specific information technologies are also a prerequisite for the inclusion of Bulgarian companies in the global production chains which facilitate the innovation process (modeling, virtual testing, quick prototype preparation) by reducing the product cycle (many times) and decreasing the marginal price of the next implementation or they are just a condition for the provision of particular product (billing systems).

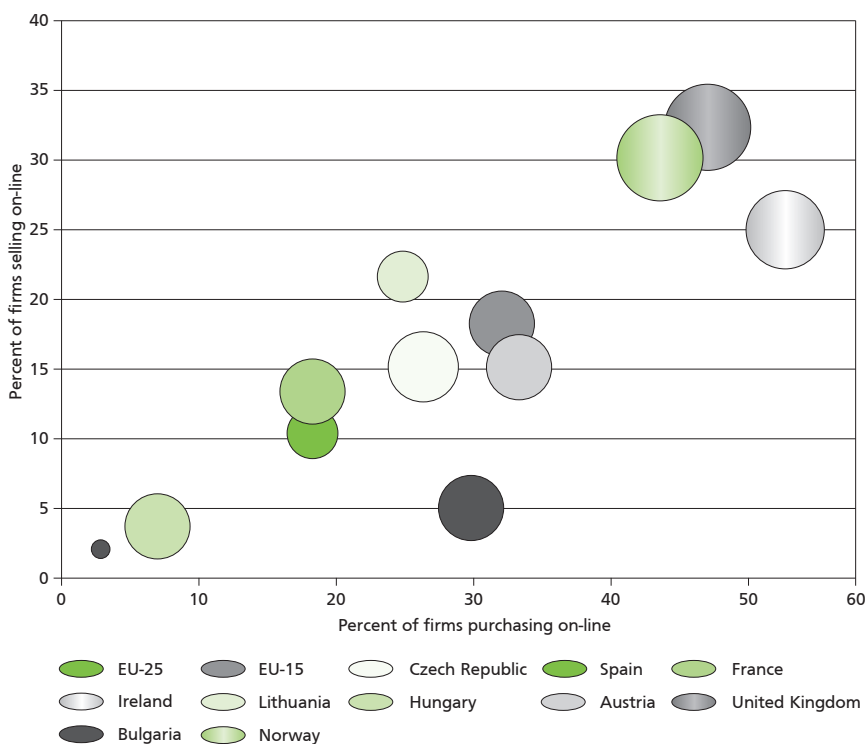
In other cases the benefits of the SPICT depend on the degree of automation and digitalization of production. The price and time for the implementation of a system for document circulation depend on whether the whole communication is already electronic, and it only has to be input automatically in the system, or the whole documentation history has to be digitalized, the habits of many

FIGURE 73. PYRAMID OF THE FUNCTIONALITIES OF BUSINESS MANAGEMENT SYSTEMS⁸⁹



Source: INA-3.

FIGURE 74. ONLINE TRADE IN 2008 IN EU-27



Source: Eurostat, 2009.

⁸⁹ Each layer of the pyramid has a volume which corresponds to the percentage of companies (shown on its left) with a certain number of functionalities.

⁹⁰ At the moment the leader in this field is OC Bulgaria, which holds the rights for the majority of tests used in business.

⁹¹ Leading universities like Harvard, Princeton, Pennsylvania, Ohio and others have buildings in Second Life, which are used as a tool for additional e-learning. What is more, at the end of 2008 a legitimate Bachelor's degree program starts in Vietnam and it will be provided in the format of a 3D game.

people changed, etc. The situation with automation of the production process in enterprises is similar. The foreign companies think that the machines used either already have digital data transmitters or these can be routinely installed. However, this process turns out to be not so easy (especially if we consider the period 2000-2008) and gives many companies the possibility to specialize as sub-suppliers whose main task is to digitalize the equipment. Some of

these companies have been granted patents in this field and have started working in foreign markets.

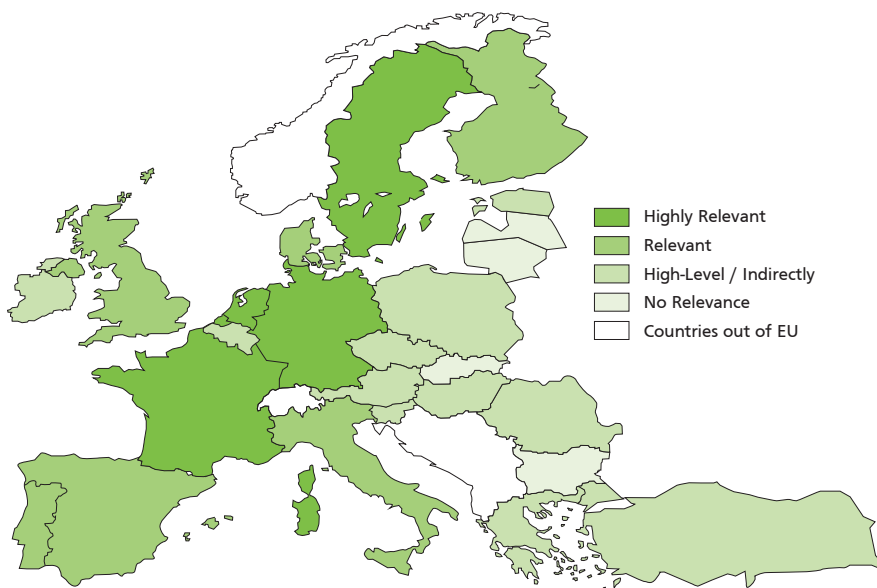
The delayed or postponed implementation of SPICT is due to a great extent to the slow formation of the necessary number of companies which implement and have enough capacity for this. These companies play the role of mini innovation hubs which routinely provide services and thus cause their clients to reproduce innovations.

Bulgaria remains the country with the worst developed online trade among the EU member states and in fact there is no change in the percentage of these who sell and buy online. The share of the online turnover increased from 0.1% to 1% in 2008. Still the greatest percentage is connected to online banking (which does not count here), the payment of utility bills and the text message payments of services (for mobile phones or online).

Research and Development in the ICT Sector

A comparative study of the ICT policies of the EU member states groups them in four categories⁹² depending on the relevance of their national and regional ICT to the R&D in the field of network enterprises (E-business). In 2007, Bulgaria is in the group of the least developed countries together with Lithuania, Latvia and Slovakia. The research priorities of Bulgaria do not find placement in three of the four sub-fields of network enterprising: enterprise interoperability, digital ecosystems for business innovation-DBE, and collaborative business networks. As to the fourth field, ambient technologies for the product lifecycle-AITPL, Bulgaria is positioned in the third category. The strategy for Accelerated Development of the Information Society (2008) envisages many activities, including in the sphere of Radio Frequency Identification-RFID. This is probably one of the reasons that Bulgaria has accumulated experience in the field of robotics and semantic technologies and also participates actively in one of the technological platforms of the EU – the one for mobile technologies.

FIGURE 75. RELEVANCE OF NATIONAL ICT POLICIES TO THE FIELD OF E-BUSINESS



Source: Comparative analysis, 1st version, ERA co-ordination Initiative in the Field of Network Enterprise, 2007.

⁹² **Very relevant:** The policies have a well developed and detailed research program in the field of network enterprise, more particularly in its sub-fields; **Relevant:** The policies have well developed and detailed research program in the field of network enterprise, but remain defined in the more general spheres like e-business, ICT for business; **General (indirectly):** ICT policies are connected to the development of the information society, the innovations, etc and can be found in other strategic documents, without being directly related to the network government. **Undeveloped (irrelevant):** the policies do not outline research in R&D and even do not take ICT into consideration.

Although the total expenditure for R&D in the ICT sector increased twice for the period 2000-2006, and the expenditure of firms rose by 50%, it can hardly be stated that there is significant progress since the percentage of expenditure for R&D according to the gross added value remains stable at 2-3%. A positive trend is the near doubling of the gross added value per company.

TABLE 16. R&D IN THE ICT SECTOR (€ MILLIONS)

	2000	2001	2002	2003	2004	2005	2006
Turnover of the ICT sector	1,127	1,500	2,248	1,940	2,121	2,421	2,747
Gross added value for the ICT sector	499	690	794	911	1010	1092	1210
Expenditure for R&D in the ICT sector	15.2	14.6	15.0	17.7	23.6	22.9	30.9
Number of companies	4,188	4,522	4,512	5,000	5,259	5,445	5,605

Source: National Statistical Institute, 2008.

Policy in the Field of ICT Development

The Bulgarian policy in the field of Information and Communication Technologies has developed chaotically and with big delays compared to world practices. The applied measures are occasionally backed up financially and generally there is a lack of regular evaluation of the progress of their implementation. In Bulgaria this is a common, long-term problem connected with the process of policy development which reveals inefficiency on an institutional level and a lack of capacity for strategic thinking by politicians.

During the 70s and 80s the country had a serious strategic vision about the role of ICT in the development of the economy which was revealed through their systematic support, i.e. industrial espionage, strategic partnerships with leading manufacturers, investments in R&D and training⁹³. However, at the beginning of the 90s all these channels were closed. The policy and regulations followed the requirements in the development of mobile telephony, radio and television. The first attempt for the development of a more systematic policy was made at the end of the 90s. This was marked by stabilization of the

economy and the beginning of the European Union integration process of Bulgaria.

The common political framework in the field of ICT was defined by the national Strategy for the Development of the Information Society (SDIS) in 1999. At first, it played an important role for the introduction of a modern legislation in the field of ICT and their application in the citizens-business-government relationship. The strategy also made a provision for a wide-membership consulting body called the Coordination Council for Information Society (CCIS) with the participation of almost all active nongovernmental organizations in the field of ICT. *The National Program for the Development of the Information Society* was updated at the beginning of 2001 and provided for a number of timely and feasible activities. The change of the government brought a shift in the institutional focus on ICT towards the narrower field of electronic government. This change of focus was outlined in the *Electronic Government*

Strategy adopted in 2002 as a positive effect of the public-private partnership between members of CCIS and the United Nations Development Program (UNDP) for Bulgaria which had started in 2000/2001. This partnership aimed at creating an organizational body that would facilitate the work of CCIS and the practical realization of SDIS. The institutional deficits started to manifest themselves soon after that. A number of government initiatives by the Minister responsible for SDIS were not in conformity with the program documents written by him. For a brief time there existed a second policy center, namely the Ministry of Economy, which supported the development of a *Strategy for Competitiveness of Bulgarian ICT Industry*. This strategy was not adopted until 2004 (after the change in the Ministry) as a result of which the Ministry of Transport and Communications returned again on the scene of ICT policy. The CCIS was established again since the former one had not functioned for three years. The new council had fewer members and focused on the ICT

⁹³ The Bulgarian equivalents of the powerful VAX machines were introduced in some mathematics high schools during the second half of the 80s even before they started being used in some enterprises.

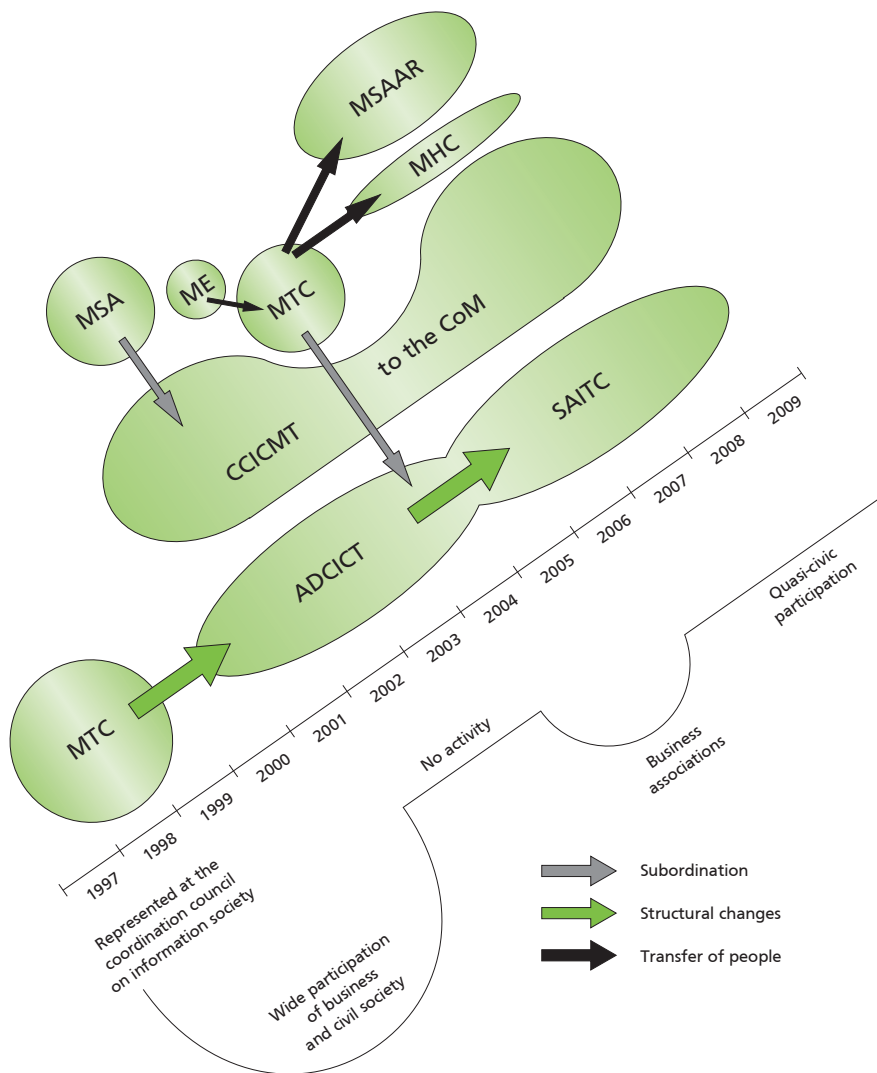
companies but in fact it started functioning at the end of 2005, following the latest elections.

There is a tendency to approve the important program documents for the development of the information society and ICT in the middle of the mandate or even during the final year. For example it was not until October 2008 that the government approved the *Program for Accelerated Development of Information Society (2008-2010)*⁹⁴, whose previous version was discussed and approved by the CCIS back in 2006. The only exceptions are the Electronic Government Strategy (2002) and the Electronic Governance Act (2007).

Another disturbing trend in the development and implementation of ICT policies is the direct borrowing of successful policies which were applied many years ago (particularly given to the speed of development of ICT) together with the uncritical pursuit of irrelevant targets. For example, the program for the development of tele-centers is still widely promoted. This program appeared in Bulgaria after the market for providing internet access in public places had reached its peak and was direct government interference in this market without added value. If this initiative had been put into practice in the period from the end of the 90s to 2000-2001 when there were pilot implementations it might have been much more useful.

In this case the European Commission also has certain blame, because it refused to accept the arguments of almost all of Eastern Europe that it is not right to measure only the percentage of *public* places (owned by the government or the municipality) with internet access, but all places with *public* access to internet. Computer and internet clubs appeared mainly in Eastern Europe and the developing countries. There are similar problems in the indicators which

FIGURE 76. ICT POLICY DYNAMICS: INSTITUTIONAL DYNAMICS IN THE PERIOD 1997-2009



Source: Applied Research and Communications Fund.

measure the progress in the information society and ICT in business. For examples, for a long time Eurostat and even other leading analytical companies did not include the broadband access through LANs and took into consideration only DSL. In this way Bulgaria was last in the ranking by broadband internet although the LANs delivered even faster access than the ADSL of some European telecom companies years ago. Consequently, this made the politicians design policies which would seem ap-

propriate to our European partners but without making a realistic analysis of their necessity and feasibility in the country. Realistic opportunities for upgrading in fields where Bulgaria shows an average European level in the dissemination of technologies or services (or at least it showed at a specific time in the past) are missed. Of course, in many cases the main reason which allowed the wider introduction of certain technologies (from cable TV and computer clubs to broadband access at home) was

⁹⁴ The analytical part of the program follows the analysis in *E-Bulgaria*. Some of the policy recommendations from the report are also used.

the fact that many regulations and copyrights were violated.

The last aspect of our country's policy in the field of ICT (i.e. the policy for stimulating R&D and education, the development of infrastructure and the diffusion of technologies in the population and business), which is of particular importance to businesses and innovations, refers to its general nature and lacks specific priorities.

The latest Strategy for Accelerated Development of the Information Society is a good example for defining specific measurable objectives in specific fields and priorities. However, the approval process still takes too long and leaves the impression that there is not the available capacity for its timely implementation. Digital content is still not viewed as a priority sphere and a basis for the setting up of new businesses.

The regional plans for development only refer to the necessity for internet access and more technologies in business but actually do not provide specific ideas which take into consideration the local characteristics of the business environment. The plans lack both analysis of the ICT usage by enterprises and a motivation for identification of their problems.



Methodological Notes, Sources of Information and Definitions

Innovation.bg comprises five groups of indicators which describe the national innovation system and its functioning:

1. Gross innovation product.
2. Entrepreneurship and innovation networks.
3. Investments and financing of innovation.
4. Human capital for innovation.
5. Information and communication technologies.

Each group contains several synthetic indicators. Working definitions which could differ from stricter theoretical definitions have been applied to the groups and the indicators. The latter consist of various numbers of statistical values displayed graphically. They are grouped in way providing the most comprehensive view of the respective component of the national innovation system. The graphs representing the values are based on the internationally recognized definitions and concepts.

The report uses innovation in its many forms and meanings. **Innovation** is the adoption of a new or significantly improved idea, product, service, process or practice in order to meet a certain need. The concept is also used in a narrower sense in some parts of the report.

TABLE 17. INFORMATION ABOUT ADDRESSES VISITED DURING INA-3

	Number
The respondent was reached at the company (260 visits)	52
The respondent does not want to participate – personally declined	396
Busy for the period of the fieldwork	27
Inexistent address; Construction site, wrong address, telephone number for the company	1994
The person contacted declines to cooperate	9
No one present at the address in the sample (346 visits)	140
Wound up, bankrupt company	106
Lack of correspondence to the selection criteria	10
Effective interviews	1004
Total number of addresses visited	3738
Total number of visits (up to two visits per address)	4152

Source: Vitosha Research, 2008.

TABLE 18. CHARACTERISTICS OF THE ENTERPRISES IN THE SAMPLE

Overall number	1004
Share of enterprises in Sofia	25%
Distribution by size	
Share of micro enterprises (under 10 staff)	22%
Share of small enterprises (between 10 and 49 staff)	40%
Share of medium sized enterprises (between 50 and 249 staff)	21%
Share of large enterprises (over 250 staff)	17%
Distribution by type of company	
Share of joint stock companies (joint stock and single trade joint stock)	20%
Share of limited liability companies (incl. sole owner Ltd)	
Share of sole traders (ST)	50%
Other (general partnerships, cooperatives, partnerships limited by shares, companies pursuant to the Contracts and Obligations Act)	21%
	9%
Average number of employed in an enterprise in 2007	133
Share of employed in the enterprises among all employed in sectors 10-74 (NACE 2007)	9%
Average enterprise age as of December 31, 2008	17 z.
Share of enterprises started before 1989	13%
Distribution by type of ownership of controlling stake	
Share of enterprises over 50% of which is owned by local private owners	86%
Share of enterprises with over 50% state/municipal ownership	6%

CONTINUATION OF TABLE 18

Overall number	1004
Distribution by type of ownership of controlling stake	
Share of enterprises over 50% of which is owned by foreign legal persons	2%
Share of enterprises over 50% of which is owned by foreign natural persons	1%
Family owned (another combination)	5%
Share enterprises having exported in 2007	15%

Source: Applied Research and Communications Fund, 2009.

Innovation Index of Bulgarian Enterprises

The index summarizes the measurement of the innovation activity at the company level and aggregates seven types of innovation of the four types applied by enterprises (to products, processes, organization and marketing) and their degree of novelty (to the enterprise, to the market or to the world) as registered by INA-3. Its values range from 0 to 100, with 0 indicating that the enterprise had lacked innovation, while 100 meaning that the enterprise had made all types of innovations at the highest degree of novelty.

Box 12. COMPONENTS OF THE INNOVATION INDEX OF BULGARIAN ENTERPRISES

1. Product innovations

- 1.1. The enterprise has started to make products new to the company
- 1.2. The enterprise has started to make products new to the Bulgarian market
- 1.3. The enterprise has started to make products new to the international market

2. Process innovations

- 2.1. The enterprise has adopted production methods/processes new to the company
- 2.2. The enterprise has adopted production methods/processes new to the sector

3. Organizational innovations

- 3.1. The enterprise has adopted new or considerably improved management methods and systems
- 3.2. The enterprise has made considerable changes in the organization of work
- 3.3. The enterprise has established new or considerably changed relations with other companies in the value adding chain

4. Marketing innovations

- 4.1. The enterprise has made considerable changes in the design or the packaging of its products
- 4.2. The enterprise has applied new or considerably changed methods for the sale and distribution of its products and/or services

Source: *Innovation.bg 2007*, Applied Research and Communications Fund.

The index considers three types of innovations, which are equal from the point of view of the positioning of the innovation – **product innovations** (what is being produced), **process and organizational** (how it is being produced)⁹⁷ and **marketing** (who it is designed for and how it is sold). The various components of the index have equal weights within their groups.

Availability of data, information sources and definitions

Innovation.bg contains secondary statistical and administrative data and data from nationally representative surveys of enterprises conducted by the sociological and marketing agency Vitosha Research. The report uses a number of freely accessible Bulgarian and foreign sources, which in some cases has resulted in differences in time horizons, definitions of the used variables and graphically represented indicators. This appendix summarizes notes, definitions and methodological explanations to the separate chapters. The Applied Research and Communications Fund updates annually the *Innovation.bg* report aiming at making it a reliable and effective instrument for monitoring the Bulgarian national innovation system.



⁹⁷ The process and organizational innovations are in turn equally weighted within the sub-group. Process innovations in INA-3 refer mostly to technologically new or improved processes. Organizational innovations usually involve purely process innovations without any technological renewal (such as the application of process and organizational reengineering). For this reason they are considered together.

1. Gross Innovation Product

1.1. Innovation product

Every three years the European Commission and Eurostat conduct the Community Innovation Survey (CIS). In 2003, for the first time a pilot CIS compliant survey was carried out by the National Statistical Institute (NSI) of Bulgaria. The latest, fourth CIS covered the period 2004-2006 and was published in 2008. It has been complemented by the results from a special nationally representative survey commissioned by the Applied Research and Communications Fund and conducted by the sociological and marketing agency Vitosha Research in 2008. The agency has adopted and slightly adjusted the CIS methodology, in order to provide both maximum comparability of the data to the ones of Eurostat and NSI. Data from the International Organization for Standardization (ISO) have also been used in the report.

Eurostat and NSI data are accessible on the internet at:

http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1090,30070682,1090_33076576&_dad=portal&_schema=PORTAL.

Manufacturing is defined to include NACE's sections C to E while services comprise NACE subdivision 51, sections I and J, subdivisions 72 and 73 and groups 74.2 and 74.3.

Innovative enterprises are enterprises which introduce on the market new or considerably improved innovation goods (products and services) and innovation processes, including new methods for providing services and channels for the supply of products. Innovation products and processes have to be new for the enterprises themselves, but not necessarily for the market. **Product innovation** is a product or service which is new or considerably improved when it comes to its main features, technical specifications, purpose, incorporated software or other intangible components. **Process innovation** is the adoption of a new or considerably improved production technology, new or considerably improved method for providing services or supplying products.

The high technology sectors of industry include the manufacturing of pharmaceutical products and preparations (NACE 24.4); office machinery and computers (30); radio, television and communication equipment and apparatus (32); aircraft and spacecraft and their engines (35.3). Medium high technology sectors of industry include the manufacturing of chemicals products (except for pharmaceutical products and preparations) (24); machinery, equipment and domestic appliances (29); electrical machinery and apparatus not elsewhere classified (31); medical, precision and optical instruments (33); motor vehicles, trailers and semi-trailers (34); railway and tramway locomotives and rolling stock (35.2); motorcycles and bicycles (35.4); other transport equipment not elsewhere classified (35.5).

Research-intensive high technology services are: post and telecommunications (NACE 64); computer and related activities (72); research and development (73). **Research-intensive market services** are: water transport (61); supporting and auxiliary transport activities and activities of travel agencies (62); real estate activities (70); renting of machinery and equipment without operator and of personal and household goods (71); other business activities (74). **Research-intensive financial services** are: financial intermediation (65); insurance and pension funding (66); activities auxiliary to financial intermediation (67). **Other research-intensive services** are: education (80); health and social work (85); recreational, cultural and sporting activities (92).

1.2. Technological product

The data in this section are taken from the European Patent Office (<http://www.european-patent-office.org/index.en.php>), the U.S. Patent and Trademark Office (<http://www.uspto.gov/>) and the Bulgarian Patent Office (<http://www.bpo.bg/bg/>). Because of the numerous changes to the European patent legislation and the more complicated information service of the European Patent Office, the available primary administrative data on submitted patent applications and registered patents cannot be used. Therefore, *Innovation.bg* uses secondary data provided by Eurostat:

http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1996,45323734&_dad=portal&_schema=PORTAL&screen=welcomeref&open=/t_science/t_pat&language=en&product=EU_TB_science_technology_innovation&root=EU_TB_science_technology_innovation&scrollto=0 (theme Science and technology, Patent Statistics).

1.3. Research product

The report has used data from the data bases of the information platform **Thomson Reuters – ISI Web of knowledge** (which includes the data bases **Web of Science, Derwent Innovations IndexSM, Biological Abstracts[®], MEDLINE[®], Journal Citation Reports[®]**) and the information platform ELSEVIER (including the following data bases: Science Direct, SCOPUS, Engineering Village, EMBASE.com).

2. Entrepreneurship and Innovation Networks

2.1. Entrepreneurship

There is no systematically developed methodology and data on entrepreneurship in the Bulgarian economy. The Bulgarian SMEs Promotion Agency (BSMEPA) is the main source of information on the current state and development perspectives of entrepreneurship and start-ups. The report uses data from the National Statistical Institute and comparative entrepreneurship data from the European Bank for Reconstruction and Development (EBRD).

The annual reports of BSMEPA are available at:

<http://www.sme.government.bg/IANMSP>

2.2. Innovation networks

Innovation networks in Bulgaria were studied based on data from sociological surveys: for the EU – Community Innovation Survey 2004-2006, published in 2008; for Bulgaria – INA-3. The CIS methodology has been adapted and slightly adjusted in order to provide maximum comparability with the EU data, which are available at:

http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1996,45323734&_dad=portal&_schema=PORTAL&screen=welcomeref&open=/&product=EU_TB_science_technology_innovation&depth=2 (theme Science and Technology).

3. Innovation Investment and Financing

Sources of the data for **R&D Investment** are NSI and Eurostat. The data are available on the website of Eurostat, theme Science and Technology:

http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1996,45323734&_dad=portal&_schema=PORTAL&screen=welcomeref&open=/&product=EU_TB_science_technology_innovation&depth=2

R&D expenditure includes current expenditure on R&D and expenditure on the acquisition of tangible fixed assets intended for R&D use made by domestic and foreign enterprises in Bulgaria. R&D expenditure is made by various **economic agents**, classified in four sectors: (a) The business enterprise sector includes all companies and organizations whose core activity is the production of market goods and services (excluding those included in the higher education sector); (b) The government sector includes public organizations and institutions which offer, rather than sell, services which meet the individual and collective needs of society and are primarily financed through the state budget (excluding the entities of the higher education sector); (c) The higher education sector includes universities, colleges, higher education institutions, research institutes within higher education institutions and university hospitals; (d) The private non-profit sector includes private foundations, associations, societies, etc, providing non-profit services.

R&D expenditure by sources of funding represent financial transfers between the enterprises and the organizations classified under the above mentioned sectors, as well as through resources, provided from abroad. In this regard, there are five sources of R&D funding: (a) enterprises' revenues; (b) the state budget (excluding those of the higher education organizations and the university hospitals); (c) the higher education organizations and university hospitals' budgets; (d) non-profit organizations' resources (foundations and associations); (e) foreign entities.

R&D expenditure by type of costs is divided into: (a) current R&D costs, which include the costs of materials, external services, personnel and other operating costs. Depreciation costs are not included; (b) costs on tangible fixed assets acquisitions intended for R&D, including the costs for purchasing land, construction costs and purchase costs of buildings, costs of building overhauls and costs of machinery and equipment acquisition.

R&D expenditure by type of research includes: (a) expenditure on fundamental research, which comprises experimental or theoretical research whose main purpose is to acquire new knowledge on the essence of phenomena and observed facts. Usually, fundamental research results do not have commercial applications and are intended for publication in science magazines or for exchanging among interested persons and organizations; (b) expenditure on applied research, which comprises original research carried out with the purpose of acquiring new knowledge which is, however, primarily directed towards achieving certain practical aims and tasks; (c) expenditure on experimental development, which comprises systemic explorations, based on available knowledge, derived from science and/or practical experience. The purpose of experimental development is to create new materials, products, and devices; to implement new methods, systems, and services or to improve considerably the already existing ones.

4. Human Capital for Innovation

4.1. Scientific career, R&D and high-tech employment

Data from NSI and Eurostat have been used. The Eurostat data is available on its website, under the theme Science and Technology:

http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1996,45323734&_dad=portal&_schema=PORTAL&screen=welcomeref&open=/&product=EU_TB_science_technology_innovation&depth=2

R&D personnel includes employees directly involved with R&D, as well as employees (managers, administrators, clerks) who provide direct support to R&D in the country as measured by physical entities or by the equivalent of full employment. Employees who are only indirectly related to R&D, such as guards, doorkeepers, canteen personnel, accountants, cashiers, etc, are not counted. **R&D personnel by sectors of performance** follows the same pattern of division as R&D expenditure by sectors of performance, according to the type of enterprise and organization in which the personnel carry out the R&D activities (see the definitions on the range of the economic sectors under the R&D expenditure indicator in this appendix).

R&D personnel comprises three main categories – research, technical and support staff. **Researchers** are professional experts directly engaged in R&D and working on the definition and development of new knowledge, products, processes, methods and systems, as well on the management of the corresponding topics (projects). **Technical staff** includes the persons with the necessary knowledge and experience in one or several fields of science and performing research and technical tasks by applying operational principles and methods under the guidance and control of researchers. **Support staff** includes skilled and unskilled workers, accountants, personnel experts, and secretarial support staff who participate in the implementation of research projects or are directly associated with them. **Research and development** includes creative work carried out systematically in order to enhance the volume of knowledge, including about humans, culture and society, as well as using this volume of knowledge for new applications. R&D consists of fundamental and applied research and experiments.

4.2. Education outcomes quality of the educational product and lifelong learning

Data from NSI and Eurostat have been used. Data from three international comparative studies have been used for a comparative measure of the quality of the Bulgarian secondary education:

Progress in International Reading Literacy (PIRLS) – an international comparative study of literacy among 9-10 year olds at the end of the primary level of schooling (4 years of schooling) conducted by the International Association for the Evaluation of Educational Achievement (IEA).

<http://nces.ed.gov/surveys/pirls/>

Trends in International Mathematics and Science Study (TIMSS) – a study of the global trends in the education in mathematics and science conducted by the International Association for the Evaluation of Educational Achievement (IEA).

<http://nces.ed.gov/timss>

The Programme for International Student Assessment (PISA) – an internationally standardized assessment of the literacy of 15-year olds at the last stage of compulsory education (8 years of schooling) conducted by the Organisation for Economic Cooperation and Development (OECD).

<http://nces.ed.gov/pisa>

Participating in lifelong learning can take many forms – education in the system of schools as well as outside it, such as courses, seminars, conferences, lectures and other forms in which the respondents have participated four weeks prior to the survey. **Formal education** takes place in schools, colleges, universities,

specialized institutions of higher education, and other training institutions according to a fixed curriculum. As a result of this kind of education one acquires an educational degree. **Informal education** is what is achieved through courses, conferences, seminars, private tutoring and other forms regardless of its link to a current or a prospective future job of the person or it is intended for personal, social or domestic uses. **Self-directed** study is done without a tutor and outside the formal educational system and informal education and is intended to enhance knowledge and skills of the individual.

5. Information and communication technologies

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APPLIED RESEARCH AND COMMUNICATIONS FUND

The Applied Research and Communications Fund is a Bulgarian research non-profit organization, registered in public benefit, established in 1991. Its mission is to support the development of **innovation** and **the knowledge economy** in Bulgaria through:

- advice and advocacy on establishing national, regional and local level **policies and strategies** for the country's successful integration into the global innovation economy;
- **research and analyses** of development trends and policy options for supporting innovation as well as information and communication technologies;
- **public-private partnerships** among businesses, public institutions, the academic community and civil society for addressing specific issues of ICT and innovation based competitiveness.

The Applied Research and Communications Fund has set up two functional units for the provision of IT and consulting services:

- **European Innovation Relay Centre – Bulgaria** is part of the largest information and consultancy support network in Europe: **Enterprise Europe Network**, and coordinates its work in Bulgaria. The Network aims to assist small and medium-sized enterprises in their innovation potential development and to raise their awareness about the European Commission's business-oriented policies.
- **ARC Consulting EOOD** is the consulting arm of the Applied Research and Communications Fund. The company offers consulting services in the fields of innovation and information and communication technologies, as well as advisory services in the design and implementation of national and international projects under the EU Framework Programs, the Cohesion and Structural Funds.

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Applied Research and Communications Fund
5 Alexander Zhendov Street, Sofia 1113
tel.: +359 (2) 973 3000 ■ fax: +359 (2) 973 3588
www.arcfund.net