Innovation.bg

The Bulgarian Innovation System in the European Union

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IRC Innovation network

CONTENTS

ABBREVIATIONS

AEAF – Agency for Economic Analyses and Forecasting
BARDA – Bulgarian Association of Regional Development Agencies
BAS – Bulgarian Academy of Sciences
BCCI – Bulgarian Chamber of Commerce and Industry
BG – Bulgaria
BIA – Bulgarian Industrial Association
BNB – Bulgarian National Bank
BPO – Bulgarian Patent Office
BSA – Business Software Alliance
BSMEPA – Bulgarian Small and Medium-sized Enterprises Promotion Agency
CEE – Central and Eastern Europe
CEECs – Central and Eastern European Countries
CERN – European Organization for Nuclear Research
CMEA – Council for Mutual Economic Assistance
CSD – Center for the Study of Democracy
DCM – Decree of the Council of Ministers
DNS – Domain Name Server
EBRD – European Bank for Reconstruction and Development
EC – European Commission
EFTA – European Free Trade Area
EIB – European Investment Bank
EIF – European Investment Fund
EPC – European Patent Convention
EPO – European Patent Office
ERP – Enterprise Resource Planning
EU – European Union
FP 7 – Seventh Framework Program of the EU for research, technological development and demonstration activities
GDP – Gross Domestic Product
GVA – Gross Value Added
HU – Hungary
IASTC – International Association of Science-Technology Centers
ICT – Information and Communication Technologies
IP – Internet Protocol
KAM – Knowledge Assessment Methodology
MA – Medical Academy
MBA – Master of Business Administration
MEE – Ministry of Economy and Energy
MES – Ministry of Education and Science
MLSP – Ministry of Labor and Social Policy
MVI – Market Value Index
NACE – Nomenclature des Activites de Communaute Europeenne
NCAS – National Centre for Agrarian Sciences
NDP – National Development Plan
NGO – Non-Governmental Organization
NIF – National Innovation Fund
NII – National Innovation Initiative (US)
NIPE – National Intellectual Products Exchange
NK-NA – Does Not Know - No Answer
NPO – Non-Profit Organizations
NPP – Nuclear Power Plant
NSF – National Science Fund
NSI – National Statistical Institute
NSRF – National Strategic Reference Framework
OECD – Organization for Economic Cooperation and Development
OP – Operational Program
PIRLS – International Reading Literacy Study
PISA – Programme for International Student Assessment
R&D – Research and Development
RIS – Regional Innovation Strategy
SCR – South Central Region
SG – State Gazette
SIBIS – Statistical Indicators Benchmarking the Information Society
SMEs – Small and Medium Sized Enterprises
SU – Sofia University
TIMSS – Third International Mathematics and Science Study
TLD – Top-Level Domain
UN – United Nations
UNCTAD – United Nations Conference on Trade and Development
US – United States
USA – United States of America
USB – Union of Scientists in Bulgaria
USPTO – United States Patent and Trademark Office
VC – Venture Capital
WEF – World Economic Forum
WIIW – Wiener Institut fur Internationale Wirtschaftsvergleiche

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SUMMARY

Bulgaria's accession to the European Union on 1 January 2007 has opened up new opportunities for socio-economic development and prosperity. The first seven years of the country's EU membership will shape the nature of the Bulgarian innovation system. The innovation policy of the Government of Bulgaria and the financial instruments for its implementation over the period 2007-2013 will be crucial for the long-term competitiveness of the Bulgarian economy.

Innovation.bg 2007 reviews the current condition of the national innovation system and gives recommendations for the improvement of the innovation potential of the Bulgarian economy. Given the importance of the EU financial instruments for the development of Bulgaria's innovation capacity, this year's report makes a review of the European innovation policy and the opportunities it offers to Bulgaria. Following the methodology of the previous edition, *Innvation.bg 2007* examines the development of the national innovation system over the last year and the opportunities for its growth in 2007 on the basis of five groups of indicators:

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

This year the analysis is supplemented by a special index of the innovativeness of Bulgarian enterprises based on the results of the annual surveys of the Innovation Relay Centre – Bulgaria, and by a profile of the Bulgarian innovative businesses based on panel data and statistical analysis.

The Innovation Index of Bulgarian enterprises reveals that a sizeable portion (over 65 %) have not introduced any innovations for the last year. Most of the Bulgarian innovative enterprises (some 24 % of all businesses) report index values below 40. The average weighed innovation index of Bulgarian enterprises was 10.2 in 2006. That shows the weak ability to combine several types of innovation and the introduction mainly of innovation with low level of novelty by the Bulgarian enterprises (products and processes new to the company or the domestic market but not to the international market). The average value of the index for the innovative Bulgarian businesses is 56.1. Highly innovative Bulgarian companies or companies with an index above the average of 56.1 account for less than 4 % of all Bulgarian enterprises.

Over the last twelve months, the Bulgarian economy has improved its gross innovation product, and the upward trend is expected to continue against the backdrop of the country's EU accession. The main driving force behind this trend is the innovative product but the research product of the country has also grown in parallel. The enhancement of the innovative and research activity has not resulted in similar development of the technological product yet. The development of the Bulgarian national innovation system is still in its early stage, which is most clearly seen in its relatively low overall results compared to the EU average. The first years of Bulgaria's EU membership will see positive developments - expanding innovation in enterprises, improved technological level and increased research in the economy.

- **Innovation product.** The share of innovative enterprises is gradually rising in Bulgaria. According to the latest official statistical data, they account for some 16 % of all companies but this is still far below the EU average. The economic sectors exposed to the most intensive international competition and penetration of foreign capital, such as financial intermediation, computer technologies, R&D, engineering and consulting services, and mining industries have scored the highest growth of innovative enterprises and the relatively smallest lagging behind the respective EU levels. The situation in the regulated utilities, transport, logistics and communications is just the opposite. The modest share of innovative businesses in the Bulgarian economy relates to the low technological intensity of the national economy - Bulgaria lags behind the leaders among the new EU Members States (Hungary, the Czech Republic and Estonia) five-fold in terms of the share of high-tech exports. The Bulgarian innovative enterprises are either in their infancy or operate on markets where the capital intensity is higher than the innovation intensity and therefore their innovative activities are characterized, first and foremost, by the acquisition of machines and equipment supplemented with training of human resources. R&D comes second, whereby only 30 % of the innovative companies (i.e. less than 5 % of all enterprises) mention them as an important innovation activity. Diversification of the product range, expansion of the market and compliance with international standards increase their relevance as effects from the innovative activity of Bulgarian innovative enterprises. The most substantial obstacle for Bulgarian innovative enterprises in their innovation activity compared to their counterparts in the EU is the lack of appropriate sources of financing.
- **Technological product.** The technological product in Bulgaria is some 50 % below the level of the EU-10. The patent activity of Bulgarian inventors before the Bulgarian Patent Office has decreased but it has increased

before the U.S. and European patent administrations. The number of granted patents, however, remains far below the average EU-10 level, which in turn is low compared to international standards. Bulgarian patents are applied for by and granted to individual holders, which makes them vulnerable to circumvention on the international markets, while their economic effect for the Bulgarian economy is low. The supply and demand on the Bulgarian technological market remain weak. Domestic and international companies perceive the intellectual property rights protection in Bulgaria as unsatisfactory; it is twice as low as in the EU-15 countries. In spite of the signs of some increased patenting activity of Bulgarian inventors, if it persists at levels lower than the average in the EU-10, Bulgaria is faced with the serious threat of remaining outside the global technological flows and faces the risk of limiting its long-term innovation capacity.

- **Research product.** The research product of Bulgaria has grown for the last twelve months but its overall level is still below the average for the new EU Member States. Bulgarian continues to lose positions with regard to the international recognition of its research product. The number of publications and citations in internationally referred journals of comparable countries like, for instance, Slovakia, is growing at faster pace than those of Bulgaria. The structure of the research product is shifting towards applied subjects similar to the structure in the new EU Member States, but at a slower pace. The share of basic science (chemistry, physics) is still high, whereas clinical medicine (closely related to the fast growing global biotechnology sector) has a much smaller share than in the EU-15 and the new Member States. The preservation of such a structure does not entail any substantial increase of the technological and innovative activity of the research sector in Bulgaria in the future. A positive sign in this respect is the growing share of Bulgarian engineering and technological publications up to twice as much as those in the EU-15. The EU Framework Programmes produce a tangible impact on the publication activity and the structure of the research product in Bulgaria. In the context of their implementation and the improvement of the overall economic situation in the country, there are positive expectations as to the development of the research product in the years to come.

The sustainable economic growth over the recent years in Bulgaria is accompanied by improving business and **entrepreneurship** environment. The macroeconomic stability in the country has created the necessary conditions for growth of enterprises and establishment of productive innovation partnerships. The proper functioning of the innovation system is still hampered by many microeconomic obstacles, the removal of which would enhance the competitiveness of Bulgarian businesses in the EU.

- **Entrepreneurship.** The number of start-ups continues to grow but it is still below the level of the new EU Member States. The increase in the share of small and medium-sized enterprises compared to micro-enterprises in the structure of Bulgarian companies is a sign of corporate growth which will improve with the further development of financial markets in the next couple of years and the easier access to the European market after 2007. The cumbersome administrative procedures and the delay of key reforms such as the introduction of a central company register are the major obstacles for Bulgarian the entrepreneurial spirit. The registration of a company in Bulgaria takes twice more procedures and treble the time than in neighboring Romania.

- **Innovation networks and sources of information.** Bulgarian innovative enterprises have expanded their cooperation in the development of new products and processes for the last twelve months. This trend is particularly strong in their contacts with foreign organizations. In 2006, the share of enterprises which developed an innovation project with external organizations increased by six percentage points in comparison to 2004. But it is still some seven percentage points below the EU-15 average. Bulgarian innovative enterprises attach the greatest importance for the development of innovation projects to their customers and suppliers. Over the last twelve months, Bulgarian enterprises have considerably improved their attitude towards consulting organizations, which is likely to be the first step towards faster development of an indigenous consulting industry in the light of Bulgaria's accession to the EU. The Internet continues to be the most preferred and widely used source of information on innovation for Bulgarian businesses.

The **investment in innovation** in Bulgaria remains related mainly to the transfer of knowledge from the EU through foreign direct investment and import of capital goods. R&D expenditure is relatively low (0.50% of GDP). The financial system of the country is growing rapidly but still fails to offer innovation-specific financing instruments. Expectations are for the increase in innovation investment to continue in the next few years under the influence of additional financing from EU funds and of a more active private sector.

- **Investment in R&D.** R&D expenditures in Bulgaria are four times lower than the average EU-15 level. Nevertheless, the structure of R&D expenditures is strongly imbalanced in Bulgaria. The share of the public sector in their financing and implementation is twice higher than that of businesses or higher education. In the EU-15 the public sector accounts for less than one-fifth of the total R&D expenditures. 90 % of R&D expenditures in Bulgaria go for operational needs, mainly salaries and maintenance in the public sector. The influx of resources for R&D from European funds will increase R&D expenditures but the improvement in the structure of the sector will depend on the national innovation policy pursued by the government in the next two or three years.
- **International transfer of innovation – foreign direct investment.** The inflow of foreign investment has grown steadily, remaining the major source for technological renovation in Bulgaria. **The share of foreign direct investment (FDI) in the gross capital formation in Bulgaria has been some 40 % for the last eight years – twice higher than in the EU-8, while the saturation of the economy with foreign investment (FDI per capita) has remained about three times less than in the same group of countries.** Most FDI are directed to the most innovative sector in the country – financial intermediation – as well as in logistics, transport, communications and real estate transactions. The share of the processing industry has decreased, which could be the signal of deteriorating qualitative structure of investments and/or saturation of the technological and innovation absorption capacity of the economy. Expectations are for FDI to retain their growth rates during the initial years of Bulgaria's EU membership depending on the level of enhancement of the country's absorption capacity through European funds.
- **Financing of innovation.** The enterprises' own resources continued to be the primary source of financing of their innovation activities in 2006, followed by banks, local and foreign partners. The highest growth among the sources of financing of innovation in comparison to the previous issue of the *Innovation.bg* report has been scored by banks and EU funds. This

trend is expected to intensify with the country's accession to the EU and the further development of financial intermediation in the economy. The specialized innovation financing instruments such as venture capital funds are still unknown to Bulgarian innovative enterprises. The vigorous development of the domestic capital market for the last two years, the accumulation of resources in long-term financial instruments (pension funds, insurance companies) and the entry of EU funds and expertise are expected to generate the first national venture capital instruments in 2007-2008.

During the transition years **human capital**, similar to physical capital, underwent quantitative and qualitative depreciation in Bulgaria. The system of secondary education and the specialized R&D employment were particularly badly affected. Since 2002-2005 all the elements of the educational product and employment have tended to improve, except for those in high-tech industries. Nevertheless, their performance is still below the EU-10 and EU-15 averages.

- **Research career, R&D and high-tech employment.** In comparison to the previous edition of *Innovation.bg*, last year saw the first big (35 %) increase of new PhDs in Bulgaria. Employment in R&D is growing, the leading sector being Bulgarian enterprises (growth rates of 30 % for the last two years). **There is growing specialization in research-intensive high-tech services in Bulgaria, where employment rates continue to be above the EU-10 average but the country still lags behind its peers in high-tech industry.** In spite of the positive dynamics in the past year, R&D employment and the share of new PhDs remain twice less than in the EU-10, while the people involved in R&D in the public sector stays disproportionately higher in Bulgaria than in the EU-10 and EU-15.
- **Education outcomes, quality of education and lifelong learning.** The education attainment in Bulgaria remains relatively lower than in the EU-10 and EU-15, especially with regard to secondary education. In higher education the significance of technologies and engineering sciences is growing in connection with and in support to the technological renovation of the Bulgarian industry. The share of the people involved in continuous education is still some nine times less than in the EU-15.

Information and communication technologies are rapidly adopted by the Bulgarian companies but currently the installed capacity is not fully utilized, especially in the micro-enterprises in the traditional sectors of the economy. The process of introduction of ICT solutions in enterprises is largely determined by administrative and evolutionary factors. In 2007 a breakthrough in the development and growth of online services and businesses is expected.

- **Use of ICT for innovation.** Although all Bulgarian enterprises, except for micro businesses, have computers, most of them use them only as a means to reduce costs and for information search (60 % of the enterprises) rather than for the introduction of innovative management and administrative solutions (10 %). The most innovative are the Bulgarian enterprises using ICT for management and marketing. In 2007, 90 % of the computers in 90 % of the enterprises will have access to the Internet, which is an important prerequisite for making these companies more innovative.
- **ICT as an innovative means of doing business.** In 2006, few Bulgarian enterprises were present on the Internet – only one in five had a functioning web-site. Their share is expected to increase to 50 % of the enterprises with over 10 employees in 2007 and 2008. The most active will be the market for online services, where numerous micro- and small enterprises are entering. They will pave the way and make conventional

businesses follow suit. This will lead to growth of marketing and organizational innovation.

The resources provided from the Cohesion and the Structural Funds and the national financing for the development of innovation and the innovative potential of the country over the period 2007 – 2013 reveal that Bulgaria will rely primarily on EU funds for the enhancement of its national innovation system. The review of the existing operational programs for the management of EU resources in Bulgaria points to the need for substantial strengthening of the administrative capacity and expertise in the public and private sector in the country for the preparation and implementation of projects in the field of innovation and for the introduction of mechanisms to improve the coordination between the individual administrative units selected to implement the set of policies which determine the innovation capacity of the country – innovation, entrepreneurship and SMEs, R&D, education, ICT. The attainment of better coordination is a necessary prerequisite for overcoming the existing mismatch between supply and demand within the Bulgarian innovation system. It will enable the country to make full use of the whole set of policies and supporting financial instruments of the EU in the field of innovation, which include the Structural Funds and the Cohesion Fund, as well as the Framework Programs for research, innovation and competitiveness of the EU.

The initial years of Bulgaria's EU membership will be crucial for the shaping of the identity and functionality of the national innovation system and for the long-term structure and competitiveness of the Bulgarian economy. The diverse catching-up experience of EU Member States in previous enlargements such as Greece, Ireland, Spain and Portugal comes to show that as well as the conditions at the start and the external constraints, national policies are of crucial importance for the successful integration into the EU. Bulgaria and the other new EU Member States have much less EU resources at their disposal in comparison to the countries from previous enlargements and much greater challenges to overcome in eliminating the lagging behind, which calls for even more careful prioritization and preparation of national policies. In this connection and on the basis of the analysis, *Innovation.bg 2007* makes several groups of **conclusions and recommendations** intended to help the discussion on a successful national innovation policy in Bulgaria.

Conclusions

- The market orientation of the Bulgarian innovation system is in its infancy: Bulgarian enterprises show low levels of innovativeness;
- The innovation, research and technological products of the country develop separately from one another in the national economy. From structural perspective their interrelations remain weak;
- The national innovation system is shaped and influenced primarily by the integration and financing in the European innovation networks and the changes in the availability of national public financing;
- The main constraints for the development of the national innovation system are the lack of suitable sources of financing in short-run and the lack of skilled human capital in the long-run.
- The national innovation system has started to improve its performance, without input from the Bulgarian public innovation policy, which is a clear signal that the time for more decisive action in this domain has arrived.

Recommendations

- Provision of greater political, administrative and financial resources for developing and implementing a national innovation policy.
- Improvement of the coordination between the national strategic docu-

ments and policies and between the administrative and financial instruments which influence the national innovation system;
- Fine tuning and coordination of the innovation resources from the EU Structural and Cohesion Funds within the country and with other programs at the European level.

The experience in catching-up of many countries in the world has borne it out that the main objective of the national policy for management of the innovation resources coming from the EU Structural and Cohesion Funds, the national budget and the EU Framework Programs in Bulgaria should be the development of "institutional instruments" which improve:

- "links with the technology frontier,
- links with markets (and sophisticated users),
- supply of needed skills, services and other inputs;
- the local innovation system/network".[1]

[1] Fagerberg, J., M. Godinho, Innovation and Catching-up, The Oxford Handbook of Innovation, p. 536, Oxford University Press, 2005.

INTRODUCTION

Bulgaria's accession to the European Union on 1 January 2007 has opened up new opportunities for the society and the economy to prosper and develop. The Bulgarian Government's vision is to develop Bulgaria into a competitive member state with high income and quality of life by 2015. The attainment of this objective calls for sustainable elimination of the development gap between Bulgaria and the leading countries in the EU-25. Historically, no uniform catching-up models exist in the world but countries which have managed to implement successful catching up strategies share some common features. These features are associated with a considerable increase of capital investment in the latest technologies in traditional economic sectors but also with the introduction of innovation, especially in the organization of production, supplies and distribution, and with the targeted penetration of national businesses into emegring and rapidly growing industries[2]. Bulgaria has already increased investment in new capital, which is intended to reach 31 % of GDP by 2011[3]. Given the scarce human resources available to Bulgaria, the only source of long-term growth is the more efficient use and the upgrading of the quality of capital and labor inputs. Increasing efficiency largely depends on the innovation capacity of the Bulgarian economy, the organization of the national innovation system and the innovation policy of the country within the EU.

Innvation.bg is intended to provide a reliable annual assessment of the innovation performance of the Bulgarian economy and the current condition and development opportunities of the Bulgarian innovation system. The report provides recommendations on the improvement of the public policy on innovation, building on the latest international theoretical and empirical studies and taking into account the specific economic, political, cultural and institutional framework of the innovation system in Bulgaria. The report targets leaders and decision-makers in the public and private sector of the country.

[2] Fagerber, J., M. Godhino, Innovation and Catching-Up, The Oxford Handbook of Innovation, Oxford Univesrity Press (2005).

[3] IMF, Bulgaria: Selected Issues and Statistical Appendix. According to calculations of the Agency for Economic Analyses and Forecasts in the National Strategic Reference Framework of Bulgaria.

Innovation.bg 2007 reviews the current condition of the national innovation system as of the date of Bulgaria's accession to the EU and gives recommendations for the improvement of the innovation potential of the Bulgarian economy. Given the importance of the EU financial instruments for the development of Bulgaria's innovation capacity, this year's report contains a special chapter, reviewing the European innovation policy and the opportunities it offers to Bulgaria. The topic of this chapter will change every year to reflect the major challenges for the innovation development of the country. Following the methodology of the previous edition, *Innovation.bg 2007* examines the dynamics in the performance of the national innovation system over the last year and the opportunities for its development in 2007 – 2008 on the basis of five groups of indicators:

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

This year the analysis is supplemented by a special index of the innovativeness of Bulgarian enterprises based on the results of the annual surveys of the Innovation Relay Centre – Bulgaria, and by a profile of the Bulgarian innovative businesses based on panel data. The *Innovation.bg 2007* report has been endorsed by the Expert Council on Innovation at the Applied Research and Communications Fund.

Methodologically, the report is based on several existing models for measuring and comparison of innovation systems: (1) the *European Innovation Scoreboard* of the European Commission; (2) the *OECD Science, Technology and Industry Scoreboard*; (3) the U.S. *National Innovation Initiative*; and (4) the *Executive Index of the Massachusetts Innovation Economy*. Detailed methodological comments and the sources of information of the report are presented in Appendix 2. A more detailed theoretical background of the structure of the report can be found in *Innovation.bg: Innovation Potential of the Bulgarian Economy*, Applied Research and Communications Fund (2005).

In Focus: The EU Innovation Policy – Development Opportunities for the Bulgarian Innovation System after 2007

The distribution of resources envisaged within the framework of the Structural and Cohesion Funds and the national financing for the development of innovation and the innovation potential of Bulgaria over the period 2007 – 2013 come to show that the country will rely primarily on European means for the development of its national innovation system. The review of the existing Operational Programs for the management of EU resources in Bulgaria point to the need for substantial strengthening of the administrative capacity and expertise in the public and private sectors in the country for the preparation and implementation of projects in the field of innovation and the introduction of mechanisms to improve the coordination between the individual administrative units selected to implement the set of policies which determine the innovation environment in the country – innovation, entrepreneurship and SMEs, R&D, education, ICT. The attainment of better coordination is a necessary prerequisite for overcoming the existing mismatch between supply and demand within the Bulgarian innovation system. It will enable the country to make full use of the whole set of policies and supporting financial instruments of the European Union in the field of innovation, which include the Structural Funds and the Cohesion Fund, as well as the EU Framework Programs for research, innovation and competitiveness.

Bulgaria's accession to the EU provides a window of opportunity for the country to develop its innovation system, using the experience of the other Member States and the European Commission, and the financial resources from the Structural and Cohesion Funds. The medium-term objectives set out by the Government of the Republic of Bulgaria in the National Strategic Reference Framework 2007 – 2013[4], the basic document for the management of the EU financing for the country, are closely related to the development of the national innovation system: (1) enhancement of the competitiveness of the economy with a view to achieving high and sustainable economic growth; and (2) development of human capital with a view to ensuring higher employment, income and social integration. Similar to the new EU Member States and Romania, after 2007 Bulgaria will have access to twice bigger average annual resources from the EU Structural and Cohesion Funds compared to the last two years of the pre-accession period. With regard to innovation and the related spheres which *Innovation.bg* follows – research, technological development, investment in ICT, entrepreneurship, education and training – this increase is even greater. In the sphere of industry support, which includes also innovation activities, the increase is 50 fold.

The requirement for complementarity of the EU funds to the national resources[5], the commitments undertaken by the Bulgarian Government for a cap on public spending, and the objective to maximize the use of the available financing[6] imply the emergence of a strong pressure to allocate resources to spheres of their easiest absorption. This creates the threat of a vicious circle, where resources are channeled into spheres where it is easiest to absorb them. These are typically related to basic, physical infrastructure. In the spheres where the Bulgarian government has planned the greatest increase of financial inflows in comparison to previous periods, it should considerably strengthen the administrative capacity for project management at the national, regional, local and sectoral levels and to carefully synchronize the national actions with those of the EU and the other Member States[7]. This is relevant also to the national innovation system of Bulgaria, which is faced with challenges in terms of the availability of financial resources and the coordination of the activities of the public institutions which form it[8]. The main goal of the Bulgarian Government in connection with the successful management of EU funds for innovation should be the attainment of optimal integration in the EU

Table 1. RESOURCES ALLOCATED BY THE GOVERNMENT OF THE REPUBLIC OF BULGARIA AND THE EU STRUCTURAL AND COHESION FUNDS FOR OVERCOMING THE LAGGING BEHIND OF THE COUNTRY

Summarized Financial Table of Public and Other Equivalent Expenditures for the Objective 'Convergence of the Regions' (Million euro at 2006 prices)	Total (national + EU)				Growth (%)
	Average Annual 2004 – 2005		Average Annual 2007 – 2013		
	EUR mn	Share	EUR mn	Share	
Basic infrastructure	**383.4**	**62.4**	**708.3**	**53.3**	**84.7**
Transport	173.4	28.2	324.6	24.4	87.3
Telecommunications	21.7	3.5	12.7	1.0	-41.6
Energy	7.2	1.2	8.1	0.6	11.9
Environment and water	136.6	22.3	307.2	23.1	124.8
Health	44.5	7.2	55.8	4.2	25.4
Human resources	**94.1**	**15.3**	**293.2**	**22.1**	**211.7**
Education	45.5	7.4	117.0	8.8	157.1
Training	37.8	6.2	149.6	11.3	295.8
Research and technological development	10.8	1.8	26.7	2.0	146.9
Production environment	**136.5**	**22.2**	**327.7**	**24.7**	**140.1**
Industry	2.1	0.3	101.1	7.6	4,645.1
Services	131.5	21.4	198.5	14.9	50.9
Tourism	2.8	0.5	28.1	2.1	892.9
Others	0.0	0.0	0.0	0.0	0.0
Total	**614.0**	**100.0**	**1,329.2**	**100.0**	**116.5**

Source: National Strategic Reference Framework of the Republic of Bulgaria 2007 – 2013, version as of October 2006 (p. 120).

[4] Version October 2006.

[5] The EU rule of complementarity means that a Member State cannot replace national financing by resources from the EU Structural and Cohesion Funds and the amount of the national public spending over the program period 2007 – 2013 should be at least equal to the amount of the real average annual national spending reached over the period 2004 – 2005. Thus EU funds are intended to lead to real economic change by allocating them into the financing of activities that are not covered by the national budget.

[6] The Report on the 2007 State Budget of Bulgaria defines as the main objective of the government's fiscal policy the maximum absorption of EU funds, while preserving the spending in the consolidated state budget at 40 % of GDP.

[7] The positive examples cited to this effect are usually Spain and Ireland, while the negative ones are Greece, Portugal and East Germany. For a more detailed analysis see Accessing EU Funds in the New Member States: Best Practice from Around Europe, Economist Corporate Network, The Economist (2005).

[8] See Institutional Framework of the National Innovation System, p. 23, *Innovation.bg: Innovation Potential of the Bulgarian Economy*, Applied Research and Communications Fund, 2005.

innovation policy and structures and the careful selection of partners and examples among the Member States for development of the administrative capacity of the stakeholders in the Bulgarian innovation system.

Main Elements and Financial Instruments of the EU Innovation Policy

Over the last decade, in the per capita income EU has decreased in comparison to the United States even when the statistical effect of enlargement is ignored. Although many analyses have been made as to the root causes for the slower growth in the EU, they could be summarized in three groups: **obstacles to innovation and reduction of investment in R&D, insufficient investment in human capital, and underutilization of ICT**[9]. The sustainable deterioration of this and other indicators in the EU have turned the acceleration of growth and productivity into a major political priority for the EU. This has focused the attention of the European Commission and the Member States on the innovation policy as a pivotal element in their efforts to create more jobs and reach higher growth rates in the Community and to develop various instruments to promote innovation activities.

As a result of the review of the implementation of the EU Lisbon Strategy as of 2005, the reported unsatisfactory results and the new budgeting cycle of the European Union for the period 2007 – 2013, the European Commission has adopted a series of documents setting priority to the development of the innovation potential of the EU and its Member States:

- **More research and innovation** – Investing for Growth and Employment: a common approach, COM (2005) 488[10]. The communication offers measures: to: (i) encourage innovation through the various EU policies (regulation, single market for researchers, public procurement and state aids, tax incentives); (ii) financing of innovation (through the Structural Funds, EU framework programs, public-private partnerships, etc.); (iii) intensified business-education/research partnerships; (iv) improved policy analysis instruments and development of National Reform Programs (for more jobs and higher growth);
- Putting knowledge into practice: a broadbased **innovation strategy for the EU**, COM (2006) 502. The Spring European Council in 2006 urged the Commission to present "a broad-based innovation strategy for Europe that translates investments in knowledge into products and services". This strategy will be implemented in partnership between the Community and the Member States. The main guidelines for the modern innovation strategy of the EU are: (i) making the EU more innovation-friendly; (ii) creation of conditions for the emergence of "lead markets" for new technological products; (iii) development of a better system for management of the European and national initiatives in innovation. The EU innovation strategy suggests a package of 10 actions of high political priority to guide the innovation activities of the Governments of the Member States and the European Commission.

The EU innovation strategy is already in the process of implementation but its main actions and effects in the Member States, including Bulgaria, will be concentrated in the period of the new financial framework of the Community 2007 – 2013. Diverse financial instruments are available to the Member Stats to develop innovation, education and research at the European, national and regional level:

- **The Cohesion Fund and the Structural Funds** are the largest items in the total Community budget, where activities are split into two: for cohesion policy (EUR 308 bn) and for competitiveness and growth policy (EUR 74 bn)[11]. All Bulgarian regions fall under the convergence objective which accounts for 82 % (EUR 251 bn) of the financial resources for the cohesion policy. The European Commission and the Member States have agreed for at least 60 % of the resources under the convergence objective to be allocated in spheres which are closely connected with the implementation of the renewed Lisbon Strategy of the EU – innovation, modernization of small and medium-sized enterprises, research, smart energy, education, etc. Over the period 2000 – 2006, 5% of the resources (EUR 10.5 bn) for the priority analogous to the new convergence objectives were earmarked for research, innovation and modernization of enterprises. The ambition of the EC is to double this share in the new budget period 2007 – 2013. The current structure of the support from the EU Structural Funds for innovation and research gives an idea of where the EU expertise and capacity are the greatest: research projects at universities and research institutes (26 % of the total resources), research and innovation structure such as public buildings but also incubators and technology transfer centers

[9] For a succinct review see Aghion, Ph., A Primer on Innovation and Growth, Bruegel Policy Brief No6/2006 u Pisani-Ferri, J. Europe's Eroding Wealth of Knowledge, Financial Times, August 23, 2006.

[10] This EU Strategy comes in response to the Report of the Independent Expert Group on R&D and Innovation appointed following the Hampton Court Summit and chaired by Mr. Esko Aho, 2006.

[11] Communication from the Commission *Cohesion Policy in Support of Growth and Jobs: Community Strategic Guidelines, 2007-2013, Brussels, 05.07.2005, COM(2005) 0299*; Cohesion Policy: the 2007 Watershed, Fact Sheet, European Commission, DG Regional Policy; Regions for Economic Change: Innovating through EU Regional Policy (2006); Innovative Actions and Strategies (2006).

(25%), innovation and technology transfer and partnerships (37%), and training of researchers (3%). The main financial instrument for the attainment of the convergence objective is the European Regional Development Fund which is supported by the European Social Fund. Innovation activities of European cities will be financed under the territorial cooperation objective of the EU cohesion policy. In 2007, the JEREMIE initiative (joining European resources for micro- to medium-sized SMEs) will be launched. Within its framework, the European Investment Bank (EIB) will facilitate the development of venture capital schemes under the cohesion program in accordance with the needs of the regions. Further resources for innovation in rural areas are envisaged from the European Agricultural Fund for Rural Development (EAFRD);

- **The 7th Framework Program of the EU** for research, technological development and demonstration activities (2007-2013) (FP 7) has received double the amount of annual resources of the previous programming period to reach EUR 50.5 bn over the period 2007 – 2013[12]. For the first time in its history the program covers a seven-year horizon[13] so that its implementation time frame coincides with that of the Structural Funds and ensures synergy between the two financial instruments. The Program covers four thematic areas: Cooperation (EUR 32.3 bn/ 64% of the Program's budget), Ideas (EUR 7.5 bn/15%), People (EUR 4.7 bn/9%) and Capacities (EUR 4.3 bn/9%). FP 7 envisages greater involvement of SMEs in the development and implementation of applied research projects intended to improve the research – business links. The goal of the EC is to have at least 15 % of the resources for the Cooperation priority (EUR 4.9 bn) allocated to SMEs. The Capacities objective is specifically targeted to the needs for preparation of the regions and countries under the convergence objective of the Structural Funds for better integration into the EU. Its activities are oriented towards the creation and integration of research infrastructures in Europe, research to support SMEs, cooperation among regions for the development of innovation activities to be financed from the Structural Funds, development of European research policy and international cooperation beyond the EU.
- **The Competitiveness and Innovation Program** (2007-2013) is a continuation of existing EU programs, bringing them together to focus on innovation. The Program has a budget of EUR 4.2 bn to be distributed among three priorities: (i) Entrepreneurship and Innovation (EUR 2.6 bn) aimed at maintaining a European network in support of SMEs and the transfer of technologies; (ii) Support to ICT policies (EUR 0.8 bn); and (iii) smart energy (EUR 0.8 bn). Although with a smaller budget, the program produces a powerful impact on the operation of FP 7 and the Structural and Cohesion Funds, providing resources for the development of European policies and identification of the future priorities in the fields of innovation, ICT and energy;
- The education programmes Socrates, Leonardo da Vinci, Jean Monnet, eLearning, Tempus, Erasmus Mundus are aimed at the

Box 1. A ROADMAP FOR A MORE INNOVATIVE EUROPE: TEN PRIORITY ACTIONS IN THE EU INNOVATION STRATEGY

Action 1: Modernization of the **education systems** of the Member States for the development of better education and innovation skills.

Action 2: Establishment of a **European Institute of Technology** by 2009.

Action 3: Creation of an open, single and competitive Eurpean **labor market for researchers.**

Action 4: Adoption by the end of 2006 of a Communication to promote **knowledge transfer** between universities and other public research organizations and industry (already achieved).

Action 5: Mobilization of the instruments of the **Cohesion Policy** (EU funds) to support innovation in the regions.

Action 6: Change of the framework for **state aid** to improve the financing of innovation and research. By the end of 2006 the European Commission will present guidance for the development of **tax incentives for R&D** (already achieved).

Action 7: The European Commission will present a **new patent strategy** by the end of 2006 and a new IPR strategy in 2007.

Action 8: Promotion of the development of **new digital products, services and business models** through better application of the existing legislation.

Action 9: In 2007, the EC will test the emergence of **lead-markets** for the development of new technologies.

Action 10: By the end of 2006 the EC will publish a Handbook on how pre-commercial and commercial **procurement can stimulate innovation.**

Source: Communication from the Commission, *Putting Knowledge into Practice: a Broadbased Innovation Strategy for the EU*, COM (2006) 502.

[12] Amended proposal for a Decision of the European Parliament and the Council concerning the 7th Framework Programme of the European Community for research, technological development and demonstration activities (2007 - 2013), COM(2006) 364 final.

[13] The previous research framework programs had four-year terms.

emergence of a single education area within the EU, playing an essential role in the enhancement of the long-term innovation capacity of the EU.

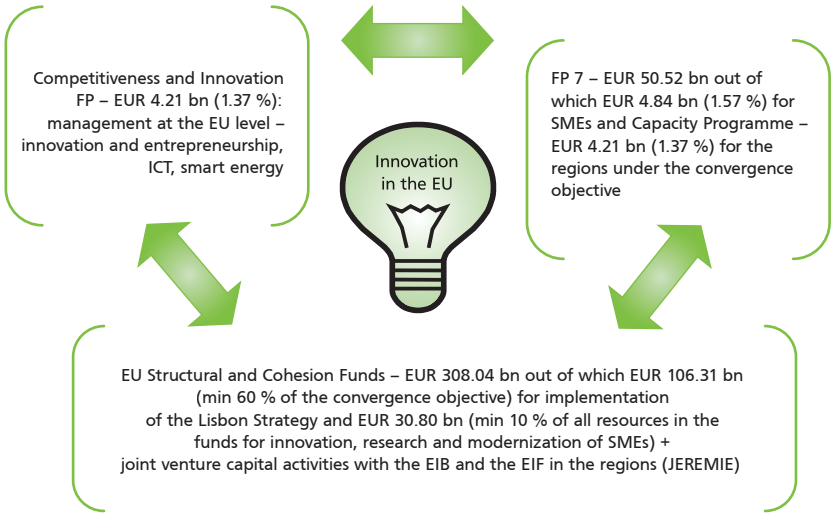
The financial instruments for the support of innovation at EU level are supplemented by several important coordination mechanisms and services:

- Innovation policy analyses. The EC maintains the electronic portal **European Trend Chart on Innovation and European Innovation Scoreboard**, collecting, processing, analyzing and disseminating information about the innovation policies in the Member States. The analyses produced under this initiative underpin the holding of numerous working meetings of representatives of the Member States to discuss the opportunities for development of innovation policies;
- The **Pro Inno Europe** initiative brings together opportunities for training and cooperation in the field of the innovation policies between the Member Stats and the regions in Europe;
- Support for sectoral innovation and clusters through the **Europe Innova** initiative. The new generation of programs for a European regional policy over the period 2007 – 2013 will promote the establishment of regional innovation clusters not only in developed urban areas but also in rural areas and less developed regions. In 2007, the EC will work out a map of the existing clusters, their strengths and cooperation opportunities;
- Services for transfer of technologies – a network of **European innovation centers** in 71 regions from 33 countries.

From the Green Paper on Innovation[14] published in 1995 to the latest communication of the Commission Putting Knowledge into Practice, it has always been the understanding of the EU that the development and implementation of the innovation policy calls for coordination in various aspects:

- The first aspect is the coordination among the various levels of development and implementation. The actions worked out at the local, regional, national, European or even global level should be complementing each other;
- The second aspect is the sectoral one. Many factors influencing innovation are shared in common by all industrial sectors but some industries have specific socio-economic characteristics and need specific policy solutions;
- The third aspect is the interaction of the innovation policy with the other EU policies since there are diverse factors influencing the capacity of businesses to innovate. This requires promotion of innovation through policies in other spheres as well and its transformation is a task going beyond the framework of a single department or ministry in the respective country;
- The implementation of the strategy should involve all stakeholders – businesses, public sector, consumers;
- Competition is the engine of innovation but policy actions and mechanisms to support innovation are indispensable. At the political level, innovation should be viewed as a priority of the Member States in order to attain the growth and jobs objectives.

Figure 1. INSTRUMENTS FOR SUPPORT OF INNOVATION IN THE EU



Note: The percents in the brackets present the share of the respective funds compared to the Structural and Cohesion Funds.

Source: Applied Research and Communications Fund on the basis of EC data (Regions for Economic Change: Innovating through EU Regional Policy (2006); Innovative Actions and Strategies (2006); Amended proposal for a Decision of the European Parliament and the Council concerning the 7th Framework Programme of the European Community for Research, Technological Development and Demonstration Activities (2007 - 2013), COM (2006) 364 final.

[14] EU Green Papers are published at the initiative of the European Commission, offering a specific theme for broad discussions by the Member States and the EU institutions. Where Member States are interested in joint actions, the EC undertakes the publishing of a White Paper and the formal elaboration of the rules in the respective field in the form of recommendations, guidelines, etc.

Bulgaria's Participation in the EU Structural and Cohesion Funds – Opportunities for the National Innovation Policy

The development of the Bulgarian national innovation system and policy will largely depend on the successful integration of Bulgaria into the European initiatives and financial mechanisms in this area. Access to European funds after 2007 makes it possible for the country to substantially increase investments in innovation, research and science, as well as in related spheres like entrepreneurship, ICT and education. In accordance with the National Strategic Reference Framework 2007 – 2013 Bulgaria will double its public spending for the implementation of policies beyond basic infrastructure, including innovation and research. The increase is expected to materialize primarily in the second half of the planning period, i.e. after 2009. The rolling over of the main bulk of resources ahead in time implies considerable strengthening of the administrative capacity of the country in the respective areas financed by European funds during the first two years of Bulgaria's EU membership.

The spending for innovation, research and science[15] which the Bulgarian Government and the European Commission plan for the period 2007 – 2013 from the European funds is allocated among several programs:

- **The Development of the Competitiveness of the Bulgarian Economy Operational Program** envisages that 15%[16] of the total value of the program (1.9 % of the total amount of the resources from the Structural and Cohesion Funds for Bulgaria or EUR 124.4 mn over the period 2007 – 2013) will be channeled into Priority Axis 1 Development of a Knowledge-Based Economy and Innovation Activities. Many actions under the other priority axes of the program are organically linked to innovation and innovation capacity building, such as the activities for promotion of entrepreneurship, establishment of venture capital funds, ICT, etc. For more clarity, they have not been included in the calculations in this section but their current condition and development potential are reviewed in the main body of the report;
- **The Human Resources Development Operational Program** provides for the implementation of the operation Development of Post-Graduate Programs for Education and Research within the framework of the priority Improvement of the Quality of Education and Training, for which 3,2%[17] of the total resources of the program have been allocated (0,5% of the Structural and Cohesion Funds for Bulgaria or EUR 33 mn over the period 2007 – 2013). Similar to the foregoing operational program, this one envisages funding of activities which produce a strong impact on the country's innovation capacity, e.g. entrepreneurship, education and training, etc. For the overall goal of development of human resources, the public (national and EU funds) is expected to treble on an annual basis after 2007. Innovation is a horizontal priority in the Human Resources Development OP, which implies that all activities in the program will have an innovation component;
- **The Regional Development Operational Program** envisages investing in innovation 1.2 % of the resources for the priority Promotion of Local and Regional Development in Bulgaria (0.2 % of the total amount of the resources from the Structural and Cohesion Funds for Bulgaria or EUR 16.3 mn over the period 2007 – 2013). The program provides for investment in ICT and development of the business environment in various regions of the country, which will promote innovation;
- **The National Strategic Plan for the Development of Rural Areas** provides for 4 % of the total resources to finance the development of innovation in rural areas and food industries. These activities will be financed through the European Agricultural Fund for the Development of Rural Areas. The National Strategic Plan for Fisheries and Aquatic Cultures also mentions the development of science in this area as a strategic objective to improve the management of fish resources but it does not present any indicative financing plan.

According to expert estimates, the total resources to be allocated for direct actions for innovation, research and science[18] from the Structural Funds (the European Regional Development Fund and the European Social Fund) will

[15] This includes only those actions under the operational programs and the National Strategic Plan for the Development of Rural Areas, which are explicitly defined as oriented towards "innovation", "research", or "science". The versions of the documents available on the official website of the Government for coordination of the European funds HYPERLINK "http://www.eufunds.bg" www.eufunds.bg as of 25 November 2006 and the updated versions (complete or demo) available on the websites of the respective line ministries have been used here. Therefore there might be some discrepancies in the data, as observed also in the government documents, but they are hardly likely to produce substantial changes in the calculations, the risk being some underestimation of the respective expenditures.

[16] The assumption in the NSRF is that the relative weights of the individual priorities will not change over the period 2007 – 2013, which is highly unlikely against the backdrop of the dynamic economic development. Changes would possibly depend on the changes in the administrative capacity of the coordinating authorities and the beneficiaries in the respective spheres.

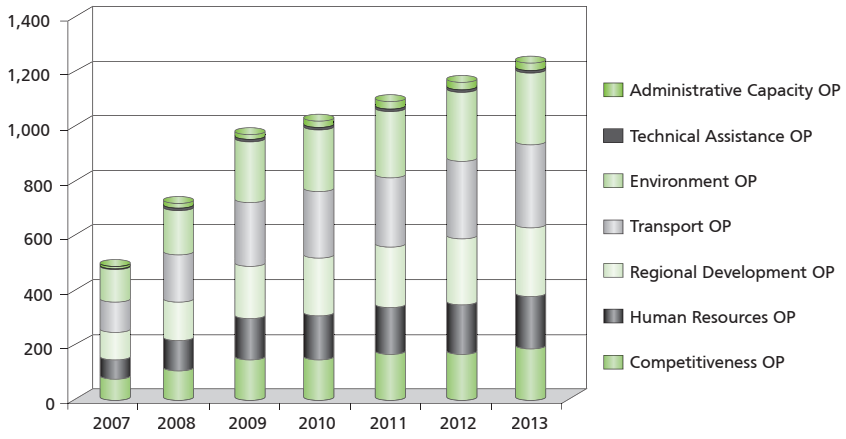
[17] The calculations are based on the assumption that the resources under the OP are the same as the resources envisaged for the respective priority under the three year program budget of the Ministry of Education and Science for 2007 due to the lack of detailed data in the available version of the program.

[18] These are the activities for which the operational programs explicitly state that they are allocated for innovation. They exclude innovation supporting activities such as entrepreneurship, venture capital financing, education, ICT, etc.

increase from EUR 12.8 mn in 2007 to EUR 32.1 mn in 2013. Spending on innovation and research would be even greater because of the added effect of the activities within the framework of the National Strategic Plan for the Development of Rural Areas[19]. In 2006, the expenditures for direct innovative activities, research and science in Bulgaria were about EUR 8 mn[20]. Hence the resources commited to the country from the Structural Funds in 2007 will be at least 50 % more than the current national financing. On top of this comes e financing from the EU Framework Programs. For the last four years Bulgarian participants have attracted EUR 31.2 mn in contracts under the Sixth Framework Program for Research, Technological Development and Demonstration Activities[21]. Under the assumption that Bulgaria's success rate will remain unchanged following the doubling of the budget of the Seventh Framework Program, we should expect the contracted amounts by Bulgarian organisations to reach some EUR 16 mn in 2007.

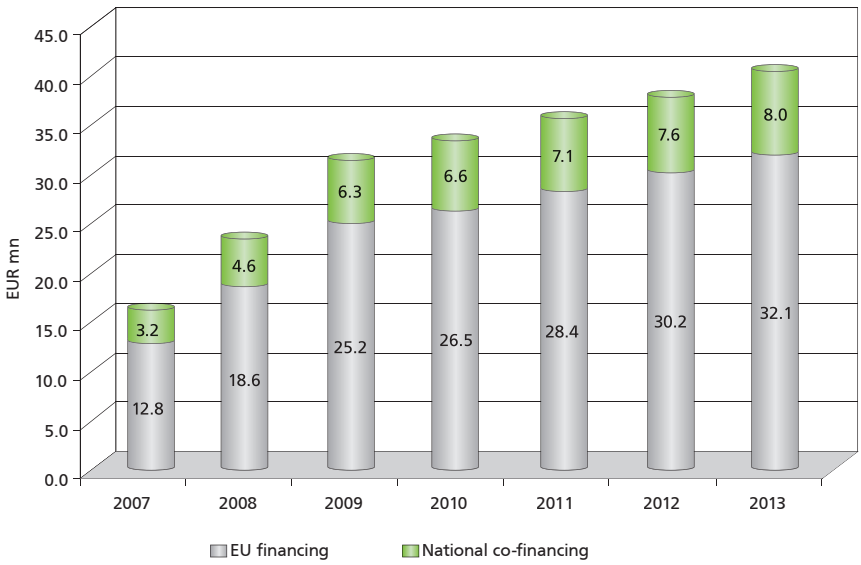
On the one hand, the substantial increase of the resources for innovation, research and science after 2007 calls for the establishment of additional administrative capacity in the country for management and coordination of the activities in this sphere. Moreover, the funds will come from different EU sources. On the other hand, from the perspective of the share in the total public and equivalent (EU) expenditures over the period 2007 – 2013, the role of research and technological development remains quite modest – 2 % or as much as that of tourism. The annual growth of this share in 2007 – 2013 compared to 2004 - 2005 is also rather small – 0.2 percentage points compared to 1.5 percentage points for tourism and over 7.3 percentage points for industry (SMEs). In the new Member States which joined the EU in 2004 the share of resources for research and technological development ranges from below 1 % in Lithuania and 2 % in Slovakia to over 10 % in Estonia[22].

Figure 2. PLANNED RESOURCES FROM THE EU STRUCTURAL AND COHESION FUNDS UNDER THE OPERATIONAL PROGRAMS FOR BULGARIA 2007 – 2013



Source: National Strategic Reference Framework of the Republic of Bulgaria 2007 – 2013, version as of October 2006.

Figure 3. RESOURCES FOR INNOVATION AND SCIENCE IN BULGARIA PLANNED WITHIN THE FRAMEWORK OF THE STRUCTURAL AND COHESION FUNDS 2007 – 2013[23]



Source: Applied Research and Communications Fund, 2006.

[19] According to the preliminary version of the plan, 4 % of the total budget will be spent on innovative activities in rural areas and on support for innovation in food industries.

[20] Including the 2006 budgets of the National Innovation Fund and the National Science Fund, which are the national project financing instruments.

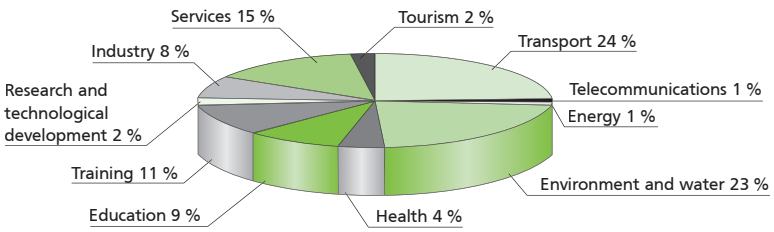
[21] EU Enlargement – What Impact on Research in Bulgaria, Romania and the EU?, Cordis News, 7 November 2006.

[22] Accessing EU Funds in the New Member States: Best Practice from Around Europe, Economist Corporate Network, The Economist (2005).

[23] The calculations are based on the assumptions about the amount of resources earmarked for innovation and research within three operation programs under the following priorities: Competitiveness OP – Development of a Knowledge-Based Economy and Innovation; Human Resources OP – Improvement of the Quality of Education and Training; Regional Development OP – Promotion of the Cooperation with the European Regions. They include only the resources which are explicitly envisaged for "innovation" and "research". The sources of data are the National Strategic Reference Framework (version as of October 2006) and the seven operational programs.

Although it is common sense to seek maximum absorption of the European funds in the initial years after the EU accession at the expense of allocating them into spheres which absorb them more easily but have no high impact on the economy like tourism or industry, these allocations should be considered carefully from the perspective of the administrative capacity and their effect on the long-term growth of the country.

Figure 4. PRIORITIES IN THE USE OF THE EU STRUCTURAL AND COHESION FUNDS BY SOCIO-ECONOMIC SECTORS



Source: National Strategic Reference Framework of the Republic of Bulgaria 2007 – 2013, version as of October 2006.

Recommendations

On the basis of the analysis and the assessment of the current condition of the national innovation system in *Innovation.bg* this year and last year, the following **recommendations** can be formulated for the successful integration of the national into the European innovation policy and for the better absorption of resources from the European funds for innovation, research and science:

- **A new strategic vision** is needed for the development of the Bulgarian innovation system in the EU in order to ensure consistency between the innovation policy and the research and technological development, ICT and education policies at the national level and coordination with the EU innovation policy. It could bring together the experience gained in the elaboration and implementation of several national documents - the National Innovation Strategy, including the available Reports on the National Innovation Policy for 2005 and 2006, and the activities of the National Innovation Fund, the National Strategy for Scientific Research 2005 – 2013, including the activities of the National Science Fund, the National Strategy for Promotion of SMEs 2007 – 2013, the draft Clusters Development Strategy, while taking into account the developments in the education and ICT spheres. It is important for this integrated document to reflect the guidelines for the development of the European Innovation Strategy and the way in which they will be consistently applied in Bulgaria within the framework of the various European financing mechanisms – the Structural and Cohesion Funds, the Seventh Framework Program, and the Competitiveness and Innovation Framework Program;
- **The coordination among the various operational programs connected to innovation** and the related spheres **should be improved** – the Development of the Competitiveness of the Bulgarian Economy OP, the Human Resources Development OP, the Regional Development OP and the National Strategic Plan for the Development of Rural Areas. Innovation as a horizontal priority should underpin also the other operational programs, especially the Environment OP, where the EU intends to develop as a global leader. The interaction between the individual operational programs should be justified from the viewpoint of their content and it should also envisage specific administrative coordination mechanisms, giving a clear outline of how the resources from the EU funds will be complemented by the other innovation financing progams at the EU level. For example, in terms of the administrative coordination, keeping the Ministry of Education and Science as the intermediary body only for the implementation of the Human Resources Development OP creates the risk of continued disproportion between innovation demand on the one side and research and technology supply on the other in the country. If we take the medium-term national development objectives set out in the NSRF as the point of departure, the leading operational programs should be those for competitiveness and human resources with clear interconnection between them and linkages to the other operational programs. The role of ICT in the individual progarms and the coordination of activities in this sphere should also be defined much more clearly;
- Special attention should be paid to the establishment of administrative capacity for management of European funds on the innovation at the regional level, where the management of activities and the burden of implementation will gradually be shifted. In this relation, after 2007, the capacity of national level authorities to integrate and coordinate innovation activities and policy should be strengthened, including the promotion of publish-private partnerships. The experience of the new EU Member States which joined in 2004 has revealed that after the first two years of absorption of resources from the Struc-

tural Funds, a need for more comprehensive and complex projects at the regional level emerged, for which their capacity proved to be much more limited[24];

- In order for the administrative capacity for developing and managing innovation projects within the framework of the European funds at regional and national level to be improved, the available European instruments in this direction should be used, such as Regional Innovation Strategies or the networks of the Innovation Relay Centers and the European Information Centers. For this purpose as early as 2007 it is necessary to implement a quick-start package of specific measures for national co-financing of these and similar initiatives supported by the EU framework programs. This will guarantee synergy between the various financing instruments of the EU innovation policy in Bulgaria and the maximum efficiency in the spending of national co-financing resources. For example, projects for Regional Innovation Strategies (RIS), a major tool of the European Commission to prepare the European (including Bulgarian) regions for innovation actions under the Structural Funds, are currently being implemented in all planning regions of Bulgaria. The South-Central Region has already developed its RIS and it already has a pipeline of projects to be financed from the Structural Funds. The other regions will be ready by the beginning of 2008 making 2007 a crucial year for the preparation of pilot projects.

[24] Accessing EU Funds in the New Member States: Best Practice from Around Europe, Economist Corporate Network, 2005.

INDEX *INNOVATION.BG 2007*

The *Innovation.bg*[25] index brings together five groups of indicators describing the national innovation system and its functioning:

1. **gross innovation product** – indicates the results of the functioning of the national innovation system in the form of new products, technologies and research, as well as the main outcomes from and obstacles to the innovation activities of enterprises;
2. **entrepreneurship and innovation networks** –presents two of the major sources of innovation for the Bulgarian economy – the establishment of new enterprises and the participation of Bulgarian companies in national and international networks for development of new products and services;
3. **investment in and financing of innovation** – reviews investment in R&D for the development of innovation and the available innovation financing instruments in the country, as well as the role of foreign investment and the import of capital goods in the transfer of foreign technologies and knowledge;
4. **human capital for innovation** – describes the existing general and specialized (research) human resources at the disposal of the national economy for adaptation and creation of innovation;
5. **information and communication technologies (ICT)** – analyses the condition and use of the available information and communication infrastructure as the conduit of knowledge and innovation.

Each group contains several synthetic indicators. Working definitions have been used for the synthetic indicators and the names of the groups might differ from similar more precise definitions in the existing literature. Indicators, in their turn, consist of a various number of existing statistical measures presented graphically and grouped so that to give the fullest possible picture of the respective component of the national innovation system. The indicators presented graphically build on internationally accepted definitions and concepts. The indicators in the

[25] For a more detailed description see Appendix 2 and *Innovation.bg: Innovation Potential of the Bulgarian Economy*, Applied Research and Communications Fund, 2005.

individual groups are not changed from one edition of *Innovation.bg* to another to ensure maximum comparability. The dynamic development of the theoretical models in this sphere, however, and the lack of updated annual data on some indicators have caused some changes and additions as reflected in the various sections.

Indicators are grouped on the basis of European and international experience in the design of such assessments so that to encompass as fully as possible the condition of the innovation system and the factors for its operation. Each indicator is chosen to meet several criteria to be included in the report, the most important ones being to ensure maximum comparability with EU and OECD countries, to be easy to understand, and to measure developments relevant for the development and well-being of the businesses and the population in Bulgaria.

The relatively early stage of development of the Bulgarian national innovation system makes the access to information in this sphere more difficult, while the available data from the official statistical sources such as Eurostat and the National Statistical Institute are two years old at best. The dynamic development of the Bulgarian and global economy, especially in the innovation sphere, requires the use of a maximum number of information sources to give a complete and up-to-date picture of the development of the national innovation system[26]. To achieve this effect, *Innovation.bg 2007* includes a brief overview of the international indexes following the development of the Bulgarian innovation system and presents for the first time the Innovation index of the enterprises in the country, constructed on the basis of the findings of surveys conducted by the Innovation Relay Centre – Bulgaria at the Applied Research and Communications Fund.

[26] Measuring Innovation 2006, The Boston Consulting Group, 2006.

International Indexes Assessing the Innovativeness of the Bulgarian Economy

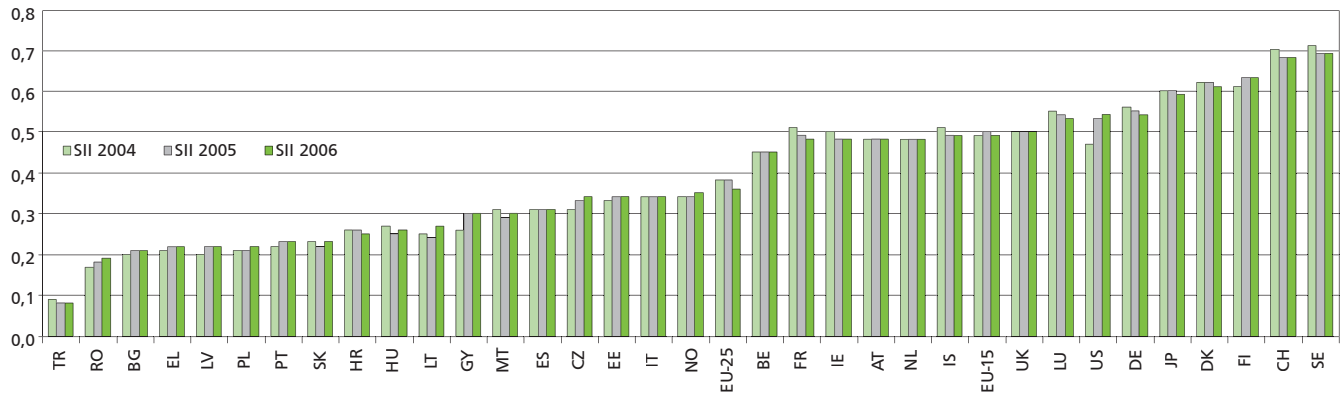
There exist several summarized international assessments of the innovative potential of countries, which include Bulgaria in their surveys: the summary innovation index of the European Innovation Scoreboard, the International Index of the National Innovation Capacity[27], the innovation indicator of the Global Competitiveness Index of the Davos World Economic Forum[28], the UNCTAD Innovation Capabilities Index, the Innovation Pillar in the Knowledge Assessment Methodology of the World Bank. In 2006, three of these indexes were updated and the results are presented briefly below[29]. The results for Bulgaria are not homogeneous across the various sources and at different points of time, which reflects to a certain extent the different ranking methodologies and also corroborates the need for further data and more detailed analysis of the structure and development of the Bulgarian innovation system.

The European Innovation Scoreboard[30] divides countries into four groups, depending on the dynamism of their innovation development compared to the EU average level on an annual basis – "innovation leaders", "followers", "catching up" and "trailers". The dynamism of the development of countries is measured by the summary innovation index. Over the period 2004 – 2006, Bulgaria moved between the groups of "catching up" and "trailers", ranking among Poland, Slovakia, Latvia, Romania and others in terms of aggregate index values. According to the scoreboard analysis, Bulgaria does not use the resources invested in innovation efficiently, i.e. the innovation investment level should have put Bulgaria in a much better economic position in Europe. The scoreboard reports a recurrent tendency of the EU-27 to lag behind the United States even when enlargement effects are exluded.

The Knowledge Assessment Methodology is an interactive tool for international comparisons in terms of various indicators, which has been developed by the Knowledge Development Program of the World Bank. It consists of 80 structural and qualitative indicators making up the four pillars of the knowledge-based economy: (1) economic incentives and institutional growth; (2) education; (3) innovation, and (4) ICT. According to its assessment, Bulgaria has substantially improved its innovation capacity for the last ten years, reaching the level of Croatia and overtaking Romania, Turkey, Latvia and Poland among the applicant countries and the new EU Member States.

The Global Competitiveness Report 2006-2007 of the World Economic Forum in Davos ranks Bulgaria last among the applicant countries and the new EU Member States in terms of the Innovation Indicator of the Global Competitiveness Index, seriously lagging behind Cyprus, Romania and Turkey which rank behind Bulgaria in terms of the indexes mentioned above. Probably the difference with the other two innovation rankings is due to the different level of data aggregation. The former two rankings include more monotonous statistical indicators which change values slowly with a certain time-lag and cover factors of the innovation environment, whereas the latter is based on surveys of businesses which are strongly focused on the development of products and might reflect

Figure 5. SUMMARY INNOVATION INDEX 2004, 2005 AND 2006



Source: European Commission, 2007.

[27] Developed by Michael Porter and Scott Stern in 1999 for the needs of the Global Report on Competitiveness of the Davos World Economic Forum. The index has not been updated since 2003.

[28] Innovation is one of the nine indicators making up the International Competitiveness Index of the Davos International Economic Forum.

[29] For the other indexes see *Innovation.bg: the Innovation Potential of the Bulgarian Economy*, Applied Research and Communications Fund, 2005.

[30] For more details see Appendix 2.

specific attitudes as of the time of the survey.

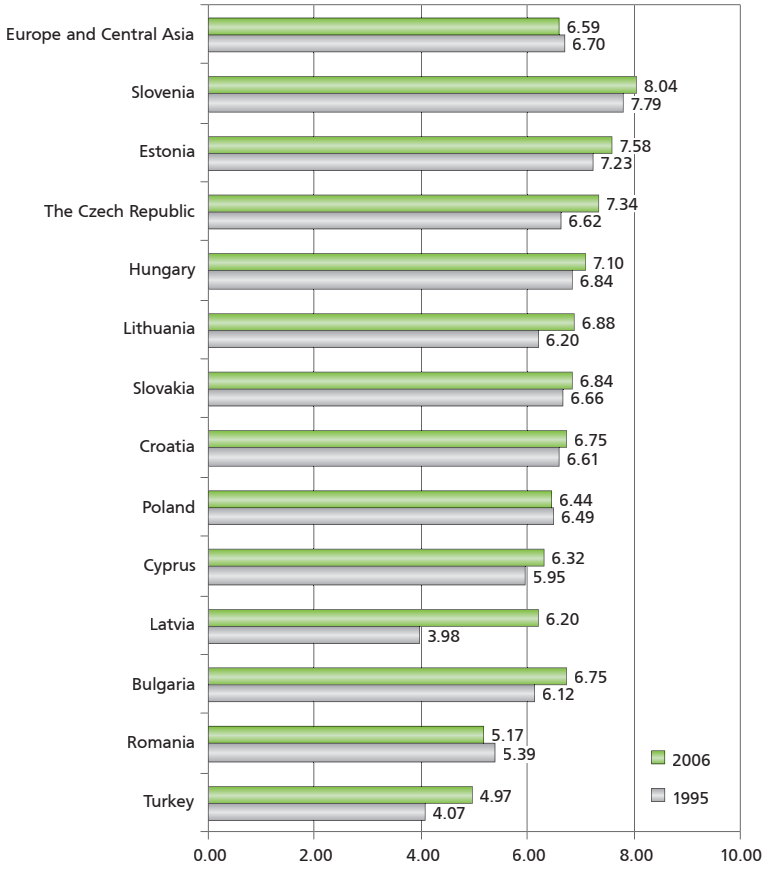
Innovation Index of Bulgarian Enterprises[31]

The disparate findings about the operation of the Bulgarian innovation system resulting from the application of different international methodologies prevent their use in the development of the national innovation policy. Therefore the macro- and/or micro-economic data collected to examine more general developments such as competitiveness should be supplemented by more detailed data on the innovativeness of Bulgarian enterprises. *Innovation.bg 2007* meets these needs, presenting for the first time an index of the innovativeness of Bulgarian enterprises to supplement the micro-economic data from the annual surveys of the Applied Research and Communications Fund used in the five groups of indicators covered by the report. Appendix 1 of the report includes also a pilot cluster analysis and a panel survey of Bulgarian innovative companies. The simultaneous application of all three tools enables *Innovation.bg 2007* to give a detailed picture of the operation and features of the Bulgarian innovation system for the needs of the national and corporate innovation policies in Bulgaria.

The innovation literature assumes that the ability to create and introduce product innovations is relevant for the initial market development stage when a multitude of competing versions of the respective good exist. As time goes by, the focus is shifted to process innovations, economies of scale and cost reduction[32]. Many surveys in Europe point out that organizational innovation is more important for the changes in the structure of employment and skills than technological (process or product) novelties, whereas the distinction between product and process innovation should not be overestimated since businesses often introduce both simultaneously in combination with organizational innovation[33]. Historically, the process of catching up in developing economies is associated not only with the acceptance and application of existing technologies in conventional economic sectors but also with innovation, especially of the organizational type, and with entry into emerging global markets[34].

Using these theoretical models, the innovation index of Bulgarian enterprises ranks innovative businesses on a 0 to 100 scale in terms of their

Figure 6. INNOVATION PILLAR IN SELECTED ECONOMIES 1995, 2006 ACCORDING TO THE KNOWLEDGE ASSESSMENT METHODOLOGY



Note: 0 = no innovation capacity; 10 = maximum innovation capacity

Source: World Bank, 2006.

[31] The Innovation Index of the Bulgarian Enterprises and the data in this section of the Report are calculated on the basis of the annual survey of innovative companies in Bulgaria conducted by sociological and marketing agency Vitosha Research as commissioned by the Innovation Relay Centre (IRC) at the Applied Research and Communications Fund, unless explicitly mentioned otherwise. It is a nationally representative survey of companies in Bulgaria based on the answers of 1,070 respondents in the country. Although coming from the same source, data in this section are not directly comparable to but are compatible with the data from the five groups of indicators of the Innovation.bg index presented below since the calculations of the innovativeness index of enterprises use not only product and process innovation, but also marketing and organizational innovation. For the sake of year-to-year comparability, the results in the five groups of indicators presented below are based only on product and process innovation. The description of the index methodology is provided in Appendix 2.

[32] Fagerberg, J., D. Mowery, R. Nelson, The Oxford Handbook of Innovation, Oxford University Press 2005.

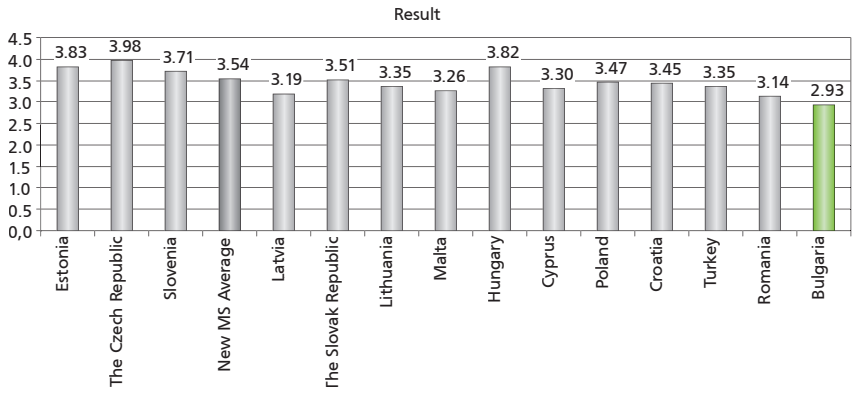
[33] Pinta, M., Innovation and Employment, The Oxford Handbook on Innovation, Oxford University Press, 2005.

[34] Fagerberg, J., Godhino, M., Innovation and Catching-Up, The Oxford Handbook on Innovation, Oxford University Press, 2005.

innovation intensity. The latter is determined by the ability of enterprises to combine several types of innovation at a time, thus generating revenues higher than the predominant market levels[35]. Furthermore it is influenced by the degree of novelty of the products introduced on the market. Innovation types determine the level of innovation intensity of enterprises, depen-ding on whether these are novelties for the company only, for the domestic market or for the sector globally.

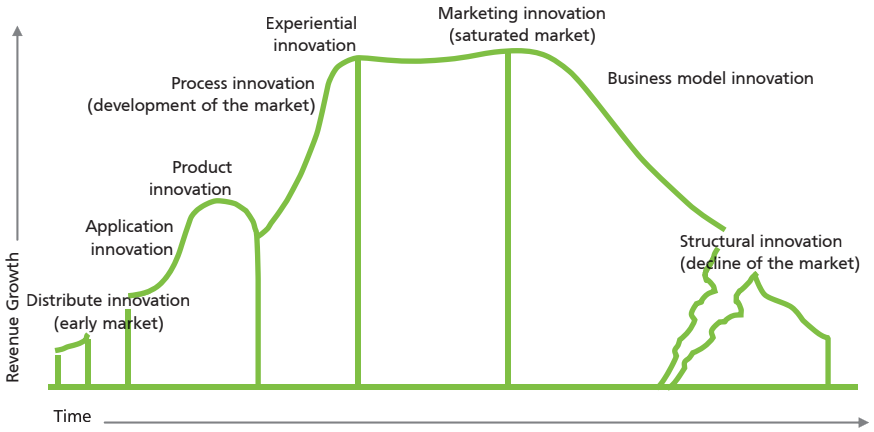
The innovation index distinguishes among three types of innovation: product, internal (process and organizational) and marketing innovation[36]. In 2006, Bulgarian enterprises introduced most often internal innovation (27% of companies) followed by product innovation (18,1%) and marketing innovation (17,5%). Companies rarely introduced only a single type of innovation. The smallest share in this respect is that of companies introducing only marketing innovation (1,6%) followed by product innovators (2,8%) and internal innovators (6,2%). This distribution is easy to understand since the introduction of a new product or process calls for extensive marketing efforts to be promoted. In the case of younger companies on the markets, such as most of the companies active in Bulgaria, product innovation requires the introduction of new promotion channels to tap into the full value-added of the innovation. Enterprises which introduced product innovation typically engaged in internal innovation as well and the latter brought about marketing innovation, too. Thus product innovations are the main innovation engine for Bulgarian enterprises, while their capability of introducing internal and marketing innovation determine their innovation intensity. The prevalence of internal innovation in Bulgarian enterprises reveals that they are active primarily on well established markets with high product saturation and small potential for revenue growth beyond the implementation of economies of scale and cost reductions. This implies that the Bulgarian companies are exposed to substantial competitive pressure at the time of their entry into the market. Thus, in order to stay on the market against the backdrop of the gradual increase of domestic labor costs, Bulgarian companies have to generate revenues from their price advantage or from the introduction of more marketing innovation or the development of new products. The choice between these alternatives depend on the innovation climate in the country and the extent to which it supports investment in the development of new products[37]. Few Bulgarian companies, less than one in ten, reach the highest innovation intensity

Figure 7. INNOVATION INDICATOR OF THE GLOBAL COMPETITIVENESS INDEX



Source: Global Competitiveness Report 2006-2007.

Figure 8. MARKET LIFE CYCLE AND INNOVATION TYPES



Source: Harvard Business Review, Moore, G., Darwin and the Demon: Innovating Within Established Enterprises, 2005.

[35] Many empirical studies reveal that the yield typically measured as the profit margin or capital gain (change of value) per share is generally higher for innovative businesses than the market levels in the respective sector and it is the highest for companies combining several types of innovation. For more details see McGregor, J., The World's Most Innovative Companies, BusinessWeek, April 24, 2006; Innovation 2006, The Boston Consulting Group, 2006; The R&D Scoreboard 2006, Department of Trade and Industry, UK, 2006.

[36] Using the definitions and methods of collecting information of Community Innovation Survey 4 of Eurostat.

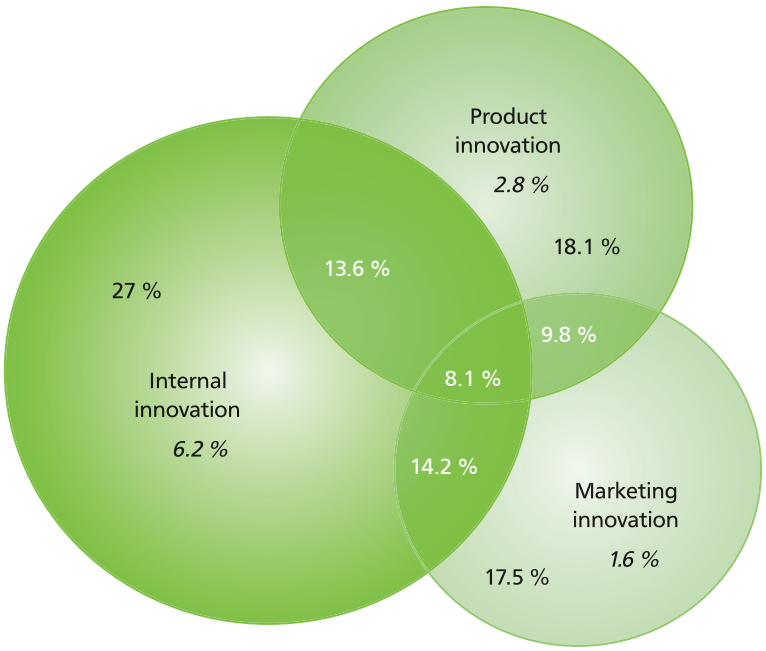
[37] See the Gross Innovation Product section.

and introduce all three types of innovation simultaneously.

The Innovation Index of Bulgarian enterprises reveals that a sizeable portion of them (over 65 %) have not introduced any innovation over the last year. **Most of the Bulgarian innovative enterprises (some 24 % of all businesses) report index values below 40, and the average weighed Innovation Index of Bulgarian Enterprises was 10.2 in 2006.** That reveals their weak ability to combine several types of innovation and the introduction mainly of innovations with low level of novelty by the Bulgarian enterprises (new to the company or the domestic market but not to the international market). The average value of the index for innovative businesses is 56.1. The highly innovative Bulgarian companies or companies with an index above the average of 56.1 account for less than 4 % of all Bulgarian enterprises. The high concentration of innovation activities in just a few companies is a normal feature of innovation. On the other hand, although there is no opportunity for international benchmarking or comparisons over time, the big difference in the average level of innovativeness among all enterprises and the innovative companies in Bulgaria is a sign of weak entrepreneurial activity in the Bulgarian economy and is a potential threat for the growth opportunities of enterprises[38].

The analysis of the relation between the Innovation Index and some other features of the Bulgarian enterprises provides important direction for the national innovation policy which, if coupled with the other available statistical indicators, could be used to enhance the innovative capacity of the Bulgarian enterprises and the economy as a whole. The Innovation Index of Enterprises is related to the **main market** on which companies operate. The index is higher than the national average level for the groups of companies that operate on the national, European and global markets. The index for the national market is lower than that for the European one by some three points, which is an indirect measure of the **weaker domestic competition**[39]. Most Bulgarian companies are focused on serving the local market (within 30 km of their location) or the regional market (within 100 km) and these two markets are characterized by lower levels of the Innovation Index than the national average one. This comes to reveal **weak innovation capacity and potential in the Bulgarian regions**, poor national innovation identity and reliance on the demand of European consumers for the development of innovative products. If the innovativeness of the local and regional markets is increased at least to the level of the national market, this will result in substantial growth of the Bulgarian economy and development of specific local innovative products with great potential for international sales[40]. This conclusion is confirmed by the relation between the Innovation Index and **the typology of partnerships** with other organiza-

Figure 9. SHARE OF BULGARIAN COMPANIES BY TYPE OF INNOVATION THEY HAVE INTRODUCED IN 2006



Note: The figure presents the share of the innovative companies in the whole set. The numbers in the overlapping sections of the circles stand for the share of companies which have introduced the respective types of innovation simultaneously. The percentage in the circles in the figure stand for the share of the companies which have introduced the respective type of innovation and the percentage immediately below the names indicate the share of the companies which have introduced only this type of innovation.

Source: Applied Research and Communications Fund, 2006.

[38] See the Entrepreneurship and Innovation Networks section.

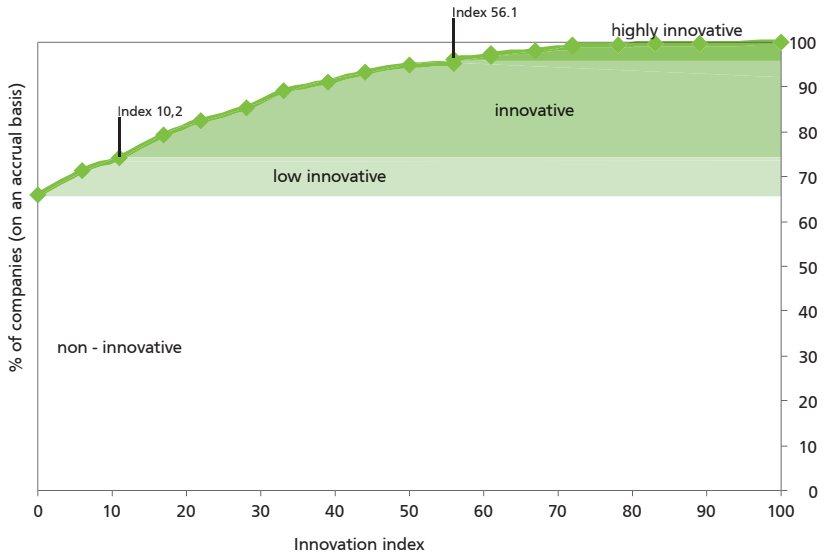
[39] See the Entrepreneurship and Innovation Networks section of this report.

[40] According to Michael Porter and his diamond of competitiveness, the capacity of businesses to innovate depends primarily on the intensity of competition on the local market and on the links with local clusters.

tions, through which the companies in Bulgaria develop their product innovations. **Innovativeness is highest in the enterprises which partner with foreign organizations.** They are followed with a small margin of several points by companies purcha-sing their product innovations from other local partners and those developing them together with local organizations. The index for the group purchasing their product innovations from foreign partners is by some three points lower than the one for the first three cases. The difference might be explained with a host of factors. Enterprises of this type probably receive ready-made innovations from their parent companies, which does not lead automatically to enhancement of the indigenous innovativeness of the subsidiary. Furthermore, knowledge of the local context and the easier exchange of tacit knowledge between local companies cannot be achieved in cross-border relations. These observations support the conclusion of last year's *Innovation.bg* report that **the entry of Bulgarian companies with strong local ties into international production networks on a partnership basis is an important factor for enhancing the innovativeness of the Bulgarian economy.**

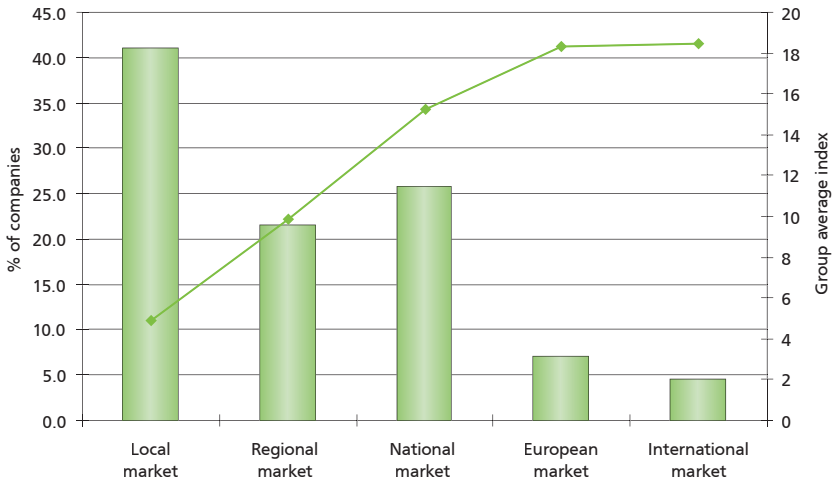
The values of the Innovation Index of Bulgarian Enterprises depends on **the planning horizon** of companies. Companies with a written business plan covering more than two years are more innovative by 30 % on the average than those planning only a year ahead. Other pilot tests of the sensitivity of the index prove that the innovativeness of enterprises depends on the quality of management (managers with a MBA degree) and not so much on the availability of technical specialists and on the job training of the staff. These findings about the crucial importance of high-

Figure 10. INNOVATION INDEX OF BULGARIAN ENTERPRISES



Source: Applied Research and Communications Fund, 2006.

Figure 11. INNOVATION INDEX OF BULGARIAN ENTERPRISES AND THEIR PRIMARY MARKET



Source: Applied Research and Communications Fund, 2006.

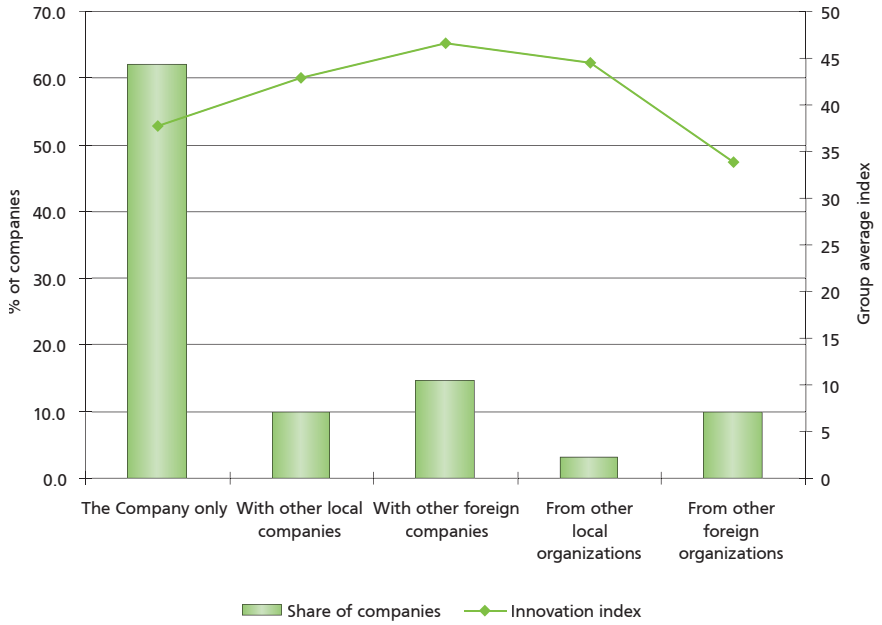
quality managers and their lack in Bulgarian businesses are corroborated by an increasing number of surveys of the Bulgarian economy. The latter, however, reveal also the importance of the staff training and the availability of good technical experts for the performance of the enterprise[41]. It might be precisely the lack of high-quality management that could be the reason for the failure of the link between the innovativeness of the enterprises and the continued training and technical expertise to develop.

The Innovation Index of Bulgarian Enterprises presented in this section of the report is a pilot exercise. It will be supplemented and extended in future editions of the report. Many conclusions pointed out here need further study. Nevertheless, the index

[41] See The Competitiveness of the Bulgarian Economy 2007, Centre for the Study of Democracy, 2007, and World Competitiveness Yearbook 2007, IMD, 2007.

provides a powerful tool for analysis of the innovation policy and strategies of enterprises in Bulgaria. It will improve the performance of the Bulgarian innovation system and create opportunities for further relevant conclusions and recommendations concerning the national innovation policy.

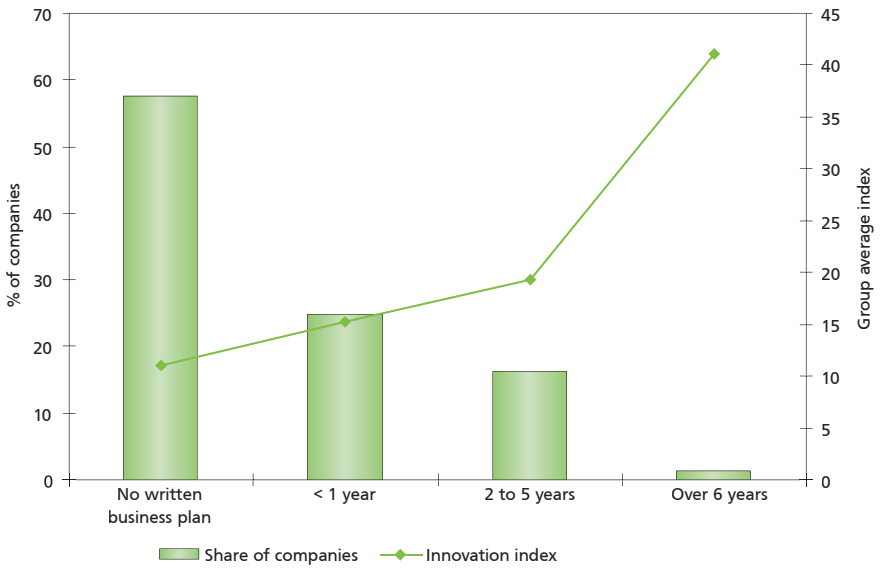
Figure 12. INNOVATION INDEX OF BULGARIAN ENTERPRISES AND THE TYPE OF COOPERATION THEY ENGAGE IN IN THEIR INNOVATIVE PROJECTS



Note: The labels are abbreviated for the sake of the layout: "company" means "primarily from the company" (no innovation cooperation), "with other local organizations" means "primarily the company in cooperation with other local organizations", etc.

Source: Applied Research and Communications Fund, 2006.

Figure 13. INNOVATION PRODUCT INDEX OF BULGARIAN ENTERPRISES AND THEIR PLANNING HORIZON[42]



Source: Applied Research and Communications Fund on the basis of Vitosha Research data and its survey Readiness of SMEs to absorb EU funds, commissioned by the Ministry of the Economy and Energy, 1,011 companies, 2006.

[42] The innovative product index of enterprises is analogous to the innovation index but it is calculated on the basis of product innovation and does not take into account internal or marketing innovation. Their levels are not directly comparable but both indexes display similar behavior.

1. Gross Innovation Product

The gross innovation product or the innovativeness of an economy is expressed in the new products and services introduced, the new technologies created and the new research results achieved. It consists of and results from the interaction of the innovation, technological and research product of the country. It is a major benchmark for the innovation policy because it makes it possible for the outcomes of the innovation system to be compared over time and geographically and for a proper assessment of the needs for change in the organization of and inputs in the innovation process.

Over the last twelve months, the Bulgarian economy has increased its gross innovation product, and the upward trend is expected to continue. The main driving force behind the rise is the innovation product but the research product of the country has also grown parallel to it. The rise, though modest, of the innovation and research activity has not brought about development in the technological product yet. The development of the national innovation system is still in its early stage, which is most clearly seen in the relatively low results it produces compared to the EU average levels. The first year of Bulgaria's EU membership will see further positive developments: expansion in the innovative activity of enterprises, improvement in their technological level and increase in research.

Innovation product. The share of innovative enterprises is gradually growing in Bulgaria. According to the latest official data, they account for some 16 % of all companies, still far below the EU average level. The economic sectors exposed to the most intensive international competition and penetration of foreign capital, such as finan-

cial intermediation, computer technologies, R&D, engineering and consulting services, and mining industries have scored the highest growth of innovative enterprises and lag relatively less behind the respective EU levels. The situation in the regulated utilities, transport, logistics and communications is just the opposite. The modest share of innovative businesses in the Bulgarian economy relates also to the low technological intensity of its economy – Bulgaria lags behind the leaders among the new EU Members States (Hungary, the Czech Republic and Estonia) more than five-fold in terms of the share of high-tech exports. The Bulgarian innovative enterprises are either in their development stage or operate on markets where the capital intensity is higher than the innovation intensity and therefore their innovation activities are characterized, first and foremost, by the acquisition of machines and equipment supplemented with training of human resources. R&D comes second, whereby only 30 % of the innovative companies (i.e. less than 5 % of all enterprises) mention them as an innovation activity. The effects of the innovation activity of Bulgarian enterprises most often relate to broadening of the product range, expansion of the market and assuring compliance with international standards. The most substantial obstacle for Bulgarian innovative enterprises in their innovation activity compared to their counterparts in the EU is the lack of appropriate sources of financing.

Technological product. The technological product in Bulgaria is some 50 % below the level of the EU-10. The patent activity of Bulgarian inventors before the Bulgarian Patent Office has decreased but has increased before the U.S. and European patent administrations. The number of granted patents, however, remains far below the average EU-10 levels which, in turn, are low compared to international standards. Bulgarian patents are applied for by and granted to individual inventors, which makes them vulnerable to circumvention on the international markets, while their economic effect for the Bulgarian economy is not tangible. Supply and demand on the Bulgarian technological market remain weak. Domestic and international companies perceive the intellectual property rights protection in the country as unsatisfactory: it is twice as low as in the EU-15 countries. In spite of the signs of slightly increased patent activity of Bulgarian inventors in Europe, if it persists at levels lower than the average in the EU-10, Bulgaria faces a serious threat of remaining outside the global technological flows and faces the risk of limiting its long-term innovation capacity.

Research product. The research product of Bulgaria has grown for the last twelve months but its overall level is still below the average for the new EU Member States. Bulgaria continues to lose ground with regard to the international recognition of its research product. The number of publications and citations in internationally refereed journals of comparable-size countries like, for instance, Slovakia, is growing at faster pace than those of Bulgaria. The structure of the research product is shifting towards applied subjects similar to the structure in the new EU Member States, but at a slower pace. The share of basic science (chemistry, physics) is still high, whereas clinical medicine (closely related to the fast growing global biotechnology sector) has a much smaller share than in the EU-15 and the new Member States. The preservation of this basic-science dominated structure does not entail any substantial increase of the technological and innovative activity of the research sector in Bulgaria in the near future. A positive sign in this respect is the growing share of Bulgarian engineering and technological publications up to twice as much as those in the EU-15. The EU Framework Programs produce a tangible impact on the publication activity and the structure of the research product in Bulgaria. In the context of further EU support for research in Bulgaria and with the further improvement of the overall economic situation in the country, there are positive expectations as to the development of the research product in the years to come.

Innovation Product

The innovation product of a country includes the new or substantially improved goods and services produced (or adapted) and introduced on its market. It is determined by the innovation activity of enterprises in the country and serves as the most important measure for the performance of the national innovation system. The key features of the innovation product and foremost its market orientation and the fact that it is the final phase of the innovation process, determine the leading role of the business (and, more specifically, of the innovation activity of enterprises) in its implementation.

Innovative Enterprises and High-Tech Exports

According to the latest available data from the National Statistical Institute (NSI)[43], the share of innovative enterprises in Bulgaria has grown to 16.2 % of all businesses with more than nine employees. The conclusion of the previous edition of *Innovation.bg* that the Bulgarian economy lagged substantially behind the average European level in terms of its innovativeness is still relevant. The average share of innovative enterprises in the EU-27 was 37 % as of 2004[44]. In spite of the lower commitment to innovation of Bulgarian enterprises as a whole, some sectors report considerable improvement in comparison to the previous survey. The most dynamic growth of the share of innovative enterprises is observed in financial intermediation (growth rate of 10.1 percentage points), computer technologies, R&D, architectural, engineering and consulting services (9.8 percentage points) and mining industries (8.4 percentage points). The weakest improvement of the share of innovation enterprises is observed in the utilities (electricity, gas and water) – 0.5 percentage points.

The sectoral comparison between Bulgaria and the EU-15 is terms of the innovative activity of enterprises reveals that, notwithstanding the improvement reported, the absolute lagging behind EU-15 is above the average level (27.8 percentage points) in mining industries (28.8 percentage points) and in financial intermediation (28.5 percentage points). On the other hand, thanks to the greater commitment of mining industries to innovation, this sector reports the shortest distance from the respective average EU-15 level of 20.6 percentage points. However, more telling are the differences in the relative lagging behind because they take into account the capital and innovation intensity of the respective economic sectors. In terms of this indicator, the sectors which stand closest to the European levels are computer technologies, R&D, engineering and consulting services (62 % of the European level) and financial intermediation (51 %). The greatest relative lagging behind is observed in transport, logistics and communications (26 %) and electricity, gas and water (27 %).

Although Bulgaria lags behind the EU-15, there are some common features in the structure of innovative enterprises. For example, **the sectors with the largest share of innovative enterprises in both cases are computer technologies, R&D, architectural, engineering and consulting services, and financial intermediation**, whereby the relative advancement of the first sector in comparison to the respective average level is higher in Bulgaria (20.4 %) than in the EU-15 (13.9 %). The greater sectoral differences in innovation performance are signs of the early stage of development of the market economy in Bulgaria. This very high concentration of innovative enterprises is confirmed also by the Innovation Index of Enterprises presented above.

The greatest propensity for innovation in computer technologies and R&D[45] and financial intermediation in Bulgaria reflects the international tradeability of these services. On the one hand, they have access to global markets and must meet the sophisticated demand and, on the other hand, competition is high on the supply side. Additional factors for the faster innovation development of these sectors in Bulgaria are the specific features of the labor market and the entry of foreign capital. Very important is the fact that the main input/capital in their production is knowledge which, although not at the best international level, is

[43] The survey of enterprises follows the model of the Community Innovation Survey and it was conducted by NSI in 2005. Eurostat published the findings of the survey in 2006. It was for the second time that the survey was carried out in Bulgaria after the pilot CIS survey of 2004, the results of which were presented in Innovation.bg: the Innovation Potential of the Bulgarian Economy, Applied Research and Communications Fund, 2005. Parallel to the NSI, Vitosha Research, the sociological and marketing agency, applied the same model to two surveys at the national level in 2004 and 2006. On the one hand, the different methodology, including the scope of the sample (number of companies and sectors) and the design of the questionnaire prevents the direct comparability of results. On the other hand, the complementarity of the two sources of information (Vitosha Research emphasized in its surveys on the more extensive collection of data on the overall innovation process in enterprises) enables their joint use for a more thorough analysis of the innovativeness of the Bulgarian economy. Whereas NSI data is published with a two-year time lag, the surveys of the Innovation Relay Centre – Bulgaria at the Applied Research and Communications Fund give a more up-to-date picture of the way in which the Bulgarian innovation system functions.

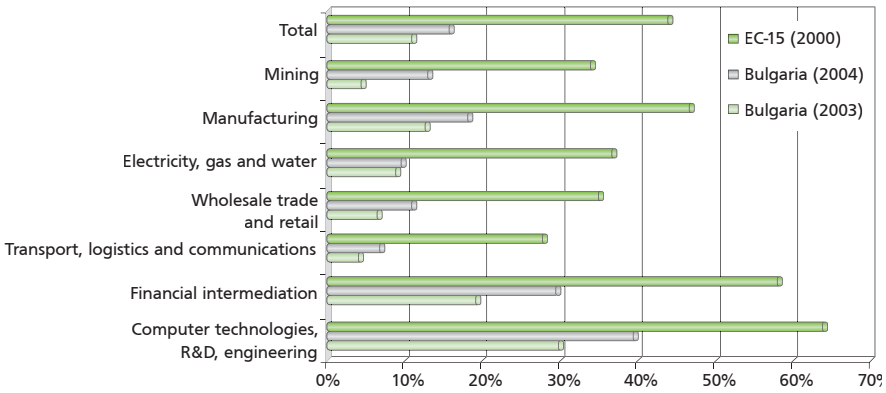
[44] According to available data from the fourth Community Innovation Survey in 2007. All data provided below on EU 15 is from CIS 3.

[45] The full name of the sector is "computer technologies, R&D, architectural, engineering and consulting services". Here and in the other sections the mentioning of any of these activities implies the whole sector as well.

rewarded dozens of times lower in Bulgaria than in the developed nations. Short-lived as it is, this price comparative advantage of domestic producers promotes their international competitiveness. The entry of foreign capital in the Bulgarian banking system (over 80 % of the assets in the sector are owned by foreign legal entities) is also a catalyst for the introduction of new products and services, enhanced competition, and improved quality of management and marketing, which inevitably requires more active innovation.

The reasons for the substantial lagging behind of Bulgaria in comparison to the EU-15 in terms of the innovation of enterprises are numerous and can be traced out on both the supply and demand side. In the context of a functioning market economy with full freedom of movement of goods, services and capital, the market demand and the competitive pressure seem to play the leading role for the commitment of enterprises to innovation. The Bulgarian market is relatively small and characterized by low purchasing power of consumers and unsophisticated demand in general. These features of the Bulgarian society are corroborated by a Eurobarometer survey[46] according to which Bulgaria is among the countries with the greatest share of the population "reluctant to" or "anti-" innovation. Still new or improved goods and services are "attractive" for 42 % of the Bulgarians compared to 39 % in the EU on the average. This typological analysis comes to show that Bulgaria is within the group of countries with the highest proportion of "anti-innovation" respondents who account for 20 % compared to an EU average of 16 %. These features of the market in the country are powerful prerequisites for the weak innovative efforts of the local enterprises. Some possible incentives in such an environment could be the export orientation of the domestic output and/or the reinforced competition in the market segment from imports. These two factors operate simultaneously in most cases and therefore the innovation process becomes a strategic and long-term choice of business. The accelerated globalization processes over the last decade further contributed to enhancing competition and emphasize the need for product differentiation, as well as vertical and horizontal integration and clustering on the supply side.

Figure 14. SHARE OF INNOVATIVE ENTERPRISES IN BULGARIA AND THE EU-15 BY ECONOMIC ACTIVITIES



Note: The names of the sectors are abbreviated for the sake of the layout. The latest available data as of the beginning of 2007 is presented.

Source: NSI, 2006, Eurostat, 2006.

The analysis of the structure of innovative enterprises in Bulgaria by types of innovation reveals a positive trend for the economy as a whole, **increasing the share of mixed innovation (both products and processes) at the expense of purely product innovation**. Nevertheless, the innovation thrust of Bulgarian enterprises towards improvement of products only remains much higher than that in the EU-15. They account for 46.2 % of the whole Bulgarian economy, whereas the respective indicator in the EU-15 is 25.4%[47]. This characteristic proves the early stage of development of the innovation system and market mechanisms in the country. Product innovation typically has lower rates of return compared to mixed or process innovation and it is oriented towards the domestic market, i.e. generally it does not improve the competitive positions of Bulgarian companies internationally. Given the fact that most Bulgarian companies focus on well established and saturated markets (EU) rather than emerging industries, the implementation only of product innovation without accompanying process innovation means that enterprises rely mainly on the low cost of products and they will receive just a small portion of the added value of the end customer.

The sectoral comparison by types of innovation exhibits **some similarities between Bulgaria and the EU-15**. Financial intermediation has the largest share of mixed innovation in both cases, while process innovation prevails in electricity, gas and water. The fact that some sectors have minimal levels of innovation specialization in Bulgaria, e.g. there is full process specialization in the utilities, while mining industries and financial intermediation report almost zero process innovation, can be explained with the pilot nature of the first survey in 2003. The recent trends traced out in the latest survey bring the types of in-

[46] Population Innovation Readiness, Special Eurobarometer, European Commission, 2005.

[47] See also Innovation Index of the Bulgarian Enterprises above.

novation by sectors in Bulgaria closer to the respective specializations in the EU-15.

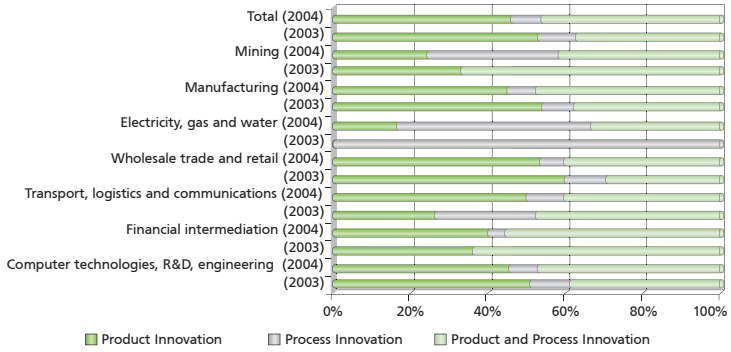
The nature of the specialization of the Bulgarian economy is best seen in the **share of high-tech exports in the overall export of goods**. This statistics reveals the low-tech profile of the Bulgarian economy even with a negative trend reported in the latest statistical survey because of the decline on an annual basis[48]. Bulgaria ranks among the last in Europe, whereby only Hungary has a high-tech specialization above the EU-15 average. Hence, **the Bulgarian innovation system is not oriented towards products with high knowledge and technological content**. Expectations are for this indicator to improve substantially after the country's EU accession, with the strengthening of market competition and Bulgaria's integration into the European research, technological and innovation community.

Innovation in the Bulgarian Enterprises: Characteristic Features

The nature and results of innovation activities of Bulgarian enterprises confirm that **the Bulgarian economy is still at an early stage of its innovation development, where capital investment prevails over innovation. To corroborate the findings of last year's report, this year, too, Bulgarian companies focus mainly on the acquisition of machinery and equipment in their innovation activities**. Innovative enterprises place R&D second and the training of employees comes third. In a dynamic pattern, much less companies saw their marketing activities as innovation in 2006 compared to the previous year. On the other hand, the training of employees and

[48] The latest available data of Eurostat is from 2004.

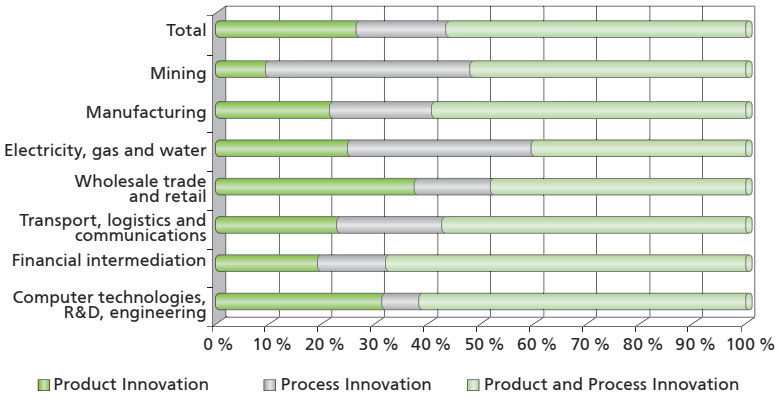
Figure 15. STRUCTURE OF INNOVATIVE ENTERPRISES IN BULGARIA BY TYPES OF INNOVATION



Note: The names of the sectors are abbreviated for the sake of the layout.

Source: NSI, 2006.

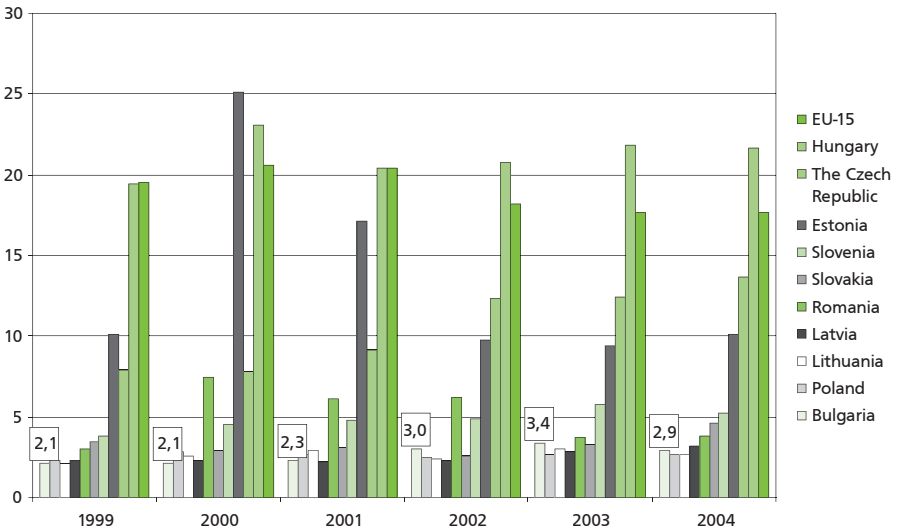
Figure 16. STRUCTURE OF INNOVATIVE ENTERPRISES IN THE EU-15 BY TYPES OF INNOVATION



Note: The names of the sectors are abbreviated for the sake of the layout. The latest available data of 2001 is presented.

Source: Eurostat, 2006.

Figure 17. DYNAMICS OF HIGH-TECH EXPORTS AS A PERCENTAGE OF TOTAL EXPORTS FOR BULGARIA, ROMANIA, EU-15 AND EU-8



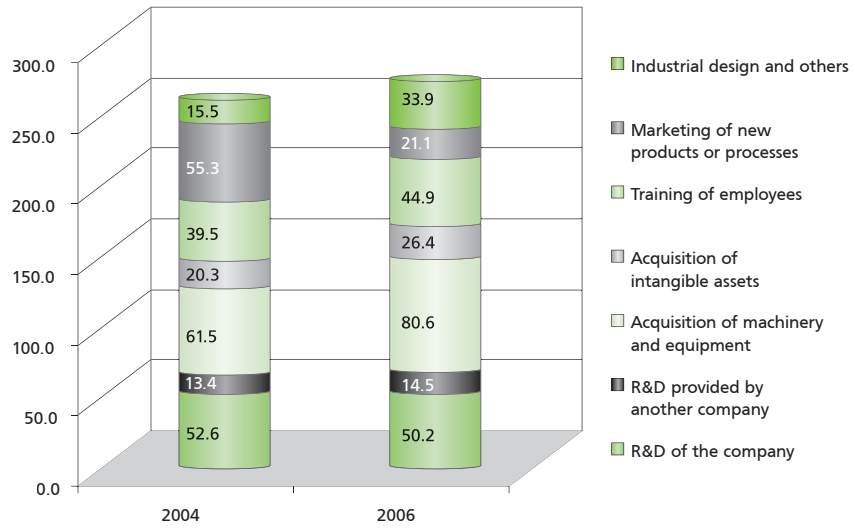
Source: Eurostat, 2006.

the acquisition of machinery and equipment had a larger share.

From the perspective of the **effects of their innovation activity**, Bulgarian enterprises are rather similar to their European competitors. Both in Bulgaria and in the EU-15, the main goal of the innovation activity is to **improve the quality**, followed by the **expansion of the product range**. The dynamic analysis of the data about the Bulgarian economy shows that the significance of the second goal grows over time. Hence, the practices of Bulgarian producers until recently to rely on competition with homogeneous products based on lower prices are replaced by **marketing of differentiated products**. This trend among Bulgarian innovative businesses is natural and expected, given the growing competition from countries with low labor costs (China, India, Turkey and Ukraine) and the rapid wearing out of the strategies based on low-cost advantages. Local companies attach increasing importance also to innovation results related to the reduction of material and energy costs per unit of output. In relative terms, however, cost reduction remains a minor goal among all effects of the innovation activities of Bulgarian enterprises.

The comparison to the average expected results from innovation in the EU-15 leads to the conclusion that Bulgarian entrepreneurs attach much greater importance to the expansion of the market, the compliance with the existing laws and standards and, the reduction of the material and energy intensity. The only result which is of greater significance for the European companies than for the Bulgarian ones is the **enhancement of the production capacity**. These features reflect the greater market scale and the more sophisticated demand, which European enterprises face, as well as the still obsolete capital equipment in Bulgaria, causing the high energy intensity of the local production. The sustainable growth of energy prices on the international markets over the recent years makes the efficiency of production increasingly relevant to local producers and they seek solutions in that direction through the innovation process.

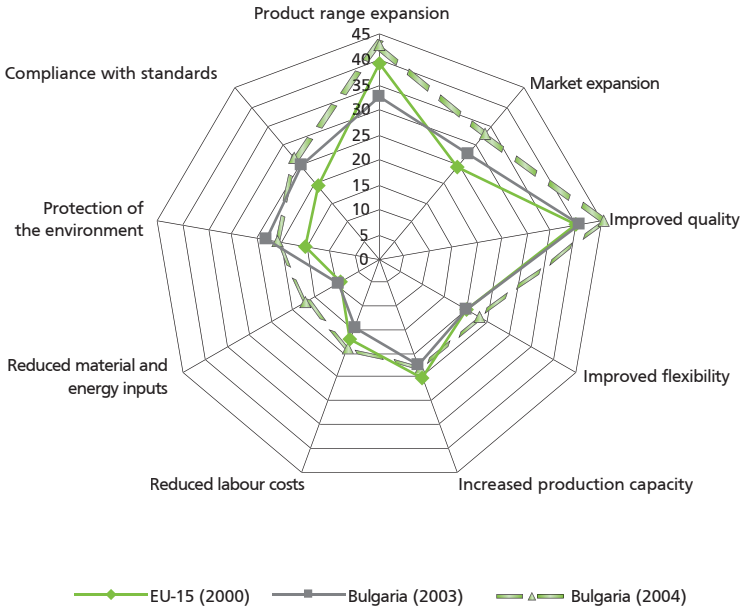
Figure 18. CONTENT OF THE INNOVATION ACTIVITIES OF BULGARIAN INNOVATIVE COMPANIES



Note: Companies answered the question "What comprises the innovation activity of your company?" The index in the figure presents the first two choices of the company: first place (x2) and second place (x1).

Source: Vitosha Research, 2006.

Figure 19. EFFECTS OF INNOVATION ACTIVITIES ON CERTAIN RESULTS OF INNOVATIVE ENTERPRISES IN BULGARIA AND THE EU-15



Note: The names of the categories are abbreviated for the sake of the layout; the figure presents the share of innovative companies which have indicated the enumerated results from their innovation activities as very important. The sum of the total exceeds 100 % because respondents have specified more than one answer.

Source: NSI, 2006, Eurostat, 2001.

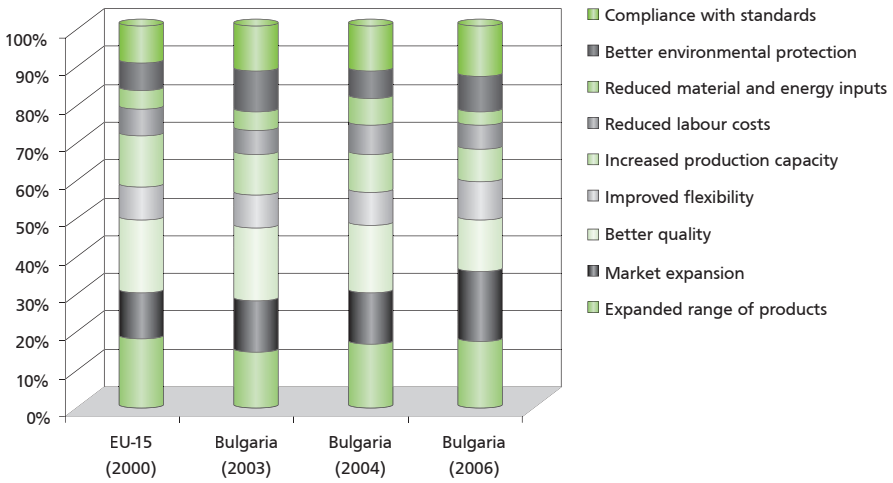
The data about the companies certified under the two major quality standards, ISO 9001:2000 and ISO 14001, confirm the two **main characteristics of the Bulgarian innovation system:**

1. The results of its operation rank Bulgaria among the last in Europe or ahead of only some new EU Member States at best;
2. In spite of the early stage of its functioning and the reporting of too low levels on most indicators, the dynamic trend is positive.

At the end of 2005, the number of companies certified under the quality assurance standard increased by 32 % on an annual basis, while the companies meeting the environmental standard increased by 88 %. Notwithstanding the considerable growth reported in the case of ISO 14001, Bulgaria still remains behind its main competitors among the new EU Member States, with a smaller number of certified companies.

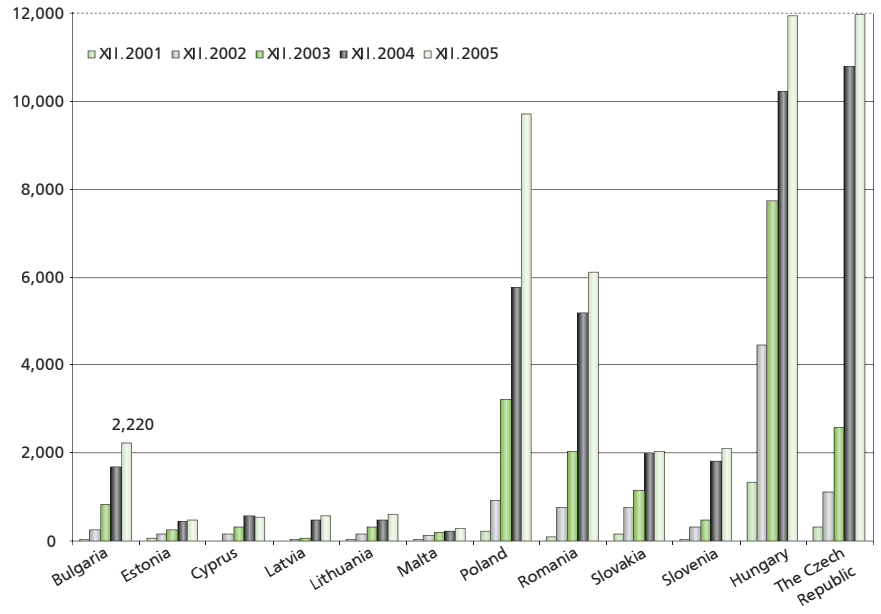
The analysis of the barriers to the innovation activity of Bulgarian companies is of special importance for the national and regional innovation policy. The main problems which Bulgarian entrepreneurs identify with regard to their innovation activities remain unchanged in comparison to last year's report and they are related to the overall market situation in the country. Ranked in terms of the percentage of innovative companies indicating the respective factor as the greatest impediment to their innovation activity, they are as follows: (1) **too high innovation costs** (this is the major problem for the enterprises in the EU-15, as well); (2) **lack of appropriate sources of financing**; (3) **excessive business risk**. These obstacles for innovation in Bulgaria require that policy efforts be directed to developing the innovation environment, to improving the investment climate and to deepening of financial markets and financial intermediation,

Figure 20. RELATIVE IMPORTANCE OF THE EFFECTS OF INNOVATION ACTIVITIES OF BULGARIAN ENTERPRISES



Source: NSI, 2006, Eurostat 2006, Applied Research and Communications Fund, 2006.

Figure 21. NUMBER OF ISO 9001:2000 CERTIFIED COMPANIES IN BULGARIA AND THE EU-10



Source: The ISO Survey-2005, ISO Central Secretariat, 2006.

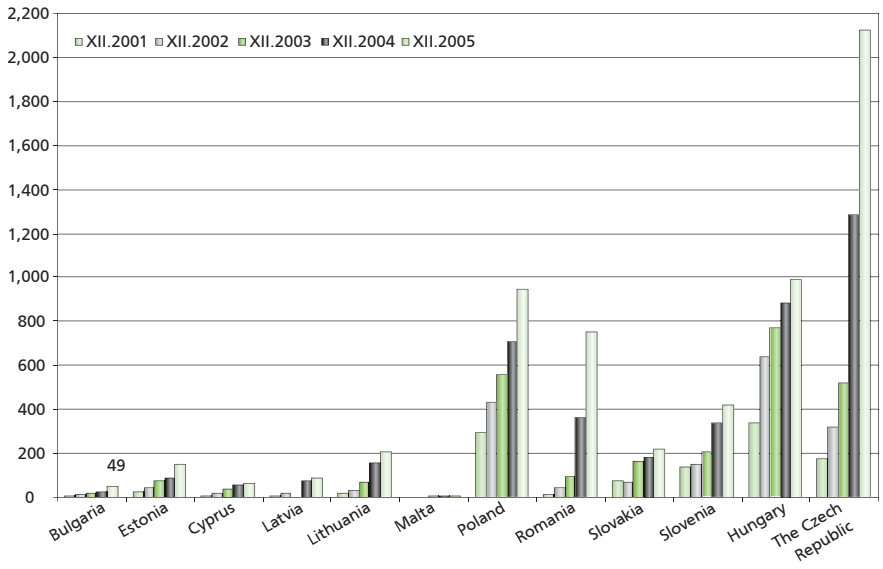
as well as ensuring greater predictability in the regulatory environment. Last but not least, priority should be attached to the regulation of alternative forms of financing for innovation (e.g. the establishment and use of venture capital funds, regional funds, etc.).

The analysis of the barriers to the innovation activities of Bulgarian companies over time reveals diminishing weight of the lack of sources of financing and the insufficient flexibility of the legal framework. **Businesses gradually start to overcome the problems typical of fledgling market economies.** Over time Bulgarian enterprises attach growing importance to the excessive business risk and the **lack of skilled manpower** as the major barriers to innovation. Thus

the problem areas to innovation identified by Bulgarian entrepreneurs, inch closer to those indicated by their European competitors. The difference in the weight of the obstacles between Bulgaria and the EU-15 is the greatest in the lack of skilled manpower, the problem being much less tangible for Bulgarian innovative enterprises. The reason could be the lower technological intensity of the Bulgarian economy which has not fully depleted the available local human resources in the unskilled labor market segments, although some economic sectors already feel great need for qualified professionals and managerial staff. Other problems which are inherent to innovation have less weight for the Bulgarian enterprises than the European ones. These are the lack of consumer interest in new goods and services and the organization-internal obstacles which Bulgarian businesses continue to underestimate. The different perception of these factors between the Bulgarian and European enterprises could be traced out in the relatively lower saturation and sophistication of the Bulgarian market and the lower level of novelty of the innovations offered by Bulgarian enterprises. In summary, the comparison of the main problems for innovation among EU-15 and Bulgarian enterprises shows that **the lack of appropriate sources of financing is relatively the most pronounced factor impeding the innovativeness of the Bulgarian enterprises.**

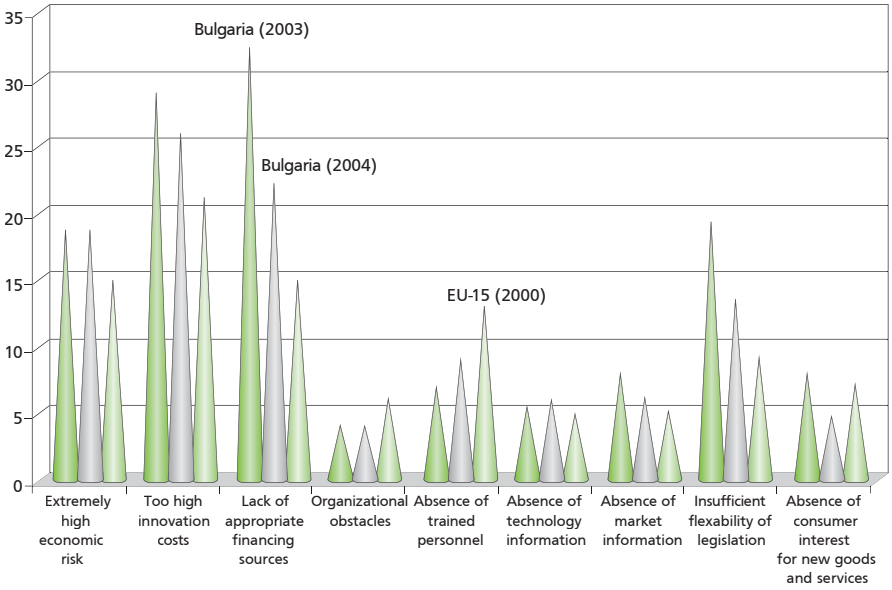
The characteristics of the barriers to innovation activities in Bulgaria and the comparison to the problems typical of enterprises in the EU-15 confirm the conclusion that the Bulgarian national innovation system is at an early stage in its development. **The low purchasing power and the unsophisticated consumer demand**, which do not generate the necessary incentives for the supply of goods and services on the domestic market, is in contrast to the **insensitivity of Bulgarian innovative companies to the lack of consumer interest** in their products as they do not identify it as an obstacle. The latter is a sign of the lack of competitive pressure on the local market and/or low levels of innovativeness of the products, which do not possess new qualities but rather satisfy existing needs and tastes instead.

Figure 22. NUMBER OF ISO 14001 CERTIFIED COMPANIES IN BULGARIA AND THE EU-10



Source: The ISO Survey-2005, ISO Central Secretariat, 2006.

Figure 23. FACTORS IMPEDING THE INNOVATION ACTIVITY OF COMPANIES (SHARE OF COMPANIES SPECIFYING THE RESPECTIVE FACTOR AS RELEVANT IN BULGARIA AND THE EU-15)



Note: The headings of the categories are abbreviated for the sake of the layout and the answers of the companies are adjusted to 100 % in all three surveys to ensure comparability of results.

Source: NSI, 2006, Eurostat, 2001.

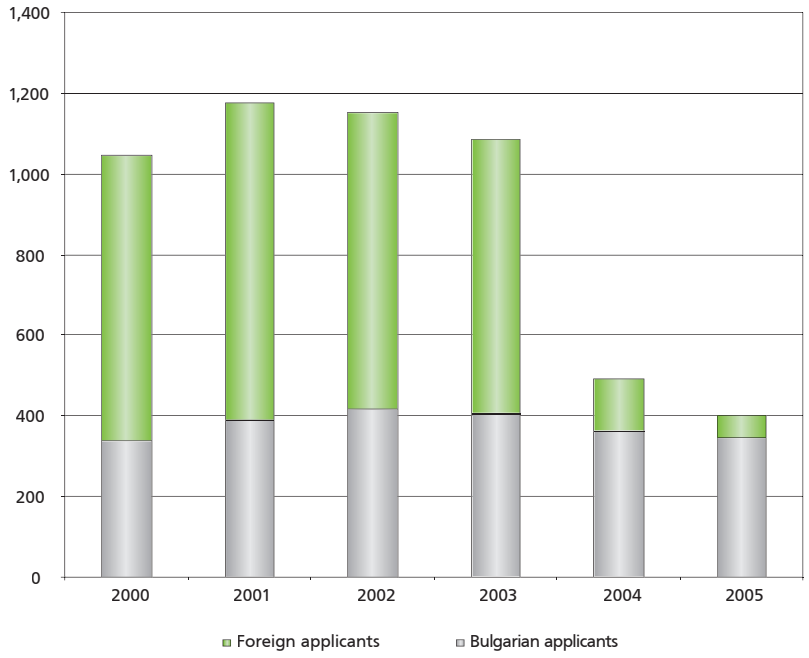
Technological Product[49]

The technological product covers the new technologies created (and adapted) in Bulgaria. It reveals the capacity of the Bulgarian economy to absorb foreign technological innovation and to create local one. It is measured by the number of patents granted to local inventors at national and international level and the development of the market for technological products in the country. The technological product is the focal point of interaction of the various institutions of the national innovation system and its condition is an important indicator of the internal dynamism of the system.

Patents[50]

After Bulgaria ratified the European Patent Convention (EPC) and acceded to it in 2002, one can expect a lot of changes in the structure of the patent activity of Bulgarian inventors and foreign applicants. Bulgaria's accession to the EPC means that the European patent obtained through a single application is equivalent to a group of traditional national patents in the countries specified by the applicant. The data from the Patent Office of the Republic of Bulgaria indicate that 5,318 applications for patent protection were received over the period 2000 – 2005 and 2,753 patents were granted. The annual number of applications for and grants of patents in Bulgaria was relatively stable in the past years with foreign applicants outnumbering local two to two and a half times. As of 31 December 2005, the total number of granted national patents for inventions and utility models was 2,165.

Figure 24. Applications for protection of inventions and industrial design at the Bulgarian Patent Office



Source: Patent Office of the Republic of Bulgaria, 2006.

Since 2004 there has been a decrease in patent applications to the Bulgarian Pagtent Office, particularly drastic (about six times) in the case of foreign applicants: from 785 applications in 2001 to 51 applications in 2005. This is the result of Bulgaria's accession to the European Patent Convention (EPC) and the opportunities it offers to applicants. The accession to the EPC has also caused the increase of applications to the EPO, where Bulgaria is specified as a country in which the patent is protected[51]. In 2003 Bulgaria was specified in 43.2 % of the applications, whereas in 2004 the percentage was almost doubled to 82.1 %, reaching 88.4 % in 2005. In terms of this indicator, Bulgaria is fully comparable with the EU Member States. The economic stability achieved in the country, which turns it into a relatively predictable market for technological and finished products also contributes to an increase in patent applications. As a result, the number of European

[49] This edition of *Innovation.bg* includes also a Technological Market section which was previously under Chapter 2 Entrepreneurship and Innovation Networks. Thus the thematic sequence of the individual chapters is improved.

[50] In 2005, Eurostat changed the methodology of patent statistics and transformed the time series which made them incompatible with the previous ones. The Eurostat methodology presents data on the patents at the European Patent Office and the US Patent and Trademark Office (USPTO). The USPTO, in its turn, maintains its own database on registered patents, which is different from that of Eurostat.

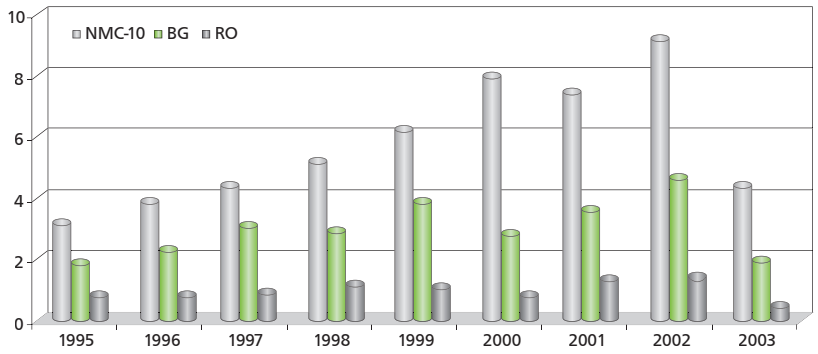
[51] EPO Annual Reports, 2003, 2004 and 2005.

patents requested to hold within the territory of Bulgaria was 187 at the end of 2005.

The revised Eurostat data on **the activity of Bulgarian inventors before the European Patent Office (EPO)** show that it is lower per million of the population than the average for the new EU Member States but higher than that for Romania. In the last year about which data is available, it followed the general trend of decline among the new EU Member States. As to the data about the patents awarded by the United States Patent and Trademark Office (USPTO)[52], the two databases of Eurostat and USPTO demonstrate different trends. According to Eurostat, where the calculation of the national affiliation of patents is more complicated, a certain decline is observed for the EU-10, Bulgaria and Romania. The USPTO data reveal a different picture, reporting the absolute number of patents granted according to the nationality of the first inventor/co-inventor. The applications at the USPTO tend to increase and prove that the interest in this type of patents is revived and one can expect new growth in the number of registered patents in the near future. This, however, does not change the observed decline in the patent activity of enterprises and citizens in Bulgaria.

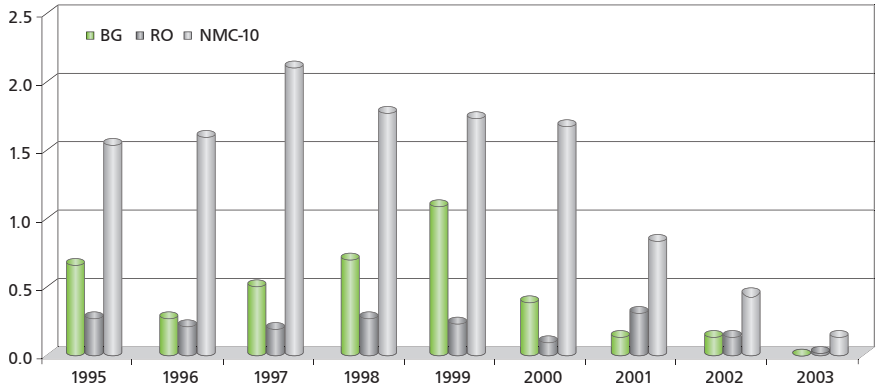
An important indicator of the condition of the patent activity in Bulgaria, which is monitored by the USPTO, is the institutional affiliation of the patent holder. The data for the last five years reveal that holders of patent rights from this office are exclusively individual inventors from Bulgaria. Similar is the situation with patents from Romania, Poland and Slovakia. However, in the other Central and Eastern European countries patent

Figure 25. NUMBER OF PATENT APPLICATIONS AT THE EUROPEAN PATENT OFFICE PER ONE MILLION INHABITANTS – BULGARIA, ROMANIA AND THE NEW MEMBER STATES (EU-10) OVER THE PERIOD 1995 - 2003



Source: Eurostat, 2006.

Figure 26. NUMBER OF PATENTS AWARDED BY THE U.S. PATENT OFFICE PER ONE MILLION INHABITANTS – BULGARIA, ROMANIA AND THE NEW MEMBER STATES (EU-10) OVER THE PERIOD 1995 - 2003



Source: Eurostat, 2006, USPTO, 2006.

Table 2. NUMBER OF PATENT APPLICATIONS AT U.S. PATENT OFFICE BY CITIZENS OF BULGARIA

Year	Number of Applications
1995	9
1996	15
1997	10
1998	15
1999	2
2000	23
2001	10
2002	10
2003	8
2004	74
2005	53

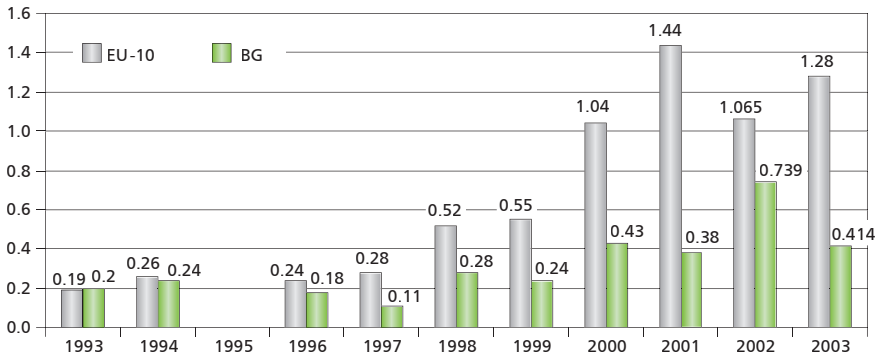
Source: USPTO, 2006.

[52] The United States Patent and Trademark Office will be referred to as USPTO or U.S. Patent Office for the sake of convenience.

holders are registered national affiliates of transnational companies. This indicates the low level of institutionalization of patent activities in Bulgaria and the fragmentation of the Bulgarian innovation system, which does not encourage the setting up of enterprises for commercialization of patents. It is much more difficult for individual patent holders to protect their patents against evasion and to gain economic benefits from their intellectual property rights than it is for patents incorporated into a protect or held by a company[53]. Bulgaria seriously lags behind in this respect from the global trends, running the risk to remain outside the international technological flows that could bring about serious negative effects for the innovation capacity of the country.

Furthermore, the Bulgarian patents at the USPTO for the last five years have been distributed in 18 technological classes, whereby there is a patent from the country in almost all of them. Patent concentration is observed only in the defense industry. At the same time, the patents from other Central and Eastern European countries like Hungary, the Czech Republic, Poland, Slovakia and Romania, point to a certain concentration in the classes related to biotechnologies (pharmaceuticals and cosmetics). This conforms to the global trend: over the period 2000 – 2004 the USPTO issued 33,666 patents in the field of biotechnology, which was 30 % more than the number of patents in the second most active technological sphere (technologies for the manufacturing of semi-conductor devices) and close to 90 % more than the number of patents in the third most active sphere of new solid body devices. Although this division is historically determined, the preservation of its structure is a sign that Bulgarian industries do not shift their activities to sectors with greater added value and might easily lose their competitive advantaged with the reduction

Figure 27. APPLICATIONS FOR HIGH-TECH PATENTS AT THE EUROPEAN PATENT OFFICE PER ONE MILLION INHABITANTS



Source: Eurostat, 2006.

of labor costs compared to the EU average level. This is confirmed also by the **very low base of high-tech patent applications at the EPO from Bulgaria**, although they have tended to increase for the last ten years similar to the other new EU Member States.

Generally, the comparison of historical data reveals that **the patent activity in Bulgaria has not regained the levels achieved in the 1870's and 1980's.** International benchmarking shows that there is a trend of growing relative lagging behind from the overall parent results of the EU-10 countries.

Technological Market[54]

Most methods of protecting intellectual property rights, such as patents, copyright, trademarks, confidentiality agreements and design registration, are relevant to few Bulgarian enterprises. In 2006, almost two-thirds of the Bulgarian SMEs and about a half of the big companies used none of the methods enumerated above. Most important for the Bulgarian big and medium-sized companies were the confidentiality agreements, trademarks and patents, while small enterprises found trademarks, confidentiality agreements and design registration to be most important for protecting their assets. SMEs point out much more rarely than big organizations that these methods for protection of intellectual property rights are very important for the company. This is due mainly to the lack of information of Bulgarian businesses as to the opportunities and characteristics of these methods and to the lack of financial resources, especially in SMEs, for their acquisition. In 2006, less than 4 % of SMEs took part in the technological market in the country, which corroborates the conclusion from the pervious edition of the report that the Bulgarian technological market is not yet a factor in Bulgaria's innovation development and it is not fully utilized to promote the innovation activity of Bulgarian enterprises. The weak activity on the technological market in the country is also a direct consequence of the low-tech profile of the Bulgarian economy. The insufficient use of the methods for protection of intellec-

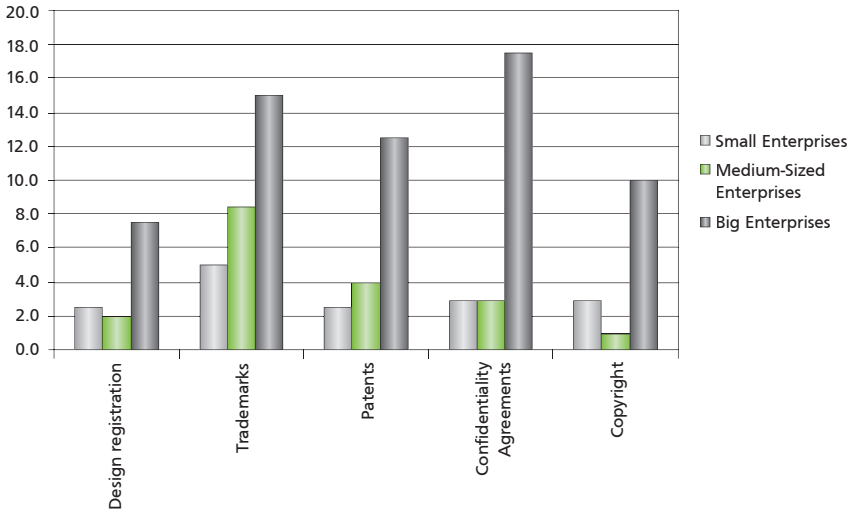
[53] A Market for Ideas: A Survey of Patents and Technology, The Economist, 2005.

[54] The term is used in a narrow sense and does not cover all the aspects and elements of the technological market as considered in the relevamt literature.

tual property rights could have adverse impact on the innovation activities of the Bulgarian enterprises.

The main obstacle to the development of the technological market and patent activity in Bulgaria is the **low level of protection of intellectual property rights**. As stated in the pervious edition of *Innovation.bg*, although the national legislation has been adjusted to the European standards and the best international models, the assessment of the level of actual protection of intellectual property rights in the country remains poor and even deteriorating. Such a conclusion is particularly alarming for the prospects of transnational high-tech companies entering the country and the opportunities for development of activities with higher added value which enjoy high level of protection of intellectual property rights, such as biotechnologies, electronics, etc. Bulgaria does not possess the market opportunities of countries like China to afford lower levels of protection of intellectual property rights and attracting investment in emerging business activities with the highest growth potential. The expectations are for the membership of the EU and the EPC to bring about improvements in this sphere but they would be constrained by the administrative capacity of the Bulgarian authorities to apply the existing legislation on the domestic market.

Figure 28. TYPOLOGY OF THE METHODS FOR PROTECTION OF INTELLECTUAL PROPERTY RIGHTS WHICH COMPANIES DEEM OF GREAT IMPORTANCE TO THEIR INNOVATION ACTIVITY, DEPENDING ON THE SIZE OF BULGARIAN ENTERPRISES IN 2006 (%)



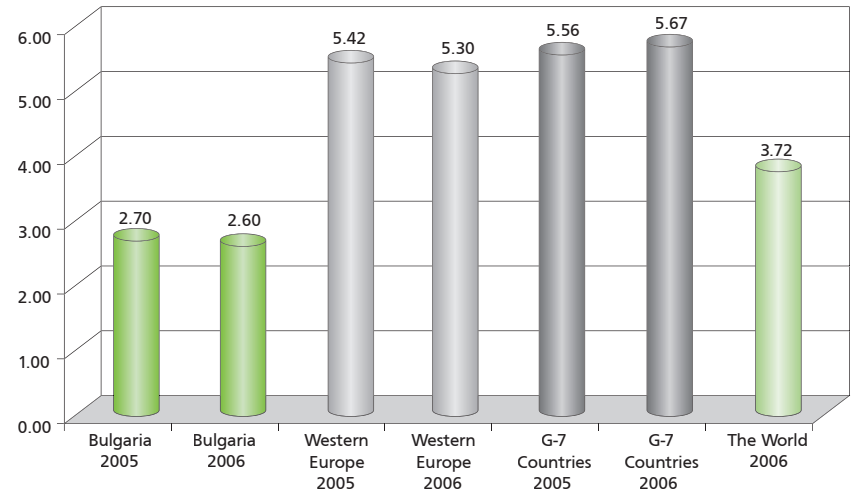
Source: Applied Research and Communications Fund, 2006.

Table 3. SHARE OF BULGARIAN SMEs WHICH HAVE ACQUIRED NEW TECHNOLOGIES ON THE DOMESTIC AND INTERNATIONAL MARKET

	Domestic Market		International Market	
	2004	2006	2004	2006
Patents, licenses, know-how	7.9	4.8	3.7	2.6
Trademarks, copyright	3.2	4.0	1.1	1.2
Designs and models, technical documentation	10.3	9.5	4.2	3.8
Others	0.4	0.6	0.2	0.4

Source: Applied Research and Communications Fund, 2006.

Figure 29. INTELLECTUAL PROPERTY RIGHTS PROTECTION INDEX



Source: The World Bank, 2006.

Research Product

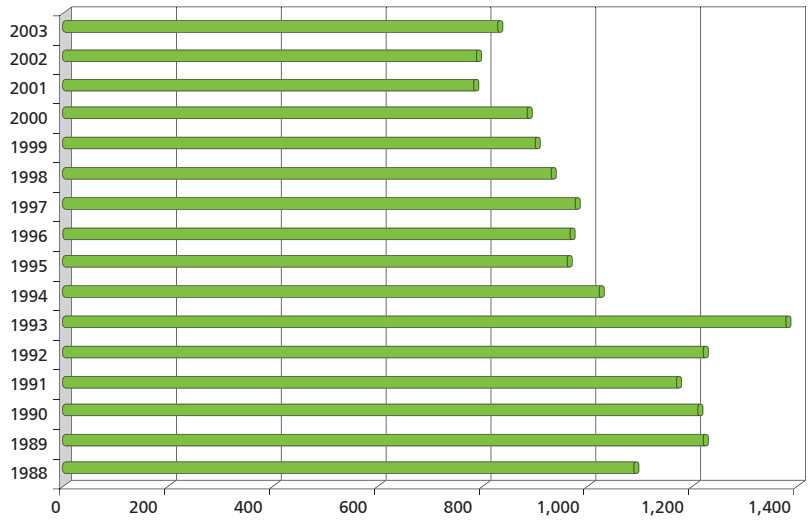
The research product is the new scientific knowledge created (or adapted) in Bulgaria. It reflects the publication activity in the country, while its quality is determined by the international convertibility of the national scientific knowledge and its contribution to the development of new research products. The research product is an important indicator for the long-term potential of the national innovation system and, in particular, for the prospects to make routine innovation based on research and development.

Publication Activity

The trend for the number of national publications to decrease in international referenced journals after 1994 was discontinued in 2001 and since then there has been a gradual but sustainable increase of the publication activity. This positive change coincided with the period of the full involvement of Bulgaria in the Fifth Framework Programme of the EU (1999 – 2002) and reflected the effect of the new structure of the international research cooperation under this Programme. The active participation of Bulgarian researchers in the Fifth and Sixth Framework Programmes of the EU gives grounds to expect that the positive changes will continue in 2007, as well, turning into a lasting trend.

At the same time, Bulgaria still lags behind the countries in the region in terms of the absolute number of publications. Although all countries felt the negative impact of the transition processes and the restructuring of their research systems, they managed to recover the pre-transition levels in the mid 1990's and then surpass them. Thus countries like Poland and Hungary have already exceeded the number of publications made in 1989: Poland by more than 50 % and Hungary by slightly less than 50 %. Over the same period, Bulgaria managed to reach only 68 % of its publications made in 1989. Together with the undetermined impact of the substantial brain-drain from Bulgarian research institutes, there are some more general reasons for the slow "resuscitation" of the research system in Bulgaria, such as the unfavorable internal structural changes in Bulgarian science, the ageing of human resources, the insufficient financing of researchers, the reduction of research at universities and higher schools in the country.

Figure 30. Number of research publications from Bulgaria at the Institute for Scientific Information (1988-2003)



Note: The number of articles has been calculated on the basis of their presence in journals classified and included in the research citation indexes and the citations in social sciences of the Institute for Scientific Information, U.S. The number of articles is based on documents divided into parts, e.g. an article of two co-authors from different countries will count as half an article per country.

Source: National Science Foundation, Science and Engineering Indicators, 2006.

Over the period 2000 – 2003, in terms of research publications per one million of the population, Bulgaria with its 100.81 publications came close to the world's average level (107.65). Bulgaria's position among the EU Member States is not different from the one described in the previous report *Innovation.bg*. **There is stabilization of the publication activity of Bulgarian researchers at levels that are not high and the position is in the bottom of the ranking within the EU** only ahead of only Lithuania, Latvia and Romania.

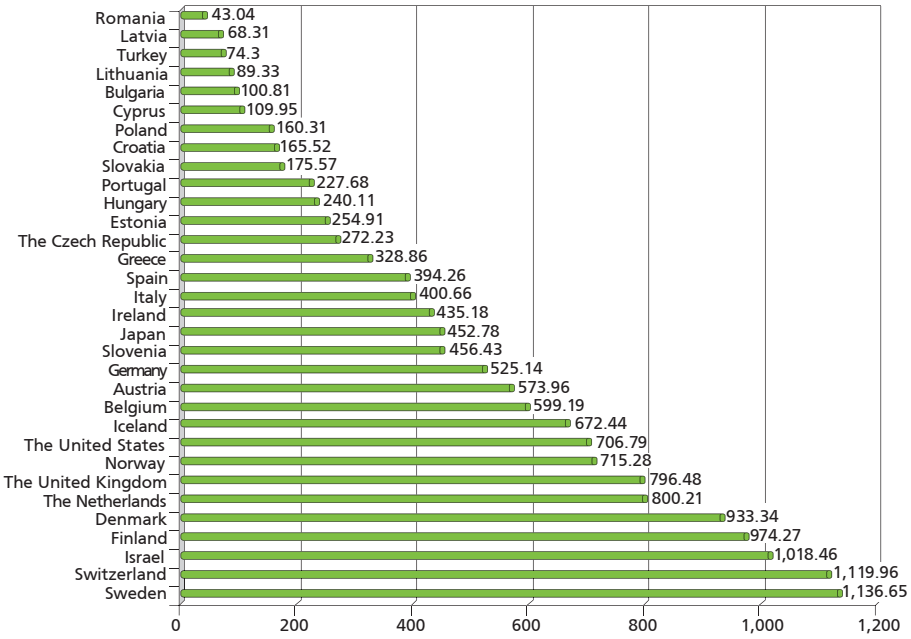
The structure of the research product in terms of main fields of science for the publication activity underwent substantial changes during the transition years.

The distribution of research publications in Bulgaria by research areas has remained roughly unchanged since the previous report *Innovation.bg*. It is worth noting the drastic **decline of the share of the research product in mathematics and the considerable increase of publications in engineering and technological sciences**. This is due to the vigorous re-orientation of Bulgarian researchers to information technologies and computer science, encouraged by the applied thrust of the European research programs, leading to re-distribution of the publication flows in these two areas accordingly.

The share of the research product in basic science in Bulgaria (chemistry and physics; biology is on the decline) continues to grow. The trend for the share of applied biomedical publications to decrease is preserved. One should point out the growth of the number of publications in the field of psycho-logy and social science that have acquired great priority in the EU Framework Programs over the recent years.

When the portfolio of the research product in Bulgaria is to be interpreted, one should take into account the strong inertia in the research system and the impact of traditions, a factor operating in other countries as well. **The comparison to some similar countries reveals a similar structure of publications:** in Poland, for instance, physics and chemistry account for 52.2 % of all publications. Hungary has the lowest share of these publications in the region – a total of 36 %. In Romania, publications in chemistry alone are almost 40 % and, together with those in physics, they reach almost two-thirds of all publications in the country. At the same time, the countries which joined the EU in 2004 are going through a process of active adjustment and coming closer to the publication structure in the EU-15, where publications in clinical medicine account for approximately one-third of all publications.

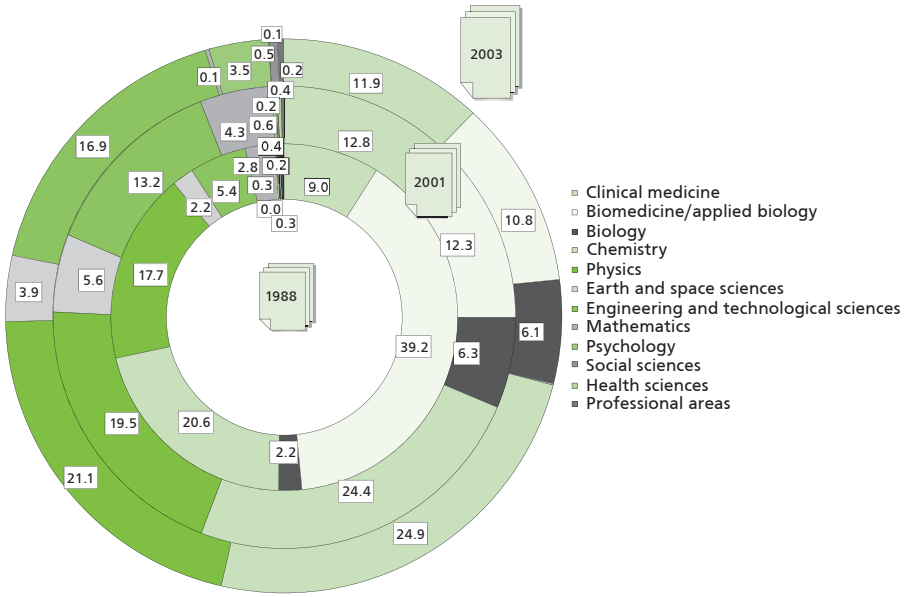
Figure 31. NUMBER OF RESEARCH PUBLICATIONS PER ONE MILLION INHABITANTS OVER THE PERIOD 2000 - 2003



Note: The number of articles has been calculated on the basis of their presence in journals classified and included in the research citation indexes and the citations in social sciences of the Institute for Scientific Information, U.S. The number of articles is based on the division of publications into parts, e.g. an article of two authors from different countries will count as half an article per country.

Source: National Science Foundation, Science and Engineering Indicators, 2006.

Figure 32. CHANGE IN THE PORTFOLIO OF RESEARCH PUBLICATIONS IN BULGARIA 1988-2003 (%)



Note: The number of articles has been calculated on the basis of their presence in journals classified and included in the research citation indexes and the citations in social sciences of the Institute for Scientific Information, U.S. The number of articles is based on the division of publicaions into parts, e.g. an article of two authors from different countries will count as half an article per country. The articles are classified into various spheres on the basis of the classification of thematic areas by CHI Research, Inc.

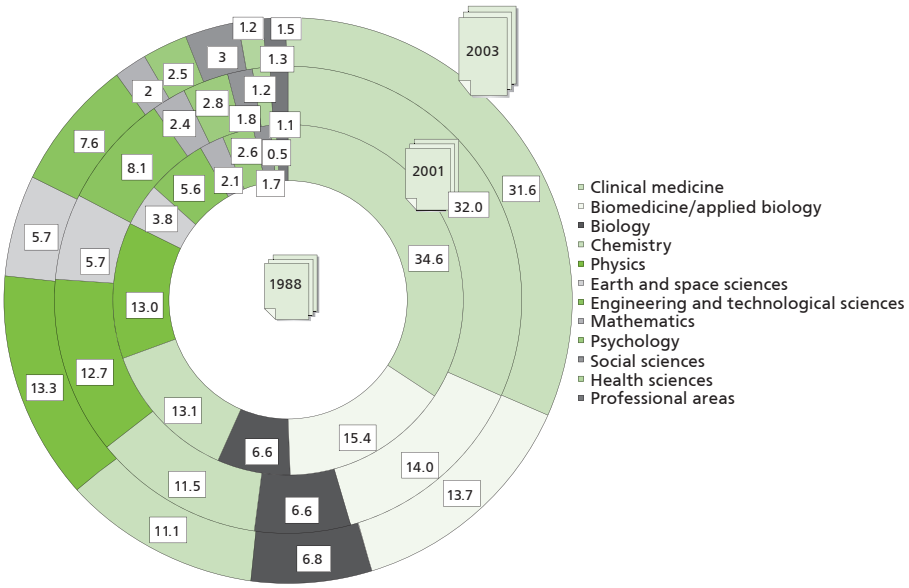
Source: National Science Foundation, Science and Engineering Indicators, 2006.

The most rapid adjustment process is in Hungary, where this sphere accounted for 26 % of all publications in 2003. The process is relatively slower in Bulgaria and the share of the research product in clinical medicine is still far from the picture in developed nations and in the EU.

The structure of the research product of Bulgaria in the years to come will be strongly influenced by its place in the European Research Area and the participation of the country in the Community research programmes and initiatives. The main project activity of Bulgaria in the completed Fifth Framework Programme was in the fields of information and communication technologies, international cooperation and sustainable development. This trend is preserved also in the Sixth Framework Program for Research, Technological Development and Innovation, although there is a decline in the participation and success rate of Bulgarian organizations under the programs for the Human Potential and the International Cooperation with third countries. The specific measures of the European Commission to establish centers of excellence in the EU applicant countries have produced a positive impact on the development of the research potential in Bulgaria. Such initiatives were put forward in the Fifth and Sixth Framework Programs, which enabled the modernization and concentration of resources, research infrastructure and human potential in the respective research areas.

The Framework Programs influence positively the balance in the types of participating institutions. Organizations from the non-governmental and private sectors have sound representation in the 5 FP, and that type of institutions prevailed in certain thematic areas (such as ICT and Innovation) in the 6 FP. Framework Programs have assisted some universities in Bulgaria to become major "players in the knowledge triangle" – education, research and innovation. The substantial strengthening of the program initiatives of the EC in research and innovation in the coming years is expected to promote and enhance the relationships of Bulgarian research teams with their European and international counterparts.

Figure 33. CHANGE IN THE PORTFOLIO OF RESEARCH PUBLICATIONS IN THE EU 1988-2003 (%)



Source: National Science Foundation, Science and Engineering Indicators, 2006.

International Recognition

The international recognition and influence of the scientific knowledge created in Bulgaria is measured by its circulation in the global research flow through citations of publications by Bulgarian authors. Notwithstanding the disproportional representation of scientific periodicals (by countries and research areas) in the U.S. databases, the indicator is so informative that it is widely used for the purposes of the research and innovation policy. In this respect, the comparisons to countries with similar features of the research system are particularly useful.

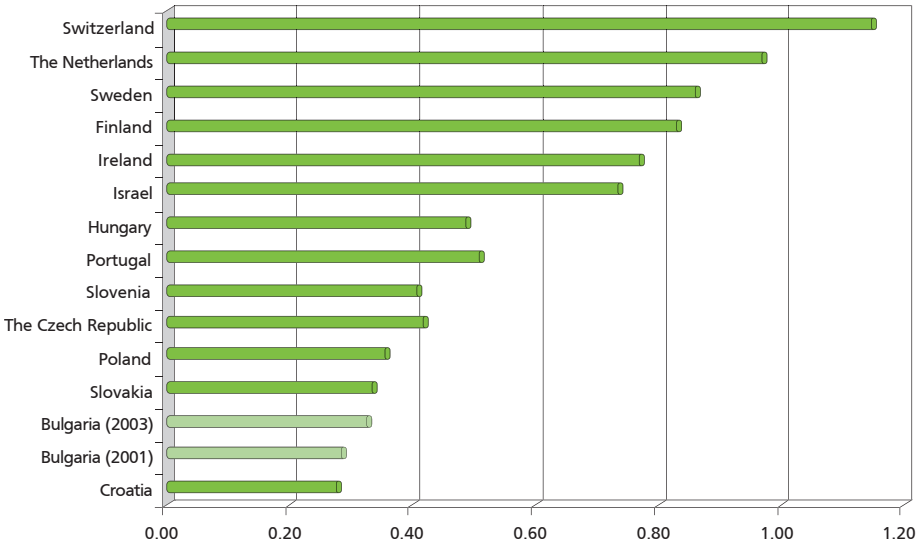
Although the absolute number of citations of Bulgaria increased in 2003, the share of the 2,360 citations for the country decreased and accounted for 0.5 % of the total number of citations in international databases. **Hence Bulgaria is losing the relative competitiveness of its research literature.** Bulgaria is worsening its position vis-a-vis the other countries in terms of this indicator. For instance, in comparison to the previous edition of the report Slovakia is already ahead in the international ranking of the relative citation rate. There are a lot of reasons for this negative development but it is a fact that the faster improvement of the economic prosperity in Slovakia since 2001 has also made the research literature of the country more popular.

As regards the citation rate in the major research areas, **mathematics** retains its leading position for Bulgaria with a relative citation rate of 0.533, i.e. there is more than one citation per two publications. **Engineering and technical sciences** come close to this level (0.495) and gain increasing potential. In the global ranking of relative citation rates

Bulgaria has improved its position only with respect to engineering and technical sciences. The tradition of areas with a relative citation rate which is higher than the average for Bulgaria is preserved: physics (0.487), chemistry (0.418), earth and space science (0.370). In spite of the positive developments in social sciences, Bulgaria still lacks good international visibility in this area, as well as in psychology. The more pronounced reason for the strong orientation of these areas to the context and to issues of local relevance is often pointed out as a reason for this situation but it is not confirmed by the comparison to other countries in the region. Countries like Hungary, Poland, the Czech Republic, Slovakia and Croatia, for example, manage to join the first 45 nations in the field of social sciences, while Hungary occupies the prestigious seventh place in psychology in terms of its relative citation rate. The lagging behind of Bulgarian social sciences is a bad sign also for the development of the various policies in the public life of the country. The latter typically build on the achievements of the respective country in socio-economic sciences.

In spite of the increased number of citations in 2003, Bulgaria still has a share of citations less than the share of its population in the 8+2 region covering the new EU Member States plus Bulgaria and Romania. General as it is, this indicator reveals at the macro-level the availability of **substantial resources for improvement of the performance of the Bulgarian R&D system.**

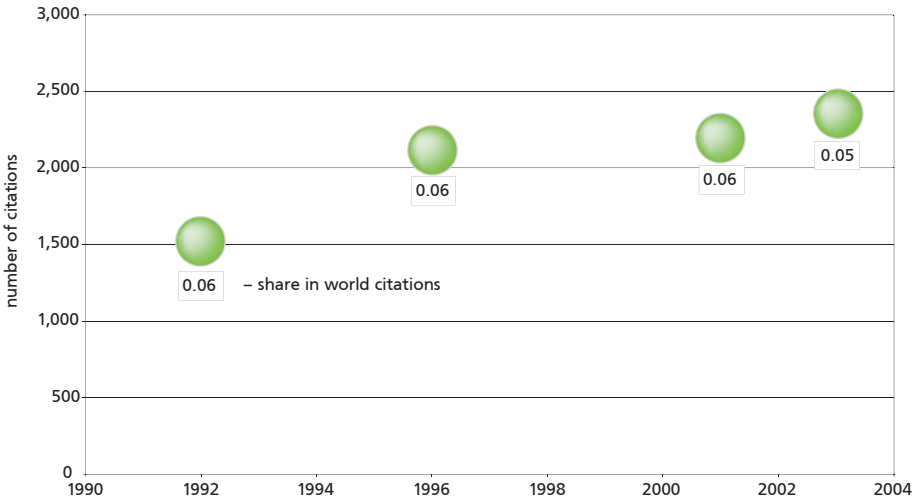
Figure 34. RELATIVE CITATION INDEX OF THE RESEARCH LITERATURE OF SELECTED COUNTRIES - 2003



Note: The relative recognition/popularity of research literature is based on the value of the relative citation index for the respective country. It stands for the share of the country in the cited literature adjusted for its share in the published literature. The citations in the country of origin are excluded. An index of 1.00 means that the share in the cited literature of the country was equal to its share in the global literature. An index of more (less) than 1.00 would mean that the country was cited relatively more (less) than its share in the world research literature. Countries with a share of citing foreign publications of less than 0.10 % or countries which did not cite scientific and engineering literature for that period have been excluded. The countries are enumerated in descending order, depending on their relative citation index in 2003.

Source: National Science Foundation, Science and Engineering Indicators, 2006.

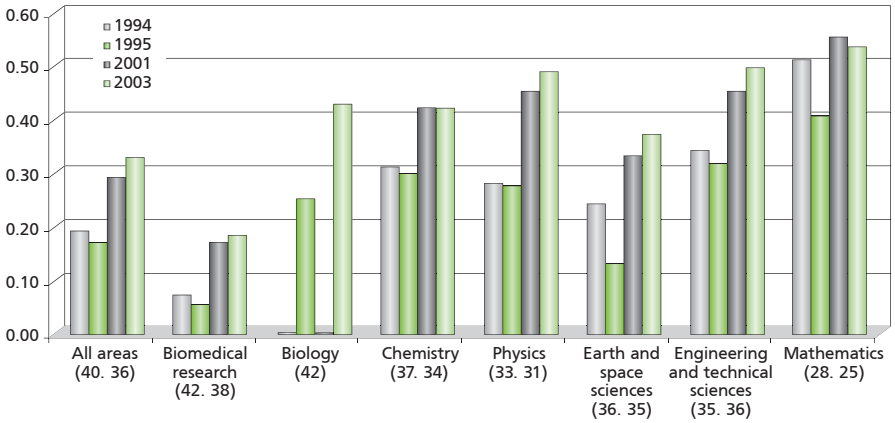
Figure 35. CITATION RATE OF RESEARCH PUBLICATIONS IN BULGARIA (NUMBER OF CITATIONS IN 1992, 1996, 2001)



Note: The number of citations is calculated on the basis of a three-year period with a two-year time lag. For instance, the number of citations for 1999 is the number of references in articles published in 1999 as to articles published in 1995-1997. The country/economy is identified through the institutional address indicated in the article.

Source: National Science Fund, Science and Engineering Indicators (2006).

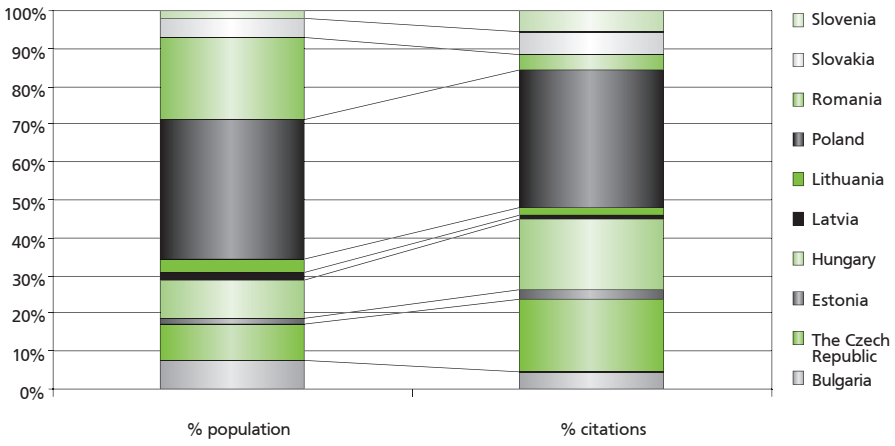
Figure 36. RELATIVE RELEVANCE OF THE CITED RESEARCH PUBLICATIONS OF BULGARIA BY RESEARCH AREAS



Note: The numbers in brackets indicate Bulgaria's position in the respective area in the global ranking in terms of the relative citation index for the last two available years (2003 and 2001 respectively). The relative popularity of research literature is based on the levels of the relative citation index for the respective country. It stands for the share of the country in the cited literature adjusted for its share in the published literature. The citations in the country of origin are excluded. An index of 1.00 means that the share of the cited literature of the country was equal to its share in the global literature. An index of more (less) than 1.00 would mean that the country was cited relatively more (less) than its share in research literature. Countries with a share of citing foreign publications of less than 0.10 % or countries which did not cite scientific and engineering literature for that period have been excluded. The countries are enumerated in descending order, depending on their relative citation rate index in 2003. Computer sciences are included in engineering and technical sciences.

Source: National Science Foundation, Science and Engineering Indicators, 2006.

Figure 37. RELATIVE CITATION RATE OF RESEARCH LITERATURE IN THE EU-8+2 COUNTRIES FOR 2003 (SHARE OF THE EU-8+2 COUNTRIES IN THE CITATIONS OF RESEARCH LITERATURE AND IN THE POPULATION OF THE REGION)



Source: National Science Foundation, Science and Engineering Indicators, 2006.

2. Entrepreneurship and Innovation Networks

Entrepreneurship and innovation networks are the main linking elements in the national innovation system. They are embodied by the start-ups and the forms of interaction, cooperation and exchange of information between the stakeholders in the innovation system. They determine the viability, adaptability and flexibility of the national innovation system. The creation of a high entrepreneurial spirit and dense innovation networks inside and outside the country should be the main goal of the national innovation policy.

The sustainable economic growth over the recent years in Bulgaria has resulted in an improvement of the entrepreneurship and business environment in the country. The macroeconomic stability in Bulgaria has created the necessary conditions for growth of enterprises and establishment of productive innovation partnerships. But the proper functioning of the innovation system is still hampered by many microeconomic obstacles, the removal of which would enhance the competitiveness of Bulgarian businesses in the EU. If they are overcome quickly and successfully, the expectations are that Bulgaria's EU membership would quickly promote innovation entrepreneurship.

Entrepreneurship. The number of start-ups in Bulgaria continues to grow but it is still below the average level of the new EU Member States. The trend of an increase in the share of small and medium-sized enterprises compared to micro-enterprises is a sign of corporate growth which will advance further with the expansion of the Bulgarian financial markets and with the easier access for Bulgarian enterprises to the European market after 2007. The cumbersome administrative procedures and the delay of key reforms such as the introduction of a central company register are the major obstacles for the entrepreneurial efforts of Bulgarians. The registration of a company in Bulgaria takes twice more procedures and treble the time than in neighboring Romania.

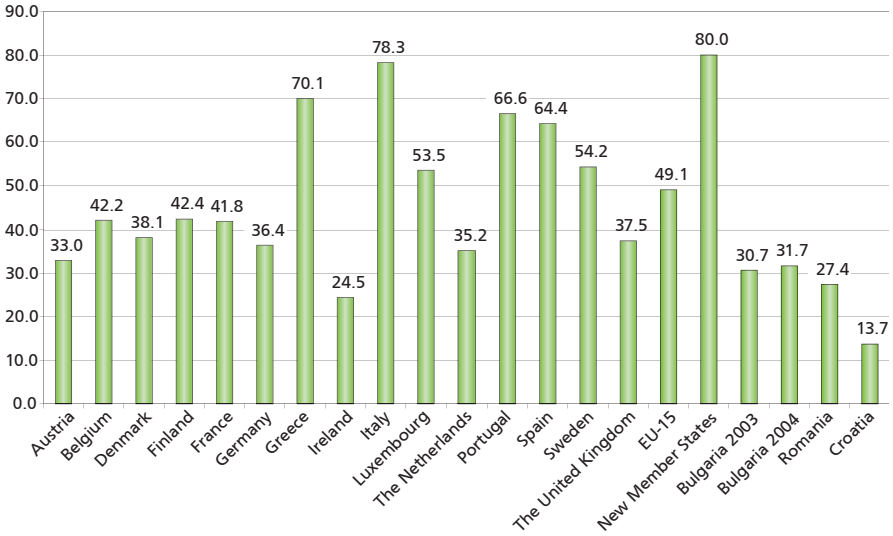
Innovation networks and sources of information. Bulgarian innovative enterprises have expanded their cooperation networks in the development of new products and processes for the last twelve months. This trend is particularly strong in their contacts with foreign organizations. In 2006, the share of enterprises which developed an innovation project with external organizations increased by six percentage points in comparison to 2004. But innovation cooperation is still some seven percentage points below the EU-15 average. Bulgarian innovative enterprises attach the greatest importance for the development of innovation projects to their customers and suppliers. Over the last year, there has been an improvement in the attitude of Bulgarian enterprises towards consulting organizations, which is likely to be the first sign of faster development of the consulting industry in the light of the country's accession to the EU. The Internet continues to be the most preferred and widely used source of information for Bulgarian businesses.

Entrepreneurship

Entrepreneurship is associated with the establishment of new companies in the country and their opportunities for development and growth. Entrepreneurial activities, in their essence, are closely related to innovation – the satisfaction of market needs through a combination of capital and human resources.

The **entrepreneurial activity** measured as the number of SMEs per 1,000 inhabitants has increased in Bulgaria by more than 3 % as compared to the previous report *Innovation.bg* but it is still **lower than that in most EU countries**. In terms of this indicator, the Bulgarian economy lags behind the ten new EU Member States from Central and Eastern Europe by over two and a half times and the EU-15 countries by more than one and a half times. The growth of entrepreneurial activities in the country is the result mainly of the continued economic stability and the improved access to bank loans for the private sector. Quite important are also some positive trends in the government policy such as the introduction of a sound strategic approach to SMEs, the reduction of the corporate income tax rate and the investment promotion measures[55]. The positive trends in the number and structure of SMEs in Bulgaria have continued for the last twelve months. The number of SMEs has increased by almost 2.9 % and the share of small and medium-sized enterprises has grown by 0.8 % and 0.1 % respectively. Employees in SMEs have increased by more than 4 % and fixed assets have grown by almost 25%[56]. These figures show the aspiration for growth and enhanced capital intensity of Bulgarian entrepreneurs. The much smaller assets size of Bulgarian SMEs compared to those in the EU countries continues to be the main hindrance in their

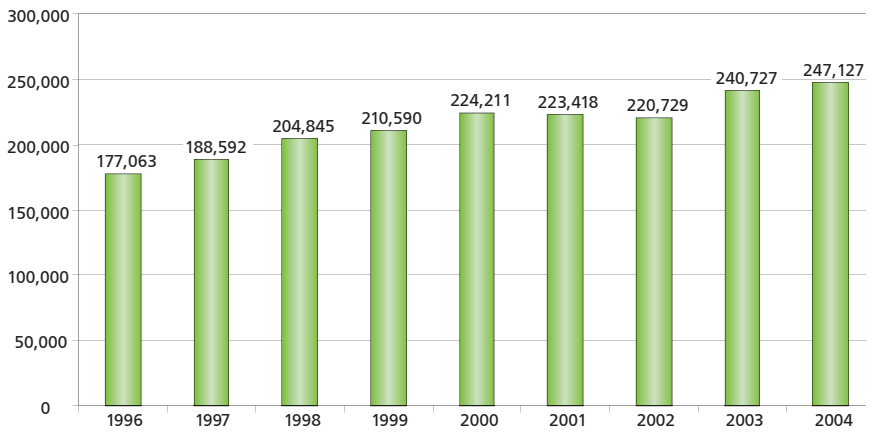
Figure 38. Entrepreneurial activity: number of enterprises per 1,000 inhabitants in the EU member states, Bulgaria, Romania and Croatia



Note: The data about the entrepreneurial activity for the EU-15 is for 2003; the data about the new Member States is for 2001; the data about Romania and Croatia is for 2000 and 2002 respectively.

Source: Own calculations on the basis of data from EBRD (2004), the Statistical Yearbook of Eurostat 2005, SMEs in Europe 2003, Observatory for European SMEs (2003); NSI (2005).

Figure 39. Number of small and medium-sized enterprises in Bulgaria (1996 – 2004)



Source: NSI, 2005, Report on Small and Medium-Sized Enterprises in Bulgaria (2003).

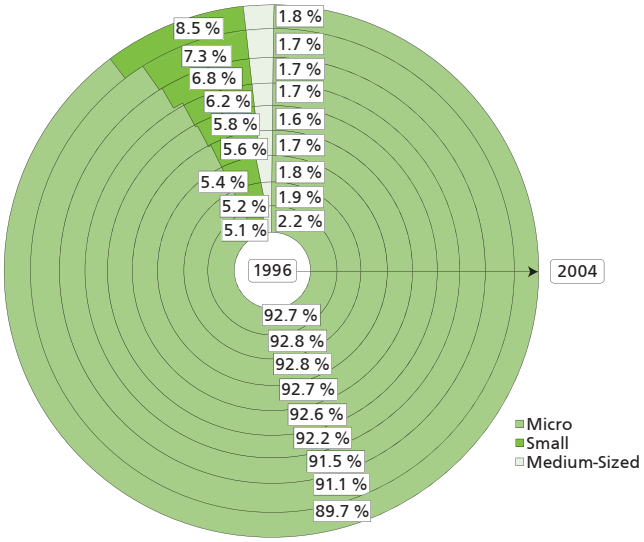
[55] OECD and EBRD (2005), Enterprise policy performance assessment: Bulgaria.

[56] NSI data.

access to capital and the implementation of innovative ideas.

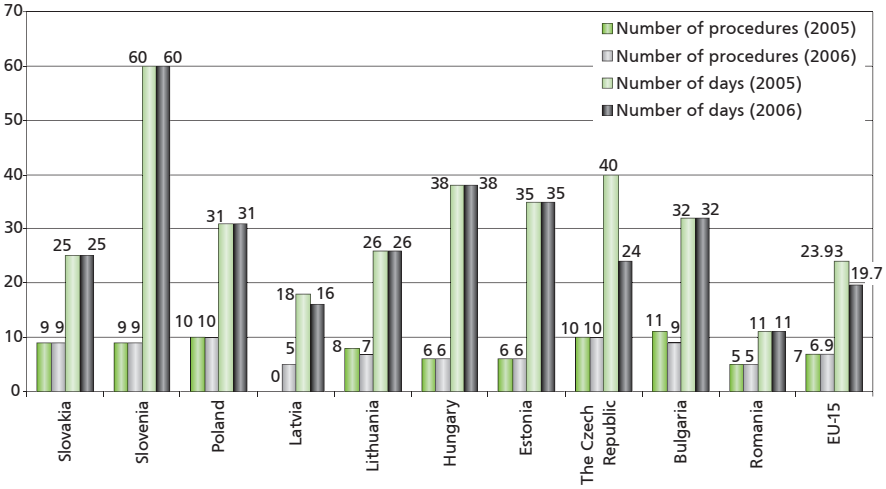
The cumbersome administrative procedures needed for the starting up and growth of new businesses continue to be a serious barrier for the functioning of enterprises and for start-ups in Bulgaria. **The country lags substantially behind in the reduction of the number of procedures and in the shortening of the time needed for starting up a business** in comparison to Romania, some new Member States and the average EU-15 levels. Romania has scored significant progress in facilitating the administrative procedures for the registration of new businesses and in terms of the number of days and the number of procedures it is ahead of both old and new EU Member States. Furthermore Romania has minimized the costs and the minimum required capital for the registration of new businesses. Bulgaria has to make much more serious efforts to reduce the number of administrative procedures and the amount of the administrative costs for the registration of new businesses. **The delayed introduction of the Commercial Register and the electronic government services in 2006, for instance, constrain the entrepreneurial activity in the country** and substantially erode the long-term innovative potential of Bulgarian citizens. Furthermore, the restriction of the access of new enterprises to the market created conditions for the occurrence of monopoly markets, which could lead to lasting negative effects for entrepreneurship in entire economic sectors.

Figure 40. DYNAMIC PATTERN OF THE STRUCTURE OF SMEs IN BULGARIA (1996 – 2004)



Source: NSI, 2005, Report on Small and Medium-Sized Enterprises in Bulgaria (2004).

Figure 41. NUMBER OF PROCEDURES AND DAYS NEEDED FOR STARTING UP A NEW BUSINESS IN BULGARIA, ROMANIA AND SELECTED GROUPS OF COUNTRIES IN 2006



Note: Luxembourg is not included in the group of the old Member States, while Malta and Cyprus are not included in the group of the new Member States.

Source: Doing Business in 2006, Removing Obstacles to Growth, World Bank.

SMEs have some peculiarities related to their size which make them different from big organizations and call for the implementation of specific policies and innovation support measures[57]. SMEs have limited resources, which creates obstacles in the various phases of the innovation process. Due to their scarce resources, SMEs find it difficult to finance their innovation activities, R&D in particular, on their own. The small number of employees affects the ability of SMEs to respond to the threats and opportunities in the external environment and the ability to successfully scan the surrounding environment for relevant information. Unlike big organizations, SMEs can influence much less their customers, suppliers, financing organizations, the labour market, trade unions and others and therefore they operate in a relatively less secure external environment.

[57] North, D., Smallbone, D., Vickers, I. (2001), Public sector support for innovating SMEs, Small Business Economics, vol. 16, pp. 303-317.

The policies and measures aimed at providing resources for innovation in SMEs should be important components of innovation policies and measures. Ownership and management merge in SMEs is observed, and for this reason, the nature of the innovative activities of SMEs depends largely on the personal goals and interests, values, attitudes, risk aptitude or aversion and preferences of their owners. SME owners prefer informal channels to obtain assistance and advice and they might mistrust formal initiatives. More often than not, they lack managerial expertise and hence they cannot identify the precise needs of the company for support to innovation. Therefore there might be a discrepancy between the perceived and actual needs for support to SMEs. The elaboration and implementation of measures to support the SME sector in the innovation sphere should build on a thorough analysis of the strengths and weaknesses of SMEs with regard to innovation activities.

Innovation Networks and Sources of Information

Innovation networks are the channels and forms of interaction and exchange of information among the stakeholders in the innovation system. The nodes in such networks are typically the most innovative companies in a country. The intensity and the means of information interaction between the nodes and the other elements of the network mark the capacity of creating new products by the individual participants and the innovation system as a whole.

Last year saw an increase in the share of Bulgarian enterprises cooperating with external organizations in the development of innovative products and processes. The share of innovative Bulgarian enterprises developing product innovations mainly on their own decreased by more than 12 percentage points on a year-to-year basis, falling below the share of that group of enterprises in the EU-15. In the case of process innovation, the decline in the share of self-relying enterprises was two percentage points and continued to be larger than the share of that group of enterprises in the EU-15.

In 2006, innovative Bulgarian enterprises enhanced their cooperation with foreign organizations in the development of new products and processes. That was the case of both joint development (innovation cooperation) and the full reliance on an external organization[58]. The level of cooperation with local organizations remained unchanged and the number of companies relying on ready-made innovation solutions slightly increased. The dynamic pattern of the innovation cooperation for the last twelve months comes to prove the development of the innovative potential of Bulgarian enterprises. The country's full-fledged EU membership further promotes the cooperation with foreign organizations and the trend of receiving ready-made innovation solutions developed by external companies will increase. The involvement of Bulgarian enterprises in the European innovation networks will enable them to get direct access to global consumers and to foreign technologies and will facilitate the dissemination of national innovation goods on the international market.

In spite of these positive trends, most Bulgarian enterprises continue to develop innovative products and processes mainly on their own, without the participation of any other organizations. Only 6.1 % of small enterprises, 11.3 % of medium-sized enterprises and 7.1 % of big enterprises identify partners as an important issue in the innovation activity of the company. The lack of cooperation with universities, research institutes, customers, suppliers and other local and foreign organizations might affect the quality of the innovation activity of Bulgarian enterprises, especially in SMEs which have scarce financial and human resources.

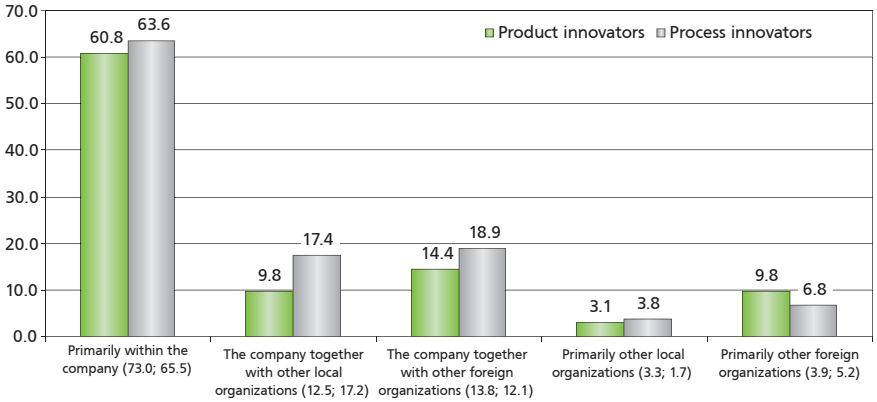
2006 saw the continuation of the trend the **innovation cooperation** of Bulgarian enterprises to be **oriented primarily to market partners and, to a much smaller degree, to representatives of the research and technological, consulting or public sectors**. The customers, suppliers of equipment, materials, components and software were their most important partners in the development of innovation projects to most of the

[58] Although no special survey was conducted into the nature of the innovation activities which Bulgarian enterprises received from foreign organizations, it was more likely a mater of acquisition of ready solutions than outsourcing.

Bulgarian innovative enterprises. In comparison to the previous report *Innovation.bg* there was a decrease of the share of Bulgarian companies which appreciated the importance of their competitors, other enterprises in the same or another sector and financing organizations as partners. At the same time, more companies pointed out the significance of universities, and private and public research institutes, although their relative importance remained low in the corporate priorities. It is alarming that the share of entrepreneurs attaching great importance to financing organizations for their innovation projects decreases, especially against the backdrop of the fact that many Bulgarian enterprises perceive the lack of sources of financing and the high direct costs for innovation as serious barriers to their innovation activities.

In 2006, Bulgarian entrepreneurs continued to use mainly market sources of information for the implementation of their innovation projects. The relevance of some information channels changed to a certain extent vis-a-vis 2005: the relative significance of the Internet, electronic media, printed materials and journals increased, while the relative significance of institutional sources of information decreased. Almost half of the Bulgarian compa-nies indicated that their customers and consumers were important sources of information for their innovation activities, while close to a quarter of all companies made reference to their suppliers and competitors. The major media channel of information for Bulgarian enterprises was the Internet (as it was in the previous year). The access to the worldwide web expanded and had great importance for Bulgarian enterprises (especially SMEs). The Internet has a serious potential to facilitate the involvement of entrepreneurs in international innovation networks and their access to global consumers and international markets. These

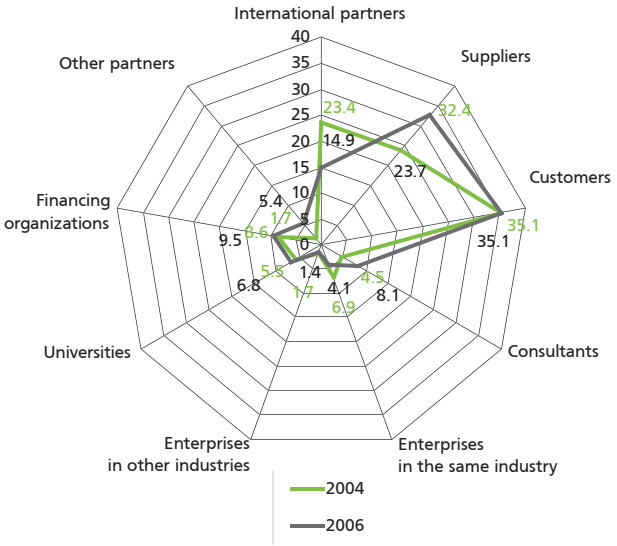
Figure 42. TYPOLOGY OF PARTNERSHIPS IN THE DEVELOPMENT OF INNOVATION PRODUCTS OR PROCESSES IN THE BULGARIAN INNOVATIVE ENTERPRISES IN 2006 (HOW WERE INNOVATIVE PROJECTS IN THE COMPANY DEVELOPED) (%)



Note: Innovative are the enterprises which offer new (improved) products or processes on the market. The numbers in brackets stand for product and process innovations in 2004 respectively.

Source: Applied Research and Communications Fund, 2006.

Figure 43. SHARE OF INNOVATIVE ENTERPRISES IN BULGARIA WHICH HAVE DESCRIBED THE IMPORTANCE OF THE ENUMERATED PARTNERS FOR THE IMPLEMENTATION OF JOINT INNOVATION PROJECTS AS "GREAT" (%)



Source: Applied Research and Communications Fund, 2006.

conclusions relate also to individual inventors and researchers who could join the growing global trend of crowd sourcing and open innovation[59].

The relative importance of Bulgarian government institutions and European institutions as sources of information for the innovation projects

[59] The terms "crowd sourcing" reflects the use of the Internet as a medium for picking ideas from "the crowd", i.e. all people on the net who are interested in a specific issue. All big international companies organize events aimed at soliciting ideas from many people on the Internet like IBM, for example. The term "open innovation" is related to crowd sourcing and stands for a new managerial approach to the development of innovation in international companies. It implies "the demolition" of the corporate walls of R&D departments and the opening of the innovation process within the company to independent sources of ideas. It was first introduced by Procter&Gamble and described by Henry Chesbrough.

of Bulgarian companies decreased more than twice in comparison to 2005. That could produce a negative impact on the access of Bulgarian enterprises to financial and other services in support of their innovation activities, which these institutions (will) provide, especially after the EU accession. The low relevance of government institutions as sources of information could make Bulgarian entrepreneurs less informed and negatively reacting to innovation-related activities of government authorities. In this context, one can explain the fact that most Bulgarian companies perceive the government policy in the innovation sphere and the national legislation and standards (or rather the lack of it) as serious barriers to their innovation activities[60].

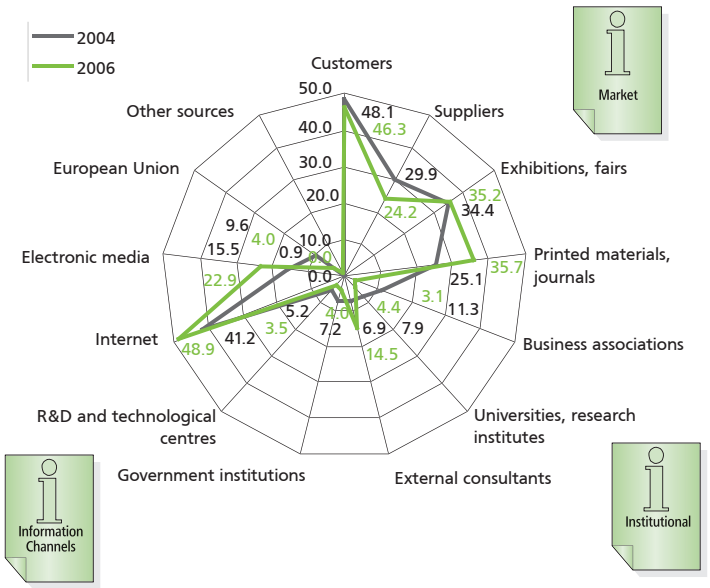
The share of Bulgarian enterprises indicating universities, colleges, research institutes and private research/technological centers as significant sources of information for their innovation projects decreased in comparison to 2005. Over 70 % of Bulgarian companies failed to use those organizations as sources of information for the implementation of innovation projects, and those companies which assessed them as significant sources of information were only a small portion of all enterprises. This once again comes to show the low level of cooperation between entrepreneurs, on the one had, and universities, colleges, research institutes and technological centers, on the other. This negative trend could affect the nature and quality of innovation activities in Bulgarian enterprises (mainly routine innovation oriented to the local market).

Box 2. INNOVATION COOPERATION – GOOD PRACTICES

The Center of Information Society Technologies (CIST) is an inter-disciplinary unit at Sofia University "St. Kliment Ohridski", engaging in R&D and training in the field of information society technologies. The main goal of the Center is to establish successful cooperation between the university, the academic community, the private sector (including SMEs), non-governmental organizations, government institutions and local authorities for the dissemination and wide use of information society technologies. The CIST maintains partnerships with many organizations, including the Ministry of Transport, the Ministry of the Economy and Energy, the Ministry of Finance, the SME Promotion Agency, BARDA, the Bulgarian Industrial Association, companies and others in various projects related to the promotion of innovation, the development of regional programs to encourage the establishment of profitable start-ups, promotion of entrepreneurship through the organization of an European Entrepreneur Day, etc.

Source: CIST.

Figure 44. SHARE OF INNOVATIVE ENTERPRISES IN BULGARIA WHICH SPECIFY THE ENUMERATED SOURCES OF INFORMATION AS VERY IMPORTANT FOR THE IMPLEMENTATION OF THEIR INNOVATION PROJECTS (%)



Source: Applied Research and Communications Fund, 2006.

[60] According to the survey of innovation activities of enterprises conducted by Vitosha Research as commissioned by the Innovation Relay Centre at the Applied Research and Communications Fund in August 2006, 28.6 % of Bulgarian innovative companies believed that the lack of a clear government policy in the field of innovation largely constrained their innovation work.

3. Investment and Financing of Innovation

The investment in innovation represents the spending on the creation (or adaptation) of innovation, technological and/or research products in the country. Its major element and measure is the spending on research and development (R&D) in the country. Investment in innovation is related to the technological intensity, depth and quality of the physical capital generated by domestic and foreign investment. FDI, together with the import of goods, represent indirect transfers to the country of R&D spending made abroad. Investment in innovation depends on the functioning of the whole innovation system but it is most closely linked to the availability and diversity of mechanisms for financing, including venture capital. The direct financial commitment of the government to R&D makes investment in innovation an important pillar of the national innovation policy.

Innovation investment in Bulgaria remains related primarily to the transfer of knowledge from the EU through foreign direct investment and import of capital goods. R&D expenditures are relatively low (0.50% of GDP). The financial system of the country is growing rapidly but still fails to offer specific innovation financing instruments. The expectations are for the trend of increased R&D investment to continue in the next few years under the influence of the additional financing from the EU funds and the more active private sector.

Investment in R&D. R&D expenditures in Bulgaria increase but they are still four times lower than the EU-15 average level. The structure of R&D expenditures in Bulgaria is strongly imbalanced. The share of the public sector in their financing and implementation is twice higher than that of businesses or higher education. In the EU-15 governments account for less than one-fifth of the total R&D expenditures. Ninety percent of R&D expenditures in Bulgaria go for operational needs, mainly staff salaries and maintenance of the equipment in the public sector. The influx of resources for R&D from the European funds will increase R&D

expenditures but the change in the structure of the sector will depend mainly on the national innovation policy pursued in the next couple of years.

International transfer of innovation – foreign direct investment. The inflow of foreign investment has grown steadily in Bulgaria, remaining the major source for technological renovation of the country. The share of foreign direct investment (FDI) in the gross capital formation has been some 40 % in Bulgaria for the last eight years – twice higher than in the EU-8, while the saturation of the economy with foreign investment has remained about three times less than in the same group of countries. Most FDI are directed towards the most innovative sector in the country – financial intermediation – as well as towards logistics, transport, communications and real estate. The share of manufacturing in FDI has decreased, which could be the signal of deteriorating qualitative structure of FDI and saturation of the technological innovation absorption capacity of the economy. The expectations for FDI to retain their growth rates during the initial years of EU membership depend on the enhancement of the country's absorption capacity through the European funds.

Financing of innovation. The own resources of enterprises continue to be the main source of financing for their innovation activities in 2006, followed by banks and domestic and foreign partners. Banks and EU funds scored the highest growth among the sources of financing in comparison to the previous edition of *Innovation.bg*. This trend is expected to increase after the EU accession and the further deepening of financial intermediation in the Bulgarian economy. The specialized instruments for innovation financing such as venture capital funds are practically unknown to Bulgarian innovative enterprises. The vigorous development of the local capital market for the last two or three years, the accumulation of resources in long-term financial instruments (pension funds, insurance companies) and the entry of EU funds and expertise are expected to lead to the emergence of the first national venture capital instruments in 2007-2008.

Investment in R&D

R&D spending is the targeted investment of the companies and the other stakeholders of the national innovation system in the creation of new products, technologies and knowledge. Its size and institutional structure reveal the R&D potential of the country, as well as the assessment which the various participants in the innovation system give to its development prospects.

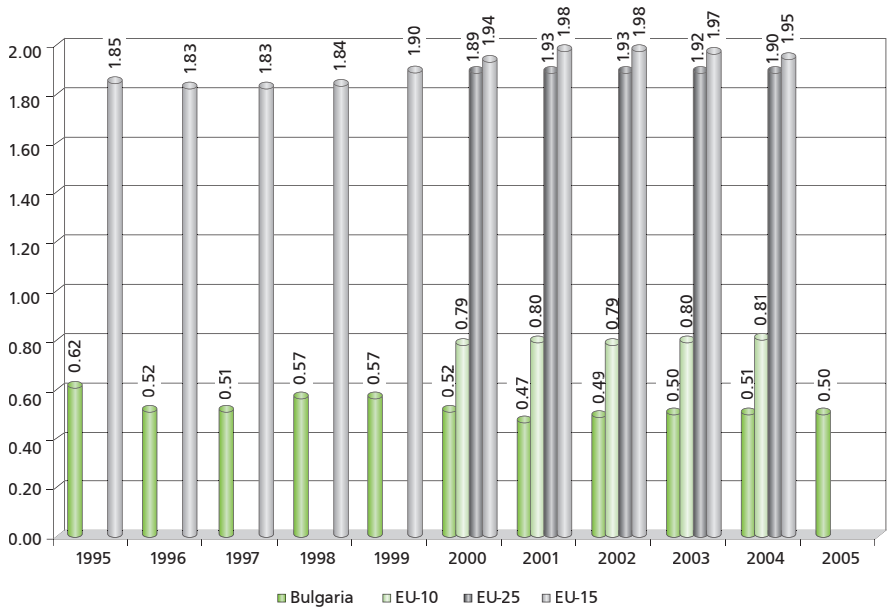
In recent years R&D spending in Bulgaria has grown by some BGN 20-30 million annually, remaining at a level around or slightly above 0.5 % of GDP. **Bulgaria spends four times less on R&D in comparison to the EU-25** and 0.3 percentage points less than the new EU Member States which joined in 2004. The Innovation Strategy of the Republic of Bulgaria envisages that R&D spending reach 1.15 % of GDP by 2013 with the help of the national innovation policy and the resources from the EU funds. Already by 2005, the forecasts of the Strategy lagged behind the real disbursements by BGN 40-60 million or 0.2 percentage points of GDP. The distance could be shortened in 2007 given the greater allocations for Bulgaria from the EU Framework Programs and the projects under the PHARE Program but it would be highly unlikely under the current condition of the national innovation policy.

After 2007, three factors will have a **positive impact** on the R&D spending in Bulgaria: (1) the resources from the **EU funds and framework programs**; (2) the **re-allocation of R&D investment from the old EU Member States** in search for new capabilities and cost cuts[61]; and (3) **allocation of more EU resources for R&D investment to the new Member States**. The data for the period 2002 – 2004 at EU level support such a scenario, although a tangible increase of the R&D spending was felt in only a couple of the EU-10 countries, i.e. Hungary, Slovenia and Estonia. Similar developments are predicted by the main theoretical papers, which emphasize that an important prerequisite for R&D flows to move from countries with big markets to countries with small markets is the access in the latter to the research infrastructure and knowledge of the former.

The **mismatch in the R&D structure in Bulgaria** observed in the previous edition of *Innovation.bg* is retained, although certain signs of improvement can be seen. Unlike EU-15, where the bulk of **R&D expenditures** are incurred and financed by the Enterprise sector, in Bulgaria more than **half of them relate to the Government sector**. For the last decade, the country has invested an average of less than 10 % of its R&D spending in capital goods and machines. Most of the other operating costs (approximately 60 %) have been allocated for salaries and social security contributions for the staff employed in R&D in the public sector.

The structure of the R&D spending of the government[62] as the largest

Figure 45. INVESTMENT IN R&D, % OF GDP



Source: NSI, 2006.

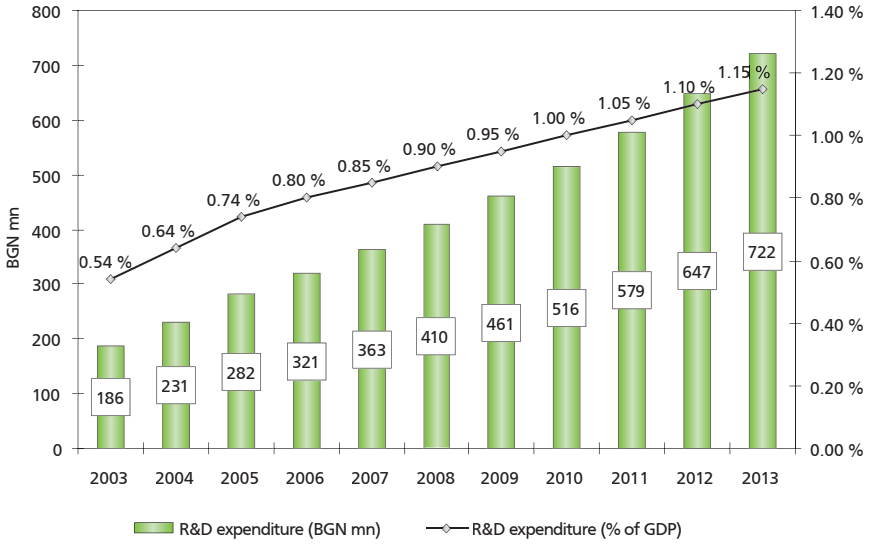
[61] According to a survey of Boston Consulting Group, 27 % of companies planned to invest their R&D spending in Eastern Europe in 2007, Innovation 2006, Boston Consulting Group, 2006.

[62] The 'Science' budget line in the central government budget. Although there are some discrepancies in the NSI data on R&D in the Government sector and the 'Science' budget line, they are minimal (below 4 %) and both have followed an overlapping dynamic pattern for the last ten years. The 'Science' item includes the Bulgarian Academy of Sciences expenditures (including its own revenues), the National Center for Agrarian Sciences expenditures, the expenditures for industrial research institutes (some have changed affiliation over the years but remain within the group), the NSF expenditures, the contributions for Bulgaria's participation in EU programs, the National Center for Information and Documentation expenditures, etc.

component of the total expenditures is skewed in comparison to the characteristic features of developed innovation systems in the world[63]. On the one hand, there prevail institutional subsidies for state-controlled institutes (National Center for Agrarian Sciences, National Center for Information and Documentation, Diplomatic Institute, etc.) and autonomous research organizations (Bulgarian Academy of Sciences). Until 2005 the share of the **government's competitive project financing** i.e. the resources allocated for the functioning of the National Science Fund was less than 2 % of the spending for the Science budget line. On the other hand, prior to the establishment of the National Innovation Fund, the government actually allocated no resources for support of R&D in Bulgarian enterprises. The whole public financing was channeled to the institutions on the supply side of R&D. Bulgaria's participation in the Fifth Framework Programme after 1999 and especially in the Sixth Framework Program of the EU after 2002 triggered a change in the structure of public financing towards competitive project financing. Over the period 2005 – 2007, there was an increase of the budget of the National Science Fund (NSF) (from BGN 12 mn to BGN 16 mn) and the National Innovation Fund (from BGN 6 mn to BGN 13 mn), thus making the share of the competitive project financing by the government increase to 12 – 13 % of the resources for the science budget line. Adding the contributions for the participation in the Seventh Framework Program of the EU, this share would reach some 20 % in 2007. At the same time, Bulgaria's involvement in the EU funds, especially through the Development of the Competitiveness of the Bulgarian Economy Operational Program, will contribute to increasing the share of R&D financing in Bulgarian enterprises and developing a denser infrastructure of intermediaries. The promotion of R&D in enterprises will be a major element also of the Seventh Framework Program of the EU. In this connection, the share of the financing from abroad in the overall R&D spending is expected to grow.

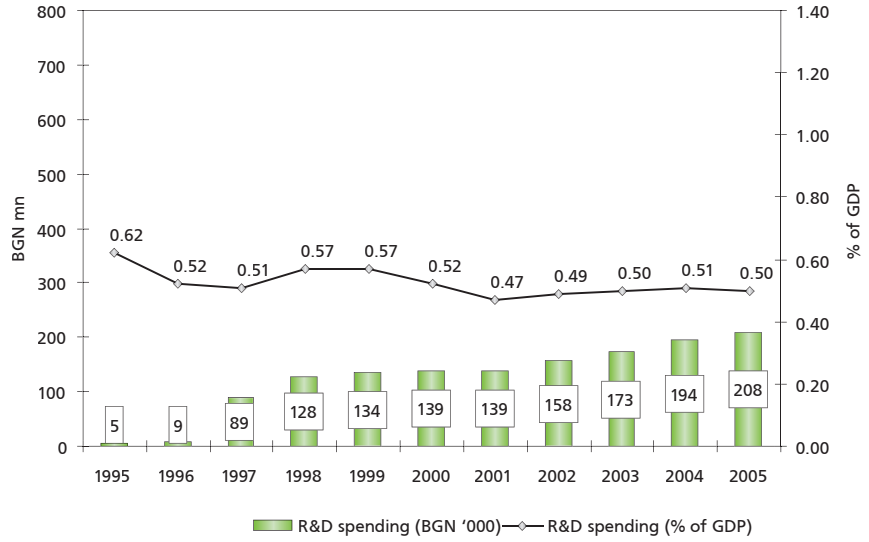
The overcoming of the imbalance in the public financing of R&D is expected to bring about gradual reduction of the disproportion in the overall R&D spending in Bulgaria. There has already been an increase in the general level of R&D spending, with the share of the enterprises rising

Figure 46. PROJECTED GROWTH OF THE R&D EXPENDITURES ACCORDING TO THE NATIONAL INNOVATION STRATEGY



Source: Innovation Strategy of the Republic of Bulgaria, 2004.

Figure 47. R&D EXPENDITURES IN BULGARIA



Note: The discrepancy in the shares and absolute values in Figures 47 and 48 for the years 2003 – 2005 is due to the differences in the GDP forecasts used in the Strategy and the actual levels of the GDP.

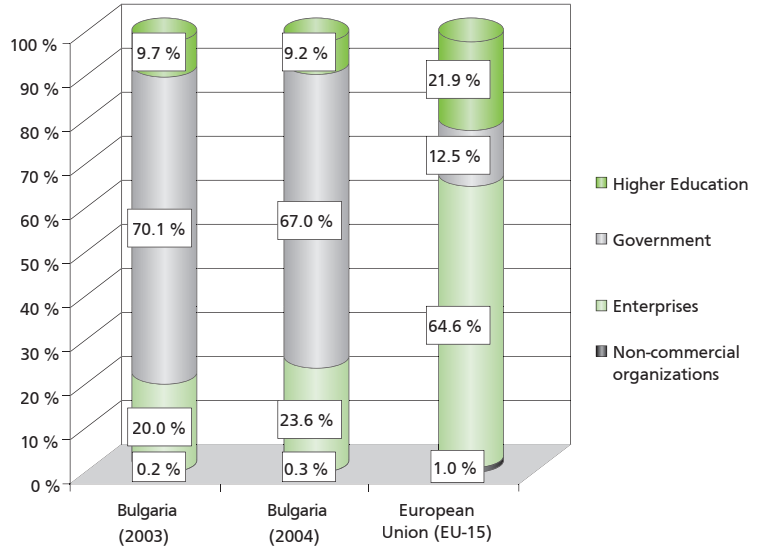
Source: NSI, 2006, NSF, 2006.

[63] For more detailed description of the main models of the structure and financing of the innovation systems of the European countries see the newsletter of the Innovation Relay Centre at the Applied Research and Communications Fund.

faster. More resources are allocated also for capital goods. Notwithstanding the special sessions of the National Science Fund on the development of research at Bulgarian universities in 2005 and 2006, their share in the R&D spending continued to be disproportionately small in comparison to the **available human resources at their disposal.**

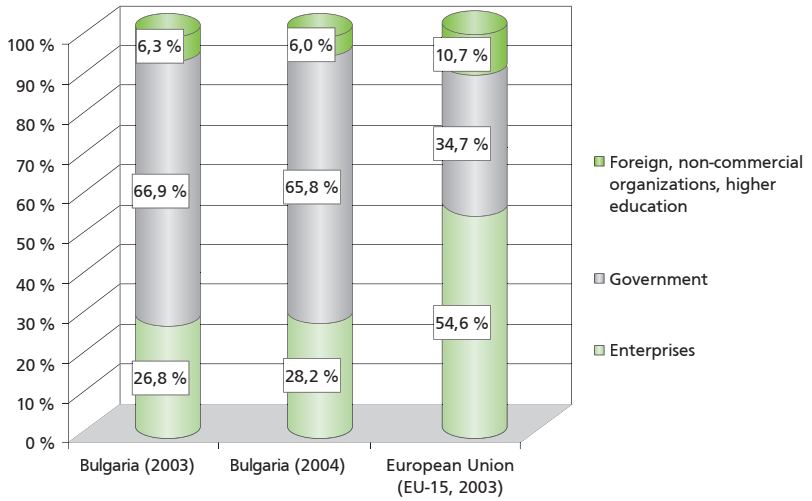
The trend has changed also in the structure of the R&D operating costs by types of research. **The share of expenditures for experimental and applied research has grown** at the expense of the spending for basic research. As the share of the enterprise sector in R&D increases, there is specific shift in the type of research. It is related also to the increased R&D spending in technical sciences. Natural and social sciences, as well as humanities have developed at faster pace over the recent years, while medical sciences even decreased their share slightly since 2002. The development of ICT activities in the country, the entry of additional foreign investment, the access to EU financing and the greater interest in the education in this sphere lead to strengthening of the position of technical sciences.

FIGURE 48. STRUCTURE OF R&D EXPENDITURES BY INSTITUTIONAL SECTORS IN BULGARIA



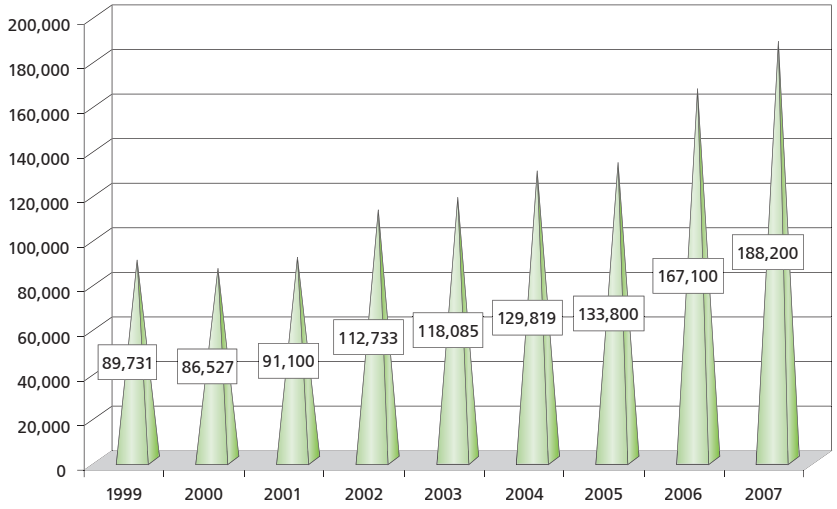
Source: NSI, 2006; Eurostat, 2006.

FIGURE 49. STRUCTURE OF R&D EXPENDITURES BY SOURCES OF FINANCING IN BULGARIA



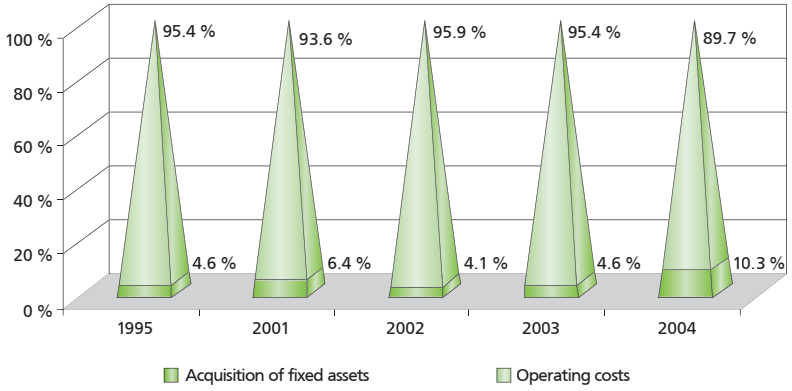
Source: NSI, 2006; Eurostat, 2006.

Figure 50. GOVERNMENT BUDGET SPENDING FOR THE 'SCIENCE' BUDGET LINE



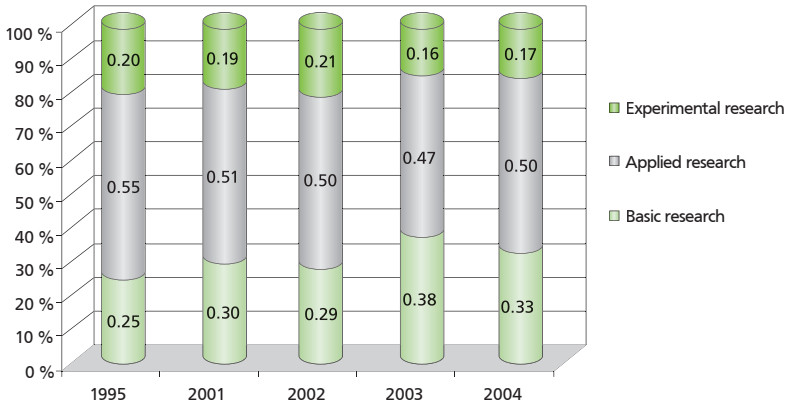
Source: Reports on the Law of the State Budget for the respective years and calculations of the Applied Research and Communications Fund, 2006.

Figure 51. STRUCTURE OF THE R&D EXPENDITURES BY ECONOMIC ITEMS (1995 - 2004)



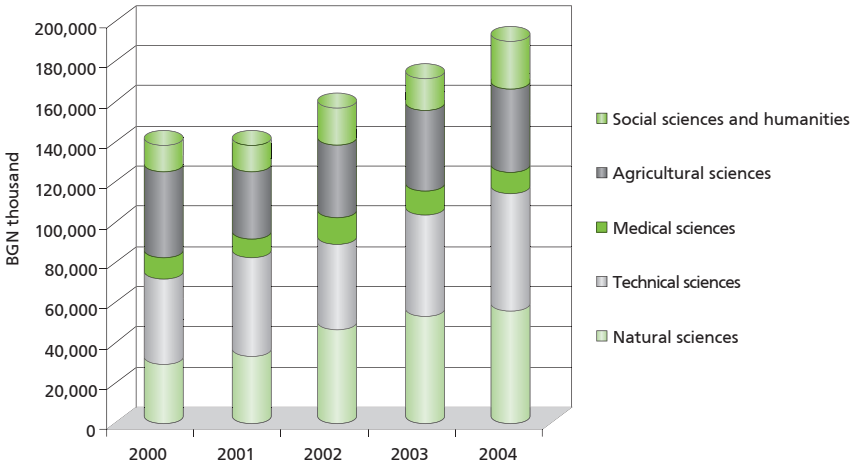
Source: NSI, 2006.

Figure 52. STRUCTURE OF THE OPERATING COSTS FOR R&D BY TYPES OF RESEARCH IN BULGARIA (1995 - 2004)



Source: NSI, 2006.

Figure 53. R&D SPENDING BY FIELDS OF SCIENCE IN BULGARIA



Source: NSI, 2006.

Box 3. COMPETITIVE PROJECT FINANCING IN BULGARIA: NATIONAL SCIENCE FUND AND NATIONAL INNOVATION FUND

The **National Science Fund** is a national institution financing research in all fields of science. The main instruments in its activity are the research competitions organized on a project- and program-based principle. The Fund is managed by an Executive Board with the participation of prominent scientists in the country. It receives administrative assistance from the Research Department of the Ministry of Education and Science. It is the successor to the National Scientific Research Fund established in 1990. The Fund administers seven financial instruments for stimulating research in Bulgaria:

- Regular annual thematic research competitions oriented to issues of importance to society and the economy;
- Competitions for young scientists and young talents;
- National research programs intended to create competitive products;
- Competitions on the basis of bilateral cooperation with other countries;
- Targeted programs and competitions for improvement of the research infrastructure, for encouragement of research at universities, for improvement of the link between enterprises and research organizations, etc.;
- Competitions for research publications.

The budget of the National Science Fund was about BGN 15 mn in 2006.

The **National Innovation Fund** at the Ministry of Economy and Energy has been established for the implementation of the Innovation Strategy of the Republic of Bulgaria adopted on 8 September 2004.

The administration of the National Innovation Fund is entrusted to the Bulgarian Small and Medium-sized Enterprises Promotion Agncy (BSMEPA). The Fund supports two types of projects:

- Applied research projects (the maximum amount of the subsidy is BGN 500,000 and the time period for implementation is up to three years, whereby the Fund covers 25 % to 50 % of the R&D costs);
- Feasibility studies (the subsidy can cover 50 % of the costs incurred and its maximum amount is up to BGN 50,000 for projects to be implemented within a year).

The budget of the National Innovation Fund was about BGN 8 mn in 2006.

Source: Annual Report 2005, National Science Fund (2006), Report of an International Review Panel of the National Science Fund of Bulgaria (2006); Bulgarian Small and Medium Enterprises Promotion Agency.

International Transfer of Innovation

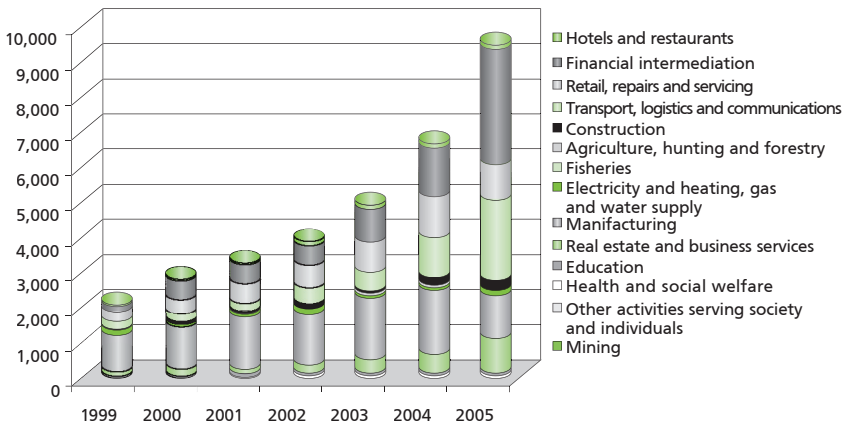
Foreign direct investment and the import of capital goods imply transfer of knowledge from abroad to the host country. The content of R&D (investment in innovation carried out in other countries) in these flows depends on the extent of novelty and technological intensity of the sectors where they are directed. The extent of knowledge transfer contained in them depends on the capacity of the recipient innovation system to absorb R&D.

The technological renovation of enterprises in Bulgaria plays a leading role in the improvement of the competitiveness of the economy on the international markets. The replacement of the obsolete production capacities and the introduction of the latest world technologies are linked to a set of activities specific to each individual enterprise. At the macro-economic level, **foreign direct investment and the import of capital goods** are considered to be **catalysts of the technologyl transfer**, as well as an **indirect measure** of its intensity. Foreign direct investment (FDI) is a driving force of economic growth for the Central and Eastern European countries[64]. The main positive effects through which a specific foreign investment can help the economic growth in a country are the **technological renovation** of the acquired enterprise and the **introduction of more efficient managerial and marketing practices**. It is for this reason that FDI flows are not just capital input but also a catalyst for new technologies and the carrier of the achievements of innovation carried out in other countries[65]. The efficiency of the process of mastering and dissemination of new technologies through foreign direct investment is not to be taken for granted, as it depends largely on the performance of the national innovation system.

Foreign direct investment accumulated in Bulgaria by economic sectors is most substantial precisely in the **sectors with a relatively big share of innovative enterprises**. The greatest beneficiary of foreign investment is the **financial intermediation** sector (35 % of the total FDI[66]), this sector having also the second largest share of innovative enterprises after **computer technologies and R&D**. Over 80 % of the FDI accumulated in Bulgaria originate from EU Member States. Hence the main source of foreign investment for Bulgaria is a region with a substantial technological base. Over the recent years, the EU Member States have invested some 2 % of the Community GDP in R&D, which implies extended access of Bulgarian companies to technological and innovation resources.

The annual FDI inflow to Bulgaria increased for the period 2003 – 2005. The average annual stock over this period was 12 % of GDP and it is expected to grow in 2006-2007. During the first half of 2006, the inflow of foreign direct investment to Bulgaria increased by 69 % on a year-to-date basis, although the technological component might have deteriorated, judging by the sectoral structure of FDI. The economic sectors which were the main beneficiaries of the FDI inflow in 2006 were real estate (38 %) and financial intermediation (19 %). Since the former group includes also enterprises whose registered main activities are defined as "business services", it is difficult to draw a conclusion as to the implied innovativeness of the foreign capital that entered the country. Still, the recent expansion of the market for real estate in terms of prices and new construction and the high growth of mortgage loans in the country are indirect measures of the prevailing share of real estate over business services in the development of the sector.

Figure 54. Stock of foreign direct investment in Bulgaria by economic sectors (1999 - 2005)



Source: BNB, 2006.

[64] For a discussion on the FDI effects on growth see Neuhaus (2005), Balasubramanyam (1996), Narula (2004) and others.

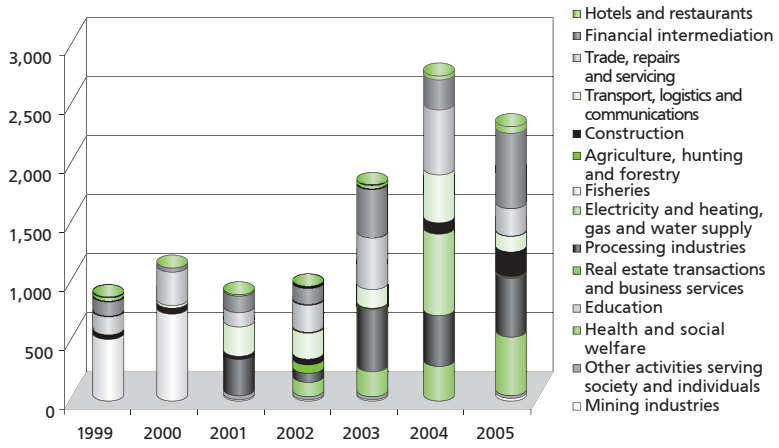
[65] It is pertinent to recall that according to the generally accepted understanding of innovation costs they include R&D expenditure, although with a broader scope.

[66] According to data from the BNB for 2005, the most recent year for which statistics is available.

Until 2001-2002 the Bulgarian economy lagged substantially behind its major competitors in Central and Eastern Europe and the EU in terms of the influx and size of FDI. The foreign capital per capita in the country was commensurate to the average level of resources attracted to the countries in South-Eastern Europe (SEE) over that period. The much larger inflow for the last three years has created conditions for an increase of the saturation of the economy with FDI. The inflows per capita in Bulgaria have been above the average level for the new EU Member States for the recent years. Although the foreign capital stock per capita in the country is still far below the respective levels in the EU-10, Bulgaria has already overtaken Romania and SEE average. When FDI is weighed by GDP, it still lags behind that of the old and new EU Member States but the catching-up trend is visible and the fluctuations in this indicator for Bulgaria follow the European cycle.

The comparison shows that over the period 1995 – 2005 the share of FDI in the gross capital formation was much higher in Bulgaria than in the EU countries. Its share in the gross capital formation rose to 56 % on an average annual basis during the period 2003 – 2005. This dependence of the investment process in Bulgaria on external capital reveals insufficient national savings and unsatisfactory internal financial resources. In this respect, the processes of deepening the financial intermediation and developing channels for providing investment resources which are alternative to the banking system, especially with regard to the innovation activity of enterprises remain relatively weak. **The role of FDI in the gross capital formation in Bulgaria is an indirect measure of the technological dependence of the country,** which will have a long-term impact on the development of the Bulgarian innovation system.

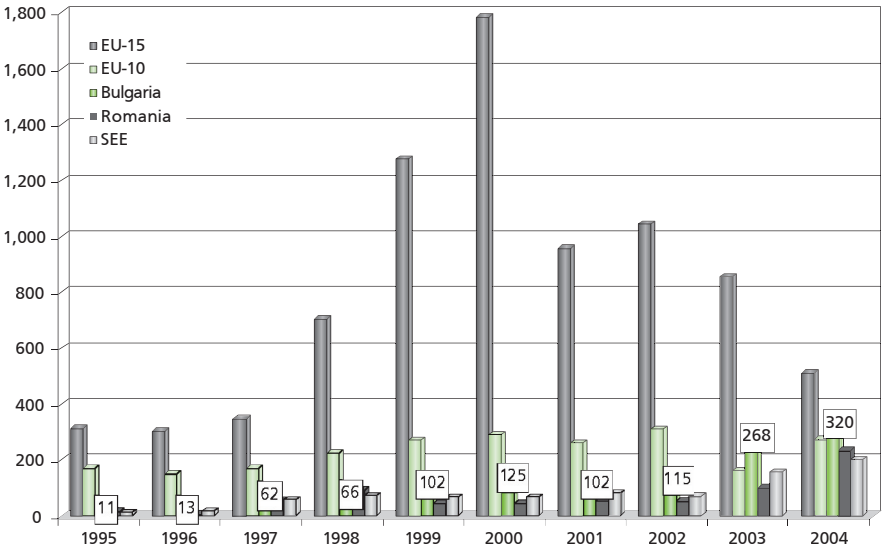
Figure 55. INFLOW OF FOREIGN DIRECT INVESTMENT TO BULGARIA BY ECONOMIC SECTORS (1999 - 2005)



Source: BNB, 2006.

Parallel to the increased inflow of FDI to the country over the recent years, the **import of capital goods** has also expanded. This process contributed to the intensive improvement of the technological level of capital goods in the country through the implicit transfer of knowledge, know-how and innovativeness imbedded in imports. Over the period 2004 – 2005, capital goods were among the most dynamic components of Bulgarian imports with an average annual growth rate of 28 %. They were the second largest import group, accounting for 27.6 % of the total imports in 2005. The main goods in this import group are machines, equipment and devices (9.5 % of the total import of goods in 2005) and transport vehicles (8.3 %). Notwithstanding the positive trend over the recent years, since the beginning of 2006 the growth rate of the import of capital goods has slowed

Figure 56. INFLOW OF FOREIGN DIRECT INVESTMENT PER CAPITA IN BULGARIA, ROMANIA AND SELECTED GROUPS OF COUNTRIES (1995 - 2004)



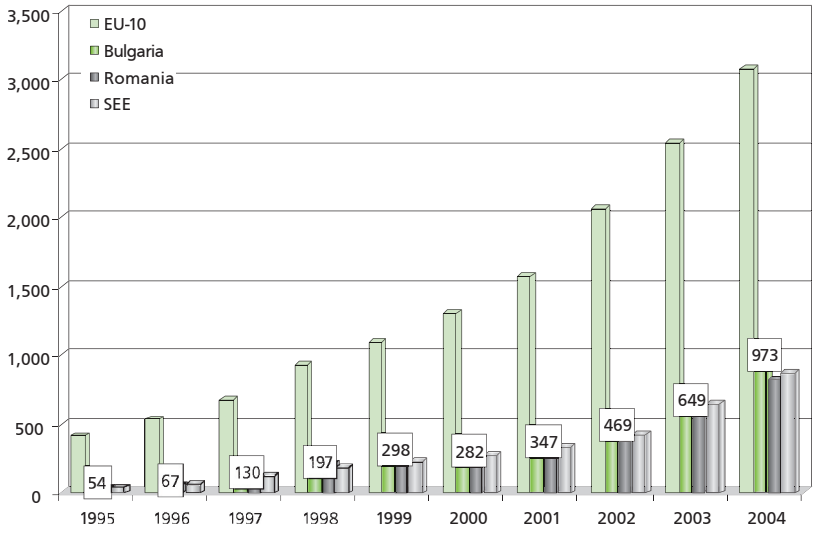
Source: UNCTAD, 2006.

down in comparison to the greater dynamism of energy resources, consumer goods and raw materials.

A salient feature of the Bulgarian economy is its high energy intensity and specialization in traditional business activities like agriculture, food industries, heavy processing and mining, trade and tourism[67]. These activities face severe international competition and low potential for long-term growth. The innovation activities of enterprises in traditional industries have lower rates of return than in the rapidly developing high-tech sectors. As a result, Bulgarian enterprises are oriented mainly to import, adaptation and introduction of new technologies from abroad and much less to investment in own R&D projects.

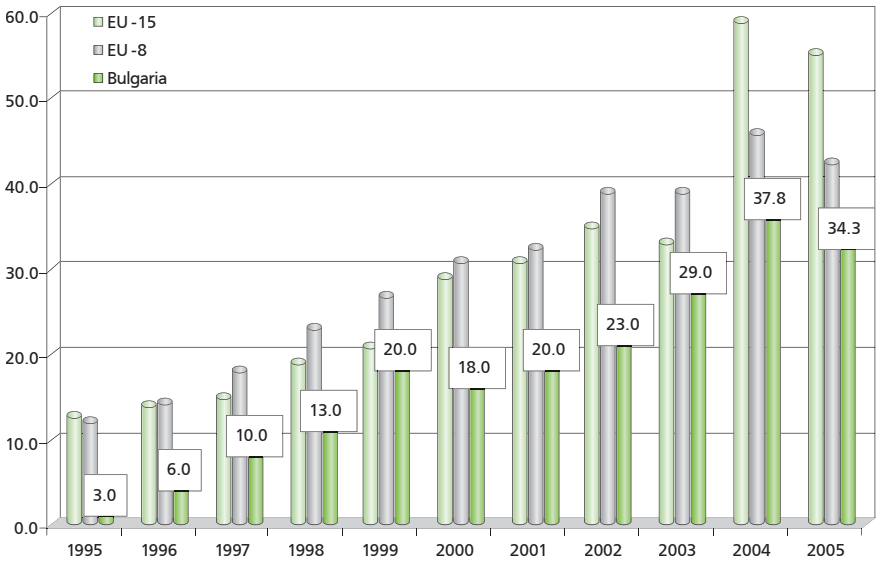
The most recent trends in the development of trade in the country prove its specialization in lower-tech sectors which, in turn, puts to question the long-term sustainability of the high economic growth rates of the last few years. The major component of the Bulgarian foreign trade is raw materials which accounted for 36 % of imports and 43 % of exports in 2005. The dynamic pattern of growth in Bulgarian foreign trade since the beginning of 2006 has been largely triggered by the price component[68] and does not exhibit any tangible improvements in the competitiveness of the economy[69].

Figure 57. STOCK OF FOREIGN DIRECT INVESTMENT PER CAPITA IN BULGARIA, ROMANIA AND SELECTED GROUPS OF COUNTRIES (1995 - 2004)



Source: UNCTAD, 2006.

Figure 58. RATIO BETWEEN FOREIGN DIRECT INVESTMENT STOCK AND GDP IN BULGARIA AND SELECTED GROUPS OF COUNTRIES



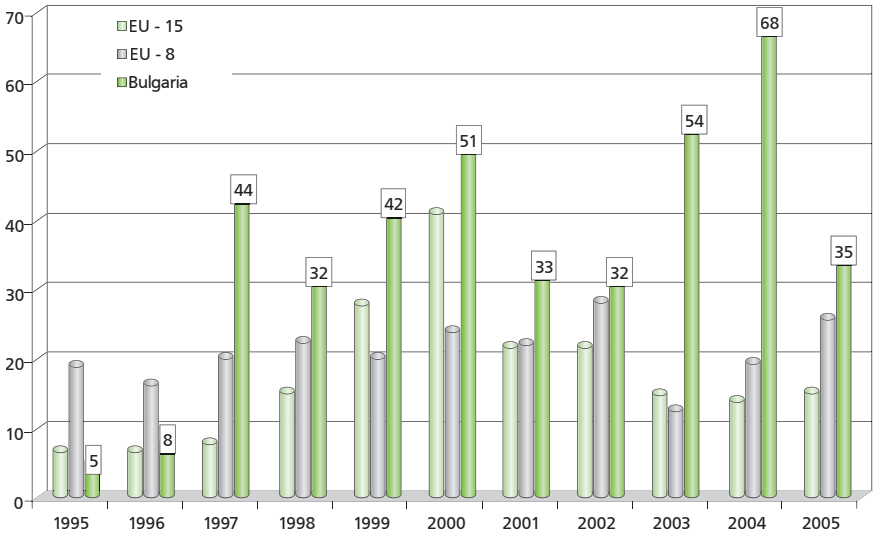
Source: UNCTAD, 2006, BNB, 2006.

[67] Furthermore, a relatively large portion of the added value is still generated by the public sector. In 2004, general government activities and mandatory social security schemes contributed 7.5 % to the value added at base prices, while the total share of the public sector in the value added was 20.4% (NSI, 2006).

[68] The greatest contribution is that of the increased international prices of energy resources and metals.

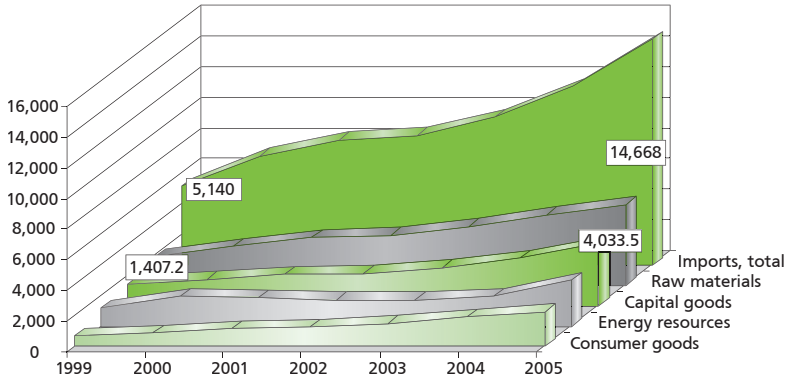
[69] For further details see Appendix 4.

Figure 59. SHARE OF FOREIGN DIRECT INVESTMENT IN GROSS CAPITAL FORMATION IN BULGARIA AND IN SELECTED GROUPS OF COUNTRIES



Source: UNCTAD, 2006.

Figure 60. BULGARIAN IMPORTS BY GROUPS OF GOODS (1999 - 2005)



Source: BNB.

Financing of Innovation in Enterprises, Venture Capital

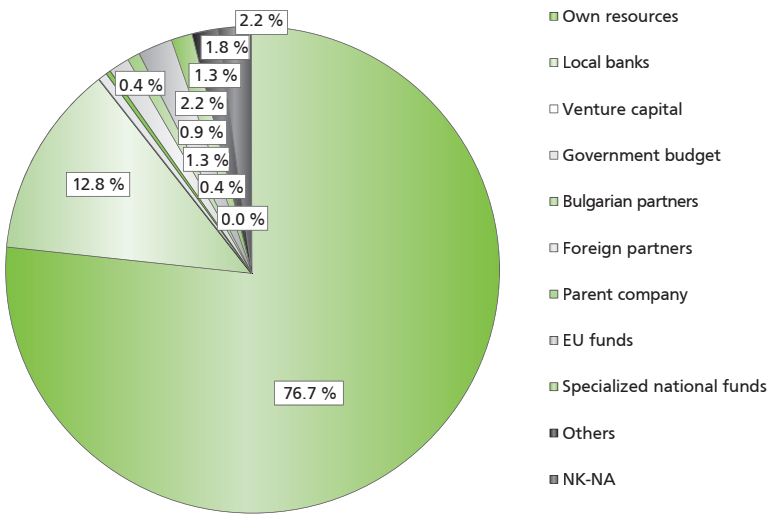
The financing of innovation relates to the general level of development of financial intermediation, the depth of capital markets and the availability of specific instruments and mechanisms to finance long-term and/or high-risk projects. It determines the risk level and the degree of innovativeness which the system tolerates and is prepared to support with resources.

Bulgarian companies still rely prima-rily on their own resources[70] to finance their innovation activities. In 2006, more than three-quarters of Bulgarian companies financed their innovation with their own resources. Thus they are greatly restricted in the scope of their undertakings and the risk they can accept. Still, the dynamic comparison of the available data confirms the importance of the **banking sector as the second largest source of financing for innovation projects of the enterprises** and the emergence of a new instrument – **EU funds and program**. The projects for support of enterprises within the PHARE Program in 2005 and 2006 and the participation of Bulgarian SMEs in the Sixth Framework Programme of the EU have ensured their recognition as important sources of financing for innovation. Undoubtedly, the role of the latter and of the banking sector will increase in the years to come. Their effect will be promoted by the emergence of venture capital funds which are envisaged for financing from the EU funds in the country.

Bank loans are the second largest source of financing for the innovation activity of Bulgarian enterprises. The credit expansion in the country for the last few years has broadened the opportunities for financing not only of more investment projects but also more innovation projects. The bank loans extended to private non-financial enterprises increased by 450 % over the period 2000 – 2005, reaching BGN 9.1 bn by July 2006. Expressed as a ratio to GDP, the average annual growth of lending increased from 5.4 % in 1999 to 20 % in 2005. The period was characterized by expansion of the total volume of loans, as well as increased share of long-term (investment) loans. Loans with maturity of over five years increased their share in the total volume of the resources lent to private non-financial enterprises from 13.4 % on the average for the period 1999 – 2003 to 28.5 % at the end of 2005 (31.1 % as of July 2006). In spite of this vigorous development, the level of financial intermediation in the country remained below the average levels in the old EU Members States (EU-15) and the new ones. Furthermore, the low-risk profile of bank financing makes it accessible only for lower-risk investment projects which could bring good economic benefits to the country.

The third most important source of financing for innovation projects pointed out by the Bulgarian companies are the **resources of local and foreign partners**. For the last few years, the trend of direct external borrowing by the non-banking

Figure 61. MAIN SOURCES OF FINANCING FOR THE INNOVATION ACTIVITY OF THE BULGARIAN INNOVATIVE COMPANIES IN 2006



Note: This is a list only of the sources mentioned by the respondents as first choice among three options.

Source: Applied Research and Communications Fund, 2006.

[70] According to the nationally representative survey of companies in Bulgaria conducted by Vitosha Research as commissioned by the Applied Research and Communications Fund.

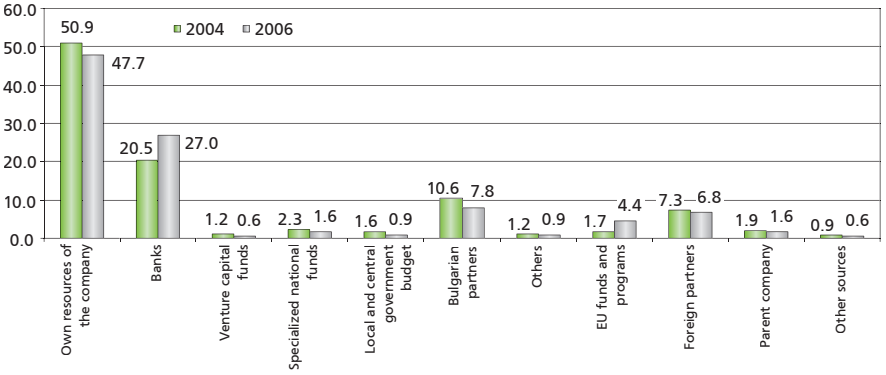
private sector has increased parallel to the expansion of bank loans in Bulgaria. Thus the private non-banking external debt presented as a ratio to the GDP grew from 9 % in 1999 to 35 % in 2005 (39 % of the annual GDP in the middle of 2006). Although the effect on the development of innovation cannot be measured precisely, this instrument is most likely to lead to the learning of new knowledge and know-how by Bulgarian enterprises and their application on the domestic market.

In spite of its relevance according to the empirical surveys, **the use of venture capital funds for financing of innovation projects is still marginal** in Bulgaria. According to the survey of the Innovation Relay Centre at the Applied Research and Communications Fund which was conducted by Vitosha Research in 2006, the answer "venture capital funds" to the question "sources of financing for innovation" was mentioned at first place by none of the respondents; one respondent ranked it second and two respondents ranked it third.

Bulgaria already offers opportunities for entry of external venture capital funds into the country. According to a survey of the global venture capital[71], European companies are the major possible source of venture capital for Bulgaria. They intend to invest 14 % of their additional capital in Central and Eastern Europe. The main reasons for investing are entrepreneurial undertakings in the region, attainment of high quality of transactions, diversification of risks and access to markets. The companies specify as major obstacles the lack of business knowledge in the region, lack of domestic investment funds, few high-quality transactions, limited opportunities for exit from the investment. A possible entry of European venture capital companies in Bulgaria would be promoted by the resources envisaged for the establishment of venture capital financing instruments from the EU funds for Bulgaria after 2007.

The condition of the stock exchange market is an indicator for "the quality of transactions" and the potential for development of venture capital in Bulgaria. The country has developed positively in this respect for the last few years, and the Bulgarian Stock Exchange has been among the most dynamic ones in the world recently. The stock price index included in SOFIX reveals the highest growth rates as compared to some major European and international indexes.

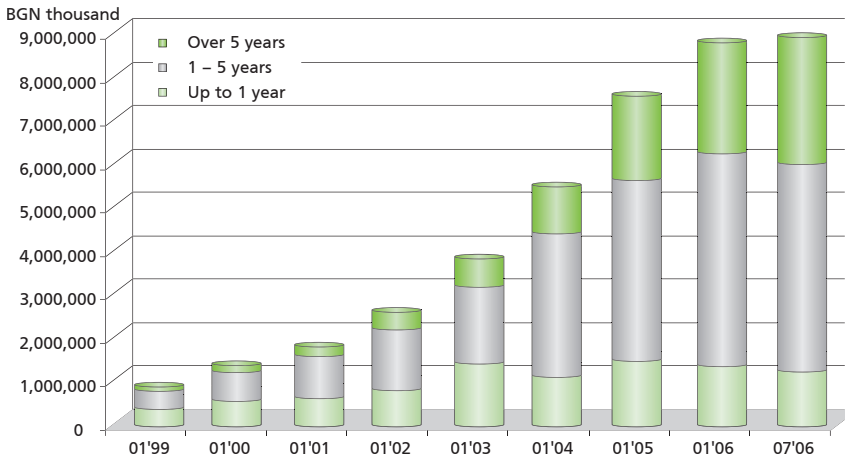
Figure 62. CHANGES IN THE MAIN SOURCES OF FINANCING FOR THE INNOVATION ACTIVITY OF THE BULGARIAN INNOVATIVE COMPANIES



Note: This is a list of the sources mentioned by the companies in first, second and third palce. The answers "don't know/no answer" have been ignored.

Source: Applied Research and Communications Fund, 2006.

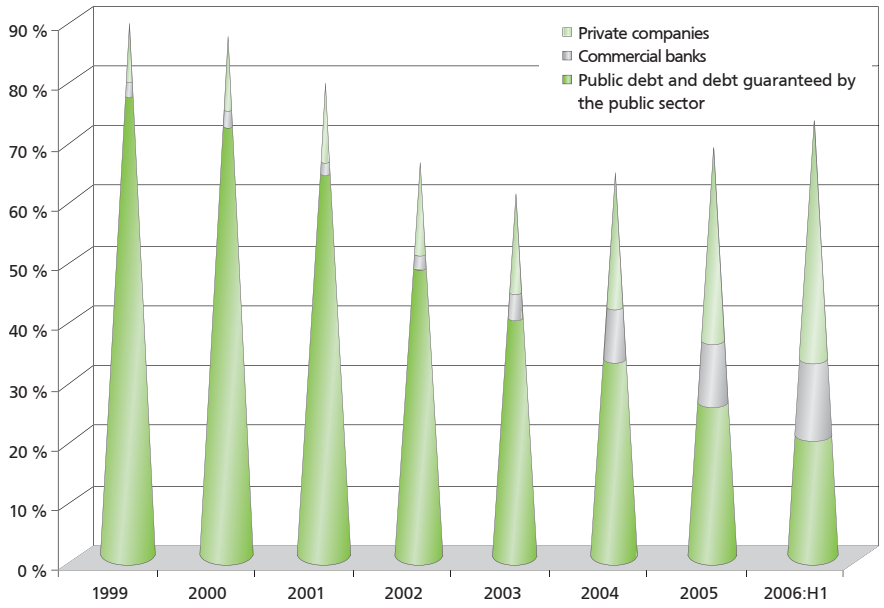
Figure 63. SIZE AND MATURITY OF BANK LOANS EXTENDED TO PRIVATE NON-FINANCIAL ENTERPRISES IN BULGARIA (1999 - 2006)



Source: BNB, 2006.

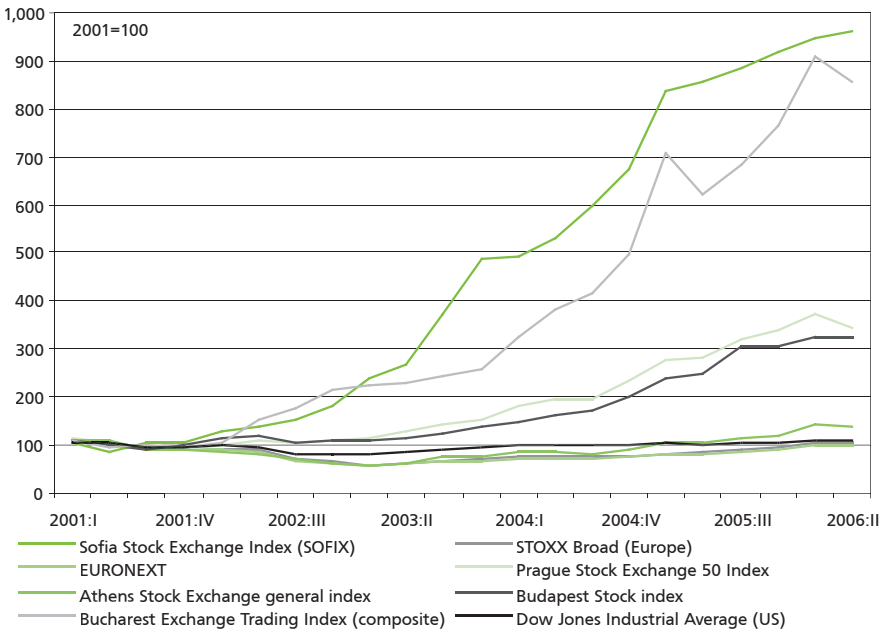
[71] Survey of Deloitte among 500 venture capital management companies (out of which 140 in Europe), 2006.

Figure 64. COMPONENTS OF THE GROSS EXTERNAL DEBT OF BULGARIA AS PERCENTAGE OF GDP (1999-2006)



Source: BNB, 2006.

Figure 65. SELECTED EUROPEAN STOCK PRICE INDEXES (2001 - 2006)



Source: Eurostat, 2006.

Box 4. PARTICIPATION OF BULGARIAN ORGANIZATIONS IN THE SIXTH EU FRAMEWORK PROGRAM FOR RESEARCH, TECHNOLOGICAL DEVELOPMENT AND DEMONSTRATION ACTIVITIES

Research is among the first activities, in which EU Enlargement turned into reality. The most recent data on the participation of representatives of various countries in FP 6 show that **Bulgaria** has 332 participants who have signed 268 contracts for project implementation, the total value of the contracts of Bulgarian participants being EUR 31.2 mn. **Romania** in comparison has 407 participants in 317 contracts worth EUR 39.8 mn.

Both countries have the largest number of successful projects in the ICT program followed by Sustainable Development, Global Change and Ecosystems. However, the participation of representatives of these two countries has been weaker than that of the other EU Member States so far. Germany has taken part in 3,027 projects, Poland in 1,005 projects, Portugal in 597 projects and Hungary in 655 projects.

Source: CORDIS, Information Service of DG Research.

4.Human Capital for Innovation

The human capital for innovation is the accumulated knowledge and skills to create (or adapt) innovation, technological and research. It is expressed through the quantity and quality of the educational product and the employment in some specific sectors such as R&D, entrepreneurship, high- and medium-tech industries. The human capital for innovation is related to the overall condition of the secondary and university education system and its important supplement - lifelong learning. The long-term nature of human capital turns it into an important target for the national innovation policy with a view to the modeling of the capacity and capabilities of the national innovation system.

During the transition years **human capital**, similar to physical capital, underwent quantitative and qualitative depreciation. The system of secondary education and R&D employment were particularly badly affected. Since 2002 – 2005 all the elements of the educational product and employment in Bulgaria have improved, except for those in high-tech manufacturing. Nevertheless, their performance is still below the EU-10 and EU-25 average.

Research career, R&D and high-tech employment. In comparison to the previous edition of *Innovation.bg*, last year saw the first big (35 %) increase of new PhDs in Bulgaria. Employment in R&D is growing, the leading sector being Bulgarian enterprises (growth rates of 30 % for the last two years). There is growing specialization in research-intensive high-tech services in Bulgaria, where employment rates continue to be above the EU-10 average but the country still lags behind in high-tech manufacturing. In spite of the positive trends in the dynamic pattern, R&D employment and the share of new PhDs remain twice less than in the EU-10, while the share of the people involved in R&D in the public sector is disproportionately higher in Bulgaria than in the EU-10 and EU-15.

Education outcomes, quality of education and lifelong learning. The education outcomes in Bulgaria remain relatively lower than in the EU-10 and EU-15, especially with regard to secondary education. Higher education achievements stagnate, although at a comparatively high level, while in structural terms the significance of mathematical and engineering sciences is growing in connection with and in support to the technological renovation of the national economy. The share of the people involved in continuing education is still some nine times less than in the EU-15.

Research Career, R&D and High-tech Employment

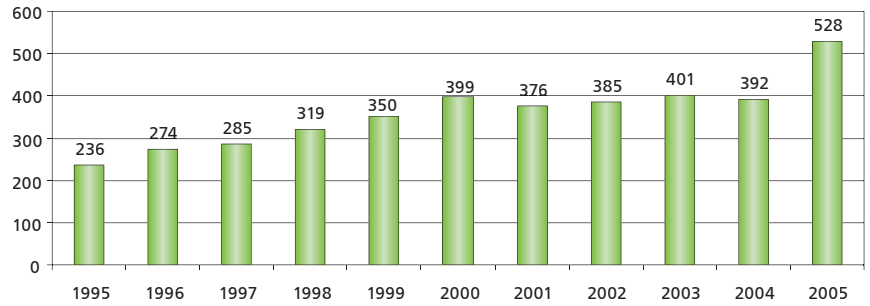
The number and quality of those who successfully complete their PhD degree reflect the dynamism and ability of the national innovation system to generate new scientific and/or technological knowledge. On the other hand, employment in R&D and in the high-tech sectors of the economy reveals the current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

2005 was the first year when the number of those who had successfully completed their PhD degree increased since 2000[72]. However, the share of PhDs in the total number of the population aged 29 to 34 is still relatively lower in Bulgaria than that in the EU-10 or the EU-15. One could assume that with a five-year time lag **Bulgaria follows the trend of increase in the population with PhD degrees in the 29 to 34 age bracket** registered in EU-10 since 2001. The opening up of the European research and education area and the EU research programs for young Bulgarians will be further incentives for taking up a research career in the next few years. The planned increase of the national resources for young research talents within the framework of the National Science Fund will create additional conditions for development of a high-quality generation of scientists in this country. Nevertheless, the conclusion in the previous edition of *Innovation.bg* about the **lagging behind in this sphere** is still valid. This fact, together with the **ageing of research staff**, poses substantial challenges to the ability of Bulgarian science to contribute successfully to the development of the innovation capacity of the Bulgarian economy.

The restructuring of the Bulgarian economy in the 1990's led not only to the closing down of many R&D units but also to the shift of many researchers from there to other economic sectors or other countries.

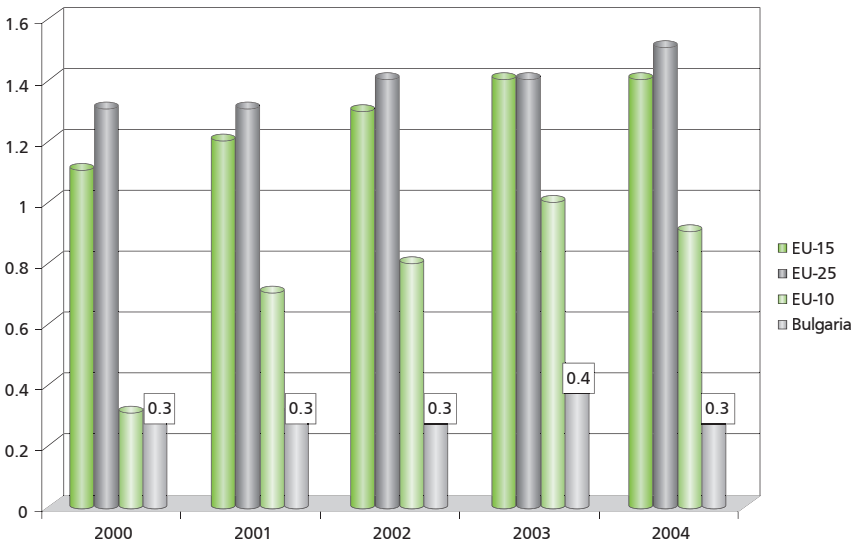
[72] According to the National Statistical Institute.

Figure 66. NUMBER OF PHDs IN BULGARIA



Source: NSI, 2006.

Figure 67. NUMBER OF PHDs PER 1,000 INHABITANTS IN THE 25 TO 29 AGE BRACKET



Source: Eurostat, 2006.

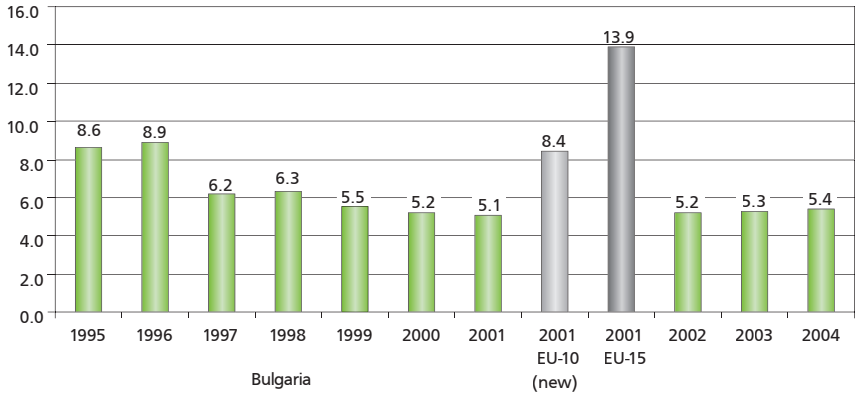
Thus the number of R&D personnel was reduced by 22 % over the period 1994 – 2004. It was not until 2002 that the trend was reversed to growth but it has not set off the reduction of the previous period yet. To compare, the countries in the European Community follow a steady upward trend in R&D jobs. Over the same period the increase there was 35 % for the EU-25 and 37 % for the EU-15. Only Romania scored worse with a reduction of 37 % at the end of 2004. The trend of increasing R&D personnel in Bulgaria could be expected to continue or even expand upon the country's EU accession.

The crisis in Bulgarian research and education during the transition period affected the **structure of the R&D personnel** and the number of R&D jobs was cut drastically in enterprises. The increase of the R&D personnel in Bulgaria for the last four years has changed also the structure of employment and increased the share of R&D jobs in enterprises. Over the period 2002 – 2004, the R&D employment in enterprises increased at the highest rates (close to 30 %) among the institutional sectors. This implies gradual reinforcement of the applied and practical orientation of the R&D personnel in Bulgaria and more significant and faster effect of its increase on the innovative productivity of the Bulgarian economy. In 2004, the greatest number of R&D personnel was employed in the government sector (66.4 %). Much further behind were the sectors of higher education and enterprises with 19.4 % and 13.8 % respectively. In the EU-25 more than a half of all researchers work in the corporate R&D divisions, i.e. they are directly involved in the introduction of new technologies or innovation and they are directly exposed to the impact of the market competition. Other 31 % carry out research at university laboratories and, at the same time, take part in the educational process. This enables young specialists to get integrated in the implementation of research projects and to be prepared for their further research career. The change in the dynamic pattern and structure of the **R&D personnel and R&D employment increase in enterprises** are expected to speed up with Bulgaria's EU accession in 2007. But they would turn into reality depending on the size and management mechanisms of the European funds for R&D in the country.

The dynamic pattern of R&D employment in Bulgaria, especially in the enterprise sector, is linked to the dynamic pattern of **employment in high-tech activities and sectors** which express the ability of the national economy to create new knowledge and to successfully convert it into competitive end products with high value added. Over the period 2000 – 2005, the employment in the high-tech sectors of the Bulgarian economy was reduced to 0.45 % of the total employment, which was twice lower than the average EU-10 level. It is important to note that employment in these sectors decreased also in the EU-15. The old Member States lag behind the United States in this respect, their industrial structure being related to more traditional medium- and medium-high-tech industries in chemical engineering and the automobile industry[73]. This makes Bulgaria's task to identify a working model for the development of high-tech industries more difficult but, at the same time, potentially more rewarding.

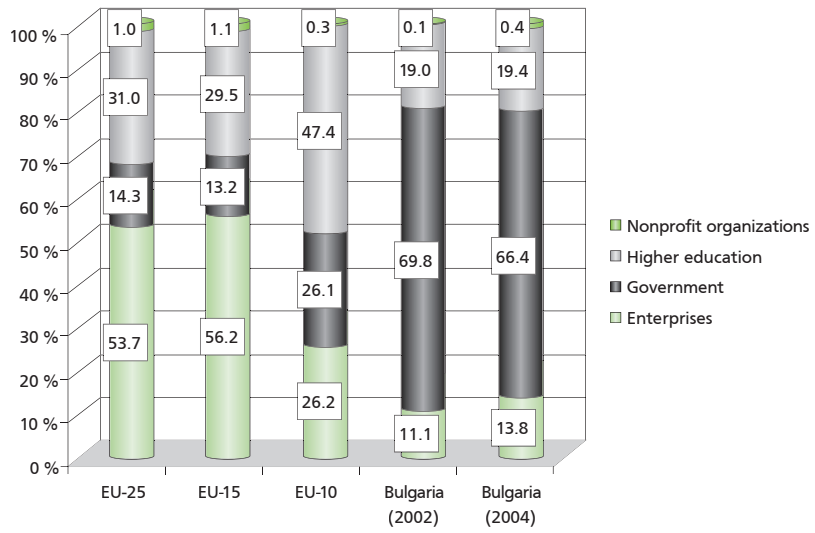
[73] See Cookson, Clive, US Widens Gap with Europe on R&D, Financial Times Europe, October 30, 2006; Ewing, J., G. Edmonson, Europe's Powerhouse: How the Young Knowledge Workers of Central Europe are Pushing the Region to a New Level, BusinessWeek, December 12/19, 2005; The Brain Business: How Europe Uses and Abuses its Brain Power, The Economist, October 12, 2006; The R&D Scoreboard 2006, The Top 800 UK and 1 250 Global Companies by R&D Investment, Department of Trade and Industry, UK, 2006.

Figure 68. R&D PERSONNEL PER 1,000 OF THE WORKFORCE



Source: Eurostat, NSI, 2006.

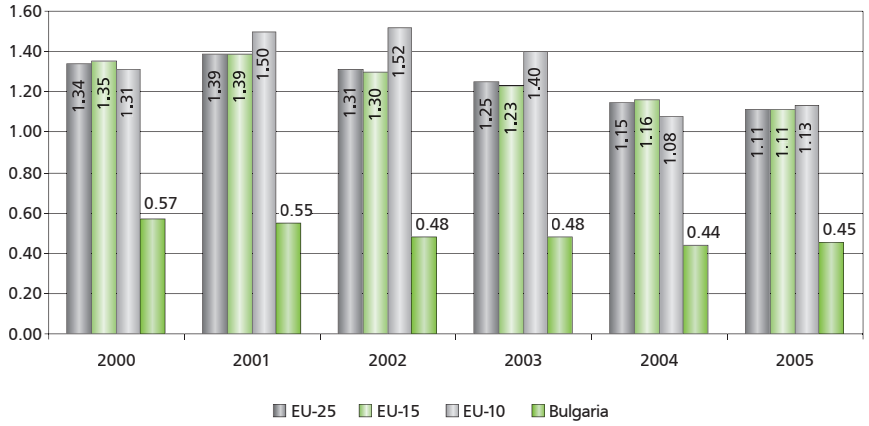
Figure 69. R&D EMPLOYMENT BY SECTORS



Note: Percentages are presented in full employment equivalent.
Source: Eurostat, 2006.

Conversely, in the sphere of the **science-intensive high-tech services** there is a steady **trend of growing employment in Bulgaria**. It increased from 2.51 % to 2.87 % of the total employment and it was higher than the EU-10 average in 2005. It probably connected to the development of information and Internet technologies and mobile communications in the country. One should keep in mind that due to the low overall employment in Bulgaria compared to the EU (both old and new Member States) one cannot draw a conclusion on the precise position of the country in terms of this indicator. Nevertheless, we can say that **Bulgaria has some specialization in high-tech services unlike the industrial ones**. Employment trends are accompanied by growing R&D investment in high-tech sectors and services as a percentage of the total investment in R&D. According to the European Scoreboard there was a 40 % increase over the period 1999 – 2002, which brought Bulgaria closer to the average EU-25 level of 89 %. For comparison, Romania has levels which were one-third lower than those in Bulgaria.

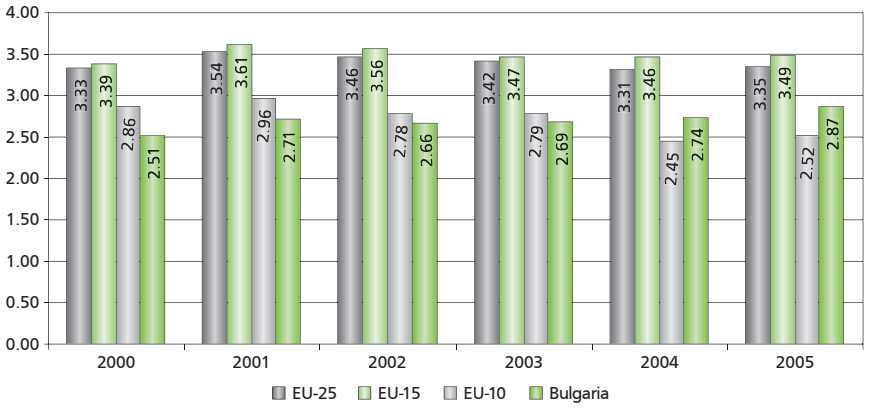
Figure 70. EMPLOYMENT IN HIGH-TECH MANUFACTURING (% OF THE TOTAL EMPLOYMENT)



Note: High-tech manufacturing is: Aviation (NACE code 35.3); Pharmaceuticals (24.4); Computers and Office Equipment (30); Electronics - Communications (32); Research Equipment (33).

Source: Eurostat, 2006.

Figure 71. EMPLOYMENT IN RESEARCH-INTENSIVE HIGH-TECH SERVICES (% OF THE TOTAL EMPLOYMENT)



Note: Research-intensive high-tech services are: Posts and Telecommunications (NACE 64); Computer and Related Activities (72); Research and Development (R&D) (73).

Source: Eurostat, 2006.

Education Outcomes, Quality of Education and Lifelong Learning[74]

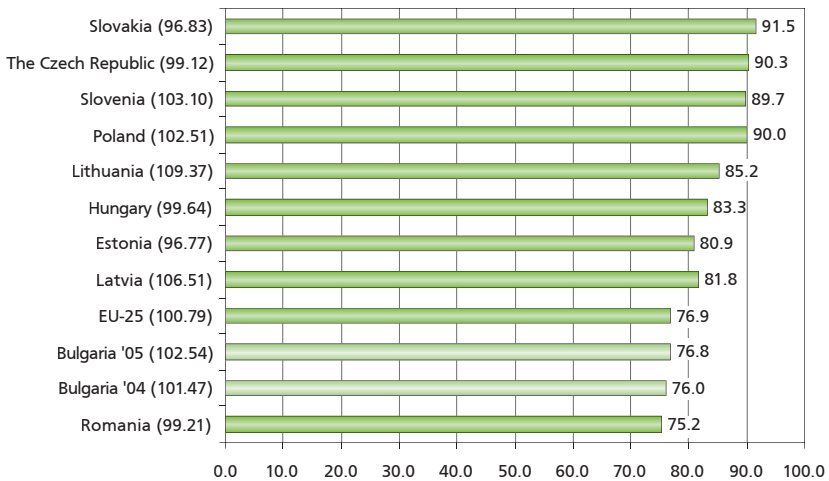
The quality of the secondary and higher (bachelor's and master's degrees) education in the country is crucial for the ability of the Bulgarian economy to absorb, use and adapt new knowledge, as well as to generate and introduce innovation. The education in science and engineering influences the abilities of the economy to introduce new technological innovation. In the modern dynamic global economy, the demand for new skills is constantly rising, which calls for the development of new qualities of the education system - for adequate lifelong learning.

A major indicator for the quality of human resources and their ability to adopt, adapt and develop innovation is the **educational structure of the population**. The data on unemployment by educational levels is very telling. In 2005, the share of the unemployed with lower than secondary education in the 25 to 59 age bracket was 17.6 % in Bulgaria. The unemployment rate among those with secondary education was 8.1 % and only 4.0 % of the population with higher education was jobless, which was better than the average EU levels (EU-25 – 4.6 % and EU-15 – 4.7 %).

In 2005, the people who had **secondary education** accounted for 76.5 % of the population aged 20 to 24 in Bulgaria. It was some ten percentage points lower than the average level for the EU-8, the EU Member States which are direct competitors of Bulgaria in terms of innovation and investment. The conclusion about the poor quality of secondary education in Bulgaria drawn in the previous edition of *Innovation.bg*[75] should be underscored: "In 2003, Bulgarian eighth grade students registered the biggest decline in their results in mathematics and sciences compared to 1995 among all countries where TIMSS is carried out[76]". The combined operation of these two negative trends, together with the deteriorating demographic characteristics in Bulgaria, come to show that, provided all other conditions are equal, in terms of human resources, **the capacity of the economy to adapt and absorb innovation and new technologies will be rather limited in the next 10 to 15 years**.

According to the European Innovation Scoreboard, the share of the people with higher education in the 20 to 64 age bracket in Bulgaria is 22 %, which is comparable to the average EU-25 level. In the total population of the country, however, this percentage has decreased for the last five years, stabilizing at 3 % against the backdrop of the rapid growth of this indicator in the EU-10. This is due to demographic characteristics rather than to any change in the educational status of the population: **the percentage of young people joining higher education in the total population in Bulgaria has dropped due to the demographic crisis in the 1990's**. The unchanged share of the Bulgarians with higher education in the "flat world"[77] implies reduced competitiveness even without taking into account the qualitative features of education

Figure 72. PERCENTAGE OF THE POPULATION AGED 20 TO 24 WITH COMPLETED SECONDARY EDUCATION IN 2005 (THE GROWTH RATE ON AN ANNUAL BASIS IS GIVEN IN BRACKETS)



Source: Eurostat, 2006.

[74] The Human Capital chapter and, more specifically, the text in this section, is not intended and cannot cover the education sector of the country comprehensively and in depth. The intention is to make an overview and outline the framework for the assessment of human capital for innovation in the country.

[75] *Innovation.bg: Innovation Potential of the Bulgarian Economy*. Applied Research and Communications Fund, 2005.

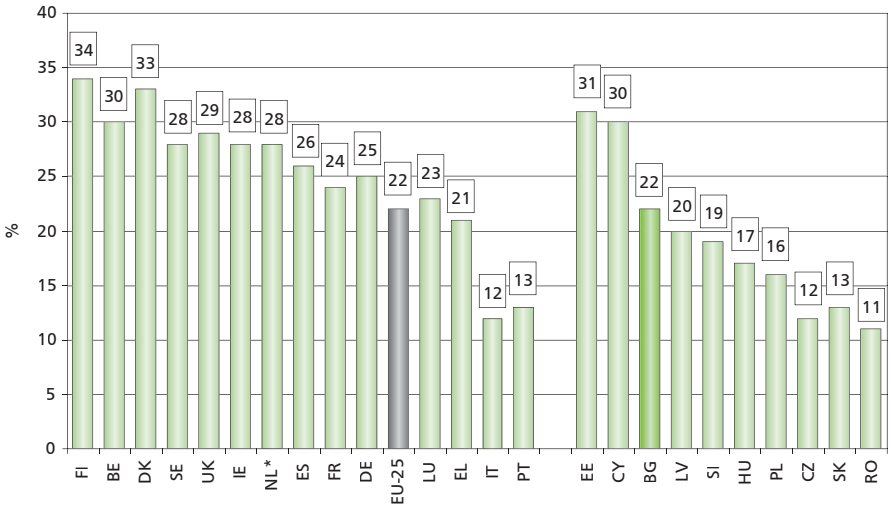
[76] International Association for the Evaluation of the Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2003.

[77] Friedman, Thomas, The World is Flat, Ferrar, Straus and Giroux, New York, 2005.

which have deteriorated substantially according to various domestic and international expert assessments[78]. The continuation of these trends puts Bulgaria far behind the most innovative economies in Europe like Finland, Sweden and Ireland. The launch of a government reform in the secondary education sector and the improvement of a financial condition of Bulgarian universities are expected to bring about a gradual positive change in most indicators for this sector after 2005 – 2006. The impact of the years of the crisis, however, is yet to be felt in the next two decades. It will be supplemented by the negative demographic trends in Bulgaria during the initial years of the EU membership.

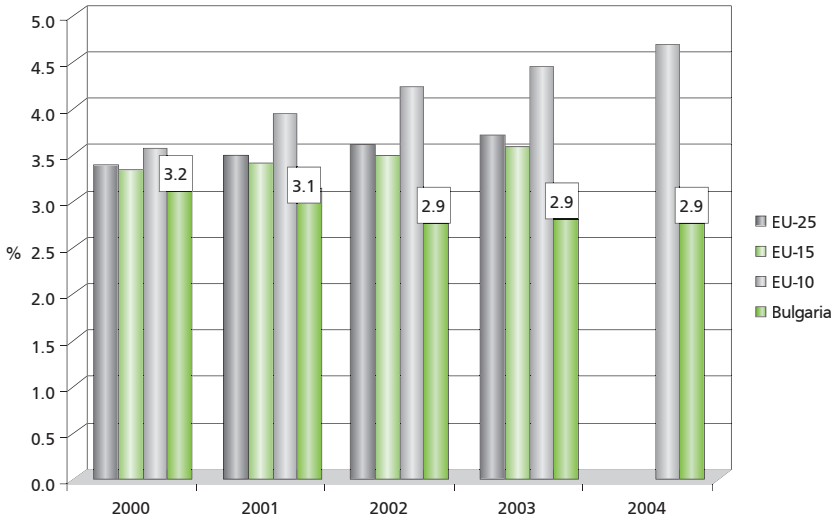
A **number of changes have occurred in the structure of the educational product** in Bulgaria for the last few years. The share of graduates in science and engineering in the total number of graduates has increased with some six to seven percentage points on the average for the last five years, reaching a comparatively higher level than that in the EU-10 and close to that in the EU-15. The percentage of new young graduates in these areas is also higher than the average EU-10 level, which, provided that the quality of the education is comparable, comes to reveal **good capacity for technological competitiveness and innovation in Bulgaria**. However, one should keep in mind the gaps in the technological intensity of the economies of the EU-10 and Bulgaria. As stated in the previous sections of *Innovation.bg 2007*, the Bulgarian economy is lower-tech than that of the EU-10 countries, which might have bearing on the profile of education in sciences and engineering. The orientation of higher schools to the needs of the labour market determines also the structure of students by science areas.

Figure 73. PERCENTAGE OF THE POPULATION WITH HIGHER EDUCATION IN THE 25 TO 64 AGE BRACKET (2004)



Note: The data on the Netherlands is from 2003.
Source: European Innovation Scoreboard, 2005.

Figure 74. PERCENTAGE OF UNIVERSITY STUDENTS IN THE TOTAL POPULATION OF THE COUNTRY



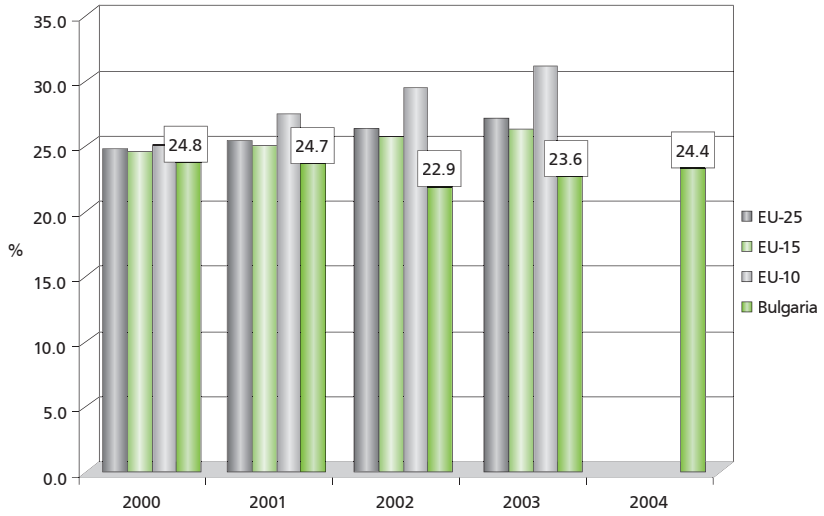
Source: Eurostat, 2006.

In the context of the dynamic technological changes in the global economy which require continuous improvement of knowledge and skills, the system of secondary and higher education is supplemented by **lifelong learning**. The levels of involvement of the population in various forms of continued training in Bulgaria have lagged behind the EU levels for the last few years. This lagging behind looks even greater against the background of the growth of the **average European level to 11** % of the population aged 25 to 64 on a year-to-year basis. **In Bulgaria this share remains at a level of about 1** %, which is indicative of the lack of understanding and capacity to improve the qualifications or to

[78] See, for example, The World Bank, Country Partnership Strategy for the Republic of Bulgaria, May 26, 2006.

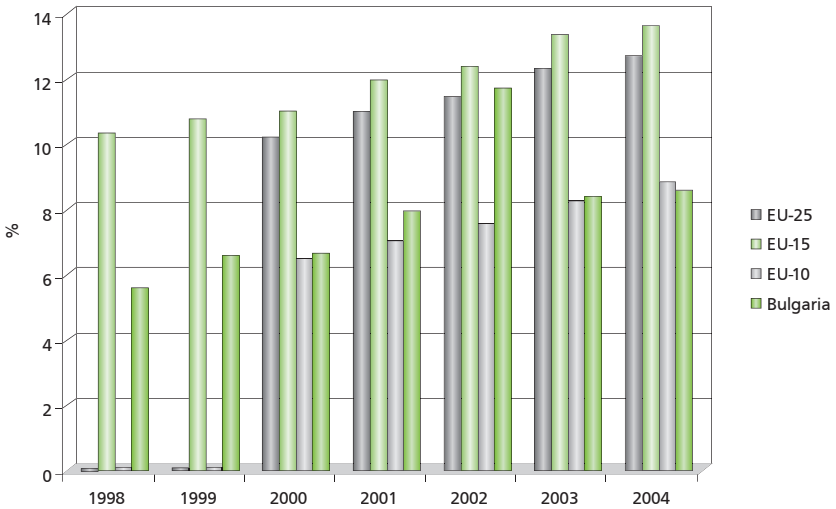
acquire new professional skills among the active population. Bulgarian employers fail to see the involvement of the employees in lifelong learning as a form of investment which could bring real and measurable results. This could be a sign of the short-term nature of some investments in the country which probably are guided primarily by the willingness to use cheap manpower.

Figure 75. PERCENTAGE OF UNIVERSITY STUDENTS IN THE TOTAL POPULATION AGED 20 TO 24



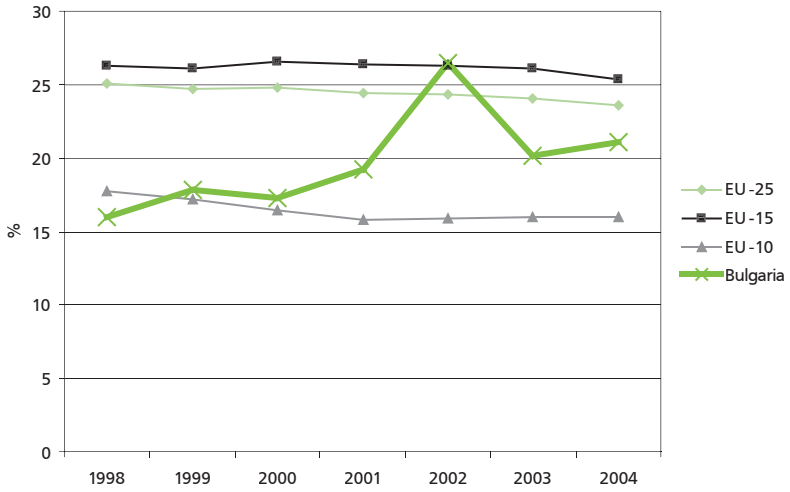
Source: Eurostat, 2006.

Figure 76. PERCENTAGE OF GRADUATES IN SCIENCES AND ENGINEERING IN THE POPULATION AGED 20 TO 29



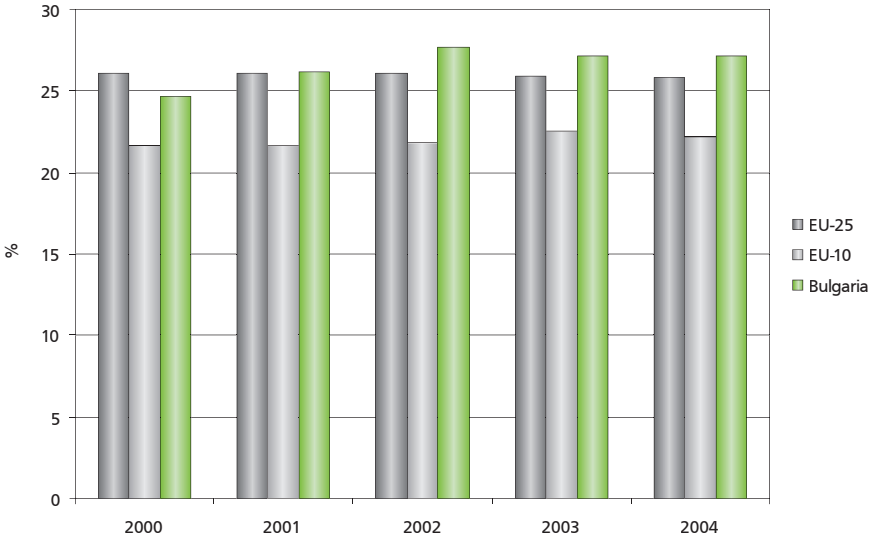
Source: Eurostat, 2006.

FIGURE 77. PERCENTAGE OF GRADUATES IN SCIENCES AND ENGINEERING IN THE TOTAL NUMBER OF GRADUATES



Source: Eurostat, 2006.

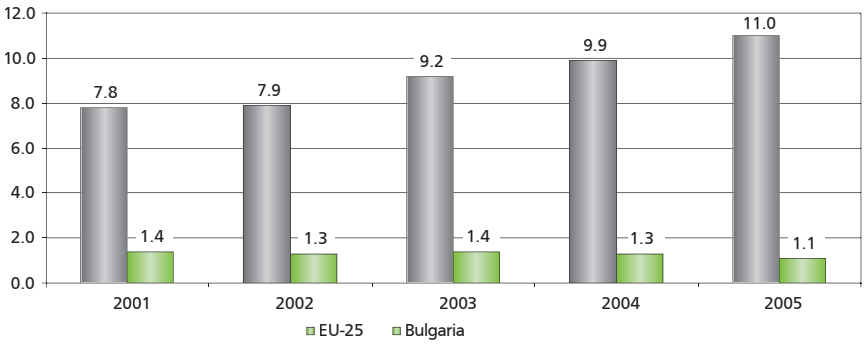
FIGURE 78. PERCENTAGE OF STUDENTS IN SCIENCES AND ENGINEERING IN THE TOTAL NUMBER OF STUDENTS ENROLLED



Note: Sciences and Engineering areas include: exact sciences, computer technologies, engineering, manufacturing, construction and architecture.

Source: Eurostat, 2006.

Figure 79. CONTINUED TRAINING – PERCENTAGE OF THE POPULATION AGED 25 TO 64 WHICH IS INVOLVED IN EDUCATION AND TRAINING



Source: Eurostat, 2006.

5. Information and Communication Infrastructure

The intensive technologization of the environment for doing business, the convergence of various information and communication technologies (ICT) and the structural changes in the consumer demand are the three most important external forces which determine the modern product, process, organizational and marketing innovation. The impact of these forces at corporate level varies in accordance with the available investment and human capital needed for the efficient absorption of technologies. The ICT infrastructure augments the positive external effects of the networking of enterprises (through contracts, equity, membership in associations, integrated business processes and information systems) and creates conditions for changes in the industrial organization and market concentration through new opportunities for management, development, production and consumption of new products in new ways at reduced transaction costs. The national innovation policy is of great importance for the development of ICT in Bulgarian enterprises against the backdrop of the substantial administrative (service standards and e-government) and financial resources (public procurement) of the government in this sphere.

Information and communication technologies[79] are rapidly entering into Bulgarian companies but currently the installed capacity is not fully utilized, especially in the micro-enterprises in the traditional sectors of the economy. The process of introduction of ICT solutions in enterprises is largely determined by administrative and evolutionary factors. The year 2007 is expected to see a breakthrough in the development and growth of online services and businesses.

[79] For a detailed review of the development of the information society in Bulgaria see *e-Bulgaria 2006*, Applied Research and Communications Fund, 2006.

Use of ICT for innovation. Although all Bulgarian enterprises have computers, most of them use their machines only as a means to reduce costs and to search for information (60 % of the enterprises) rather than for the introduction of innovative managerial and process solutions (10 %). Most innovative are the Bulgarian enterprises using ICT in management and marketing. In 2007, 90 % of the computers in the enterprises are expected to have **access to the Internet**, which is an important prerequisite for making them more innovative.

ICT as an innovative tool for doing business. In 2006, few Bulgarian enterprises were **present on the Internet** – only one in five had a functioning website. Their share is expected to increase to 50 % of the enterprises with over 10 employees in 2007 and 2008. Most active will be the market for online services, where numerous micro- and small enterprises are entering. They will pave the way and make traditional businesses follow suit. This will lead to growth in marketing and organizational innovation.

Use of ICT for Innovation in Bulgarian Enterprises

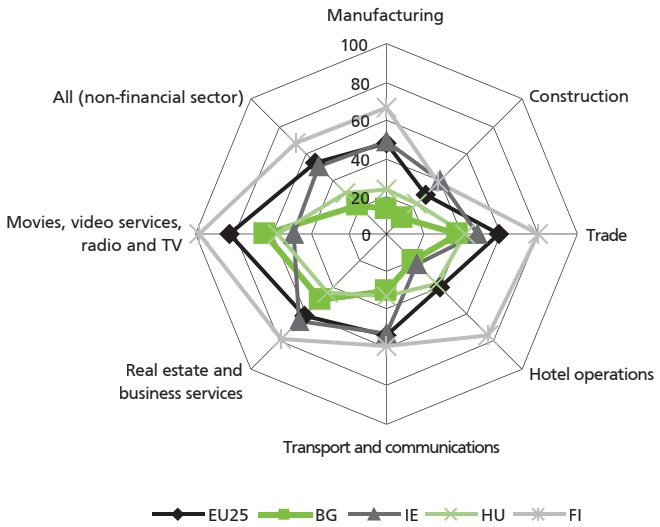
The availability and especially the way of use of ICT in enterprises is an important factor for their innovativeness. The access to the Internet and the application of various software solutions enhance labor productivity and lead to the identification of new product, process, marketing and management solutions. ICT have particularly strong impact on the innovativeness of R&D-intensive services.

In 2006, all Bulgarian enterprises with more than 10 employees already had at least one computer. 28 % of the enterprises with less than 10 employees had no computer. Those are typically micro-family businesses with low added value and a market limited to the local community, which are a kind of self-employment or are positioned in underdeveloped regions of the country. **The process of computerization of Bulgarian enterprises is evolutionary and administratively determined rather than an element of their proactive innovation promotion strategy.** Only in micro-enterprises the higher computerization of workplaces is a factor for greater innovation. They are most likely representatives of the sector of R&D-intensive services such as consultancy, architecture, engineering services, design, etc.

The share of employees using a computer at their workplace in Bulgarian enterprises increased by 6 % annually over the period 2000 – 2005 but it was **unevenly distributed** and at a **comparatively low level** – below 30 % in 2006. In some 60 % of the enterprises computers and the available information technologies facilitate primarily secretarial work, document registration and accounting activities, while only 10 % of the enterprises use automatic systems management, production or relations with customers. The later group of enterprises is associated with a much higher innovation level, their index[80] being over twice higher than the average for the country. This development is largely determined by the prevalence of low-tech industries and the specialization in the lower-tech segments of high-tech sectors in Bulgaria[81]. Bulgarian enterprises have not been integrated in the international knowledge production networks yet, as these networks require creative use of IT rather than applying IT only as a cost reduction tool.

93,5 % of business computers in Bulgaria have Microsoft operational systems installed on them and 2,6 % use Linux[82]. The market share of office packages and applications in the open-source alternatives accounts already for some 15 % of the jobs and 7 % of the enterprises. The introduction of free software is usually associated with the need to minimize costs but an equally important reason is innovation, the desire to be in a constant beta-state. The enterprises using office packages alternative to Microsoft are more innovative (average index 0.2) than those using Microsoft only (average index 0.15). **The correlation between innovation and the use of free/open-source software at the corporate level** is confirmed also in international comparative studies conducted by researchers from Harvard University[83].

Figure 80. PERCENTAGE OF THE EMPLOYEES USING A COMPUTER AT THEIR WORKPLACE AT LEAST ONCE WEEKLY BY ECONOMIC SECTORS (% OF ALL EMPLOYEES)



Source: Eurostat, 2006.

[80] Innovation Index of Bulgarian Enterprises. For a detailed description see the relevant chapter above.

[81] Bulgaria 2010: the Economic Challenges. Report for the President of the Republic of Bulgaria, Sofia, 2005.

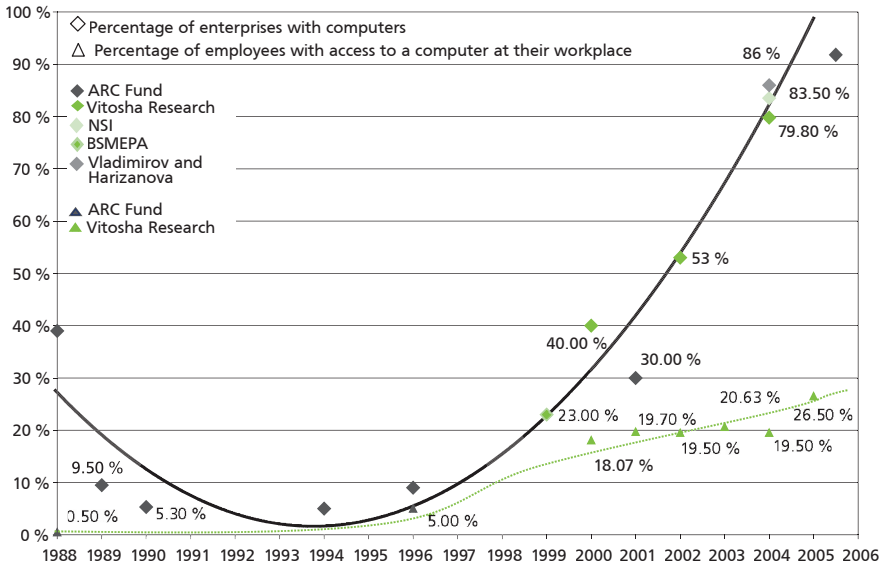
[82] Indirect assessment according to the share of the population using the respective operational system on the computers at their workplaces. Source: Vitosha Research, January 2006.

[83] Casadesus-Masanell, R., and P. Ghemawat, Dynamic Mixed Duopoly: a Model Motivated by Linux vs. Windows, 2003.

As a rule, any enterprise which has equipped its office with computers since 2000 has access to the Internet. Exceptions are the companies motivated to purchase computers only for warehouse and accounting records and issuance of computer-based receipts, where the use of computers does not require access to the Internet (employees have only face-to-face contact with the customers). **The growth rate of the Internet penetration will reach its upper limit in 2007[84], i.e. about 90 % of the computers and 90 % of the enterprises.** In the beginning of 2006, some 70 % to 82 % of the enterprises were connected to the Internet, thus enabling 21 % to 30 % of the employees to have access to the Internet from their workplace.

There are huge variations in the frequency and purpose of the Internet usage among the users at their workplace. Only 2 % of the employees are fully online, while more people (11 %) use the Internet occasionally in their work, typically up to one hour a day, mainly for correspondence, music and news. Although it has shorter time for work on the Internet, this group of people is more active than the rest (using the Internet longer hours) and accommodates more distance learning courses related to their work or to the upgrading of their skills. The number of remote workplaces (both temporary and permanent) is growing.

Figure 81. COMPUTERIZATION OF ENTERPRISES IN BULGARIA



Source: *e-Bulgaria 2006*, Applied Research and Communication Fund, 2006.

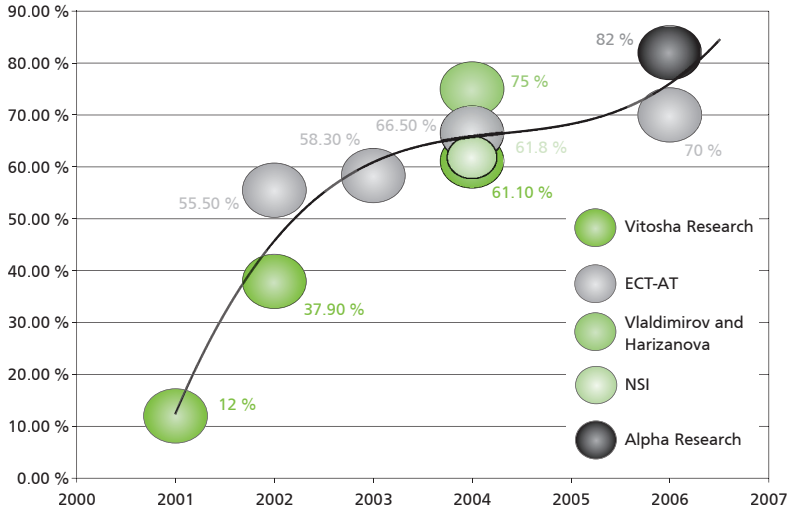
Table 4. INNOVATION INDEX OF BULGARIAN ENTERPRISES AND THE SOFTWARE APPLICATIONS THEY EMPLOY

Software Application	Enterprises (%)	Average Innovation Index
Automated document registration	18 %	18
Accounting software	63 %	14
Storage software	35 %	17
Project management and team work	4 %	25
ERP	1 %	49
Account Management System	8 %	24
Average index for the country		11

Source: Vitosha Research, 2006.

[84] Forecast of the Applied Research and Communications Fund.

Figure 82. ENTERPRISES WITH ACCESS TO THE INTERNET



Source: *e-Bulgaria 2006*, Applied Research and Communications Fund.

ICT as an Innovative Tool for Doing Business in Bulgarian Enterprises

ICT and the access to the Internet enable the development of innovative online services in existing companies and the starting up of new Internet-based businesses. In fact, it is precisely this group of start-ups that has scored some of the highest growth rates in the modern global economy, creating an entirely new industry, business online and on demand.

Websites and the opportunities for placing orders and paying online belong to the portfolio of **enterprise marketing innovations**. During the second quarter of 2006, 21 % of the enterprises[85] in Bulgaria had an operational website and another 2.5 % had a site which, for some reasons[86] was inactive for the period April – June 2006[87].

The easier access to content management systems and the opportunity for people with basic computer literacy to create websites and to use a relatively simple interface to maintain dynamic websites have **tangibly tilted the ratio between own and outsourced websites** (2 to 1 during the first half of 2006 compared to 1 to 2 in 2002 and almost 100 % outsourcing in the beginning of the web presence of companies).

The increased percentage of Internet users (32 % of the working population with a forecast to reach 44 % in 2007)[88] makes companies adjust and seek special strategies to reach their users on the basis of the Internet, as well as develop their distinctive advantages based on web technologies. The first distinctive feature is the address of the site. The beginning of the period was characterized by a shift in the ratio between own and outsourced domains in favour of the former. The choice of companies is primarily .com domains – 56 % of all sites are located there, while .bg sites in the Bulgarian space account for 35 %.

Secondly, after the occasional investment in Internet-based advertising prior to 2002, most of the bigger-companies in Bulgaria have paid more serious attention to the marketing planning in the web space for the last two or three years. This calls also for a more professional attitude to the development of the website. 43.4 % of the operational corporate sites have been designed by providers specialized in this sphere. However, companies still fail to pay sufficient attention to the Internet exposure of their sites.

The next few years are expected to see **further penetration of conventional offline enterprises into the online space**. The mushrooming of small innovative online-based companies will surpass 50 % of the enterprises with more than ten employees with own websites at the end of 2007 or the beginning of 2008. They will provide not only information but also specific additio-

[85] The survey was conducted in April – June 2006 on the basis of a representative sample (number of employees) of 1,004 enterprises which were active in 2000.

[86] From a site which is temporarily inaccessible (but identifiable in the Google cache) to unpaid subscription fee for the own domain.

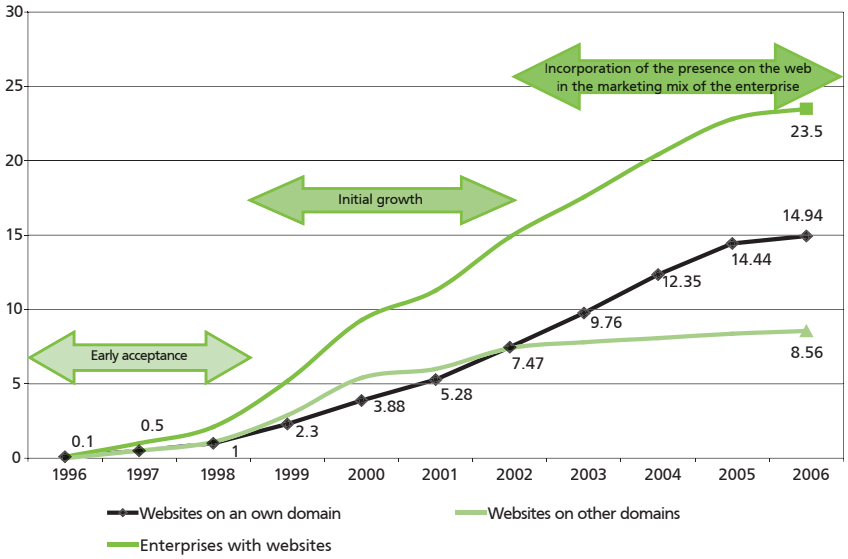
[87] Survey of the Applied Research and Communications Fund.

[88] Vitosha Research, January 2006.

nal services to their customers to lure them[89]. More often than not, online companies are "service superstructures" of existing enterprises which are slower or maintain partnerships with these small enterprises until the market is developed (e.g. home shopping offered by big store chains).

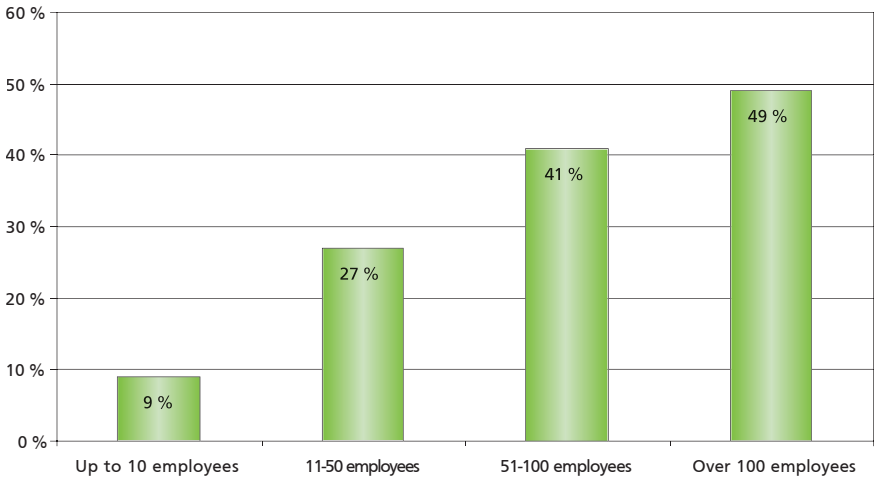
Small companies are subject to greater competition for their survival and therefore they are **more adaptive and more inclined to offer opportunities for online placement of orders**. 17 % of micro-enterprises (below 10 employees) with websites of their own offer such an opportunity as compared to the national average of 11 %. They seem to be also the most aggressively exposed sites with the highest average forecast Google Page Rank. Growth of Google Page Rank is forecasted only in 7.5 % of the enterprises. There is an average of five links per corporate site, mainly free catalogues, while some 4 % of all enterprises use advertising banners. Banners are estimated to generate about 70 % of the revenues from advertising and the other 30 % are equally split among sponsorship, context advertising and the groups of advertising via the e-mail, announcements, etc.

Figure 83. DYNAMIC PATTERN OF THE ENTRY OF ENTERPRISES IN THE WEBSPACE



Source: Applied Research and Communications Fund, 2006.

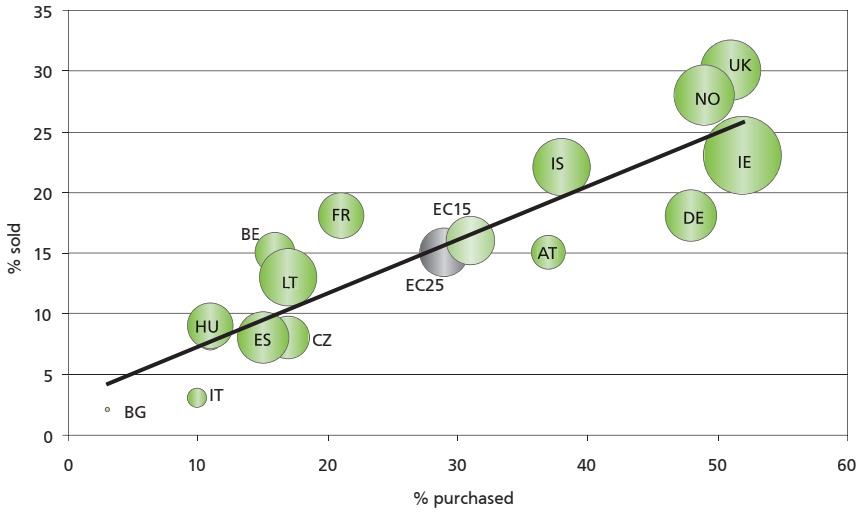
Figure 84. PERCENTAGE OF COMPANIES WITH A WEBSITE ACCORDING TO THE NUMBER OF EMPOYEES



Source: *e-Bulgaria 2006*, Applied Research and Communications Fund.

[89] The problem with the retention of customers and the provision of additional services with higher added value to existing customers are among the typical problems in business unlike the assumption that the biggest problem is the access to customers ("the first transaction").

Figure 85. PERCENTAGE OF ENTERPRISES WHICH PURCHASED OR SOLD GOODS/SERVICES AND SHARE OF THEIR ONLINE-BASED TURNOVER IN SELECTED EUROPEAN COUNTRIES



Note: The size of the bubles in the chart stands for the average share of the online-based turnover of companies.

Source: Eurostat, 2006.

Table 5. CHARACTERISTIC FEATURES OF THE WEB PRESENCE BY SIZE OF THE ENTERPRISE IN BULGARIA

Website Characteristics	Up to 10 employees	11 – 50 employees	51 – 100 employees	Over 100 employees	Average
In Bulgarian	93 %	83 %	84 %	79 %	84 %
In English	54 %	66 %	67 %	75 %	67 %
In the .bg domain	29 %	36 %	28 %	43 %	35 %
In the .com domain	56 %	53 %	61 %	53 %	56 %
Availability of a Careers section, announcement of vacancies, online applications, etc.	10 %	13 %	9 %	16 %	12 %
No information about the track record and/or identity of the company	24 %	28 %	16 %	6 %	17 %
Opportunities for online orders	17 %	11 %	9 %	10 %	11 %
Hit counter	26 %	19 %	23 %	22 %	22 %
Designed by an external company	51 %	32 %	48 %	43 %	43 %
Average Google Page Rank	2.293	2.298	1.930	2.353	2.216
Average Forecast of the Google Page Rank	2.575	2.511	1.982	2.397	2.344
Average age (only for the sites on own domains)	3 years	5 years	4 years	5 years	4 years

Source: *e-Bulgaria 2006*. Applied Research and Communications Fund, 2006.

Towards a National Innovation Policy for Higher Growth in the European Union – Recommendations

The first seven years of Bulgaria's EU membership will shape the Bulgarian innovation system. The government innovation policy and the financial instruments for its implementation over the period 2007 – 2013 will be crucial for the long-term structure and competitiveness of the Bulgarian economy. In this connection, *Innovation.bg 2007* offers some important conclusions and recommendations for the Bulgarian national innovation policy in the first seven years of Bulgaria's EU membership. They build on the first edition of *Innovation.bg* of 2005, the analysis in this report and the existing instruments for assessment of the innovation performance of Bulgarian enterprises, i.e. the innovation index of the enterprises and the innovation profile.

The market component of the Bulgarian innovation system is in its initial stages of development: Bulgarian enterprises have low levels of innovation performance.

Although innovation may come from various sources and it depends on the interaction of a whole set of organizations in the national innovation system, the company[90] (or the individual entrepreneur) remains its main driving force and exponent.

The share of innovative enterprises in Bulgaria is about 16 % – 20 %: two to three times less than the EU-15 average. Highly innovative companies which offer several types of innovation (product, process, organizational and marketing innovation) in an integrated manner account for less than 4 % of all Bulgarian enterprises. Bulgarian innovative companies perceive their innovation mainly as investment in machinery and equipment. Only a half or so of the Bulgarian innovative enterprises (8 % to 10 % of all companies) resort to research and development in their innovation activities. **The low innovation intensity of Bulgarian enterprises is reflected in some interrelated features of the economy:**

[90] Fagerberg, J., Mowery, D., Nelson, R., The Oxford Handbook of Innovation, Oxford University Press, 2005.

- Some of the lowest research and development (R&D) expenditures of the business sector in Europe (0.15 % of GDP);
- Limited demand for and employment of R&D peronnel in the private sector (0.07 % of the workforce);
- Low-tech manufacturing profile – the percentage of high-tech exports in Bulgaria is three to seven times less than that in the leading new EU Member States (Hungary, the Czech Republic and Estonia), while employment in high-tech industries is more than twice less than the EU-10 average;
- Weak intellectual property rights protection and underdeveloped technological market in the country. According to international estimates, the intellectual property rights protection is about twice weaker in Bulgaria than in the old EU Member States.

Another factor for the weak innovation performance of Bulgaria is the **weak entrepreneurial activity and the small average size of Bulgarian enterprises**. The number of SMEs per 1,000 inhabitants in Bulgaria is almost two to three times lower than in the EU-15 and the EU-10 respectively. The time and efforts to start a new business in Bulgaria are greater than in the country's direct competitors – Romania, Lithuania, Latvia, Slovakia or Poland. Micro- and small enterprises account for some 88 % and 10 % of all enterprises respectively, although they generate less than one-third of all the employment and value added in the economy. The average size of the assets of Bulgarian enterprises in all size categories is much smaller than that of their competitors in the EU. These specific features of the Bulgarian enterprises influence the innovation activity in the country along several lines:

- **Leaving aside the handful of companies which invest in R&D, innovation in the Bulgarian economy is quite limited.** Most Bulgarian micro- and small enterprises remain outside the innovation economy of the country because they are not eligible for bank financing and there are no specialized instruments to support high-risk innovation projects (venture capital, business angels, etc.). In fact, 30 % of micro-enterprises in the country are isolated from the global information network since they do not have a computer – the major source of information for innovative companies in Bulgaria;
- Bulgarian innovative micro- and small enterprises flock to **the sector of R&D intensive high-tech services which do not require big capital expenditures**. The employment in these service sectors is higher in Bulgaria than in the EU-10 and continues to grow. Seventeen percent of all micro-enterprises in Bulgaria which have a web-site of their own offer opportunities for online shopping and this share is higher than the country's average of 11 percent;
- **The competitive environment on the domestic market does not produce sufficient pressure for innovation and development of enterprises.** According to the World Bank estimates, competition pressure on the domestic market is weaker than the average level for Central and Eastern Europe and the world as a whole. More than a half of the Bulgarian non-innovative companies declare that they have not innovated because the market environment does not require them to do so. At the same time, the companies competing on the European market are more innovative than those operating on the local and national market. The share of innovative enterprises is the biggest in the sectors exposed to the strongest international and domestic competition – computer technologies, architecture, engineering, R&D, financial intermediation and manufacturing.

- From structural perspective the innovation product and the research and technological products develop separately from one another in the national economy – their interrelations are weak.

The Bulgarian innovation system is structurally imbalanced. Unlike innovation leaders in the world, Bulgaria has the **public sector as the major R&D investor, employer and implementer**. The public sector provides 65 % of the financing, 66 % of the jobs and 67 % of R&D activities in the country. Ninety percent of the R&D financing and employment in the public sector depend on direct institutional subsidies used for covering operating costs of quasi-state research institutes without any correlation to performance indicators. Such disproportions are typical of countries in **the initial phase of the organization of a market-based innovation system** and they can become serious obstacles to the innovation development in Bulgaria:

- Bulgarian innovative companies do not recognize the public R&D sector as a partner in their innovation activities. Thus the supply of research and technological product subsidized by the government does not correspond to the market demand in the country. This leads to loss or drain of knowledge outside Bulgaria;
- The lack of market mechanisms (both incentives and disincentives) to regulate the efficiency of R&D in the public sector may lead to excessive supply of research product in specific areas or the system as a whole, which could further erode their value and increase the need for government subsidies. Some signs of such a development can already be detected. For instance, the structure of Bulgarian research publications is oriented primarily to basic science (chemistry, physics) and it does not react to the vigorous development of applied research for the last decade e.g. clinical medicine serving the biotechnology sector. Another sign of emerging inefficiency is the lower presence of Bulgaria in citations in research literature (4.6 %) in comparison to the share in the R&D employment (7.1 %) of the EU-8+2 region;
- The limited innovation performance of Bulgarian enterprises and the weaker practical orientation of the R&D sector of the country result in a lower technological capacity of Bulgaria and inability to absorb the latest and most profitable global technologies. The Bulgarian technological product remains unchanged and even dwindles against the backdrop of the increasingly dynamic global trends in the most innovative sectors.

- The Bulgarian national innovation system is shaped and influenced mainly by the integration in and financing from the European innovation networks and the changes in the public innovation policy and financing.

For the last ten years, some 40 % of the investment in the capital and technological renovation of the country on the average has come from foreign capital. At the same time, the Bulgarian economy remains three times less saturated with foreign direct investment[91] as compared to the EU-10 average level. **Bulgarian companies tend to cooperate more with foreign than local partners in the development of innovation projects** and the enterprises engaging in such cooperation are among the most innovative in the country. Foreign partners are also sources of funding for Bulgarian innovative enterprises. While the innovation product is influenced by foreign investment and cooperation, the main factor for the development of the

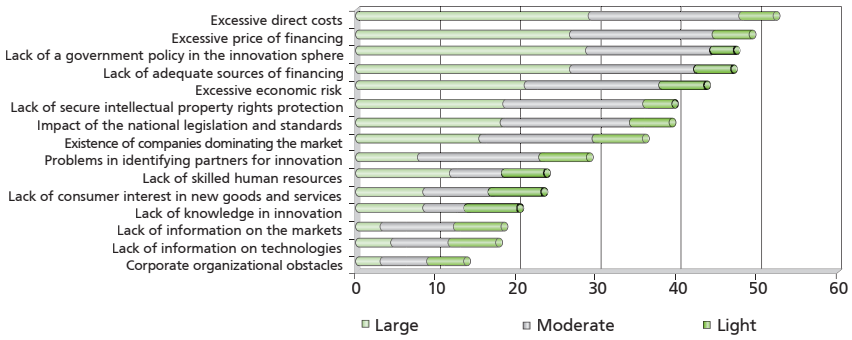
[91] Measured as FDI per capita.

research product for the last two to three years has been the participation in and financing from the EU Framework programs for research; as a matter of fact, they represent the only available source to Bulgarian research organizations for pure research projects. Bulgarian enterprises have already started to recognize the EU funds as the fifth most important source of financing after their own resources, banks, local and foreign partners. The other sources of financing, which are less visible but very relevant due to their specific thrust to Bulgarian companies and research organizations, are the two competitive project financing instruments of the Bulgarian government, the National Science Fund and the National Innovation Fund. The allocation of resources from the NSF to the development of the research potential of Bulgarian universities, for example, has increased their share in R&D. The NIF appeared on the radar of the medium-sized and big Bulgarian enterprises immediately after the opening of the first three bidding sessions, which is a clear sign of hunger for resources for innovation. The national innovation policy, coupled with the EU policy and financing instruments and foreign direct investment, will play an essential role in the strengthening of the innovation capacity of the Bulgarian economy.

➧ The main constraints for the development of the national innovation system are the lack of suitable sources of financing (from the short-term perspective) and the lack of skilled human resources (from the long-term perspective).

The various analyses, benchmarks and techniques used to study the innovation performance of Bulgarian enterprises reveal similar results with regard to the main obstacles to innovation in the country. At present, this is undoubtedly the **lack of suitable sources of financing and the excessive direct costs for the development of innovation projects**. These are the factors which produce the highest barriers to innovation in the EU-15, too. But when the dynamic pattern is traced out, the factor which shows the highest negative dynamic in Bulgaria is the lack of skilled human resources. The Bulgarian economy has begun to feel the decline in the quality of human capital between 1990 and 2003. It is most visible with regard to secondary education and the specialized R&D areas – PhD programs, research careers, R&D employment. The problem is exacerbated by the ten times lower level of participation of Bulgarian workers in lifelong learning compared to their counterparts in the EU-15.

Figure 86. INDEX OF THE DEGREE OF NEGATIVE IMPACT OF BARRIERS ON THE INNOVATION ACTIVITIES OF BULGARIAN INNOVATIVE ENTERPRISES IN 2006



Note: The index is calculated as an average weighed of the share of the enterprises specifying the respective factor as a barrier to their innovation activity. The weights of these barriers are 3*(large), 2*(moderate) and 1*(light).

Source: Applied Research and Communications Fund, 2006.

High ranking among the constraints for the innovation activity of enterprises are the **poor quality of the business and the competitive environment and the lack of a clear government policy in the innovation domain**. The relatively poor quality of the overall business environment in the country, especially with regard to competition, is the reason also for the small share of innovative companies in Bulgaria. The assessment that there is no clear government policy in the innovation domain is perhaps a combination of the perception of enterprises about the general market environment and the relatively small budget financial commitment to this domain. The innovation needs of Bulgarian enterprises and their expectations from the government in this respect are way beyond the capabilities of the young innovation policy in the country. The development of the national innovation policy, together with measures for improving the business environment, will be the major factors to determine the speed and direction of the development of the Bulgarian innovation system.

The national innovation system has started to improve its performance on all counts - the time for policy action has come.

Notwithstanding the substantial lagging behind the average EU levels, most parameters of the Bulgarian national innovation system have improved for the last couple of years. The gross innovation product is growing, entrepreneurship rises and the percentage of small and medium-sized enterprises is increasing. The influx of foreign investment is developing at higher rates than in the EU-10, bank financing and the access of companies to foreign financial resources is improving. The share of competitive R&D project financing by the government and the access to the European Framework Programs in the research area are growing. The decline in secondary education has stopped, while the number of post-graduates and graduates in science and engineering has increased. All Bulgarian enterprises with more than 10 employees are connected to the World Wide Web via ICT. Weak as they are, these positive signals come to show that the time has come for decisive action for the development of a national innovation policy to reduce the deterrent effects of the barriers to the innovation activities of Bulgarian enterprises, to establish a favorable environment for the development of innovation, and to shape the future identity of the national innovation system.

Table 6. THE THREE BIGGEST CHALLENGES FACING THE INNOVATION SYSTEM IN BULGARIA AND THE MEASURES UNDERTAKEN IN RESPONSE TO THEM

Challenges	Measures
Creation of knowledge: low investment in innovation, especially in R&D by enterprises	Specific measures have been undertaken (one or two but insufficient)
Insufficient efforts to support the human potential for innovation through lifelong learning	No specific measures have been undertaken (probably a debate but no signs of preparation of a policy response)
Industrial structure with employment mainly in low-tech industries, reduction of employment in medium- and high-tech industries and decrease of the export of high-tech products	Development of a policy (intended and new measures, e.g. announcement in the National Lisbon Reform Program, etc.)

Source: European Innovation Progress Report (2006).

The first years of Bulgaria's EU membership will be decisive for the shaping of the identity and functionality of the national innovation system and the long-term structure and competitiveness of the Bulgarian economy. The diverse experience of EU Member States in catching up after previous enlargements, e.g. Greece, Ireland, Spain and Portugal, indicates that as well as the initial conditions and external constraints for the successful integration of the countries in the EU, the policies applied are of paramount importance. Bulgaria and the new EU Member States have much less resources at their disposal in comparison to those available during previous enlargements, while the challenges (the distance to be covered in order to overcome the lagging behind) are much greater, which calls for even more careful prioritization and preparation of national policies. In this connection and on the basis of the conclusions drawn so far, *Innovation.bg 2007* is making several groups of **recommendations** aimed at supporting the discussion on the formulation of a successful national innovation policy.

Box 5. VIEWS ON THE NATIONAL INNOVATION SYSTEM AND POLICY BY WINNERS OF THE INNOVATIVE ENTERPRISE AWARD OF THE APPLIED RESEARCH AND COMMUNICATIONS FUND

Evgenii Manahov, Executive Director of Daisy Technology, the winner of the 2006 Innovative Enterprise Award of the Applied Research and Communications Fund, perceives **what the government has done so far in the sphere of innovation as extremely insufficient**. "Regrettably, there is only lip service paid to high-tech incubators in Bulgaria, while in Germany, for instance, they are common practice. Small companies there start from **incubators** providing very attractive conditions for renting space, using equipment, legal services, etc." Similar is the situation in Taiwan, China and the United States which have **innovation centers**, where companies have access to information and various services that otherwise cost a lot of money. Evgenii Manahov is convinced that **it is not the government's business to give this money but it can provide the minimum infrastructure** that will make life easier for big and small companies alike. He gives the example of Taiwan and its well developed structure of companies that keep continuous contacts, exchange know-how and ideas, and provide for a continuous flow of information at lower costs. This enables even small companies to have access. "If they do not have such information and equal start, they will never make it to become big", says Evgenii Manahov. The human potential is insufficient. The Executive Director of Daisy Technologies finds **human resources to be the biggest problem for the development of technologies in Bulgaria** and he believes that the availability of good engineering potential in the country is a myth.

* * *

"Unlike the EU Member States, Bulgaria has a very slow innovation process", says also Petar Petrov, Manager of Point L Bulgaria, the winner in the competition of innovative small enterprise in 2005. "We always live on the verge of risk and all the time run before the financial tsunami which might overtake us if we fail to re-invest most of the revenues". Although it takes part in three European projects, Point L is put to continuous test. It has to invest own resources in the project implementation. It is only after the completion of the project that the resources to finance it are reimbursed. Therefore Petar Petrov suggest that innovative companies receive government guaranteed low-interest loans against endorsement of the contract for the implementation of the project until the resources from the European programmes are disbursed.

Source: The Capital Weekly, issue 43, 29.10.2005.

- The government should provide greater political, administrative and financial resources for the implementation of the national innovation policy

The experience of developed innovation systems in Europe (Finland, Sweden, Germany, Denmark, Austria) reveals that the success of the national innovation policy in generating growth and jobs and in improving the competitiveness of the economy depends critically on commitment at the highest political level. Typically this commitment is undertaken in the triangle among the Ministers of the Economy, Science and Technologies, and Finance under the direct supervision of the Prime Minister. In 2005 and 2006, the European Commission adopted a series of communications specifying the important place of the innovation policy among all other EU policies, including the rules for the management of the Structural and Cohesion Funds. The special position of a Vice President in charge of the development of enterprises and industry was created. In this respect, Bulgaria already has a rich institutional infrastructure through the existence of a National Innovation Council, the Economic Policy Council, the Economic Development Council and the Advisory Board for Foreign Investment and Financing chaired by the Minister of the Economy and Energy, the National Science Council chaired by the Minister of Education and Science, the Advisory Board for Information Society led by the Chairman of the State Agency for Information and Communication Technologies and the Intellectual Property Rights Protection Council chaired by the Minister of Culture. Innovation should feature high on the agenda and policies which these bodies work out and advise.

Box 6. POLITICAL COMMITMENT TO INNOVATION AT THE HIGHEST LEVEL IN FINLAND

"In my capacity of Prime Minister, I personally lead the Information Society Development Program of the Finnish Government. Innovation is high on our policy agenda both in Finland and in the EU. My personal commitment in this respect as a Prime Minister sends a strong signal that innovation and the development of the information society are important priorities for the Government."

Speech by Matti Vanhasen, Prime Minister of Finland on the Innovation Day in Brussels, 9 November 2006.

Source: Press service of the Government of the Republic of Finland, 2006.

The high political commitment to innovation should be directed along three lines:

- With a view to the implementation of the national innovation policy and given the growing importance of innovation in EU policies, it is necessary to build **additional administrative capacity at the national and regional levels** for coordination and support of the measures for the implementation of the National Innovation Strategy. Particularly urgent is the need for capacity to develop and implement the innovation policy at the regional level (NUTS II). Regions will be the major level implementing the EU innovation strategy with support of resources from the Structural and Cohesion Funds. In this connection, priority should be attached to the establishment of a National Network of Regional Innovation Strategies[92] in the country under the Minister of the Economy and Energy, integrating the documents under preparation with the national

[92] Currently, Regional Innovation Strategies are being prepared for all planning regions in Bulgaria, which will be ready by the beginning of 2008. The South-Central Region developed its RIS in 2004.

innovation policy. Thus better compatibility and coordination of innovation policies will be achieved at the European, national and regional levels;

- Enhancement of the **competitive project financing directed at innovation, research and technologies** from the national budget (National Science Fund and National Innovation Fund), as well as the EU Structural and Cohesion Funds. According to the latest available official estimates under the National Strategic Reference Framework[93], in spite of the substantial increase of the resources for research and technological development from the Structural and Cohesion Funds in Bulgaria by some 150 % over the period 2007 – 2013 in comparison to 2004 – 2005, they remain with relatively low priority as a percentage of the envisaged total annual resources – 2 % or less than the resources envisaged for the development of tourism. At the same time, the R&D investment already lag behind the resources planned within the framework of the Innovation Strategy of the Republic of Bulgaria by approximately BGN 40 to 60 million in absolute terms and by more than 0.2 % of the GDP in relative terms;
- Special attention should be paid to the quality of **information supply for the implementation of the national innovation policy**. The available indicators and surveys at the national and European level reflect the condition of the innovation system with a two years delay in the best scenario, e.g. the data on the R&D investment in 2005 was published at the end of 2006 and the beginning of 2007. In the context of the dynamic development of the Bulgarian economy it is necessary to introduce at least one annual sample survey of companies in Bulgaria to give an idea of the current condition of the national innovation system. It should be combined with the development of a nation-specific methodology for analysis of innovation activities in the country. The existing European and international benchmarks, albeit useful for gauging the general condition of innovation in the country, fail to reflect the local specificities and often produce contradictory signals as to the development trends and orientation of the national innovation system.

- Improvement of the coordination between strategic documents, policies and administrative and financial instruments which influence the Bulgarian national innovation system.

In order for the innovation policy to generate growth, it needs consistency and alignment to the other strategic priorities[94]. This conclusion is in the underpinnings of the efforts of the European Commission to ensure the mainstreaming of innovation in all other Community policies from the enlargement to the environment, security and home affairs. According to many European analysts[95] **the EU is still far from reaching the required consistency and alignment of policies with regard to innovation**, which implies that Bulgaria should develop its own approach and avoid the uncritical application of EU initiatives in this sphere.

- The country has adopted or is preparing a series of strategic documents directly related to innovation and the innovativeness of the Bulgarian economy: Innovation Strategy of the Republic of Bulgaria (adopted), National Research Strategy 2005 – 2013 (adopted by the Council of Ministers, pending approval by the National Assembly), National Strategy for the

[93] As of 14 September 2006.

[94] Aghion, Ph., A Primer on Innovation and Growth, Bruegel Policy Brief, October 2006.

[95] Ibid.

Promotion of Small and Medium-sized Enterprises 2007 – 2013 (draft), National Cluster Development Strategy (draft), Information Society Development Strategy (adopted), National Employment Strategy (adopted), National Strategy for Continued Vocational Training, etc. What is necessary now is either to integrate some of them under the guidance of a single ministry within the Innovation Strategy or to ensure the organic link among the strategic documents at the level of both wording and implementation mechanisms. For this purpose, special review of the individual strategies could be undertaken to make proposals on their better integration;

- Many government policies other than the innovation policy produce substantial impact on the innovation activities of enterprises and should be used in a better targeted manner to promote innovation in the country. For example, the foreign investment policy should be oriented to attracting innovation (R&D)-intensive foreign investors to the country on the basis of clear identification of the innovation advantages of the country. In 2006, less than a half of the 100 most innovative companies in the world[96] were present on the Bulgarian market, most of them having trading offices rather than manufacturing and/or R&D activities here. The investment policy should be supplemented by adequate tax and fiscal policy with respect to R&D. In this connection, the work started at the BulgariaInvest Agency to attract investment in the most rapidly developing high-tech spheres in the world and Europe, such as biotechnologies, ICT, health, energy efficiency, should continue. In order to be competitive to the leading new EU Member States in this sphere, Bulgaria needs to develop its own system of tax incentives and support for R&D, following the example of the Czech Republic, Hungary and Estonia. The EU would also support such a strategy in the context of the new rules for state aid in the innovation sphere[97] and the promotion of the use of the public procurement system for innovation in the Member States[98];
- The national innovation system will benefit a lot from the close coordination among the main government competitive project financing instruments to fund innovation, research and technological development, i.e. the National Innovation Fund and the National Science Fund. The two funds support different phases of the innovation process, which calls for supplementing of their actions in the priority areas and financing mechanisms. The closer interaction between the two funds would also ensure dissemination of expertise and knowledge, which would strengthen their institutional development. The National Science Fund, for instance, which has longer track record and experience, could help the institutional strengthening of the National Innovation Fund.

- More precise direction and coordination of innovation resources from the EU Structural and Cohesion Funds within the country and with other programs at the European level.

The resources from the EU funds will exert substantial influence on the strengthening and development of the national innovation system over the period 2007 – 2013. They might change the identity and development of the national economy

[96] Ranking of BusinessWeek magazine and the Boston Consulting Group for 2006.

[97] In November 2006, the European Commission published a new *Framework of State Aid for Research, Development and Innovation*.

[98] Communication from the Commission Cohesion Policy in Support of Growth and Jobs: Community Strategic Guidelines, 2007-2013, Brussels, 05.07.2005, COM(2005) 0299.

but they could also exacerbate some disproportions and the dependence on the past. For this reason, *Innovation.bg 2007* starts and ends this analysis with recommendations on the use of the **EU Structural and Cohesion Funds for promotion of innovation in the country**:

- The National Strategic Reference Framework[99] and its Operational Programs envisage financing of innovation in almost all documents, except for the Environment and Transport Operational Programs. The main bulk of the financing in this sphere is concentrated in Priority 1 Development of the Knowledge-based Economy and of the Development of the Competitiveness of the Bulgarian Economy Operational Program. The leading role of this Operational Program in the financing of innovation is justified given the main challenge for the national innovation system identified in this and other analyses: strengthening of innovative enterprises and their investment in R&D. The consistency and integration which the innovation policy needs to generate growth call for the establishment of organic links among the individual measures to support innovation and the respective elements of the national innovation system. Hence the measures for support of innovation under the Competitiveness Operational Program should be aligned to those under the Human Resources Development and Regional Development Operational Programs and the National Strategic Plan for the Development of Rural Areas. This would enable the integration of individual measures in the various stages of the innovation process and at the different geographical and regional levels (national, regional and local). A possible practical approach is to establish interrelated intermediary bodies between the operational programs. Such interrelation of programs would provide maximum flexibility and openness of financing from the EU funds: those who seek financing would have numerous points of access, which would increase the chance for better absorption of the resources under all programs;
- Precise balance should be struck between the higher absorption rates of resources and their orientation to more complicated but strategically relevant and sustainable projects. It is normal to seek maximum absorption of the resources during the first two years of the operation of the EU funds in the country, following the experience of the new EU Member States which joined in 2004. However, shorter-term and easier projects with high absorption rates typically produce less useful impact on the growth and development of the country. Hence, as far as the innovation sphere is concerned, Bulgaria should allocate an increasing share of the EU resources to more complex projects for the development of the innovation infrastructure (incubators, technological parks, technology transfer centres, national and regional financing instruments, ICT, etc.) at the expense of direct investments in the development of the innovation capacity of individual enterprises. The same approach is relevant to the resources allocated for the development of human capital – the re-orientation should shift investments from training to education;
- The attainment of maximum effect from the resources coming from the Structural and Cohesion Funds calls for good coordination not only within the country but also with the other EU programs for support of innovation, research and technological development – the Competitiveness and Innovation Programme and the 7th Framework Program for Research, Technological Development and Demonstration Activities. For example, resources from the national budget or the European funds should be used to promote and assist the participation of the private sector (compa-

[99] Version as of 14 September 2006.

nies, non-governmental organizations, business associations, etc.) in the EU Framework Programs. Quite often they are the basis for the development and preparation of activities and measures under the EU funds for the following budget period. For instance, the Regional Innovation Strategies financed under the Sixth EU Framework Program in Bulgaria are primarily aimed at preparing the local and regional authorities of the country for the implementation of the innovation policy and the development of pilot innovation projects to be financed from the EU funds.

The experience in catching-up development of many countries in the world has borne it out that the main objective of the national policy for management of the innovation resources coming from the EU Structural and Cohesion Funds, the national budget and the EU Framework Programs should be the development of institutional instruments which improve:

- "links with the technology frontier,
- links with markets (and sophisticated users),
- supply of needed skills, services and other inputs;
- the local innovation system/network"[100].

[100] Fagerberg, J., M. Godinho, Innovation and Catching-up, The Oxford Handbook of Innovation, p. 536, Oxford University Press, 2005.

Appendix 1. Innovation profile of the Bulgarian enterprises

Innovation profile[101]

During recent years the Bulgarian economy showed clear signs of stabilization and growth. The main macroeconomic indicators GDP, foreign direct investment and currency reserves increase at sustainable rates. Unemployment decreases and the private sector started unfolding its potential. In this situation the key future challenge for Bulgaria is the increase of economic competitiveness. The main factor for achieving higher competitiveness, at which the EU policy is also directed, are investments in innovation.

For tracing out the innovative structure of the Bulgarian economy this section outlines the innovation profile of the Bulgarian enterprises. The profile is based primarily on the empirical data collected in 2004 and 2006 through a survey of the enterprises following the Community Innovation Survey model. In the process of work several variables, which characterize the current status and the potential development of the Bulgarian national innovation system were identified. These nine variables are:

- Provision of innovative products on the market;
- Development of innovative products;
- Provision of innovative processes on the market;
- Development of innovation processes;
- Funding of the innovation activity of the companies;
- Significance of the realized innovative activities for the company;
- Governmental support for the development of the innovative activity of the companies;
- Factors, impeding the companies' innovative activity;
- Reasons for the lack of innovative activity.

The empirical data collected by surveys, conducted by Vitosha Research agency under assignment by the Innovation Relay Centre in 2004 and 2006 allows the review of the dynamics of the selected nine indicators for the past two years.

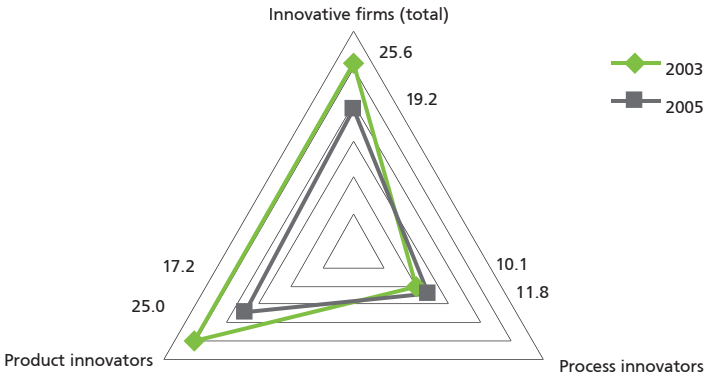
Companies, which have implemented innovative processes or products in 2006 are 19.2%[102] of all enterprises in the country. The survey in 2004 revealed that the innovative enterprises in the country develop predominantly product innovations, with a smaller number of process innovations. In comparison, the data on the EU companies reveal an opposite tendency. The prevailing part of European businesses supplies mixed innovations. In this respect there is also a clear move in Bulgaria towards an increase of process innovations – 10.1% in 2004, 11.8% in 2006 of the enterprises implemented process innovations.

The innovation activity of Bulgarian companies varies depending on their size according to number of their employees. In microfirms (less than 10 employees), the number of product innovations is three times less than in big firms (more than 250 employees), and for the process innovations this ratio increases up to 1 to 4.

[101] This analysis is an endeavor for a more complex statistical study of the innovative activity of the Bulgarian enterprises. It is based primarily on empirical data from two surveys conducted by Vitosha Research in 2004 and 2006 and commissioned by the Innovation Relay Centre at the Applied Research and Communications Fund. Since they are pilot surveys the results and the conclusions are still under discussion and they are not directly comparable with the conclusions drawn in the main body of this publication. They aim to develop the toolkit for analysis of the innovativeness of the Bulgarian enterprises, to facilitate the discussion and as a preparation for the *Innovation.bg 2008* report.

[102] Calculated on the basis of firms giving an answer 'YES' to at least one of the questions: 'Has your firm supplied the market with innovation (new or considerably improved) products (goods or services) in 2005?' and 'Has your firm introduced innovation (new or considerably improved) production methods for supply or sale of goods and services, that are new for the firm or the industry in 2005?'

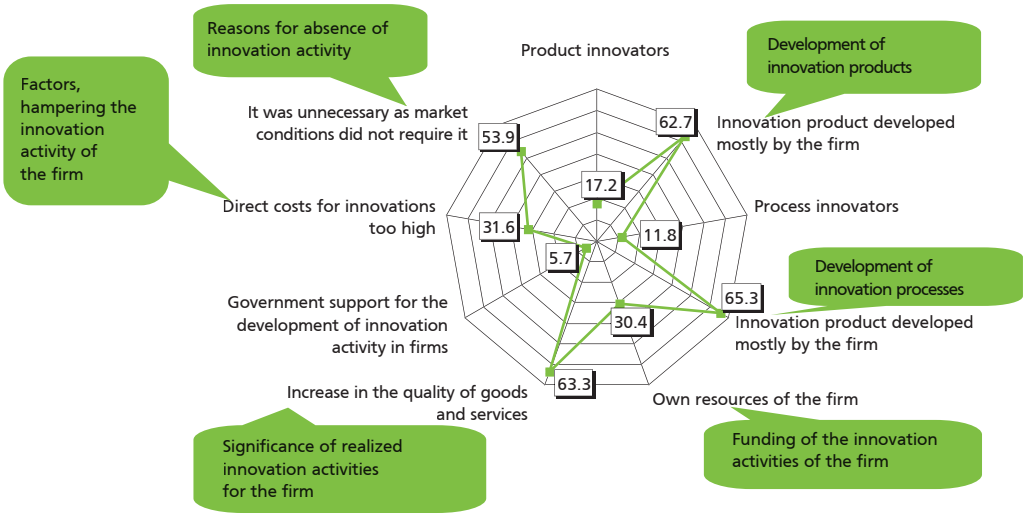
Figure 87. THE INNOVATION PYRAMID OF THE BULGARIAN ENTERPRISES (%)



Source: Vitosha Research, Applied Research and Communications Fund, 2006.

The Bulgarian enterprises still do not perceive the business environment as friendly for the development of innovation products and processes. Most of the Bulgarian innovatice companies develop innovations, which they define as new only for the firm itself, i.e. the innovation activity of the enterprises is oriented to products already existing on the market. While this might be a symptom of investment in effectiveness it does not bode well for the innovation potential of the companies. The number of innovations, which are a novelty for the domestic and/or the international market, is much smaller. The development of innovative products and processes in the country is done primarily by the firms themselves. The majority of Bulgarian firms with lower turnover develop their innovation products and processes by themselves (as their size precludes them from leveraging outside resources), while companies with annual turnover exceeding BGN 2 000 000 are oriented towards cooperation with foreign partners.

Figure 88. INNOVATION RADAR OF THE BULGARIAN ENTERPRISES – 2006 (%)



Source: Vitosha Research, Applied Research and Communications Fund, 2006.

Another variable defining the innovation profile of the Bulgarian firms is the funding of their innovation activity. As the development of innovations in Bulgaria is concentrated in the individual firm, not surprisingly the funding of innovations in most of the Bulgarian companies is done mainly with own financing. Therefore, cooperation with local and foreign organizations should be defined as a priority area for the national innovation policy. Another area, which badly needs attention, is the stabilization and improvement of the links between science and business. Currently almost 70 % of the Bulgarian innovative firms declare lack of cooperation with science organizations.

Bulgaria's accession to the European Union imposes requirements for the introduction of European and international quality standards by the Bulgarian companies. Hence innovations in Bulgarian firms are often directly related to meeting standards. Between 2004 and 2006 the number of Bulgarian companies, which implemented standard related innovations grew by more than 10 p.p.

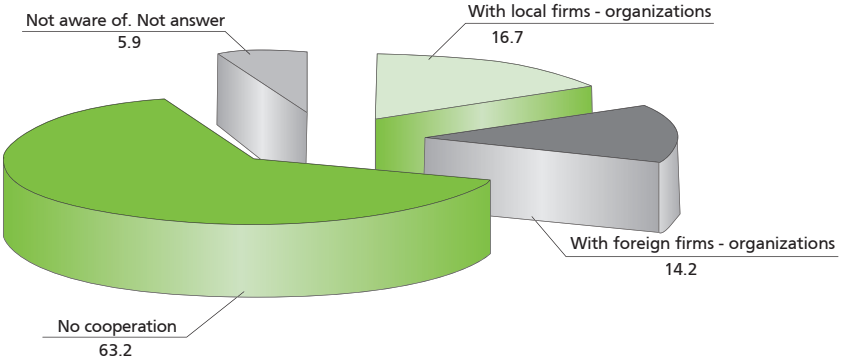
In 2006, 5.7% of the innovative firms in Bulgaria have received government support for their innovative activity. The National Innovation Fund has supported half of them. The rest of the firms have received support from various European programs, such as the Sixth Framework Program, Eureka, etc. Government support has reached primarily firms with a high annual turnover – over BGN 500 000, i.e. big enterprises by Bulgarian standards. Considering the fact that more than 90% of the Bulgarian firms are micro or small, they have been left out of the government's support schemes. Therefore, it might be better for the Bulgarian government to focus more funds for the development of innovation activities in smaller companies, as enterprises with high turnover can fund their innovation activity on the commercial market.

In 2006 the innovative enterprises in Bulgaria single out the too high costs of innovation as the biggest barrier to their innovation activity. In comparison, in 2004, the factor, which hampered innovative companies to the highest degree, was the absence of financing. In addition, many Bulgarian innovative firms define the absence of a clear government policy in the innovation domain as one of the leading barriers to innovation activity – 31.5%.

Non-innovative Bulgarian companies complete the picture of the innovation activity of the firms in the country. They comprise 80% of all Bulgarian firms. The primary reason they point out for not developing innovations is the lack of necessity for market oriented innovations. According to the Bulgarian non-innovative companies the market conditions in the country do not require innovation. There is a clear innovation divide between the small and the large firms in the country. Most of the microfirms (64%) have not introduced innovative products or processes during the last year, while in the large firms this share is almost twice lower (38.5%).

The EU accession and the integration of the Bulgarian economy with those of the other Member States should be used by the Bulgarian government as a catalyst for the development of the innovation activity of the firms in the country. The market enlargement may prompt the break in the capsulated way of creating market oriented new products and processes in Bulgarian companies and may lead to an increased cooperation between organizations and scientific institutes. Some 31% of the firms in the country share that they have developed the their innovations in cooperation with other organizations.

Figure 89. INNOVATION COOPERATION OF BULGARIAN FIRMS (%)
(WITH WHOM COMPANIES DEVELOP THEIR INNOVATIONS)



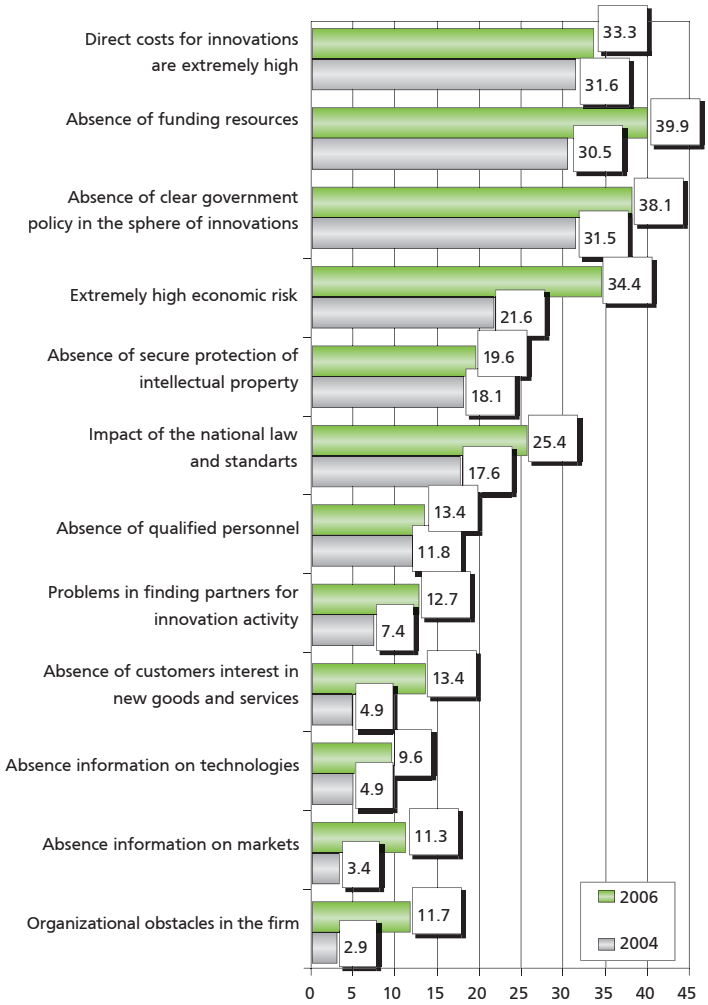
Source: Vitosha Research, Applied Research and Communications Fund, 2006.

Table 7. DISTRIBUTION OF THE INNOVATION PROFILE OF THE BULGARIAN ENTERPRISES PER SIZE OF THE FIRM AND PER TURNOVER VOLUME (%)

	Product innovators	Innovation product developed by the firm only	Processes innovators	Innovation processes development by the firm only	Innovation funding - own resources of the firm	Significance – increase in the quality of goods and services	Government support	Difficulties – direct costs for innovation are extremely high	Absence of innovation – it was not necessary because the market conditions do not require it
Annual turnover									
Up to 20 000	28.6	50.0	35.7	80.0	100	20.0	0.0	20.0	77.8
20 001 – 50 000	10.5	75.0	7.9	100.0	100	50.0	0.0	0.0	64.7
50 001 – 100 000	8.3	71.4	7.2	66.7	90	60.0	0.0	20.0	60.8
100 001 – 200 000	12.0	83.3	8.0	100.0	100	57.1	0.0	28.6	62.8
200 001 – 500 000	18.1	60.0	13.4	72.7	88.9	81.3	0.0	31.3	61.5
500 000 – 1 000 0000	20.0	58.8	13.1	63.6	95	45.0	5.3	44.4	53.8
1 000 001 – 2 000 001	25.4	76.5	16.4	81.8	84.2	61.1	5.6	47.1	54.2
over 2 000 000	32.7	47.2	21.6	58.3	93.2	64.3	14.0	26.2	54.4
Size of firms									
Micro firms	12.0	52.4	8.0	57.1	93.9	58.3	2.2	27.3	64.0
Small firms	17.5	67.6	13.3	68.5	87.4	65.5	6.0	34.6	48.9
Medium firms	24.6	61.7	15.1	60.7	94.5	63.5	7.5	28.8	44.9
Large firms	34.6	77.8	33.3	87.5	92.3	66.7	8.3	38.5	38.5

Source: Vitosha Research, Applied Research and Communications Fund, 2006.

Figure 90. FACTORS, HAMPERING THE INNOVATION ACTIVITY OF THE BULGARIAN FIRMS (%)



Source: Vitosha Research, Applied Research and Communications Fund, 2006.

Cluster analysis

The innovation development of Bulgaria depends on various economical factors on micro and macro level. For the outline of a more complete and clear picture of the Bulgarian innovation potential, the standard statistical and empirical indicators and analytic techniques have limited value as they study the isolated influence of individual factors. The classification of the elements of an aggregate on the basis of multiple indications would have a higher cognitive significance. Therefore, for the purposes of the analysis it is appropriate to apply summarizing multi criteria statistical methods as the cluster-analysis[103].

For the purposes of the cluster analysis part of the survey variables used until now have been replaced. The variable-factors selected for the cluster analysis are:

[103] It gives the opportunity to focus the attention on a certain number of groups and to compare their development as per specific factors. In its essence the cluster analysis represents a sequence of practical calculation procedures, grouping ***n*** number of observed units or objects in ***k*** number of groups-clusters, using ***p*** number of criteria. The objects assigned to each cluster are similar to each other and differ from those, grouped in the other clusters.

- Market supply of innovation products or processes;
- Expression of the innovation activity of the firm;
- Annual spending for capital investment of the firm for 2006;
- Amount of spending on innovation activity - % of turnover;
- Sources of funding of the innovation activity of firms;
- Government support in the development of innovation activity in the firms;
- Main market of firms;
- Size of firms as per number of employees;
- Main sector of activity of firms.

Due to the non-homogeneity of the observed variables and the initial stage of development of the Bulgarian national innovation system it was necessary to preliminarily define/assume the expected number of clusters. The variety in the methods and means for innovation activities implies that without prior limitation of cluster groups, a great number of clusters would be formed, containing a small number of firms, which would hamper the analysis' reliability. On the basis of preliminary tests the number of clusters was determined at 6, which allowed carrying out the analysis as completely as possible and to present accurate and adequate data[104]. The higher number of groups allows for the factors chosen for the analysis to display their diversity to a higher degree.

The cluster analysis included 89 of the surveyed firms. It divided the observed total in three groups. Despite the small number of innovative products and processes introduced on the market by the companies in the past year, the innovation activity of the firms in all clusters has undergone positive development. The second cluster is the largest. It groups most of the firms used in the analysis. The innovation activity of companies in this cluster is characterized by R&D provided by other firms. This observation confirms the finding that most of the Bulgarian innovative firms adopt existing innovations in order to improve the effectiveness of their business and do not create their own innovative products. The amount of spending on innovation development in this cluster is between 6% and 10% of their annual turnover. This group illustrates the specifics of most of the firms in the country and reveals that the innovation activity is dependant on the size of the firm. Firms in this cluster self-funding their innovation activity. They belong to production and distribution, and their main market is the national one.

A smaller number of firms are concentrated in the third cluster. Firms in this group are similar to these in cluster 2. The specifics of this cluster are in the high spending on investment in innovation. Most of the firms in the group have declared that they are spending over 40% of their turnover on innovation. Despite the smaller number of firms found in this group, it can be defined as the most innovative in comparison with the rest.

The fifth cluster consists mainly of small firms with 11 to 50 employees and working on regional markets (within 100 km from their facilities). This group differs from the second and the third cluster with the investments its members companies made in training of personnel directly related to innovations in 2006. The defining factor for this characteristic feature can be traced down to the main sector of operation of the companies in the cluster – tourism, in which the quality of the personnel is most directly related to revenues.

[104] This is the place to note that this particular number of clusters makes sense only for the data received from this research and in its repeated realization there is a high probability to be inadequate.

Table 8. RESULTS OF THE CLUSTER ANALYSIS OF BULGARIAN INNOVATIVE FIRMS (FINAL CLUSTER CENTERS)

	Cluster					
Factors	***1***	***2***	***3***	***4***	***5***	***6***
Market supply of innovation products or processes	Yes	Yes	Yes	Yes	Yes	Yes
Expression of the innovation activity of the firm	Acquisition of machines and equipment related to innovation	R&D provided by another firm	R&D provided by another firm	Acquisition of intangible assets	Training of personnel explicitly related to innovation	Marketing activities
Annual spending on capital investment of the firm for 2006	50 000 – 100 000	100 001 – 200 001	50 000 – 100 000	200 001 – 500 001	20 001 – 50 000	100 001 – 200 000
Amount of spending on innovation activity - % of turnover	31 % – 40 %	6 % – 10 %	Over 40 %	11 % – 20 %	11 % – 20 %	Over 40%
Sources of funding of the innovation activity of firms	Other	Own sources of the firm	Own sources of the firm	EU funds and programs	Own sources of the firm	Own sources of the firm
Government support in the development of innovation activity	No	No	No	Yes	No	No
Main market of firms	National	National	National	Regional	Regional	Regional
Size of firms as per number of employees	51-250	51-250	51-250	51-250	11-50	51-250
Main sector of activity of firms	Real estate operations, leasing activity and business services	Production and distribution	Production and distribution	Processing industry	Hotels and restaurants	Production and distribution

Source: Vitosha Research, Applied Research and Communications Fund, 2006.

All but one cluster report no government support. Only less than 6% of all companies have received financial help from the state in the development of their innovations. Most of the clusters indicate that the innovation activity performed by the companies is primarily related to the acquisition of machines and equipment for the development of new market oriented products along with R&D provided by another firm. This demonstrates that the level of development and introduction of innovative products and processes by the Bulgarian enterprises is still in its initial stage and may increase in the following years.

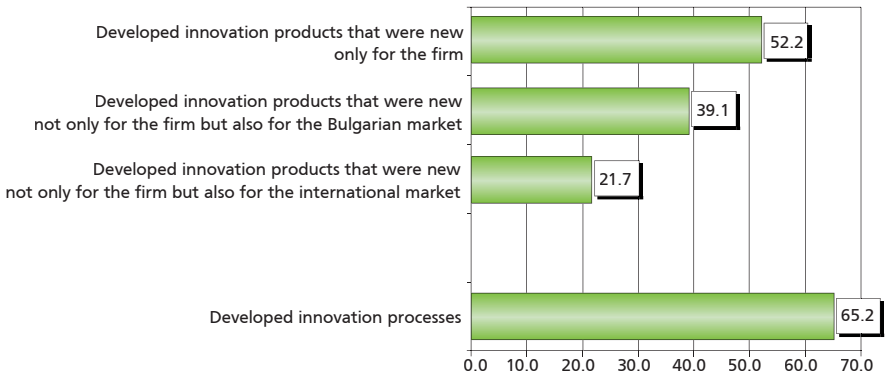
In the rest three clusters a very small number of firms are distributed, and this is an expression of the early stage of development of the innovation system in the country. In spite of the low share of the firms under analysis, and their inhomogeneous structure, the data presented by the cluster method confirm the conclusions and recommendations made both in the present and the preceding report *Innovations.bg*.

Panel Survey

The analyses presented so far examine the innovation activity of Bulgarian enterprises in the framework of the whole national economy. However, in order to examine the inter-firm mechanisms of creating innovative processes and products in Bulgaria, it is necessary to use a different type of analysis. The two surveys of 2004 and 2006 allow for the development of a panel survey, involving 9 % of the innovative firms[105], which have already participated in 2004. This analytical method provides an opportunity to observe the dynamic development of innovative companies over time. The main conclusions obtained by this approach comply with the ones presented in the preceding analysis.

The results of the panel survey reveal a change in the structure and a decrease in the innovation activity of the firms in 2006 against 2004. Only half of the

Figure 91. INNOVATION ACTIVITY OF COMPANIES IN THE PANEL - % OF THE FIRMS, WHICH HAVE DEVELOPED INNOVATION PRODUCTS OR PROCESSES IN 2004 AND 2006



Source: Vitosha Research, Applied Research and Communications Fund, 2006.

[105] The 2004 survey sample involved 270 innovative firms, i.e. companies which have supplied innovation products or processes in 2003. In 2006 23 of them were on the sample and allowed a panel survey.

organizations in the panel, which have supplied innovation products in 2004, have developed and introduced new ones in 2006. The strongest decrease is observed amongst products which are new not only to the firm but to the international market as well. This shows that innovative Bulgarian firms might be highly vulnerable under the competitive pressure of competitors from economically more advanced countries.

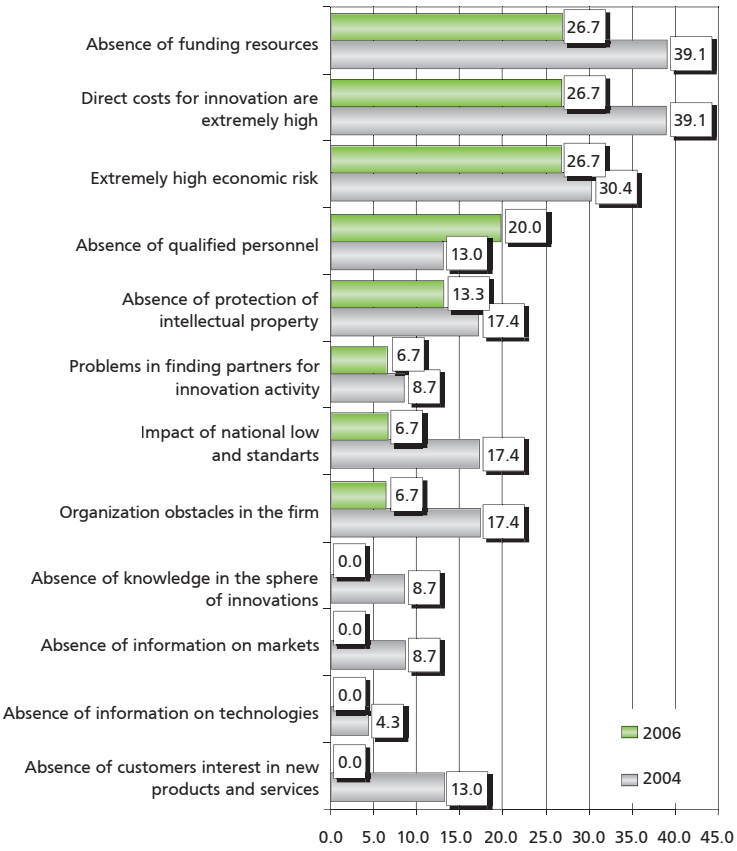
The dynamics of the factors hampering the innovation activity of the firms in the panel provides useful information on the development of the national innovation system and its bottlenecks. The only barrier which has increased its negative impact on the innovation activity of the panel firms in 2006 by almost 50 % is the absence of qualified personnel. However, it is still not the number one barrier to innovation in the panel firms. It comes only after the financial obstacles (absence of finance, high costs of innovation and high economic risk). The latter are indicators of the underdeveloped general economical and innovation environment in the country. The reduction in the hampering power of all indicators, however, is encouraging. The improvement is a most probably a consequence of the improved macroeconomic stability and growth in the country.

The innovation activity of firms in the panel is directed mainly to provision means and methods for the development of new markets, i.e. market expansion. As the cluster analysis outlines and the data from the panel survey confirms the innovation activity of the Bulgarian innovative enterprises is concentrated in the acquisition of machines and equipment related to innovations. This is a sign that Bulgarian companies prepare themselves for the competitive pressure of the European market and might soon embark on bolder projects for developing indigenous innovation.

Similar to the data for the whole Bulgarian economy, the innovations created by the firms involved in the panel are directed mainly towards expanding the product range, increasing product/service quality, etc. This is an expression of the preparation of the Bulgarian firms for the competition with the enterprises in the EU. This might be one of the factors for the reduction of the supply of innovations in the panel of firms in 2006 compared to 2004. The companies have most probably focused their entire attention during the period to ensuring the required investments for meeting the standards of the Internal Market of the European Union.

All three types of analysis presented in this annex (innovation profile, cluster analysis and panel survey) outline that the Bulgarian innovation system is still in its infancy. The continuing equipment of companies with machines and technologies, assisting the development of the innovation activity is a sign

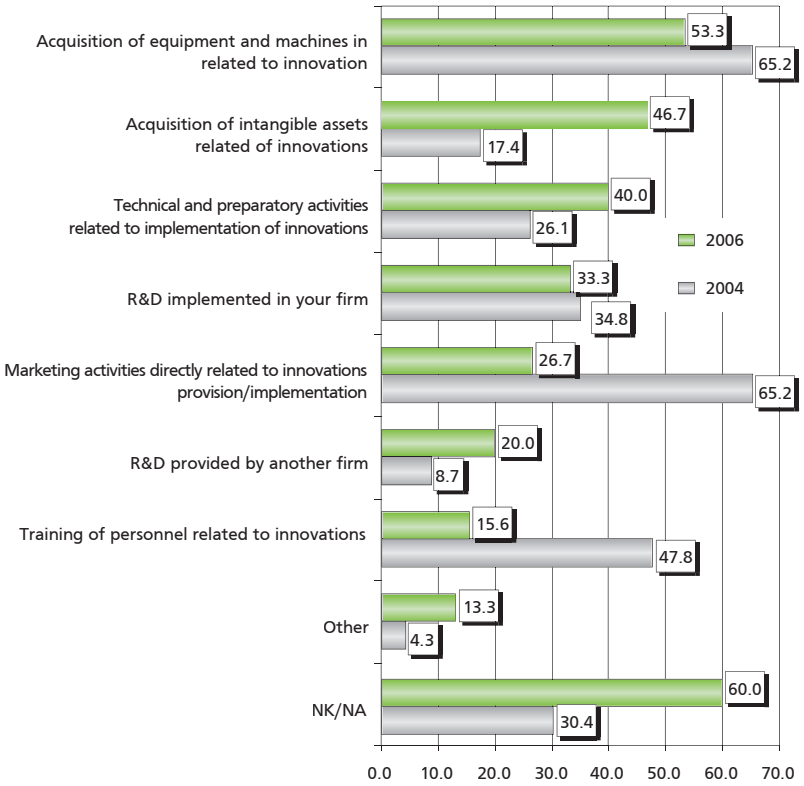
Figure 92. FACTORS HINDERING THE INNOVATION ACTIVITY OF FIRMS IN THE PANEL (SHARE OF THE FIRMS DEFINING THEIR IMPORTANCE AS 'GREAT')



Source: Vitosha Research, Applied Research and Communications Fund, 2006.

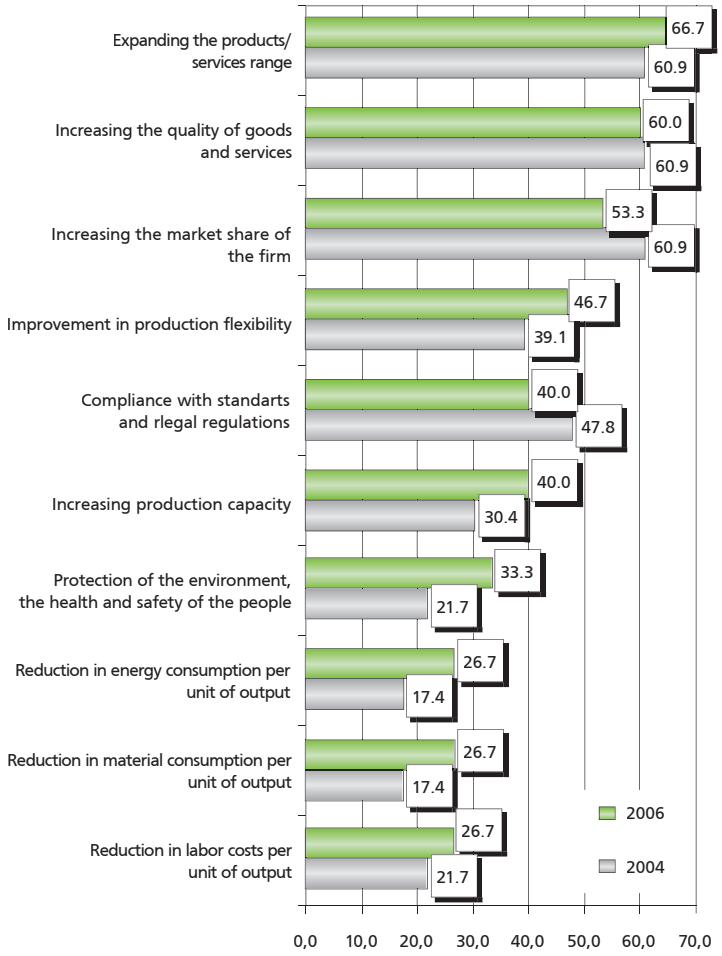
that the business in Bulgaria takes seriously the challenges of the country's EU membership. The major barrier for the innovation activity of the Bulgarian innovative enterprises after 2007 will be the absence of qualified personnel and the limited range and availability of financial instruments for the implementation of innovation projects. Government financial support is already acknowledged by the Bulgarian innovative companies but it has not yet produced any sizable effect on the innovation potential of the economy. Despite the relatively early stage in the development of the national innovation system of the country, all the prerequisites, for growth of market innovations in the following two years, are present.

FIGURE 93. CHARACTERISTICS OF THE INNOVATION ACTIVITY OF FIRMS IN THE PANEL



Source: Vitosha Research, Applied Research and Communications Fund, 2006.

FIGURE 94. SIGNIFICANCE OF THE IMPLEMENTED INNOVATION ACTIVITIES FOR THE FIRMS IN THE PANEL (SHARE OF THE FIRMS DEFINING THE SIGNIFICANCE AS 'GREAT')



Source: Vitosha Research, Applied Research and Communications Fund, 2006.

Appendix 2. Notes on methodology, information sources and definitions

Innovation.bg is based on several existing models for measuring and comparing innovation systems:

- The *European Innovation Scoreboard* of the European Commission is an instrument of the Lisbon strategy for economic, social and environmental renewal of the European Union, which compares the innovation systems of EU member and candidate countries to the innovation systems of USA, Japan and the countries of EFTA. The scoreboard aims at coordinating innovation activity at European level and at stimulating innovation and investment in R&D. *Innovation.bg* is an attempt to further develop and adapt that instrument to the specific conditions in Bulgaria, following the example of countries such as Great Britain and Estonia[106] (http://trendchart.cordis.lu/scoreboards/scoreboard2004/index.cfm).
- The *National Innovation Initiative – NII* and the *Index of the Massachusetts Innovation Economy in the USA* monitor the condition of the innovation system in the country and in the state of Massachusetts respectively in an international comparative aspect through an innovation index[107]. The governments of the different states draft their own initiatives for annual benchmarking and strategies for development of their regional innovation systems, most widely recognized of which is the innovation index of the State of Massachusetts (http://www.mtpc.org/institute/the_index.htm);
- *The OECD Science, Technology and Industry Scoreboard 2003* is the most wide-ranging model for comparing science, technology and innovation achievement of OECD member countries. It also depicts the changes in the characteristics and functioning of the innovation process over time (http://www1.oecd.org/publications/e-book/92-2003-04-1-7294/).

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

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

Each group contains several synthetic indicators. For them and for naming the above groups *Innovation.bg* uses working definitions, which can differ from similar and more narrow definitions used in the innovation literature. In turn, the synthetic indicators comprise a different number of statistical indicators, presented in graphic form. They have been grouped so that they can ensure the most thorough idea of the respective component of the national innovation system. The indicators presented in graphic form have been chosen to reflect internationally acknowledged definitions and concepts.

The report uses the term *innovation* in numerous meanings and forms. ***Innovation*** is the marketing of a new or considerably improved idea, good, service, process or practice with the purpose of satisfying a particular need.

International methodologies for assessment of the innovation capacity of countries

Innovation.bg presents the results for Bulgaria from the application of several **international methodologies for assessment of the innovation capacity** of countries:

[106] The Estonian Economy, Competitiveness and Future Outlooks: R&D and Innovation Policy Review.

[107] Porter, M. and N. Stern, The Challenge to America's Prosperity: Findings from the Innovation Index, US Council on Competitiveness (1999).

The Knowledge Assessment Methodology is an interactive benchmarking tool created by the Knowledge for Development Program of the World Bank. It consists of 80 structural and qualitative variables which measure the countries' performance on four Knowledge Economy pillars:

1. Economic Incentives Regime;
2. Education;
3. Innovation;
4. Information and Communications Technologies.

The methodology and data are accessible at the World Bank's website at:
http://www.worldbank.org/KAM

The European Innovation Trendchart (http://trendchart.cordis.lu/) elaboration was commissioned by the Lisbon European Council in March 2000. It focuses on high-technology innovations and presents indicators, which follow the progress of the EU countries in achieving the Lisbon goal. The European Innovation Trendchart encompasses four groups of indicators:

- human resources for innovation (5 indicators);
- creation of new knowledge (3 indicators, one of which is divided into patents from the European and patents from the US Patent and Trademark Office);
- dissemination and application of knowledge (3 indicators);
- financing of innovation, results and markets (6 indicators).

It uses mainly Eurostat data or data from private sources, when official sources are not available. Six of the indicators originate from the European Commission's structural indicators. They monitor the innovation effectiveness since 2005 – e.g. how well the countries transform their innovation assets into innovation results.

Michael Porter and Scott Stern developed and published **International Index of the National Innovation Capacity** in three issues of the Global Competitiveness Report (1999, 2001-2002, 2004-2005). In the last issue the authors used data from a survey of the innovation capacity, carried out in 2003 among business representatives from 78 countries (Executive Opinion Survey). The index is not present in the reports issued after 2004-2005. Data from the Global Competitiveness Report are accessible at the World Economic Forum in Devos website:

http://www.weforum.org/pdf/Global_Competitiveness_Reports/Reports/gcr_2006/gcr2006_rankings.pdf

The Innovation Capability Index of the United Nations Conference on Trade and Development (UNCTAD) is published every two years in the World Investment Report (http://www.unctad.org/Templates/Page.asp?intItemID=1485&lang=1). According the established methodology the index measures three levels of innovation capability – high, middle and low. It is calculated as the non-weighted average of: a) the Technological Activity Index and b) the Human Capital Index.

Innovation Index of the Bulgarian enterprises

An Innovation Index of the Bulgarian enterprises is introduced for the first time in this issue of *Innovation.bg*. It is based on the annual survey of the innovativeness of the Bulgarian companies, carried out by sociological and marketing agency Vitosha Research, commissioned by the Innovation Relay Center at the

Applied Research and Communications Fund. It ranges between 0 and 100, as 0 means that the company has practically no innovation, and 100 – the most innovative enterprises.

The index assesses the innovativeness of the firms based on three groups of indicators (sub-indexes) - related to **product** innovation, process and organizational, or **internal** innovation, and **marketing** innovation. These groups are included in the index with equal weights. The weights of each indicator in the composite sub-indices are given in brackets.

1. **Product innovation (1/3)**
   - 1.1. Innovation products only for the firm (1/6)
   - 1.2. Innovation products not only for the firm, but for the Bulgarian market as well (1/3)
   - 1.3. Innovation products not only for the firm, but for the international market as well (1/2)
2. **Internal innovation – process/organizational (1/3)**
   - **2.1. Process innovation (1/2)**
     - 2.1.1. Innovation production methods, which are new only for the firm (1/3)
     - 2.1.2. Innovation production methods, which are new for the firm and the sector (2/3)
   - **2.2. Organizational innovation (1/2)**
     - 2.2.1. New or considerably improved management methods and systems (1/3)
     - 2.2.2. Considerable changes in the organization of work (1/3)
     - 2.2.3. New or considerably changed relations with other companies (1/3)
3. **Marketing innovation (1/3)**
   - 3.1. Considerable changes in the design or the package of the products (1/2)
   - 3.2. New or considerably changed methods for sale and distribution (1/2)

Availability of data, information sources and definitions

Innovation.bg contains 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 resources, which in some cases has resulted in differences in time horizons, definitions of the used variables and graphically represented indicators. Wherever possible and appropriate the Internet source of the data used in Innovation.bg has been provided in this appendix. Authors cannot guarantee that the links provided here will be the same over time. This appendix summarizes notes, definitions and methodological explanations to the separate chapters. The Applied Research and Communications Fund will annually update the *Innovation.bg* report aiming at making it a reliable and effective instrument for monitoring the Bulgarian national innovation system with respect to public and private innovation policy.

1. Gross Innovation Product

1.1. Innovation product

Every three years the European Commission and Eurostat (the EC's statistical body) conduct the Community Innovation Survey (CIS) – a EU wide survey of enterprises. In 2003 for the first time, a pilot CIS compliant survey was carried out by the National Statistical Institute (NSI) of Bulgaria, and the data derived from it was presented in the beginning of 2005. *Innovation.bg* combines this data with results from a special nationally representative survey of Bulgarian enterprises of the sociological and marketing agency Vitosha Research, contracted by the Innovation Relay Centre (IRC) in Bulgaria in 2004. Vitosha Research has adopted and slightly adjusted the EIS methodology, in order to provide both maximum comparability of the data to the one of Eurostat and NSI and to capture Bulgarian specifics. By 2008 IRC and Vitosha Research will carry out two more nationally representative surveys for Bulgaria. Data from the International Organization for Standardization (ISO) has also been used in the report.

Eurostat and NSI data are accessible on the Internet at: http://epp.eurostat.cec.eu.int/portal/page?_pageid=0,1136250,0_45572555&_dad=portal&_schema=PORTAL (тема Наука и технологии – Science and technology); MOC (http://www.iso.org/iso/en/iso9000-14000/certification/isosurvey.html).

In all tables and figures in this section, EU-15 excludes Ireland, Luxembourg and Great Britain. Manufacturing is defined to include NACE's sections C to D. Respectively, 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) or/and innovation processes, including new methods for providing services and channels for marketing goods. Innovation products and processes have to be new for the enterprises themselves, but not for the market they serve. **Product innovation** is a good or service, which is new or considerably improved when it comes to its main features, technical specifications, purpose, incorporated software and/or other intangible components. **Process innovation** is the adoption of a new or considerably improved production technology, new or considerably improved method for offering services and/or marketing a product. **Innovation economy** is used as a synonym of knowledge economy and knowledge-based economy. **Tacit knowledge** is obtained through on the job experience and is usually passed on though personal contact.
According to OECD definition **high-tech sectors** are: a) the production of medicinal substances and products, b) the production of office and computing technology, c) the production of radio, TV and communication technology, d) the production of aircraft and spacecraft and their engines.

1.2. Technological product

The data in this section is 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 in 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.cec.eu.int/portal/page?_pageid=0,1136250,0_45572555&_dad=portal&_schema=PORTAL (Topic Science and technology).

1.3. Research product

The National Science Foundation of the USA provides the most comprehensive and accessible database for internationally comparative information on scientific publications and citations of science literature. It is in turn based on data from the Institute for Scientific Information (USA), Thomson Scientific, and CHI Research. The classification of science areas, according to which CHI Research distributes the scientific publications and quotes, is presented in Appendix 2.

The data from the National Science Foundation is available at:
http://www.nsf.gov/statistics/

2. Entrepreneurship and Innovation Networks

2.1. Entrepreneurship

There is no systematically developed methodology and data on entrepreneurship in Bulgaria. 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 NSI and comparative entrepreneurship data from the European Bank for Reconstruction and Development (EBRD).

The annual reports of BSMEPA are available for download on the Internet at: http://www.sme.government.bg.

2.2. Innovation networks

Innovation networks in Bulgaria have been studied based on data from sociological surveys: for EU – Community Innovation Survey 1998–2001, published in 2003; for Bulgaria – the nationally representative survey of the sociological and marketing agency Vitosha Research, contracted by the Innovation Relay Centre in Bulgaria in 2004. Vitosha Research has adopted and slightly adjusted the EIS methodology, in order to provide both maximum comparability of the data to the one of Eurostat and NSI and to capture Bulgarian specifics. By 2008 IRC and Vitosha Research will carry out two more nationally representative surveys for Bulgaria. Data from the International Organization for Standardization (ISO) has also been used in the report.
The data on EU are available in the Internet at:
http://epp.eurostat.cec.eu.int/portal/page?_pageid=0,1136250,0_45572555&_dad=portal&_schema=PORTAL (Topic Science and technology).

3. Innovation Investment and Financing

3.1. R&D Investment

Sources of the data for this section are NSI and Eurostat. The data are available on the Internet website of Eurostat, theme Science and Technology:
http://epp.eurostat.cec.eu.int/portal/page?_pageid=0,1136250,0_45572555&_dad=portal&_schema=PORTAL.

R&D expenditure includes current expenditure on R&D and expenditure on the acquisition of long term assets, intended for R&D use, which are made by domestic and foreign enterprises in Bulgaria. R&D expenditure is made by various **economic agents**, classified in four institutional sectors: (i) 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); (ii) The government sector includes public organizations and institutions, which offer, rather than sell, services, which satisfy individual and collective needs of society and which are primarily financed through the state budget (excluding the entities of the higher education sector); (iii) The higher education sector includes universities, colleges, higher education institutions, science institutes within higher education institutions and university hospitals; (iv) The private non-profit sector includes private foundations, associations, societies, etc, offering non-profit services.

R&D expenditure by sources of funds 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: (i) enterprises' revenues; (ii) the state budget (excluding those of the higher education organizations and the university hospitals); (iii) the higher education organizations and university hospitals' budgets; (iv) non-profit organizations' resources (foundations and associations); (v) foreign entities. **R&D expenditure by type of costs** is divided into: (i) current R&D costs, which include the costs of materials, external services, personnel and other operating costs. Depreciation costs are not included; (ii) costs on long-term asset acquisitions, intended for carrying out 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: (i) expenditure on *fundamental research*, which comprises experimental and/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 outputs and are intended for publication in science magazines or to exchange among interested persons and organizations; (ii) expenditure on *applied research*, which comprises indigenous research, carried out with the purpose of acquiring new knowledge, which however is primarily directed towards achieving certain practical aims and tasks; (iii) 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.

3.2. International transfer of R&D investment

The data on foreign direct investment and imports in Bulgaria are provided by the Bulgarian National Bank (BNB) and the United Nations Conference on Trade and Development (UNCTAD).

For the purposes of the economic analysis, the Bulgarian National Bank publishes the tables on Bulgarian **import** by end-use. The basic principles in the distribution of the commodities in the respective groups are: purpose of their use and degree of processing. **Direct investment** is a category of international investment in which a resident of one economy – a direct investor – acquires a lasting interest (at least 10% of the ordinary shares or the voting power) in an enterprise resident in another economy – a direct investment enterprise. The direct investment includes both the initial transaction, through which the relationship between the direct investor and the direct investment enterprise is established, and all subsequent transactions between them[108].

The data are available on the Internet websites of BNB and UNCTAD:
www.bnb.bg and www.unctad.org (section Statistics).

[108] Source: BNB.

3.3. Financing innovation

The data on the level of financial intermediation in Bulgaria is provided by the Bulgarian National Bank. The data on the sources of innovation financing at enterprises has been gathered through a nationally representative survey of the sociological and marketing agency Vitosha Research, commissioned by the Innovation Relay Centre in 2004. The availability of venture capital in the country is an expert estimate of the Applied Research and Communications Fund.

4. Human Capital for Innovation

4.1. Scientific career, R&D and high-tech employment

This section uses data from NSI and Eurostat. The Eurostat data is available on its Internet website, under the theme Science and Technology: *http://epp.eurostat.cec.eu.int/portal/page?_pageid=0,1136250,0_45572555&_dad=portal&_schema=PORTAL*.

R&D personnel includes employees, directly involved with R&D, as well as employees, who provide direct support to R&D (managers, administrators, clerks) working in the country, 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 institutional sectors under the R&D expenditure indicator in this appendix). Participation in continuous education, also known as **lifelong learning**, comprises all forms of education and training - the education in the formal education system, as well as outside the system, participation in organized courses, seminars, conferences, lectures, etc.

4.2. Education outcomes, quality of education and lifelong learning

This section uses data from NSI and Eurostat. To put the quality of high school education in Bulgaria in an international perspective the section also employs data from the tests of the International Association for the Evaluation of Educational Achievement (IEA) and the Third International Mathematics and Science Study (TIMSS) in 1995, 1999 and 2003.

The TIMSS results are available on the Internet website of the National Centre for Education Statistics (USA): http://nces.ed.gov/timss/index.asp

5. Information and Communication Infrastructure

The data, presented in this section, is explained in detail in the *e-Bulgaria 2005* report of the Applied Research and Communications Fund, and can be found on the Internet at: http://www.bgrazvitie.net/e-Bulgaria/

Appendix 3. Science Literature Classification

Clinical Medicine

Addiction related diseases

Allergy

Anesthesiology

Arthritis and rheumatism

Cancer

Cardiovascular system

Dentistry

Dermatology and venereal diseases

Endocrinology

Health, related to environment and profession

Fertility

Gastroenterology

General and Gastrointestinal Medicine

Geriatrics

Hematology

Immunology

Various clinical diseases

Nephrology

Neurology and Neurosurgery

Obstetrics and Gynecology

Ophthalmology

Orthopedics

Ear, Nose and Throat

Pathology

Pediatrics

Pharmacology

Pharmacy

Psychiatry

Radiology and Nuclear Medicine

Respiratory system

Surgery

Tropical Medicine

Urology

Veterinary Medicine

Biomedical Studies

Anatomy and Morphology

Biochemistry and Molecular Biology

Biomedical Engineering

Biophysics

Cell Biology, Cytology and Histology

Embryology

Genetics and Heredity

General Biomedical Study

Microbiology

Microscopy

Other Biomedical Studies

Eastern Europe/Central Asia

Parasitology

Physiology

Virology

Nuclear Technology

Operation Research and Management

Biology

Agriculture and Food Studies

Botany

Milk Product and Animal Studies

Ecology

Entomology

General Biology

General Zoology

Oceanology and Hydrology

Other Biology Studies

Other Zoology Studies

Chemistry

Analytical Chemistry

Applied Chemistry

General Chemistry

Inorganic Chemistry

Physical Chemistry

Polymers

Physics

Acoustics

Applied Physics

Chemical Physics

Fluids and plasmas

General Physics

Other Branches of Physics

Nuclear and Particle Physics

Solid State Physics

Earth and Space Sciences

Astronomy and Astrophysics

Earth Science and Planet Science

Environmental Science

Geology

Meteorology and Atmospheric Sciences

Oceanography and Limnology

Engineering Sciences and Technologies

Airspace Technologies

Chemical Engineering

Civil Engineering

Computers

Electric and Electronic Engineering

General Engineering

Industrial Engineering

Materials Engineering

Mechanical Engineering

Metals and Metallurgy

Other Engineering and Technologies

Mathematics

Applied Mathematics

General Mathematics

Other Mathematical Sciences

Probabilities and Statistics

Psychology

Behavior and Comparative Psychology

Clinical Psychology

Evolutionary and Child Psychology

Experimental Psychology

General Psychology

Human Factors

Other Psychology Branches

Psychoanalysis

Social Psychology

Social Sciences

Anthropology and Archeology

Regional Studies

Criminology

Demography

Economics

General Social Sciences

Geography and Regional Science

International Relations

Other Social Sciences

Planning and Urban Studies

Political Science and Public Administration

Scientific Research

Sociology

Health Sciences

Gerontology and Aging

Health Policy and Services

Child Care

Public Health

Recovery

Social Research on Medicine

Speech-Language Pathology and Audiology

Professional Areas

Communication

Education

Information and Library Science

Laws

Business and Management

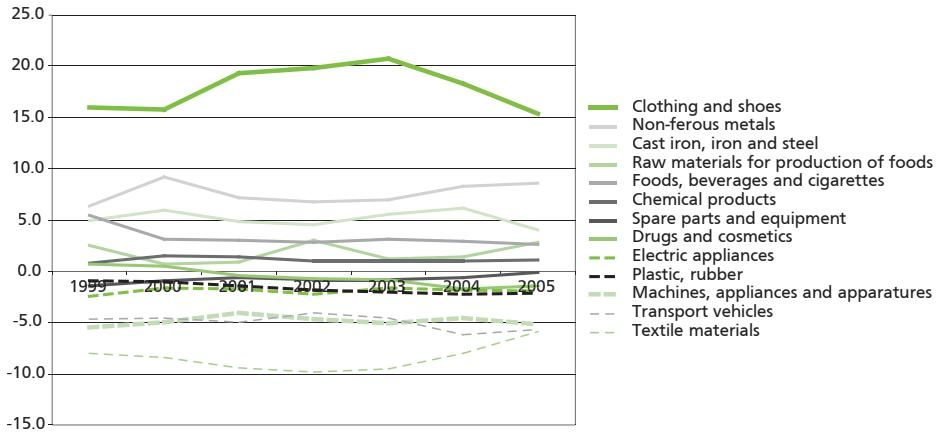
Other Professional Areas

Social Work

Source: Institute for Scientific Information, Science Citation Index and Social Sciences Citation Index; and CHI Research, Inc. Science & Engineering Indicators - 2004.

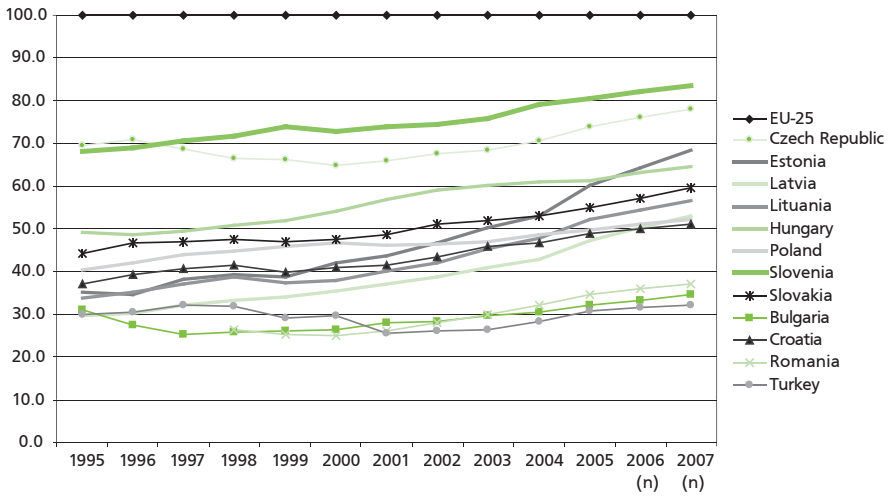
Appendix 4. Additional Data

FIGURE 95. REVEALED COMPETITIVE ADVANTAGES[109] IN BULGARIAN IMPORTS AND EXPORTS (1999 – 2005)



Source: Bulgarian National Bank and Applied Research and Communications Fund.

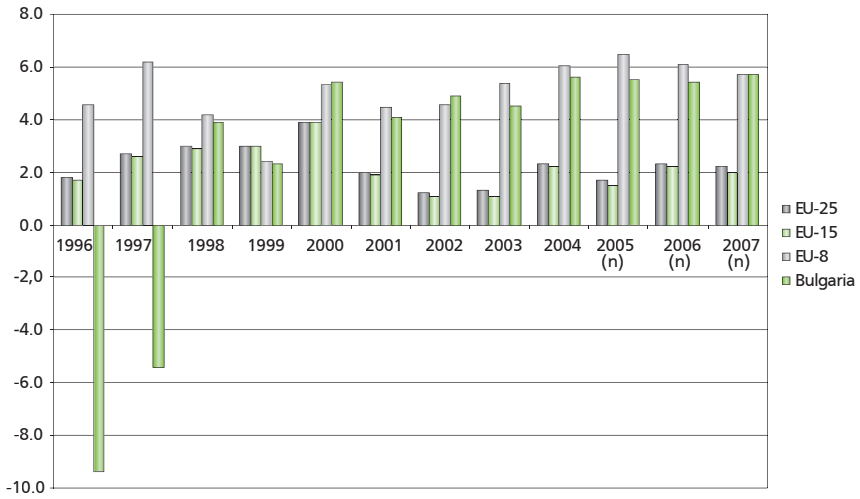
FIGURE 96. GDP PER CAPITA FOR THE NEW EU MEMBER STATES AND BULGARIA (IN PURCHASING POWER STANDARD; EU 25 = 100)



Source: Eurostat, 2006.

[109] Revealed comparative advantages are measured as the difference between the export share of a product group in total country exports and the import share of the same product group in total country imports (Xi/X - Mi/M).

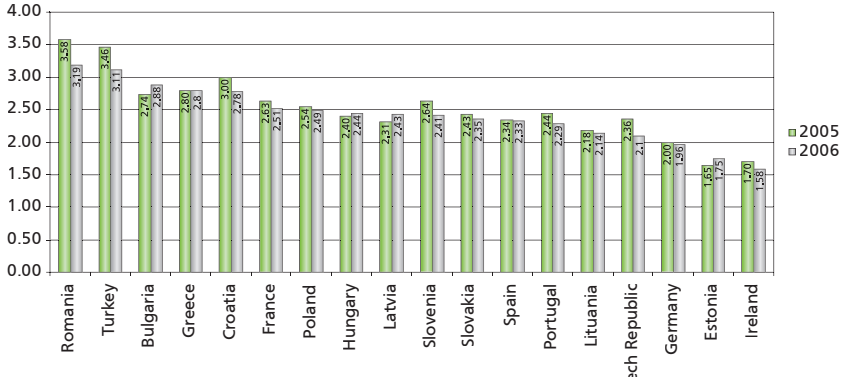
Figure 97. REAL ANNUAL GDP GROWTH IN EU-25; EU-8 AND BULGARIA (1995-2007)



Note: Real GDP growth for EU-8 is the average of the real GDP growth in the separate economies.

Source: Eurostat, 2006.

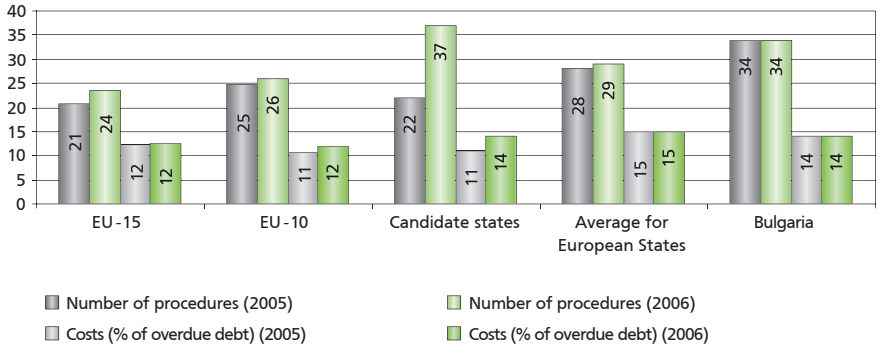
Figure 98. HERITAGE FOUNDATION'S INDEX OF ECONOMIC FREEDOM IN BULGARIA (2005-2006)



Note: Economically free countries – score under 1.99 on a scale of 1 to 5.

Source: The Heritage Foundation.

Figure 99. STARTING A BUSINESS – COMPARISON WITH THE OTHER EUROPEAN COUNTRIES



Note: Due to lack of data, Cyprus, Luxembourg and Malta are not included in the calculations; Averages for European groups include Albania, Macedonia, Bosnia and Herzegovina.

Source: Doing Business in 2006, Removing Obstacles to Growth, World Bank (January 2004 data).

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