# Human Capital for Innovation

Making the most of the potential of modern technology and turning the country into an attractive destination for foreign investment on the basis of an advanced high-tech sector (as would seem to be the declared goal of the Bulgarian government)[41] depend on several factors:

- Culture supporting and fostering innovation;
- Knowledge creating the preconditions for implementation of modern technologies;
- Capacity for mobilization and pursuit of ambitious goals.

All three factors can be regarded as conditional on human capital qualities. Under the conditions of increasing complexity of technologies, blurred geographic boundaries and changing values, it is worth noting the additional need for:

- "broadband" people – sufficiently open-minded and capable of responding quickly even to weak external signals and of achieving what they believe in;
- leaders – either brilliant technocrats or visionary politicians – to put in place the environment that can help form such broadband people.

In times of economic hardship it is worth asking ourselves: Does Bulgaria possess such people? What are the limits of their capacity? Will they manage to take our society into the future? The answers depend on the state of the education system; the quality of the education services; lifelong learning skills;

[41] Government Program for Bulgaria's European Development 2009-2013, http://www.government.bg/cgi-bin/e-cms/vis/vis.pl?s=001&p=0233&n=1&g=

the pool of highly qualified specialists available to the economy; and how well their knowledge is put to use in areas of high added value. The present section considers the progress made under these and other related indicators, the emerging trends in the past few years, as well as the future prospects.

# Academic Career, Employment in R&D and High-tech Sectors

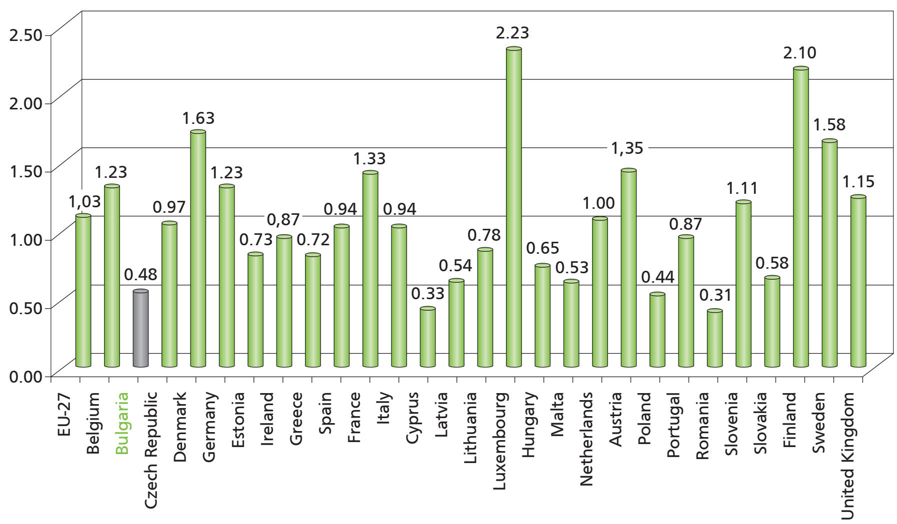
The personnel engaged in academic and technological R&D is indicative of the available human resources directly responsible for the creation, application and dissemination of new knowledge in the field of technologies. The indicator of employment in high-tech and medium high-tech sectors characterizes the country's specialization in areas with a high level of innovation activity. In turn, employment in R&D-intensive services is of great importance for the promotion of innovation particularly in the field of information and communication technologies.

## What Are the Available Resources?

Along with increasing investment in R&D and innovation, the advanced countries and the fast-growing Asian economies mark significant growth in the number of researchers and those engaged in technological research and development.[42] In the period since 2000, the number of researchers in China, for example, has doubled. Within EU-27, the rate of growth under the same indicator is twice higher than that achieved in Japan and US and three times as high in terms of the proportion of researchers in the workforce. Nevertheless, employment in Europe essentially remains less research-intensive compared to other leading economies. There are pronounced differences among member countries under this indicator.

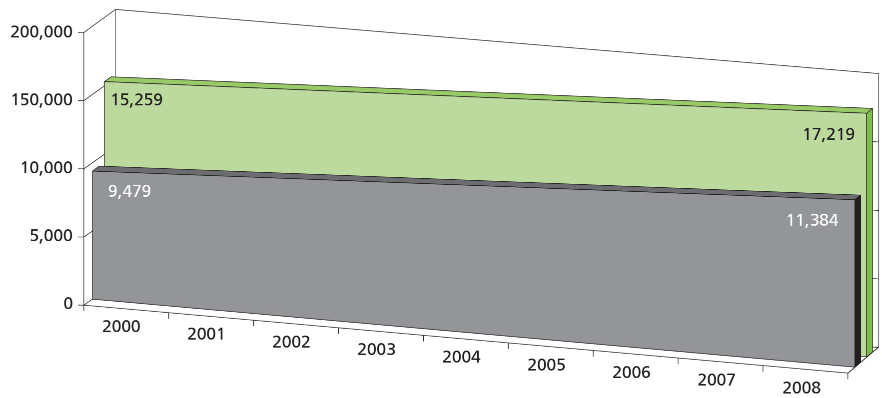
In 2008, the average level of **R&D employment** in EU-27 reached 1.03 % of the workforce, which is nearly 12 % higher compared to 2000. All member countries that passed the 1.5 % threshold continue to mark growth in the share of R&D personnel. It has been most notable in Denmark (18 %), followed by Finland (11 %) and Sweden (6 %). Bulgaria is at the bottom, ahead of only Cyprus, Poland and Romania. However, in terms of the pace of change, Romania marks one of the highest rates, with nearly a 29 % increase in the share of R&D personnel in the workforce. **While Bulgaria marks a positive change, it hardly exceeds 2 %, which shows that the country continues to lag behind.**

**Figure 31. Personnel, % of workforce, in FTE equivalent, 2008**[43]




**Source:** Eurostat, 2010

**Figure 32. R&D personnel (total and researchers) in Bulgaria in FTE equivalent**




**Sources:** Eurostat, NSI, 2010

[42] *A More Research-Intensive and Integrated European Research Area;* Science, Technology and Competitiveness key figures report 2008/2009, Directorate-General for Research, European Commission, 2009. http://ec.europa.eu/research/era/pdf/key-figures-report2008-2009_en.pdf

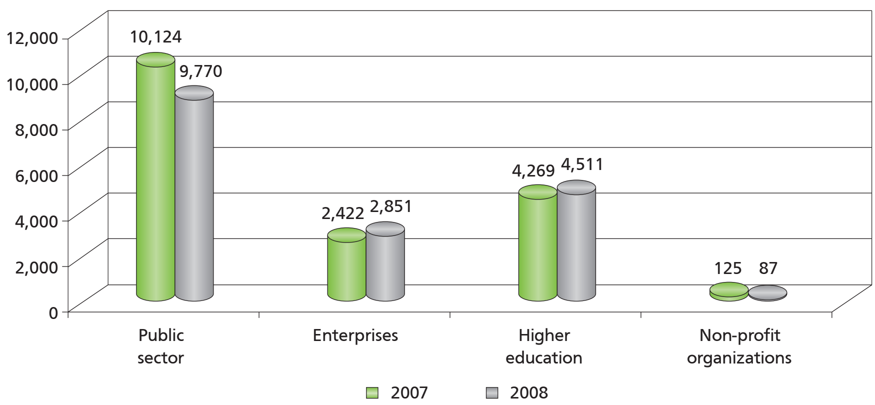
[43] The data on Greece and France are for 2007.

By preliminary NSI data for 2008, R&D personnel in Bulgaria amounts to 17,219 people in full employment equivalent, marking a nearly 13 % increase from 2000. The number of researchers, who constitute the highest-qualified category of R&D personnel, reached 11,834 in full employment equivalent (or 66.1 % of total R&D personnel). This category displays the highest rate of growth (20 %) accompanied by a relative drop in the share of technical (decrease by more than 5 % from 2000) and support (increase of barely 6 % from 2000) staff.

In 2008, the R&D personnel distribution by sector remained unfavorable in terms of the desired shortening of the innovation process, more pronounced practical orientation of R&D, and stepping up the adoption of the newly developed or improved products/processes in business. Compared to earlier periods, the distribution of R&D personnel by sectors still runs contrary to European and world trends of a relative increase in their share in business compared to the public sector.

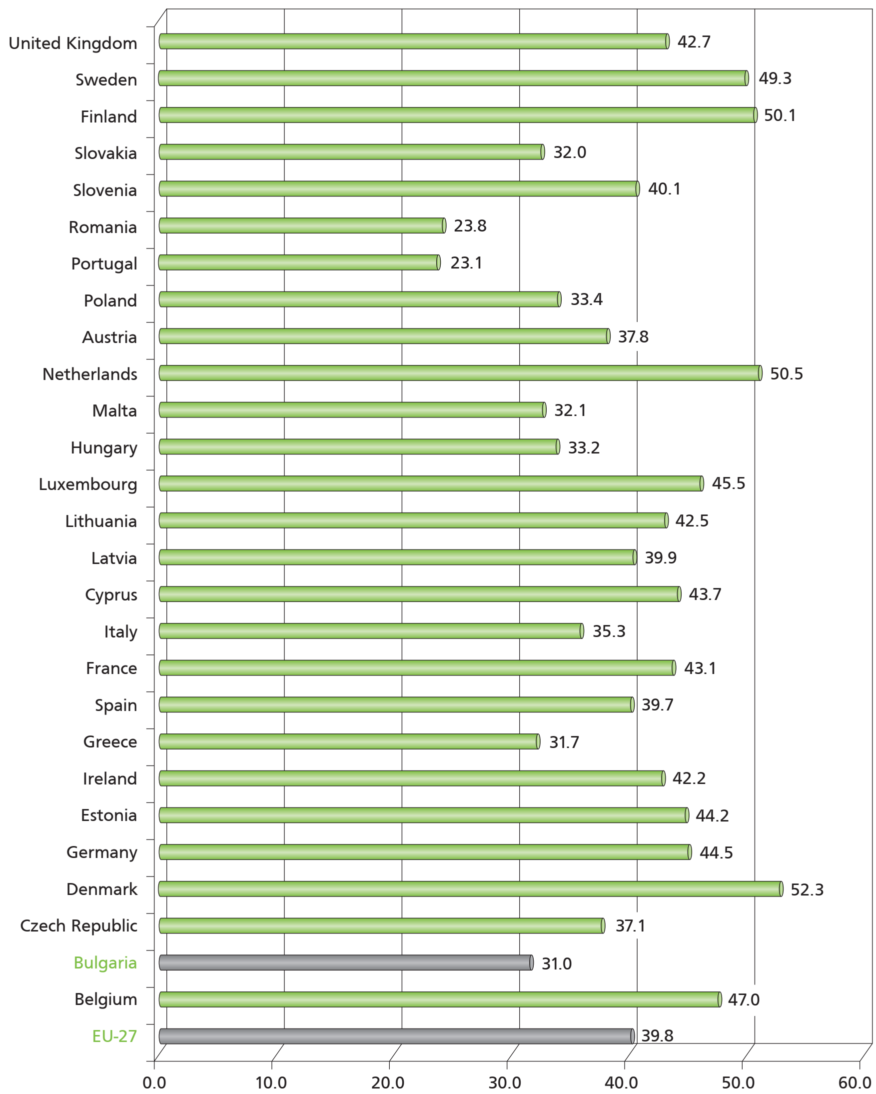
The indicator **R&D human resources** measures how well supplied the economy is with highly qualified personnel with the capacity to further the development of science and technology. By latest available data,[44] all member countries mark an increase in the share of those engaged in R&D out of all those included in this category (the general indicator comprises even those who possess the necessary qualification but were registered as unemployed in the respective period of time). **There are two exceptions – Lithuania with a decrease of close to 18 % and Bulgaria**

FIGURE 33. R&D PERSONNEL BY SECTOR IN FTE EQUIVALENT, BULGARIA




**Source:** NSI, 2010

FIGURE 34. PERSONS ENGAGED IN R&D[45], % OF WORKFORCE IN THE 25-64 AGE GROUP, 2008




**Source:** Eurostat, 2010

[44] Eurostat for the 2000 – 2007 period.

[45] The human resources engaged in scientific and technological work are measured in accordance with the definition laid down in the Canberra Manual and include both the population with successfully completed higher education in science and technology areas and those who do not possess such formal education yet perform work requiring it.

**with a decrease of nearly 3 %.** For the remaining countries the positive change ranges from 33 % for Ireland to 2 % for Finland. The increase of 31 % in the case of Romania comes close to the highest registered value for Ireland.

In Bulgaria, in 2008, **those engaged in R&D in the high-tech industrial sectors and knowledge-intensive** services as a proportion of total R&D personnel amounted to nearly 6 %, which is close to the EU-27 average (6.84 %).

The increase by nearly 102 thousand in the number of R&D staff over the period 2000 – 2008 has been accompanied by considerably more effective use of the potential of this personnel category. Whereas in 2000 the unemployed in this group amounted to 5.5 %, in 2008 their share dropped to 2.2 %. **However, there has been a persistent alarming tendency (equally confirmed by the data on researchers) of declining share of young people choosing science and technology as their preferred career path.**

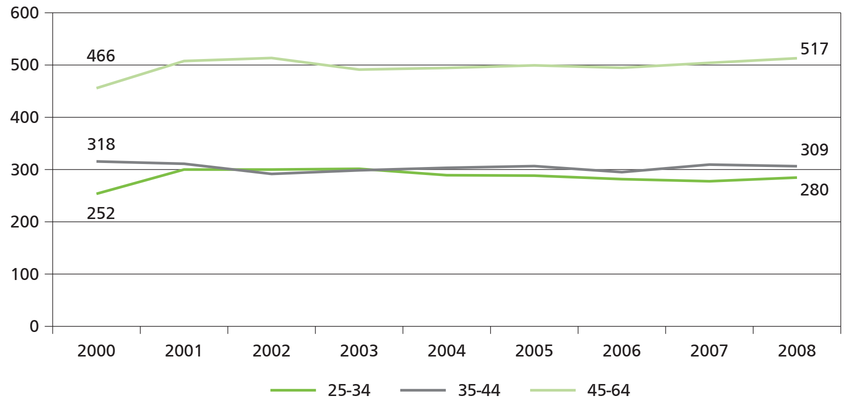
Further insight as to the potential of the country's human resources to create new technological knowledge, to facilitate its implementation and foster active demand for new/improved products can be gained through the **researchers** indicator.

In the 2002 – 2008 period, the number of researchers in Bulgaria fell by nearly 5 % from 21,952 to 20,829 people. Over the same period, academic staff on average in EU-27 (a category close in meaning but not fully overlapping with the researchers category) marked an increase by close to 13 %. The decline in the number of researchers in this country has been accompanied by another two unfavorable trends.

To begin with, the present relatively balanced distribution of researchers by scientific field may be disrupted over the coming years in favor of social sciences and the humanities. Without underestimating the latter's role as a field of application and implementation of social innovations, it should be noted that the declining relative share of scientists at university and government research units and laboratories in the areas of technical, medical, and natural sciences may put at risk the country's potential to create new technological knowledge and to train specialists in the fields of activity where it is most readily applied. **The decline is most significant as regards the number of scientists in the technical fields (nearly 12 %), followed by medical sciences (slightly more than 8 %) and natural sciences (3 %).** The same trend is present in agricultural sciences where by NSI data the number of scientists dropped by 3.6 %. These findings are confirmed by the data on the Agricultural Academy (AA) and the Bulgarian Academy of Sciences (BAS).

Secondly, there is a process of aging of the scientific community, which is the outcome both of the low appeal of a career in science to young people and of their deficient performance (protracting the duration of doctoral study, working on dissertations of little scientific and/or practical contribution, dropping out of research programs and academia to pursue other career paths, mostly out of financial considerations) in the process of planning and pursuing a professional career in science.

**Figure 35. PERSONS ENGAGED IN R&D IN BULGARIA, BY AGE GROUP, THOUSANDS**




**Source:** Eurostat, 2010

## Box 5. HUMAN RESOURCES IN SCIENCE AND TECHNOLOGY: AGRICULTURAL ACADEMY

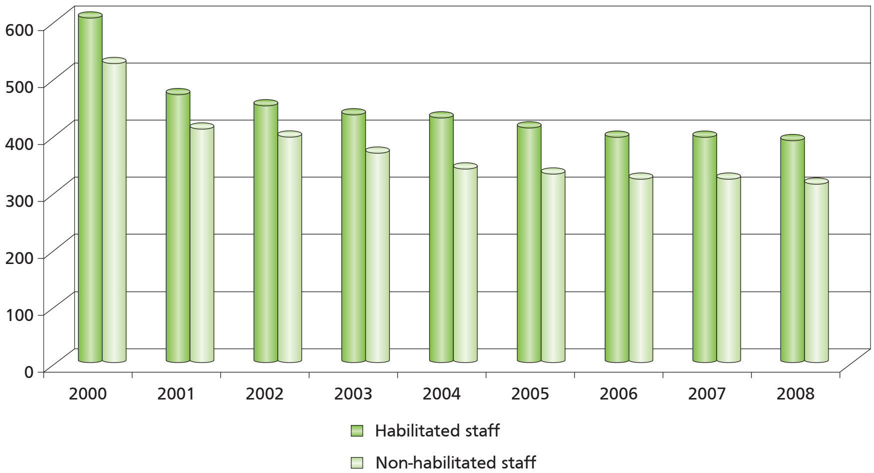
The Agricultural Academy (AA) conducts scientific and applied research, service and support activities in the fields of agriculture, animal farming and the food-processing industry. The AA comprises 48 units, of which 25 research institutes, 22 experimental stations, and the National Museum of Agriculture.

**Potential:**
The decentralization of research activity at AA into 25 regional units allows scientific coverage of the whole country.

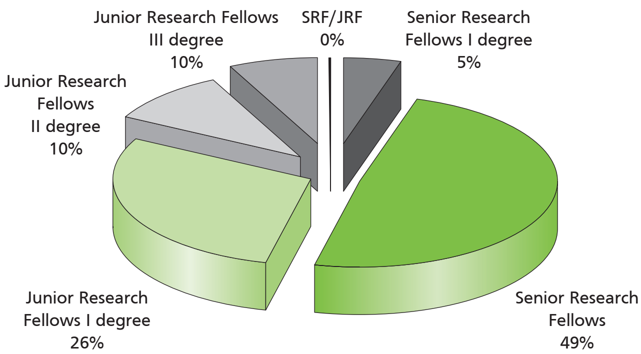
The applied focus of the AA research projects and support activities bring the results of scientific activity as close as possible to the very problems of agricultural farms they aim to address.

More than two-thirds of the copyright protected technological knowledge in this country in the field of agricultural sciences is owned by AA (more than 316 certificates for new plant and animal species issued by the BPO by the end of 2008).

**AA RESEARCH STAFF QUALIFICATION STRUCTURE BY ACADEMIC DEGREE AND TITLE IN 2000 – 2008**




**AA RESEARCH STAFF QUALIFICATION STRUCTURE BY ACADEMIC DEGREE AND TITLE IN 2008**




**Challenges**
Plummeting number of scientists at the Academy – over the 2000 – 2008 period, the decline has been in the range of 40 %.

Marked imbalance in staff qualification structure at the research institute level – the ratio of habilitated to non-habilitated staff members ranges from 10.0 (Institute of Agricultural Economics, Sofia) to 0.1 (Institute of Fishing Resources, Varna).

In excess of 54 % of the AA staff members are aged over 50 years, of whom one-third are over 60.

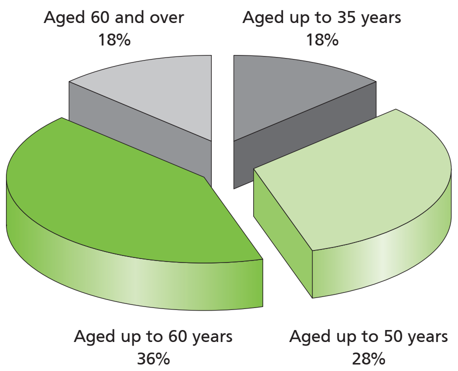
Effective mechanisms have not been put in place for speedy practical implementation of scientific findings – high-yield plant varieties and new animal breeds, complex soil cultivation and agricultural production technologies. Medium-sized and small farms are unaware of opportunities for collaboration with AA institutes.

**Scientific works and publications, 2008**

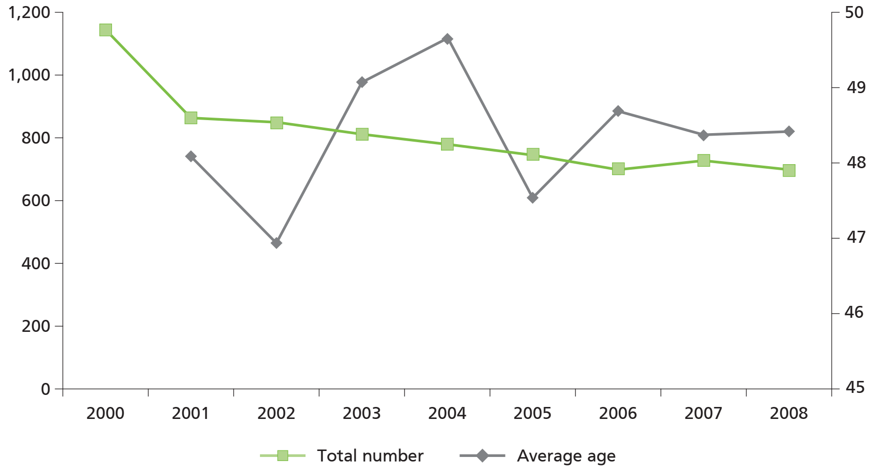
| International journals with impact factor | International journals without impact factor | Collections of papers from international events | Bulgarian journals, works of higher education institutes | Collections of papers from national conferences | Monographs and books | Popular science articles |
|---|---|---|---|---|---|---|
| 40 | 118 | 462 | 522 | 226 | 82 | 443 |

## Box 5. HUMAN RESOURCES IN SCIENCE AND TECHNOLOGY: AGRICULTURAL ACADEMY (CONTINUATION)

**AGE STRUCTURE OF AA ACADEMIC STAFF, 2008**




**TOTAL NUMBER AND AVERAGE AGE OF AA ACADEMIC STAFF**




**Source:** Annual Report 2008, AA, 2009

## Box 6. HUMAN RESOURCES IN SCIENCE AND TECHNOLOGY: BULGARIAN ACADEMY OF SCIENCES

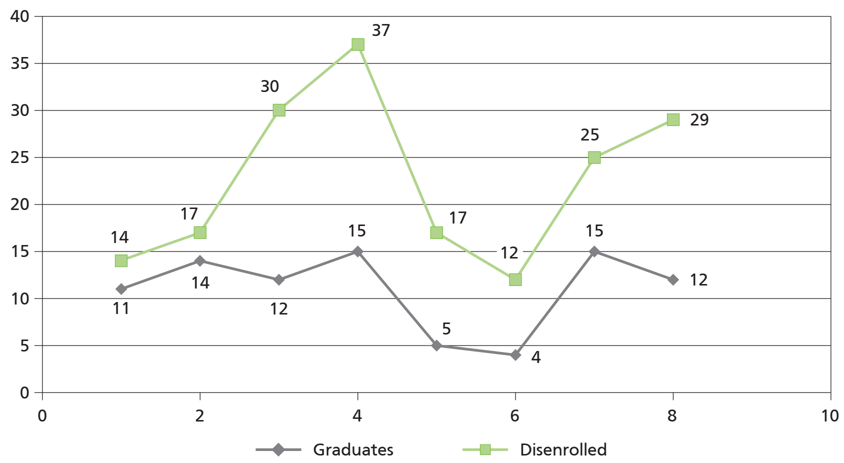
The Bulgarian Academy of Sciences (BAS) was founded 140 years ago. At present its activity falls into four main areas: fundamental research, applied research, education, scientific services to the Bulgarian government and public. BAS comprises 74 research units distributed as follows by scientific field: mathematical sciences (5), physical sciences (9), chemical sciences (8), biological sciences (16), earth sciences (11), engineering sciences (7), humanities (11), social sciences (7), as well as 11 specialized units, for the most part based in the city of Sofia. The staff of BAS numbered 7,641 in 2008, of whom 47.6 % (or 3,638 people) researchers.

**Potential:**

BAS has an impressive record of international collaboration – it maintains relations with 35 countries across the world and more than 40 foreign academies of sciences and other scientific institutions; takes part in EU framework programs, COST, EUREKA, PHARE; is a member of a number of international governmental and non-governmental research organizations; takes part in the NATO research programs.

Employing 17 % of the academic staff in this country, BAS accounts for about 60 % of the annotated scientific publications and successful project applications under international EU and NATO research programs.

**BAS GRADUATES AND DISENROLLED DOCTORAL STUDENTS, NUMBER, 2008**



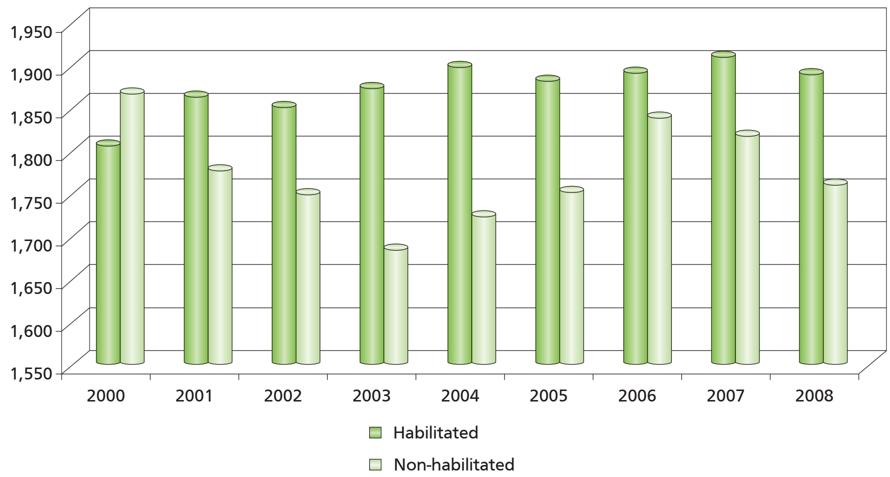
## Box 6. HUMAN RESOURCES IN SCIENCE AND TECHNOLOGY: BULGARIAN ACADEMY OF SCIENCES (CONTINUATION)

Additional project financing has been increasing consistently and the amount of 55 million levs reached in 2008 constitutes a nearly 11-fold increase from 2002.

**Challenges:**
BAS constitutes a mega structure with the ambition to conduct the bulk of fundamental and applied research in this country, with strong geographic concentration and a complicated management structure.

The spending of public funds on scientific, research, and innovation activities is not managed by the principal body administering government funds (Ministry of Education, Youth and Science), which is a precondition for their ineffective spending.

**SCIENTISTS AT BAS, 2000 – 2008**




As regards patent and licensing activity, the pattern for the country as a whole is applicable to BAS as well – the bulk of the applications and patents maintained are in the name of the inventor rather than the scientific unit in which the respective invention was developed

**Human resources and outcomes of research at BAS by field of science, 2008**

| Field of science, Institute* | Number of scientists | Number of doctoral students 31.12. | Scientific publications in international journals and periodicals per scientist | Total publications per scientist | Patents** | |
|---|---|---|---|---|---|---|
| | | | | | Patents maintained | Patents applied for |
| BAS – total | 3638*** | 616 | 0.55 | 2.36 | 54/84 | 74/95 |
| | | | | | | |
| Mathematical sciences | 313 | 63 | 0.92 | 2.61 | 2/1 | 3/0 |
| Physical sciences | 509 | 44 | 0.81 | 1.67 | 10/5 | 12/15 |
| Chemical sciences | 443 | 57 | 0.82 | 1.70 | 6/45 | 10/50 |
| Biological sciences | 684 | 121 | 0.66 | 1.98 | 5/21 | 3/22 |
| Earth sciences | 517 | 70 | 0.36 | 2.09 | 3/11 | 10/7 |
| Engineering sciences | 359 | 46 | 0.16 | 1.35 | 28/1 | 36/1 |
| Humanitarian sciences | 508 | 119 | 0.35 | 4.47 | - | - |
| Social sciences | 264 | 96 | 0.17 | 3.34 | - | - |

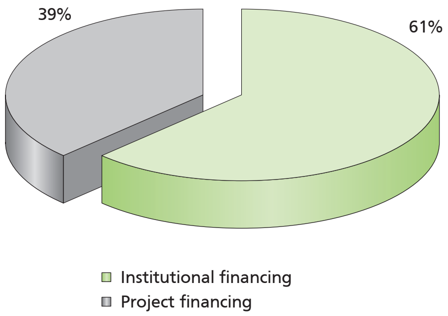
* Noted in parenthesis: Standard scientific assessment/Modified overall assessment on average for the units in the particular field on a 5-grade scale.

** Patents are recorded according to the name of the applicant – BAS Permanent Research Unit/Author or other.

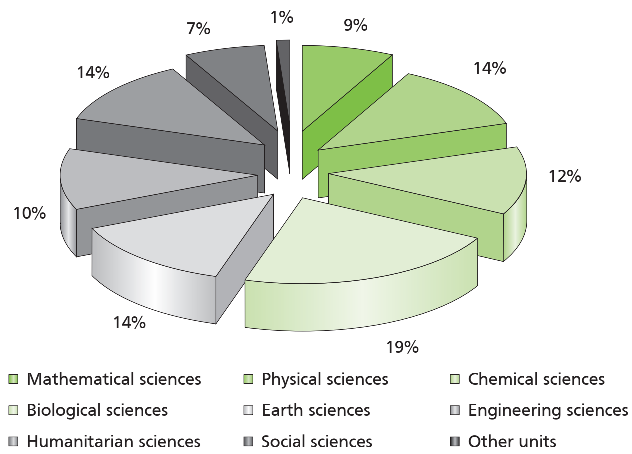
*** The total number includes 41 scientists from other BAS units.

## Box 6. HUMAN RESOURCES IN SCIENCE AND TECHNOLOGY: BULGARIAN ACADEMY OF SCIENCES (CONTINUATION)

**BAS FINANCING, 2008**




**BAS SCIENTISTS BY FIELD, 2008**



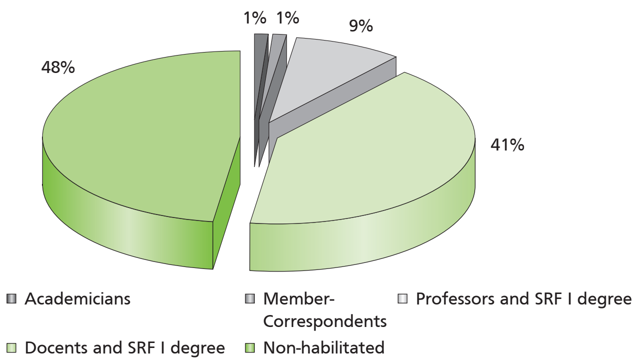

**BAS research financing by field of science, 2008**

| Field of science, Institute* | Number of scientists | Additional financing from projects and contracts | | | | Innovative research projects | |
|---|---|---|---|---|---|---|---|
| | | National Science Fund, number of projects | Bulgarian ministries, institutions and companies, number of projects | International companies and organizations, number of projects | Total funds received | Total projects | Additional financing, in thousands of levs |
| BAS – total | 3638** | 725 | 703 | 1234 | 55,152,949 | 2907 | 48,047 |
| | | | | | | | |
| Mathematical sciences | 313 | 30 | 108 | 127 | 5,384,689 | 332 | 2,386 |
| Physical sciences | 509 | 93 | 61 | 176 | 14,117,119 | 418 | 13,926 |
| Chemical sciences | 443 | 147 | 36 | 157 | 8,528,791 | 435 | 8,599 |
| Biological sciences | 684 | 243 | 137 | 280 | 6,595,887 | 691 | 6,596 |
| Earth sciences | 517 | 96 | 157 | 208 | 7,591,667 | 472 | 7,591 |
| Engineering sciences | 359 | 48 | 53 | 72 | 7,593,972 | 257 | 7,594 |
| Humanitarian sciences | 508 | 47 | 120 | 146 | 3,426,726 | 93 | 234 |
| Social sciences | 264 | 21 | 30 | 56 | 1,621,127 | 209 | 1,121 |

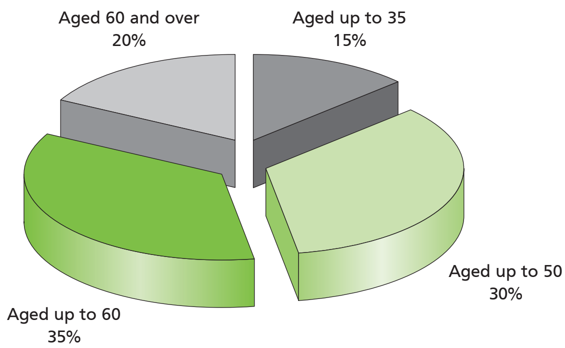
* Noted in parenthesis: Standard scientific assessment/Modified overall assessment on average for the units in the particular field.

** The total number includes 41 scientists from other BAS units.

**STRUCTURE OF BAS SCIENTISTS BY ACADEMIC DEGREE AND TITLE, 2008**




**AGE STRUCTURE OF BAS SCIENTISTS, 2006**



**Box 6. HUMAN RESOURCES IN SCIENCE AND TECHNOLOGY: BULGARIAN ACADEMY OF SCIENCES (CONTINUATION)**

The assessment conducted by European experts at the end of last year of the scientific level of BAS units confirmed that some BAS institutes have the potential for international competitiveness but fell short of providing most of the answers as to the future directions of development of the organization. The more notable reasons included the following: the experts (scientists themselves) applied criteria of assessment of the outcomes of research that did not take into account their potential for practical implementation; there were certain limitations on the supply of information for the purposes of the analysis and assessment; the analysis did not examine the compliance of publicly funded research with the established national priorities for the country's economic development.

The reform is still pending at BAS and, while it needs to be supported from without, it would be doomed unless the committed involvement is ensured of the researchers from within.

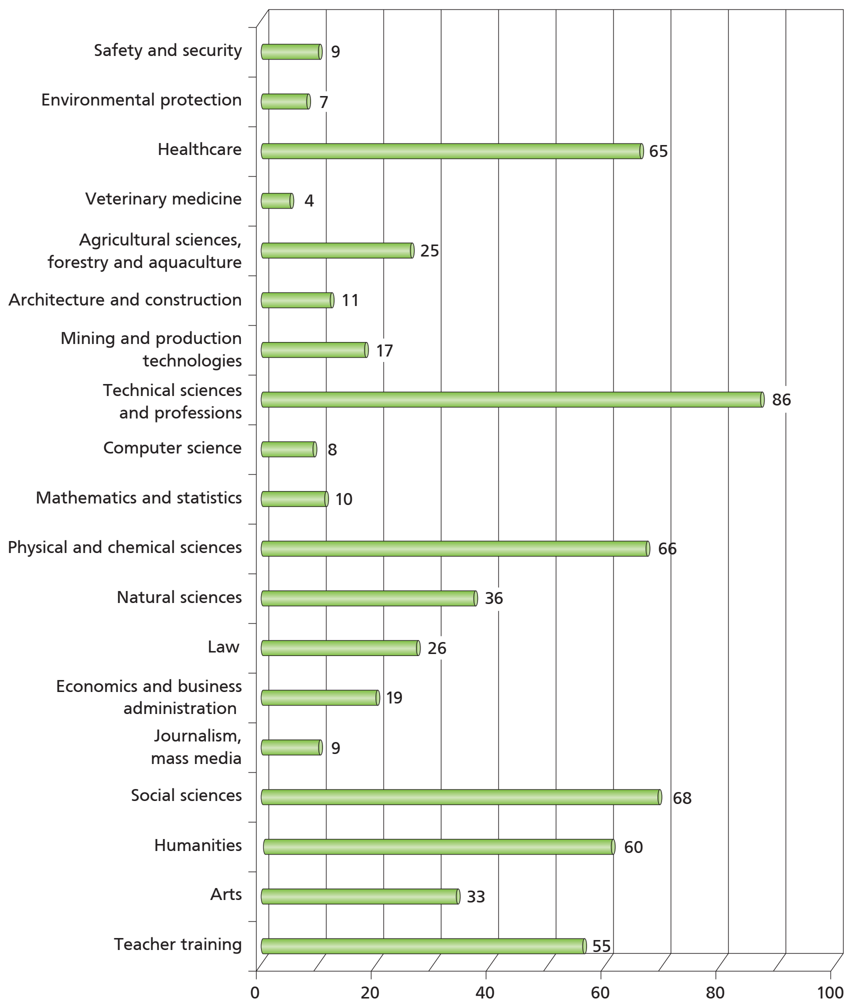
**Sources:** BAS Report, 2006 and 2008; Report of the Committee for the Scientific Assessment of BAS Institutes, November 30, 2009

## Development Potential

The noted trend for EU-27 to surpass the US and Japan in terms of increase in the number of R&D staff applies equally as regards the growing number of **doctoral graduates.** By Eurostat data, as of late 2005, their number in EU-27 reached 100,000, which constituted an increase of 4.8 % on an annual basis, versus 53,000 doctoral theses accepted in the US (+3.3 %) and 15,000 in Japan (+4.6 %). Two of the largest economies in EU-27 account for 40 % of the doctoral graduates – Germany, with more than 24,000 people, and United Kingdom, with approximately 16,000. In excess of 5,000 doctoral students successfully complete their studies in the science-and-technology fields of education[46] in Germany, United Kingdom and France as a whole.

**Since 2005, Bulgaria too has registered an increase in the number of doctoral graduates with an all-time high on an annual basis reached in**

**Figure 36. NUMBER OF HIGHER-EDUCATION AND DOCTORAL DEGREES AWARDED, BY FIELD OF SCIENCE, 2008**[47]




**Source:** NSI, 2010

[46] According to ISCED97, the science-and-technology fields of education are: life sciences (ISCED42); physical sciences (ISCED44); mathematical sciences and statistics (ISCED46); computer science (ISCED48); technical and engineering sciences (ISCED52); production and processing sciences; (ISCED54); architecture and construction (ISCED58).

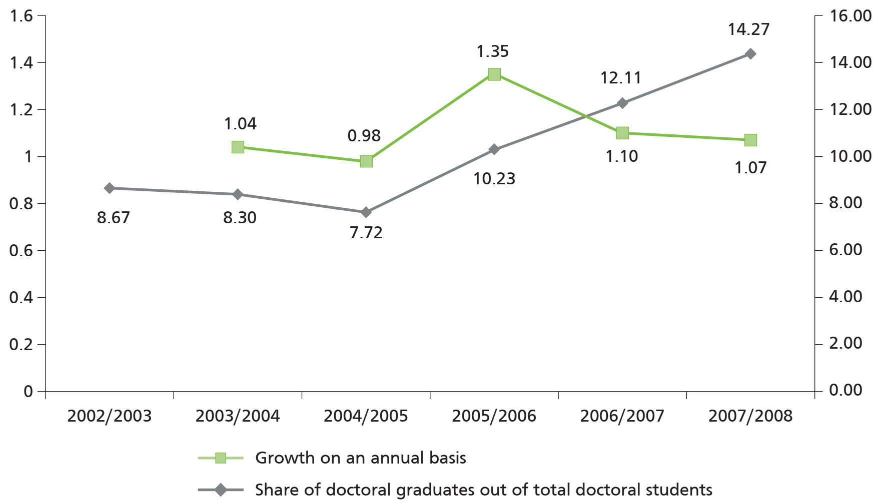
[47] The data concerning the fields mining and production technologies and veterinary medicine are for 2007.

**the academic 2005/06, when the increase amounted to 34.7 %.**

The number of graduate students in the academic 2007/2008 was 453 less than the previous year and this drop of nearly 10 % was registered for the second consecutive year. The shrinking number of graduate students is the outcome of two opposite trends – increasing number of doctoral graduates and decreasing number of newly enrolled doctoral students, which finds confirmation in the continually increasing share of graduates in the total number of doctoral students.

In 2008, the latest year for which NSI has released official data, 36 % of the doctoral students were in science-and-technology fields. Their share in the population in the 20-29 age group in 2006 (0.22 %) was twice as large as their share in 2000. The leaders in this respect are Finland (1.36 %) and Sweden (0.83 %) and among the new member countries, the Czech Republic (0.68 %). Austria is the only country that appears to be losing ground compared to 2000, with a decrease amounting to more than 30 %.

**Figure 37. DOCTORAL GRADUATES: INCREASE ON AN ANNUAL BASIS AND SHARE OUT OF TOTAL NUMBER OF DOCTORAL STUDENTS IN THE PERIOD 2002-2008, %**




**Sources:** Eurostat, 2010; NSI, 2010

# Education Level, Quality of the Education Product, and Lifelong Learning

The indicators concerning the level of education and the share of higher-education graduates, particularly in science and technology show the availability and changes in the pool of qualified human resources as an essential precondition for successful implementation of innovation. An important characteristic of the human capital to modern economies is the skill to acquire new knowledge and improve one's education and qualification – an immediate result of involvement in formal and informal lifelong learning.

## Has Bulgaria been training more researchers?

Since 2000, EU-27 has registered a marked upward trend as regards the number of **university graduates** both in absolute terms and as share in the population in the 20-29 age group. Europe encourages enrollment in bachelor and master degree programs through the measures to develop the European Research Area and the European Higher Education Area, as well as by implementing the goals of the Bologna process (student and teacher mobility, credit acquisition and transfer system).

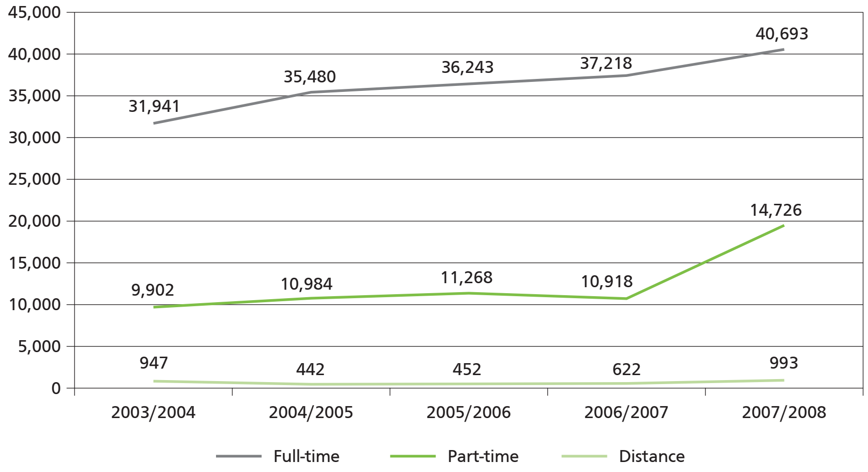
Fully in line with this trend and regardless of the negative demographic characteristics, the number of newly enrolled university students in Bulgaria continues to grow. In the past five academic years, their number has increased by 31 %, with the largest growth registered among part-time university students (more than 3.5 times). The situation differs as regards full-time students – the 30 % increase in the number of newly enrolled students in baccalaureate programs comes close to the overall trend while professional baccalaureate programs barely register an 8 % increase. However, there is still no sufficiently reliable data on the quality of the education obtained both academically and in terms of practical value (relevance and business realization potential).

By Eurostat data, in the past nearly 10 years in the EU-27 there has been a steady decline in the number of university graduates in science-and-technology fields – an indicator that measures the pool of qualified workforce available to the economy in areas of importance to the development of technologically innovative products and processes. A similar, though more pronounced, trend is observable in Bulgaria. After an increase up to 2002, there has been a decline of nearly 9 % (compared to 6 % decrease in EU-27 since 1998).

Structurally, the distribution of higher-education graduates by field within EU-27 has not undergone any significant changes in the past ten years. The increase in relative share amounts to 10 % for social science, law and economics graduates and 5 % in the field of healthcare, while there has been a drop in the relative share of graduates in the fields of education, humanities, natural, technical and agricultural sciences ranging from 2 to 17 %. In Bulgaria, the changes have been more conspicuous – from a 61 % drop in the field of education to a 51 % increase in natural sciences.

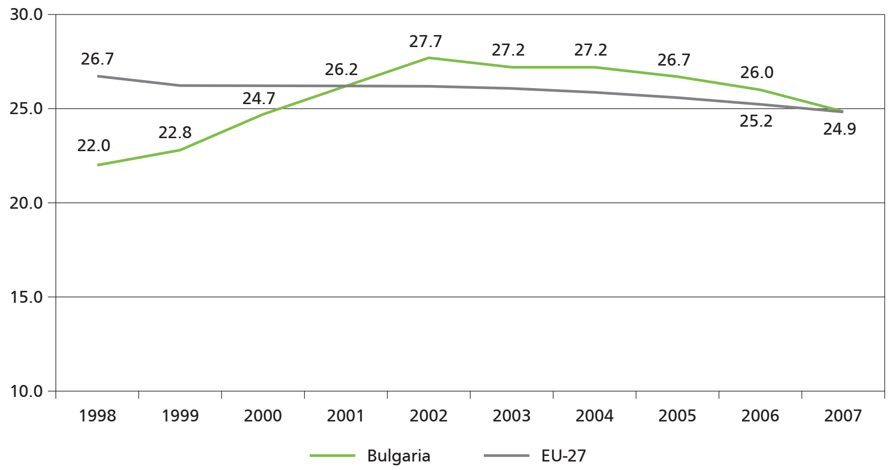
The most alarming tendency is to be found in the fields of healthcare and social sciences. The withdrawal of students from these specialties contravenes the modern priorities of advancement of science and technology (nano- and biotechnologies, adopting ICT-solutions in medicine) and the demographic trends in Bulgarian and European society (aging

**Figure 38. NUMBER OF NEWLY ENROLLED STUDENTS – BULGARIAN CITIZENS, BY FORM OF EDUCATION**




**Source:** NSI, 2010

**Figure 39. HIGHER EDUCATION GRADUATES IN SCIENCE-AND-TECHNOLOGY FIELDS, % OF ALL STUDENTS**[48]




**Source:** Eurostat, 2010

population and increasing burden on the social systems of the member countries).

## Lifelong Learning

The acquisition of new knowledge and skills is a precondition for the speedier dissemination of technological innovations in the various areas of public life and as the only way of counteracting the trend of the level of qualification of those in employment falling short of the dynamic development of science and technology and the new knowledge with a multidisciplinary pur-

[48] Includes all students who have been awarded a baccalaureate (ISCED 5a) or higher degree according to the Classification of Fields of Education and Training (KOO-2008): natural sciences (KOO42), physical and chemical sciences (KOO44), mathematics and statistics (KOO46), computer science (KOO48), technical sciences and technical professions (KOO52), mining and production technologies (KOO54), architecture and construction (KOO58).

pose. The advancement of the so-called horizontal technologies (ICT, nano- and biotechnologies) and the solutions they offer in all other sectors of the economy, as well as the now mandatory energy efficiency requirements necessitated by the deepening climate changes impose new requirements for the human capital – to possess in-depth knowledge in specific professional areas as well as the skill to combine and use know-how developed in different fields and for different purposes.

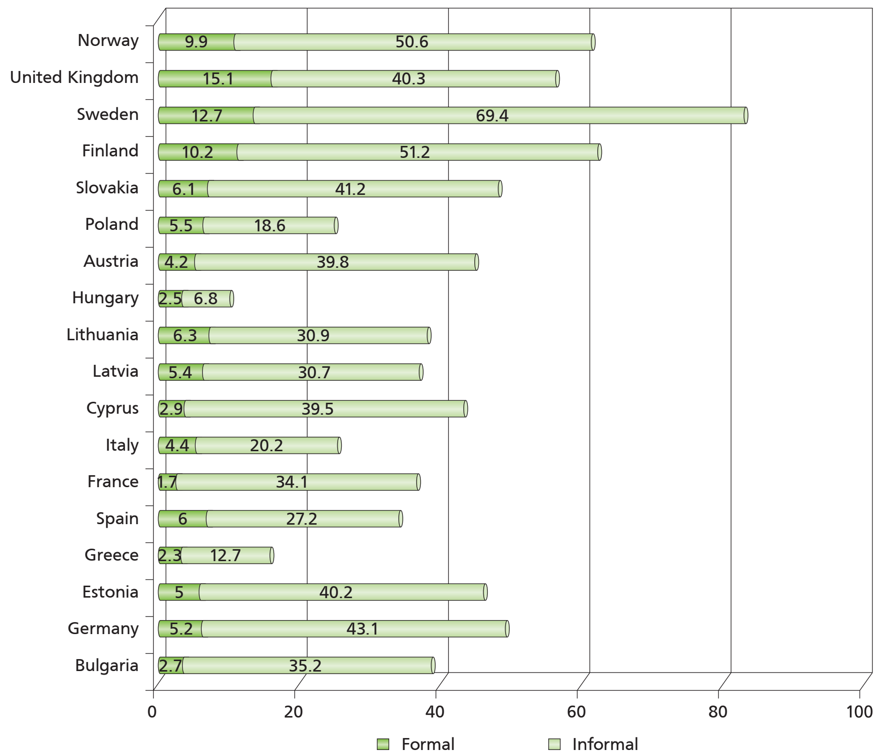
The 2007 Adult Education Survey by Eurostat showed that one-third of the EU-27 population aged 25-64 years participated in formal and informal learning.[49] About 80 % were involved in informal learning, which is less expensive and time consuming. Another 6 % were engaged in formal learning.[50]

Bulgaria's poor record in this respect (only France, Greece, and Hungary out of the countries surveyed had lower indicators regarding participation in formal training) is indicative of lasting and difficult problems in the education system (the focus is more on providing knowledge than teaching the skills to acquire new knowledge) and in business (spending on staff training is still not viewed as a long-term investment and ways have not been found to retain the anticipated positive effect within the company).

In a time of economic crisis (as is to be expected for the Bulgarian economy for at least another year), the measures to encourage participation in continuing education are not among the priorities on the agenda. Even after 20 years of transition towards establishing market conditions and democracy the list of pending reforms is still applicable: education reform; reform in the field of science and research; overcoming the fragmentation within the national innovation system; enhancing the innovation potential of the economy and increasing business innovation intensity.

Regardless of the abundance of strategic and program documents, Bulgaria still lacks a critical mass of people ready to take risks, to work hard to achieve their goals and to face new challenges. Knowledge could hardly become the new medium of exchange in Bulgaria unless a few but clear-cut priorities are defined even in a time of crisis. It is further indispensable to lay down the conditions and procedures for their implementation and to mobilize the available resources to achieve this goal.

**Figure 40. PARTICIPATION IN CONTINUING EDUCATION, %**




**Source:** Eurostat, 2009

[49] Formal learning takes place at schools, colleges, universities, specialized higher education institutions or other education establishments on the basis of a pre-established curriculum and set number of academic hours. An education degree is obtained as a result. Informal learning occurs in the form of courses, conferences, seminars, private lessons or other forms, regardless of whether it is of relevance to the trainee's current or future work or is motivated by personal, family or social reasons. Self-learning takes place in the absence of a tutor, outside the formal education system, and is aimed at improving the individual's knowledge and skills.

[50] Boateng, S.K., *Significant Country Differences in Adult Learning,* Population and Social Conditions, Eurostat, Statistics in focus, 44/2009.