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SCIENCE POLICY: A TOOL FOR COPING WITH CHALLENGES

Adolf Filáček*

Abstract

The article deals with selected aspects of science and research policy of the EU (R&D policy) relevant to the development of innovation culture. Present changes in this field are related to the changes in production and distribution of knowledge, to the new goals and priorities in science and research of the European knowledge society, and to the new social, economic, and political challenges, presented by the broadening and intensifying global competition. The study points out the role of the central administration of science by the European Commission, the function of the Framework Programs of the EU, and its consequences for the science policy in the Czech Republic.

Keywords: *science and research policy of the EU; science and research policy of the Czech Republic; innovation culture*

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1. Introduction

The European Union intends to strengthen its standing in a globalizing world (the so-called Lisbon process concentrates especially on the economic competitiveness). European societies therefore need to increase their competitiveness in different aspects, and this requires an active approach on the part of their citizens, seeking to solve problems at the European, national, and regional levels. The citizens will be demanded to become active actors in the European societies, contributing to their development, while respecting cultural, ethnic, and linguistic differences. Without doubt, an important role will also be played by the social sciences and humanities – together with a constant educational activity and lifelong educational doings of the citizens.

The political and economic transformation of the Central and Eastern European (CEE) countries in the 1990s has also affected their research system, mainly in the social sciences and humanities. The radical changes, including also more or less deep decrease in financing, initiated major reforms of the R&D systems. The implementation of these reforms [Provazník, Filáček, Křížová-Frýdová, Loudín, Machleidt 1998] was constrained by economic and fiscal crisis, which followed the transition to a market economy. The ways and decisions how to cope with both new problems and opportunities were different in CEE countries according to their situation, position of research system, and also traditions and cultural aspects [Mayntz et al. 1998]. There are both general trends and significant differences between CEE countries and research disciplines. The differences are in financial threats and coping strategies, personnel reductions, forms of institutional transformation, relations between academies and the university sector, support of basic and applied research, engagement of business and enterprise sector in research activities, and new patterns of international collaboration in research.

2. Contemporary challenges for Europe

The present world economic development, including the impacts of the financial and economic crisis, presents a number of challenges to the European Union: the world that used to be bipolar has become multipolar in many aspects. This change manifests itself also in the fields of science, research, development, and innovation processes.

China and India have become important agents on the world scene in many fields of research; generally it can be said that the Asian influence has intensely grown, regarding especially applied research. The United States and Japan have been traditional rivals of the EU in this respect; most of international comparisons dealing with EU have taken these dominant partners into account. If the recent trends will continue, the United States and Europe will be loosing their scientific and technological supremacy for the benefit of Asia. India and China could account for approximately 20 %[1] of the world's R&D, i.e. more than the double of their current share. Since 2000 the intensity of the Chinese research effort has increased by almost 50 % and it now has a greater annual volume of publications than Japan [Research EU, 2009: 8]. In the field of science, as at the economic, political or military levels, the growing strength of emerging Asia is rapid and dramatic.

The EU currently spends about 1,85 % of GDP on R&D; in monetary terms it represents annual expenditures of about EUR 210 billion. But there is a wide range of expenditures per individual member states; it is from below 0,5 % to nearly 4 % of GDP across EU countries. Moreover, 80 % of these expenditures come from only five countries: Germany, the UK, France, Italy, and Spain [Eurostat 2008]. Research intensity in ERA is generally growing (Table 1); from 27 Member States 20 of them have increased the share of R&D budget in total expenditures (GERD) since

[1] For trends estimation see *The World in 2025* [2009: 10].

2000 and in 12 countries this increase was more than 10 % and in Estonia and Latvia more than 50 %.

By comparing EU-27 with United States and Japan (Table 1), it is possible to say that except the share of publications worldwide and number of researchers (partially also in R&D effort and number of researchers (FTE) per 1000 workers, where the trend since 2000 is remarkable), EU is not dominating and having negative trends.

Table 1: *Comparison of EU-27, United States and Japan in 2006 figures and trends since 2000*

Indicator	EU-27	U.S.A.	Japan
R&D effort (in billions of Euros)	214	274	118
Trend (real nominal numbers)	+15 %	+10 %	+22 %
Number of researchers (FTE - in thousands)	1 301	1 388	710
Trend	+18 %	+8 %	+10 %
Number of researchers (FTE) per 1000 workers	5,60	9,30	10,70
Trend	+12 %	+3 %	+11 %
Intensity of effort as % of GDP	1,84 %	2,61 %	3,39 %
Trend	–1,2 %	–4,5 %	+11,5 %
Share of private sector financing	55 %	65 %	77 %
Trend (for EU 2000-2005)	–3 %	–7 %	+6 %
Share of publications worldwide	37,6 %	31,5 %	7,8 %
Trend	–5 %	–6 %	–16 %
Share of patents (2005 figures) worldwide	30,9 %	33,1 %	16,3 %
Trend	–14 %	–17 %	+56 %

One of the problems, which should to be solved, is the so-called European Paradox: although R&D is of world-standard in Europe (it is indicated by quality of publications), and the R&D expenditures are growing – the scientific achievements have little impact on generating and diffusing innovation (patent statistics also confirm the paradox).

EU can serve, by building the European Research Area (ERA), as a model of national and regional integration, but the governing system of ERA is complicated. In most member states there exists a multitude of governmental actors and research priorities, which is necessary to engage into a common research stream. Europe is losing ground, hindered by its fragmented past (not only in R&D). The well known Lisbon target – 3 % of European GDP – is very far, mainly due to private sector shortcomings.

Europe's present position is also based on some advantages, but multipolar global scene in world R&D competition is influencing it. That is the reason why for Europe it is very important to be competitive in R&D, and to find such research and innovation strategy, which would contribute to sustainable development of the so-called European knowledge society. And the contemporary European research labyrinth (consisting of different European, national, and regional levels) should be transformed into European Research Area without barriers.

3. ERA and science policy in the EU

The creation of ERA is the answer to the above-mentioned challenges in the spheres of science, technology, and innovation policy. The current, rather rigid constellation of "27+1" (27 national and 1 pan-European policy) should be substituted by a more dynamic and open model with better connections to national policies of research and development. ERA is closely connected with the expectations that higher coordination together with solidarity and cohesion can better distribute different resources (both financial and human capacities), reduce the negative external fac-

tors resulting from insufficient informedness of participants and mobility of resources, and so exceed the "critical mass" in human potential and research infrastructures.

The creation of ERA tends towards the creation of tools that would increase the number of research projects coordinated within the whole of Europe. Till now the all-European resources of financing present about 6 % of total overall R&D expenditures; this share is considered to be insufficient for the realization of common European science policy. The different European initiatives of joint research programs were experimentally attested in the ERA-Net projects of the 6th Framework Program and in some cases it was shown that these "bottom-up" based joint research programs,[2] financed by the "Common Pot" method, are effective and interesting for smaller countries.

Another important activity, which is initiated, subsidized, and coordinated by the DG Research EC, is the creation of procedures of the so-called Joint Programming (within the framework of the so-called "EC Indicative Strategic Research Roadmap"). In practice, this means that soon a joint coordination and financing of projects in three large areas should be established. One of them is related to research in humanities and social sciences; it is the thematic conglomerate "cultural heritage, climate change and security." In these areas the member states of the EU should finance projects by the "Common Pot" method. Joint Programming will undoubtedly change the current situation in financing European science and research.

[2] The Academy of Sciences of the Czech Republic is a partner in a HERA project (Humanities in the European Research Area, see www.heranet.info), financed from the 6th Framework Program. 14 HERA partners have established Joint Research Programmes HERA for two topics: „Cultural Dynamics" and „Humanities as a source of Creativity and Innovation". Unfortunately, the Academy of Sciences of the CR cannot take part in them (ask for finances for the Czech participants in projects submitted in these two programs), since from legislative reasons it was not possible to contribute financially by the „Common Pot" method.

Until now, the main tools for building up ERA were the EU Framework Programs. In the current finishing 6th Framework Program the participation of Czech research teams was relatively successful. 1.068 Czech teams participated in 876 projects; this is approximately 1.6 % of the participation of all EU Member States (but it is less than the share of the Czech Republic's population in the total EU-27 population). These data place the Czech Republic 21st in the EU-27. If we rank states by absolute numbers of participations in FP6 projects, the Czech Republic comes 16th. Czech participants enter projects with an overall budget of EUR 189.808 millions and seek aid of EUR 130.056 thousands from the Commission.[3]

The European Research Area is being created not only because of more effective administration of research and innovation projects, but also because of enhancing the attractivity of research professions and stimulating interest in science and research. The future unified ERA should enable researchers:

- To move and interact, to benefit from high-level infrastructures;
- Work with networks of different European research institutions;
- Share, teach, value, and use knowledge effectively for social, business, and policy purposes;
- Optimize European, national, and regional research programs in order to support the best research throughout Europe;
- Develop strong links with partners around the world;
- Enable for Europe to benefit from worldwide progress of knowledge;
- Contribute more effectively to global development and take a leading role in international initiatives to solve global issues.

[3] See data in [Analysis, 2009].

The new form and practice of research in European countries have and will have many new characteristics:

- Both personal and thematic networking of the top research facilities will appear, while new communication technologies, such as computer networks and the Internet, will be utilized;
- It will be necessary to finance on a larger scale some more extensive and more expensive projects and research facilities in Europe (i.e., CERN);
- It is necessary to find tools and resources for more proficient support and better investments into R&D (indirect tools of support by both the state and the EU, patent policy, support of risk investments into risk projects);
- To pay more attention to the support and development of social and ethical values relevant to research and the utilization of its outcomes;
- One of the most important changes includes the mobilization of human resources, i.e.:
- the creation of conditions for higher mobility of researchers and the implementation of "European" dimension into the scientific career within the European Union and other European countries;
- the support of excellent scientific specialists, especially in the front-end research centers, the appraisal of the work and role of women in research;
- better stimulation of young people to work in research and to pursue scientific careers; the goal is to make the best of experiences with successful transfer of research results into practice (i.e., into the innovation process or into other form of public utilization) and to use them with transfers on both regional and local levels;

- the support of women in their interest in working in science and research, the creation of legislative and financial conditions for fulfilling their roles both personal and professional;
- the involvement of European regions, non-profit sectors, and civic initiatives in research projects, where they should gain larger role in the processes of European decision making and distribution of finances for the research activities;
- the making of Europe into an attractive place for researchers from all around the world.

4. CZ situation: continuous changes of research system

In principle, the process of transformation can be divided into different stages. The first one, completed at all the types of Czech research institutions approximately between 1993 and 1998, was marked by a number of sweeping changes, primarily in the objective conditions of organising and funding the country's research system (mainly a legislative framework, a combination of institutional and a targeted research funding, the principles of privatisation).

As a result of the changes to date, foundations have been laid for the construction of a research system based on principles of democracy, free competition and support for top-level, internationally compatible research projects. In the Czech Republic, the research system has now been adjusted to the institutional forms applied in western democracies, and operates quite satisfactorily (at least in the sphere of basic research) under the competitive free market conditions and democratic pluralism.

Academy of Sciences of Czech Republic (ASCR)

The significant reduction of personnel in the year 1993 (50 per cent for ASCR as a whole, some institutes were abolished)[4] was carried out selectively on the basis of productivity and the promise of research field; the staff reductions were implemented using objective evaluation of both research teams and individual research team members. So in the next stages, namely in Academy of Sciences, became the system of evaluation an important part of the transformation. ASCR introduced the first cycle of its regular evaluations between 1994 and 1996, with the second cycle coming in the years 2000–2001, and the third cycle in 2004. Evaluation results were first taken into account in budgeting for 2002, and since then they substantially affect especially the accrual of expenses directed to science in the evaluated workplaces.

Ongoing evaluation at all levels constitutes an integral part of managerial work, encompassing also a differentiated manner of allocating funds to institutes and – inside the institutes – to individual research teams. The way of implementing this mechanism depends on the management of each academy institute individually. The last stage of ASCR transformation, which was finished in 2008, is the change in legislative framework (with the significant impact on financing) and involves the functioning of research institutes under the rules of the law for public research institutions.

Research in the university sector

Unlike the post-war development at Western European universities, a specific problem facing the Czech Republic is the fact that the country's long-standing separation of university education and training from academic research was accompanied by a general disregard and neglect

[4] In 1993 in ASCR 22 scientific institutes and four service facilities were abolished, and the number of personnel in the Academy of Sciences was halved as compared with 1989.

for the universally valid cultural, humanistic and social-critical roles of science. It is, therefore, only natural that the key goal of transformation in the Czech Republic was substantially to raise the share and quality of academic research. While correcting the current situation, efforts were made to accentuate the ethical and humanistic aspects of science and to devote more attention to the social responsibility of the research sector.

Throughout the period of transformation the Czech universities have seen a major upsurge. However, the level of research at some of the newly established university and research centers is below the general standards, while research has not been the primary concern of some of those facilities. Especially at smaller universities, situated away from the traditional university centers, the requirements for a high level of university teachers and research cannot be fully met.

On the other hand, one should welcome the fact that the process of differentiation has really occurred in Czech university education and training as anticipated. New centers of research and invention have been established with links inside the country and abroad. And unlike universities where top-level research can hardly be anticipated and where university education and training is likely to have different functions, distinctly research-focused universities are gradually shaping up in the Czech Republic.

Research in the business enterprise sector

Research and development organizations in the enterprise sector of the research formed the biggest component of the total system of the research and development (R&D). In the year 1990 these organizations employed 64 per cent R&D workers (i.e. 68 thousand workers); 88 per cent of them were engaged in the research within an industry. In 1990 the biggest part of them was employed in the machine-building industry (48 %), further in electrical industry (15 %) and in chemical industry (10 %). So these three

branches comprised about three quarters of the industrial research realized in the enterprise sector [Statistical 1993].

In the year 1991 number of these workers dropped to 44 thousand persons (to 65 %) and in 1992 to about 31 thousand persons (i.e. % of the original number of the year 1990). In 1995–1998 was the number of workers estimated to be 23 thousand persons. At present the personnel according to the Czech Statistical Office [see Research and Development Indicators 2008: Table 5] (more precise source needed) are about 13 thousands in FTE what means about 25 thousand employees as an average; most of them in manufacture of machinery equipment, instruments, motor vehicles, and other transport equipment, real estate, renting and business activities, research and development institutes, manufacture of chemicals, chemical products, and pharmaceuticals.

Privatization of the sphere of research and development (voucher privatization form)[5] in the Czech Republic was carried within the framework of so called „big privatization" in two waves. The first wave comprising 58 institutes with 13 000 employees, was completed in the year 1993. Additional 51 institutes with 14 000 employees was privatized in the following second wave.

Coping strategies

From the very beginning, there was no consonant opinion as regards the advancement of transformation within research community and the decision sphere. The old regime style bureaucratic practice of research and development management and deformations of its social functioning in the command economy were generally withheld. However, opinions concerning transformation capacity of existing research institutions scale

[5] Voucher privatization is a privatization method where citizens are given or can inexpensively buy a book of vouchers that represent potential shares in any state-owned company.

of state financing and state regulations of various units of research were markedly different. Moreover, part of the research community was aware of the fears associated with the continuity of the forty years long development of science and research system, of interests, aspirations and value attitudes, which were produced and reproduced by the system. The research community also feared what radical transformation of the science system can bring to the research personnel, especially disruption of long research programs and the loss of talented people.

In the first approach, it was thought proper that the transformation process should be headed to a clear final conception of the future research and development system, conveyed by definite and narrowly formulated priorities of the state science policy. In accordance with this attitude, the transformation of both science and research institutions and the whole system of science and research should get more or less uniformly organized form; it should represent a controlled process realized by decision organs in charge.

In the second approach, transformation was not primarily understood as a transition from one system of research and development to another, realized according to precisely defined procedures, but more as an opening of space for flexible and democratic pursuance of optimal alternatives, based on acquirement of certain elementary starting-points and principles corresponding with the overall political and economic direction of society. Among such principles we can find especially freedom of scientific work, scientific competition, and focus on the world's development trends of science, and other principles, on which systems of science and research are based in the advanced countries. Within this conception, transformation processes get more spontaneous and initiative form. They lean on the operation of natural mechanisms of selection and permanent pursuance of consensus in accordance with standard principles of scientific community.

If we analyze the transformation period of the development of the Czech science in the 1990's [Filáček 2009], we may say that after the radical

reduction of government funds into research in the early 1990's, the Czech Republic's science and research community did not resort to a defensive "survival strategy", but decided to take up public demands addressed to science together with the internationally recognized standards of evaluation of the quality of research. Following on from there, changes were made in re-orienting and restructuring research and in reducing substandard sections of the country's research potential which proved to be unable to adjust themselves sufficiently to the new conditions. Many researchers experienced the radical application of the new evaluation criteria as a shock, but a positive attitude to this step soon turned out to be a key to the success of the entire transformation of the Czech research institutions.

Present situation

Current situation in transition of Czech research and development system is mostly influenced by financing (both by its volume and procedures). The overall support of science, research, and development was in principle increasing for the last ten years (Figure 1), but it is still far to the Lisbon target of three per cent of GDP. Also the public financing of R&D performance from the governmental budget is still under the promised volume of 0.7 % of GDP (Figure 2) and the expenditures in enterprise research sector (BERD) are low not only in percentage of GDP, but also in real value of its volume (both in $ or PPP $).[6] This long-term deficiency of financial means for R&D was reflected in the past insufficient state of technical and information facilities in series of workplaces. At present helps the support of infrastructure building from the Structural Funds very much in this respect.

R&D personnel in the Czech Republic at 31. 12. 2008: total 74 500 physical persons, including 1/3 of females. Increase in personnel from

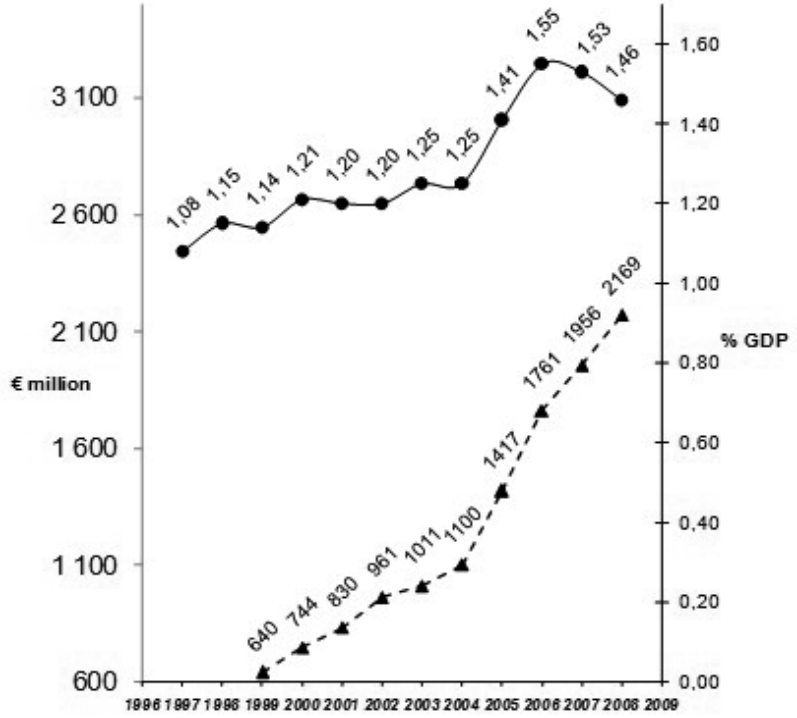
[6] More data see in [Analysis 2009].

2000 to 2008 is 140 % (average annual growth is 4.8 %). R&D personnel in FTE in 2008: 50 808; annual growth 3 %. Number of researchers at 31. 12. 2008: 44 240 physical persons; annual 2008 growth 4 % (average annual (2000-2008) growth 4.8 %). Total R&D CZ expenditures: 54 108 mil. CZK (2 164 mil. EUR); it means small annual decline (0.3 %). In 2000–2007 continuous growth 10.8 % to more than twice volume of expenditures. More than half (52 %) of expenditures came from BERD; the second were public sources (41 %) and the third were foreign sources (5.3 %). Sectors of performance: BERD 61.6 %, GERD 21 %, HERD 17 %, non-profit sector 0.4 %.

Concerning the number of researchers (and generally all R&D employees) employed in the field of research and development per one thousand labors, it represents roughly one half of the average of that number recorded in developed EU countries. Namely for the Czech Republic, it is 5.1 researchers in FTE (Full Time Equivalent) per 1 000 workforce. In 2006, the highest number of researchers per 1,000 people in the workforce was reported, as in the case of R&D personnel, in the Scandinavian countries (Finland – 15.1, Iceland – 13.0, Sweden – 11.9). The Czech Republic (5.1) and Slovenia (5.7) achieved values close to the EU-27 average (5.7). The other new Member States were again below the EU-27 average with this indicator (Slovakia – 4.4, Hungary – 4.1, Poland – 3.5). In the EU-27, researchers accounted for 59 % of all R&D personnel. The highest shares of researchers in research personnel were recorded in Korea (84 %), Portugal (82 %), China (81 %) and Poland (81 %). In the Czech Republic, 55 % of all R&D personnel were researchers.

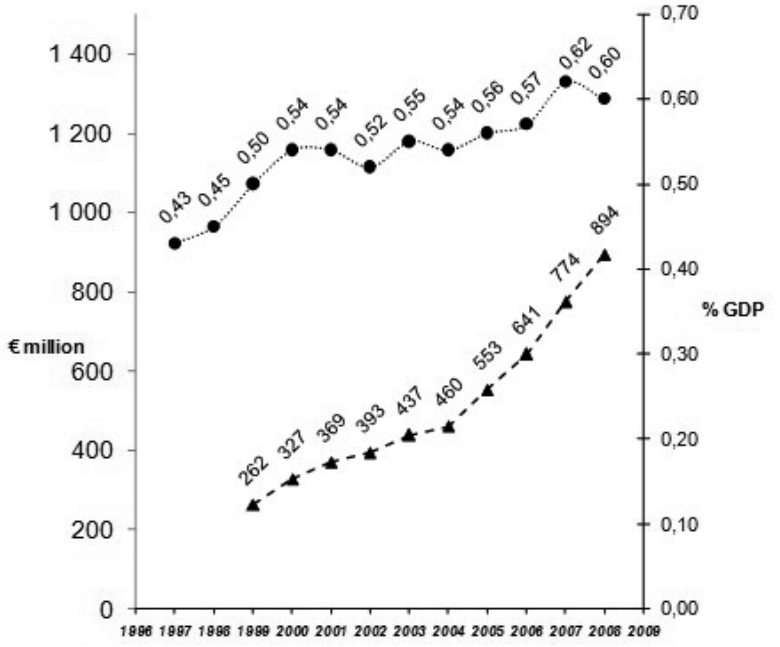
The decisive role in Czech economy is playing the export into countries with developed market economy, namely trade with EU countries reached a very high share. On the other hand the results of trade with developing countries have in recent years worsened as the imports have abruptly risen, while exports went down. The percentage of export of products from high-tech industries in the total export of the Czech Rep.

Figure 1: *Overall R&D expenditures from all sources (in € million and % of GDP) in the Czech Republic*



Note: *Calculations of expenditures in € thousand are based on average exchange rates for mentioned years from the beginning in 1999.*
Source: *R&D Indicators 2008. Czech Statistical Office, Prague 2009, available at http://www2.czso.cz/csu/2009edicniplan.nsf/publ/9601-09-za_rok_2008*

Figure 2: *R&D expenditures from public sources (in € million and % of GDP) in the Czech Republic*



Note: *Calculations of expenditures in € thousand are based on average exchange rates for mentioned years from the beginning in 1999.*
Source: *Office of the Government of the Czech Republic, Research and Development Council 2009*[7] *and Czech Statistical Office, Prague 2009*

[7] See details in [Analysis 2009].

has been growing rapidly over the last years (from 8,2 % in 1998 to 12,7 in 2008, see Table 3) [Analysis 2009], and is approaching the volumes in Austria and Germany. Increased exports of cars, office machines, PCs, radios, TV sets and communication facilities are the major driving products behind this. Among positive trends also belong rising employment in high-tech services (3,18 % in 2003) and in manufacturing industries with medium-tech to high-tech technologies (8,71 % in 2003) in percent of overall employment.

The indicator of the technology balance of payments (0,65 % GDP in 2002) is markedly higher than in other new Member States and similar to the situation in Germany. Significant lag behind the EU-15 countries exists in patent applications and granted patents, both in case of European Patent Office and US Patent and Trademark Office. On the other hand the numbers of invention applications filed in and patents granted in the Czech Republic are relatively high and mostly from abroad (80 %) which shows on a remarkably intensive transfer of knowledge.

Concerning the human capital, the Czech Republic boasts one of the highest upper-secondary school completion rates in the OECD. In 2002, 88 % of the Czech population aged 25 to 64 had at least completed upper secondary school. On the other hand, only a small proportion of the Czech population has completed university. Despite the fact that the number of students studying in public universities increased from 89 to 236 thousands between 1990 and 2003, only 14 % of the population aged 25 to 64 has a university degree, compared to an OECD average of 23 % (and EU-25 average of 22 %).

Generally is possible to say that in the Czech Republic the continuous changes of R&D sphere are going up to now. A very important legislative change entails the creation and action of the law on public research institutions; all ASCR institutes and most other research organizations are functioning according to this law now. The R&D&I Council of the Czech Republic was formed and the newly established Technology Agency will be

distributing finances to applied research and development. During last ten years the non-profit sector in R&D was growing in nominal numbers of expenditures (but not in the percentile rate), and is very important in deep research into specific problems of Czech civil society. Its activities support a participation of citizens in discussion and assessment of research priorities and technology impacts on life in individual regions.

5. Features of Czech science and research culture

The integration of Czech science, research, and development into the European Research Area is the main goal of the transformation of Czech society in this respect. It is a complex and multifaceted process, which includes "catching up" of the system of economic and social functioning of the developed countries of the EU, proceeding from the economic level, traditions, and other cultural conditions of Czech society.

The basis of the Czech way is approaching and catching up the European standards of the R&D system functioning (not the copying the structure of European R&D institutions itself). This process has a variety of features, which are connected with different aspects of Czech past societal and cultural development. Simplifying the complex concept of cultural sources of innovation (because of targeted description), it is possible in connection with science policy to analyze the following "cultures:"

- *Culture of transformation:* defensive and active strategies (see coping strategies above); in Czech conditions in nineties the success of transformation in governmental and university sectors, and failure in business enterprise sector;
- *Culture of inland collaboration:* part success in collaboration of ASCR with some partners from university sector (mainly Charles University); part success in relations between business enterprise and university sectors, but failure in relation of

ASCR with regional universities and also of inner relations in university sector. Until now the most research organizations are learning how to collaborate under new economic conditions (contemporary in the economic depression context);

- *Culture of international collaboration:* after long isolation (mainly in the humanities and social sciences) R&D institutions are getting experiences and „tacit knowledge" how to collaborate. Good progress is seen due to Framework programs (Czech research teams are not very successful), Structural Funds and various bilateral programs;
- *Culture of evaluation of research outputs:* very good level, the European standards reached. In ASCR evaluation from 1992 (then cyclic regular evaluation in 1995, 1999, 2004, 2008) using mix of a peer review and scientometric methods. It was based on a structured detailed report including quantitative indicators. Reports assessed by foreign evaluators (at least three). Evaluation realized by independent committee (1/3 members from ASCR, 2/3 external experts – universities, applied research, industry). Evaluation results approved by Academy Council and decisions taken by Academy Assembly of ASCR. Evaluation procedures done by governmental R&D&I Council of the Czech Republic are based mostly on quantitative evaluation (counting points for different R&D outputs), which is directly used for budgetary decisions;
- *Culture of assessment of research organizations:* In the Czech Rep. the research organizations are mostly assessed by evaluation of their research outputs. There were rare attempts to use benchmarking methods, too. In connection with the RECORD project (Recognizing Central and Eastern European Centers of RTD: Perspectives for the European Research Area) the benchmarking methodology was tested

for assessment in R&D&I sphere. As a result of this benchmarking [Filáček 2003], 40 research organizations/institutes in the Czech Republic were included in the RECORD Map of the International Centers of Excellence. Furthermore, the possibility of recognizing innovative action in the framework of various types of research organizations was verified as well as the possibility of indentifying good practice that could be repeated and implemented and thus lead to continuous improvement of the effectiveness of the evaluated workplaces.

- *Culture of evaluation of grant proposals:* In the Czech National Foundation (GACR), Grant Agency of ASCR, and other research councils (mostly ministerial agencies) is similar and comparable with European Science Foundation and other main European research councils;
- *Culture of research ethics:* In ASCR approved the Ethics Codex and the Code of Research; there exists the Committee for Ethics both in ASCR and at the governmental R&D&I Council, too.
- *Culture of administration:* The responsibility and main legislative competence for R&D is given to the Ministry of Education, Youth and Sports CR; proposing the distribution of short term and medium term financing from public sources is in the competence of R&D&I Council of the Czech Republic (Government of the CR and Parliament are approving it). ASCR is responsible for basic research; the administration in ASCR is very democratic one. The similar situation is also in university sector. Contemporary there are some discussions concerning the application of quantitative evaluation results prepared by R&D&I Council (direct influence of obtained evaluation points on state budget support) and the authority and competence of R&D sectors representatives in governmental R&D&I Council.

- *Culture of management the R&D&I organizations:* The culture of management is different according the R&D sector and type of organization. The position of managers is in principle done by legislative norms, newly e.g. by the law on public research institutions. R&D managers are also getting experiences and "tacit knowledge" and their abilities are approaching the European standards. On regional and local levels had appeared new kinds of managers dealing with R&D services dealing with intermediation[8] of R&D&I activities (optimizing supply of scientific and technological services, with demand of R&D&I companies and organizations or any other actors using or interested in using these services, e.g. national or regional stakeholders) [Filáček 2008];
- *Culture of financing:* In general, R&D financing is still fragmented into about 12 main research councils. Discussions are going about the rate of institutional versus targeted financing. The main should be a transparency of money allocation and spending.
- As for fund allocations from the state budget in ASCR, the sufficient information on the scientific performance of the institutes of the ASCR is displayed since years 2000–2001 from previous evaluations, providing the Academy Council with a topical yardstick for future differentiated allocation of institutional resources to individual institutes. Evaluation

[8] Definition of an R&D&I intermediary is as follows:
– R&D&I intermediary is defined as a public, private, or public/private institution with a mission of optimizing interface between supply of scientific and technological services and demand of an enterprise, groups of enterprises, or any institution in this respect;
– Intermediaries communicate, animate, and support joint projects between SMEs and research institutions acting as brokers. Universities, research centers, private companies, or technology transfer centers can play a role of S&T intermediary.

results were first taken into account in budgeting for 2002, and since then they substantially affect especially the accrual of expenses directed to science in the evaluated workplaces.

- Some contemporary disagreement is generated by fact that R&D&I Council is changing financial conditions and evaluation point tables every year. The financial crisis and economic depression is resulting GDP stagnation, from which follows a zero growth of R&D expenditures. More, financial legislative norms are rigid and their novelty is promised. But now, under the condition of increased state budget deficit is not possible to believe in financial improvement.
- The practice of finance distribution based on evaluation shows that:
- the outcomes of the scientific work are to be judged with regard to their quality and gains, not only to quantity;
- scientometric data can only be one of the bases for evaluating workplaces;
- the evaluation system should always include peer-review methods or international panels of specialists concentrating on comprehensive evaluation of the outcomes;
- the quantitative evaluation of the publication activity cannot mechanically provide an insight into the quality of the research work; it can only serve as one of the starting points for evaluating research workplaces, which can signal either exceptionally high or low productivity of a workplace;
- the evaluation system based on classification on points, which would become a reason for hunting points, would be counterproductive (in preferring quantity to quality) in its consequences;
- *Culture of governance connected with R&D:* It is influenced by non-stable political situation before votes 2010, by zero

growth of GDP, economic crisis, and privileges support of applied research. There are seen some other challenges for future governance:

- absence of discussion with the public, insufficient participation of non-profit R&D sphere in R&D governance;
- growing interest within Czech society in the issues of a spiritual, philosophical, cultural and ethical nature, decline in interest to study technical and natural sciences;
- the speed of scientific, technological and economic developments – and the social changes stimulated by them – has posed a major problem of how to integrate such developments into society, how to master their undesirable ramifications and how to search for equilibrium between quantitative economic growth and the quality of human life. The relationship between expert opinion and democratic decision-making appears to be of great importance;
- key issue is dialogue between science and society. As far the Czech Rep. is concerned, such a vital dialogue has been so far replaced by efforts to popularize science, and well-meant endeavors aimed at making the general public understand science and its importance. But a genuine dialogue necessitates a two-way model, i.e. efforts to win over public understanding for science should be supplemented with endeavors to make scientists understand public attitudes as well.

6. Conclusions and challenges

- R&D infrastructure and human capital are potential major bottlenecks. So is necessary greater support of research infrastructure, and better financial motivation for the best scien-

tists to work in Czech research centers, legislative support for the mobility (domestic and international) of researchers;
- Support for various types and new forms of learning including doctoral studies and studies organized within the enterprise sector, learning and acquisition of skills directly within the innovation process;
- Research and development in a company sector in the Czech Republic is still a weakness of the economic conditions. State support (e.g. through tax system) of wider engagement of business and enterprise sector in research activities is a way to reach the Lisbon targets;
- The main problem regarding R&D is the very low level of demand for research from businesses. The main reason for this lack can be found in the fact that the foreign companies often use short-time advantages of the inland investment incentives and existing lower wage level;
- Analyzing the features of Czech science and research culture it is seen the fundamental knowledge result concerning the Czech R&D system: national R&D systems in Europe could differ, but there must be *a common vision and concept*. Without it is for EU impossible to cope future challenges, to be enough competitive in R&D and to find such research and innovation strategy, which would contribute to sustainable development of the so-called European knowledge society. Building European Research Area is the necessary decision for Europe at a crossroad!

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