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TRANSFORMATION OF THE ACADEMY OF SCIENCES: FROM SCIENCE IN SOCIETY TO THE RESPONSIBLE SCIENCE FOR SOCIETY

The radical changes in the 1990s, including the more or less steep decrease in its financing, initiated major reforms of the Czech Academy of Sciences (CAS). The differences between the CAS and the other R&D sectors consisted in the extent of financial threats posed to them and in coping strategies, personnel reductions, forms of institutional transformation, support of basic and applied research, engagement of business and enterprise sector in research activities, and new patterns of international collaboration in research. The transition process involves more stages; its developments up to now have resulted not only in institutional changes, plurality of financial sources, new methodology and procedures of science assessment, but also in the contemporary goal-directed programme "Strategy CAS21 – Top Research in the Public Interest." This new concept addresses ideas of what are called "Responsible Research and Innovation" and "Science for Society."

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1. Introduction

The revolutionary events in former Czechoslovakia in 1989 and the subsequent developments in the period 1990–1992 paved the way to the preparation for and establishment of an independent Academy of Sciences of the Czech Republic, which launched its activities in January 1993. The far-reaching institutional changes, prepared in 1992 and based on the previous evaluation of all the institutes of the former Czechoslovak Academy of Sciences in the Czech Republic, were implemented in 1993 and continued in the following years. These changes led to the transformation of both the structure of the Academy of Sciences as well as its research focus, and eliminated the con-

sequences of the erstwhile "Sovietization," ideological indoctrination and political repression.

The specific pattern of the transformation of the Academy of Sciences can be seen in a transformational response to the changes in the social and economic conditions in the country (primarily the dismantling of its central planning and science management, and introduction of a combination of institutional and special-purpose financing) and in active integration of scholarly research into the country's new and fast-changing socio-economic fabric. This integration took the shape of institutional and organizational changes both in the network of the Academy of Sciences institutes, as well as the manner of functioning of the individual institutes and their cognitive thematic focus. The ultimate goal of this modernization and transformation was gradual attainment of the standards of functioning in science and research common in the advanced European democracies (this concerned primarily assessment of the actual standards of scientific performance of the individual institutes, and scientific efficiency of their research teams).

A major component of the transformation of the Academy of Sciences is integration of its research activities within the European Research Area. This is a complex and multi-faceted process, encompassing the task of "catching up" with the system of economic and social functioning of scientific institutions in the advanced EU countries. This goal is based on this country's current economic level, its traditions, and other cultural prerequisites for promoting science in the Czech society.

2. Two Approaches to Transformation

In the early 1990s, there was no common approach to the transformation procedures in the research community on the one hand and the decision-making sector in the Czech Republic on the other. Generally speaking, both sectors agreed in their rejection of the bureaucratic science and research management, as practiced by the former totalitarian regime, and its deformation of the social functions of science in the command economy. But they differed in their opinions of the transformational abilities of the existing science research institutions, in the extent of state funding and state regulation of different sections of the research community. At that time, sections of the research community also voiced concerns, emanating from their awareness of difficulties associated with the continuity of the previous 40-year developments of the science and research sector, its topics, aspirations and value-related attitudes it had produced and reproduced, as well as apprehensions

of what a radical transformation of the system of science might bring to the researcher personnel, particularly fears of the loss of talent and disruption of the time-tested research programmes.

As for the actual mode of implementing the goals of transformation, two different approaches emerged,[1] each of which offered to introduce specific features into the real procedure and shapes of the transformation process.

The first model promoted a process of transformation heading towards a clear-cut and definitive vision of the future science and research system to be mediated by quite specific and clearly formulated priorities of the state science policy. In accord with this model, the transformation of science and research institutions and the entire system of science and research should have been more or less uniformly organized, constituting a well-controlled process, implemented under the permanent stewardship and managerial supervision of external authorities.

Under the second blueprint, transformation was not primarily perceived as a transition from one particular system of science and research to another according to strictly established principles, but rather as a process of opening up space for a flexible and democratic search for optimal alternatives, namely by mastering specific elementary starting points and principles, corresponding to the overall political and economic trends in society. The above principles included primarily the freedom of scientific work, competition in science, focus on worldwide development trends in science and research and other principles, underlying the current science and research system applied in the Western democracies. As envisioned within this concept, transformation processes should assume a more spontaneous and initiative-driven nature and should proceed from natural selection mechanisms as well as a constant quest for consensus in keeping with the standard rules guiding the functioning of the science community.

This concept of transformation has eventually won the support of the state authorities and the majority of the research community. In fact, it was based on the task of embracing the elementary principles corresponding with the society's overall political and economic objectives, but it assumed that implementation itself would be driven by initiative and possibilities of the researchers themselves. That was why the transformation did not proceed under any central management, assuming a more or less spontaneous

[1] For a detailed explanation of the elaboration of the transformation concept, see Stanislav Provazník et al., *Transformace vědy a výzkumu v České republice* (Prague: Filosofia, 1998), chapters III and VI (in Czech).

character. As a result, researchers took the initiative and creatively transformed the research sector into a system adequate to the newly emerging circumstances that accompanied the political and economic reforms in society, while shedding any unrealistic visions of an easy and trouble-free journey.

A general prerequisite for the science community's active support of the transformation process proved to be its early success in quickly overcoming, alleviating, and explaining away the initially burgeoning fears. This was primarily helped by the fact that one of the very first moves by employees in the science and research sector was introduction of inner democracy in the individual research-performing organizations and throughout the research community. The country's new democratic regime made it possible to search for consensus, while resolving most conflict situations, which inevitably arise during a radical transformation, in a conciliatory manner, through agreement and compromise.

In this respect, a very positive role was played primarily by the science community of the Academy of Sciences, which overwhelmingly espoused the radical transformation and initiated most of the steps in its specific implementation. When compared with the experience of the transformation of the research systems in the other post-communist countries, the science community in the Czech Republic was possibly the only one which had not set, as its prime goal, any passive "defense" and perpetuation of the existing research potential, but, on the contrary, promoted mainly its refocusing and modernization in keeping with the boarder trends both in worldwide science, and especially in the economic and social changes in the Czech society. Active involvement of the country's science community in the process of radical restructuring of its own research system stands out as a salient feature of its positive attitude to social transformation.

3. Key Personnel Transformation Steps in the Academy

Immediately after November 1989, the then Czechoslovak Academy of Sciences (ČSAV) launched single-handedly its broadly based transformation, accompanied by a thoroughgoing institutional reconstruction focused primarily on the following tasks:

- Construction of an institutional structure vital for the guarantees of academic freedom in charting its own research programme and for the functioning of democratic self-administration by scientists themselves. Learned societies were separated from research-performing organiza-

tions. In this way, the remaining residues of the Soviet-type Academy of Sciences have been abolished.

- Gaining considerable autonomy of all academic scientific centers; all these facilities established their own scientific boards, which were and still are elected by creative personnel. The principle of appointing new directors of such institutions on the basis of competitive hiring procedure has been instituted.
- Introduction of specific forms and procedures needed for permanent attainment of high quality of scientific performance and social relevance of research, as well as high efficiency of researchers and their teams; their core lies in systematic, regular, and independent evaluation of scientists, research teams and centers in terms of the quality of their research.
- Substantive selective reduction of the number of personnel and research-performing organizations based on assessment of their quality. Between 1990 and 1991, and then again at the end of 1992, scientific performance of the individual research facilities was assessed, leading to the reduction of their staff down to one half of the number of personnel in 1989, and to the abolition of 23 research-performing organizations with lower scientific levels or inadequate research specialization.
- Formulation of a science concept of the Academy of Sciences following an in-depth research quality assessment with a view to the local research traditions, development tendencies in world science and the needs of the Czech society. The science concept is designed to streamline the sectional structures of research in a way to facilitate development of newly emerging research domains and to support long-term research programmes. Their characteristic feature has been an enhanced focus on basic research.
- Abolition of the former privileged position of the Academy of Sciences within the country's science and research sector, especially in relation to universities. The Academy of Sciences has thus become one of the several, equal research sectors competing with the other spheres of the research system for allocation of research funding. Foundations have then been laid for the Academy's new position and functioning within society, while seeking to balance the basic focus of scholarly research

with other key components – share in education, upbringing, and practical application of research outputs.

Back in February 1993, the Academic Council[2] approved the abovementioned radical reduction of research-performing organizations, mostly effective as of July 1, 1993. The abolished or delimited facilities were funded according to the budget of the Academy of Sciences approved by that Academic Council, and in keeping with the relevant contracts on the establishment of joint research centers.

The total number of personnel of the Academy of Sciences was reduced from 13,896 (in natural persons), as of December 31, 1989, to 7,127, as of December 31, 1993, when the stage of sweeping reductions of the Academy's institutes was completed. The total extent of reductions accounted for 48.7% (see Table 1). The volume of reductions was highest in the field of social sciences and the humanities branches of research (56.8%), reflecting the radical changes (and not only by removing former ideological deformations) in the thematic and methodological focus of social science research.

Converted average number of employees of the Academy of Sciences (so-called FTE – Full Time Equivalent according to the OECD methodology) was reduced from 12,501 in 1989 to 6,524 in 1993; in 1994 the number kept slightly decreasing to reach the value of 6,365 FTE converted employees (see Figure 1), having reached 51.2% of the 1989 figure. On the contrary, as of December 31, 1994, the number of personnel of the Academy of Sciences in natural persons rose slightly (Table 1), namely by 148 persons, i.e., by 2% as compared with 1993. The number of university-educated researchers and scientists in the category of natural persons increased. This rise in the number of Academy of Sciences personnel in terms of natural persons, accompanied by a cut in the converted number of employees in natural persons, was caused by the fact that researchers were employed in part-time jobs.

The process of reducing personnel in the individual institutes sought, as much as possible, to leave intact what were perceived as productive research divisions. Whenever possible, in terms of financial resources and operation of the institutions concerned, the numbers of researchers were affected less than the numbers of office and technical services employees; as a result, the percentage of university-educated researchers grew (Figure 1). This increase has been evident ever since, with the exception of the year 2004, which showed a slump in this indicator due to a change in the system of reported

[2] See Annual Report of the Academy of Sciences of the Czech Republic for 1993 (in Czech).

binding indicators (indicator of the number of converted employees ceased to be a binding indicator for drafting budget for that particular year). In the following years, the share of researchers has kept rising, and now university-educated researchers account for more than 60% of the Academy of Sciences personnel (Figure 1).

The process of reducing employees in the individual scientific branches was irregular and selective. As for the Academy (unlike the university sector) reductions were concentrated, to a large extent, on the field of the humanities and socio-economic sciences. These domains saw not only personnel reductions to less than half of their original numbers (as shown by Table 1), but also large-scale personnel changes[3] (up to three quarters of the total[4]) in the structure of research teams in the institutes belonging to those scientific branches. The institutes and research projects greatly indebted for their existence to the former totalitarian regime and its ideology were abolished already in early 1990.

Those humanities and social sciences research institutes, whose real research had not been overshadowed by ideological paradigms in the past, saw only changes in their research focus and changes in their research personnel. In the past decade, researchers in the humanities and social sciences have accounted for 17% of the overall number of researchers employed in the Academy of Sciences, in the overall expenditures the share of this research domain amounting to roughly 16% of the Academy's total budget. Consistent transformation changes have resulted in the humanities and social sciences now having, primarily in the Academy of Sciences, a long-term, far-reaching, and internally intertwined research programme, proceeding from the consensual attitudes of scientists and their perception of the society's actual priorities.

Foreign analyses of the transformation processes in the Academies of Sciences of the Central and Eastern European countries have usually appreciated the fact[5] that the Czech Academy of Sciences succeeded in utilizing the results of its evaluation and the subsequent radical personnel reductions, caused by financial restrictions, for raising the productivity of its scientific performance, and that the Academy of Sciences researchers willingly opened up to international evaluation, accepting and espousing the value system

[3] A similar analysis of the transformation of the Academy of Sciences may be found in Provazník et al., *Transformace vědy a výzkumu v České republice*.
[4] Ibid., 98.
[5] Renate Mayntz, Uwe Schimank, and Peter Weingart, eds., *East European Academies in Transition* (Dordrecht: Kluwer, 1998).

that gives priority to the freedom and autonomy of research even at the cost of greater existential uncertainty.

4. Last Decade of the Czech Academy of Sciences Financing

Development of the Czech Academy of Sciences (CAS) personnel in the last decade had shown the positive trend of increasing the percentage of researchers with a university education in the total number of the CAS personnel in FTE. Year by year gradual growth of the CAS personnel in FTE was closely connected with the high stability of the total CAS financial resources,[6] when the finances from the public resources (CAS own state budget chapter, resources from other chapters of the state budget e.g. of other grant agencies, resources from EU operational programmes) and the financial means raised by the CAS institutes themselves (owned by CAS institutes according to the Law No. 341/2005 Sb. about public research institutions) mutually complemented each other.

Figure 2 shows the total CAS financial sources and the percentage of the CAS own state budget chapter (every year approved by the Parliament of the Czech Republic) in the frame of the Czech state budget. It is seen that in the period from 2010 to 2015 the percentage of CAS own budget chapter has decreased from 52,2% to 29,3% from CAS total expenditures, then slowly increased to 40% and 39% in the year 2018 and 2020 respectively.

Figure 3 shows the total CAS financial sources and another important indicator that is the percentage of the public research institutes (economically functioning according to the Law No. 341/2005 Sb. about public research institutions) own resources. In the last decade this indicator was moving around near 30% from the CAS total expenditures except the year 2016 when it jumped up to 36% and then fell to 23% in the year 2018 and 2019.

From 2010, there was a gradual growth of the total financial means of the CAS by more than CZK 6 billion to the year 2015, despite the decrease of direct support through state budget chapter of the CAS by approximately CZK 1,5 billion. This development was made possible by an increase in the funds coming on competitive basis from other state budget chapters by more than CZK 3 billion in total (of which the major part were the means from operational programmes) and partially by an increase in the financial means raised by the CAS institutes themselves by CZK 1.4 billion (predomi-

[6] See CAS Annual Reports, accessed December 21, 2022, https://www.avcr.cz/en/about-us/annual-report.

nantly revenues from the licenses of the Institute of Organic Chemistry and Biochemistry CAS). The percentage of CAS own budget chapter from CAS total expenditures has decreased from 52,2% in the year 2010 to mere 29,3% in the year 2015.

In 2015,[7] the Czech Academy of Sciences managed a total of CZK 16,035.6 million of which CZK 4,693.7 million came from its own budget chapter. The share of the resources from its own budget chapter in the total financial resources dropped from 45,8% in the year 2011 to mere 29,3% in 2015 (Figure 2). However, this relative decrease was caused by the increase of resources from other chapters of the state budget (mainly due to drawing on the resources from EU operational programmes) and by the increase of the own resources of the CAS institutes (Figure 3 – predominantly revenues from the licenses of the Institute of Organic Chemistry and Biochemistry CAS). The resources from other chapters of the state budget are not sufficient to compensate for the low level of institutional of funding of the CAS, because the resources from operational programmes are available to only a few institutes of the CAS.

In the period 2015–2021 the share of resources from CAS own budget chapter (Figure 2) increased to nearly 40% (in the year 2018, then stagnation). The year-on-year increase in the share of resources from its CAS own budget chapter of 3% was mainly due to the reduction of the resources of public research institutions (a decrease in income from licenses of the Institute of Organic Chemistry and Biochemistry) and a drop in resources from other chapters (without operational programmes).

Contemporary, in the present- and post-COVID19 economic situation in the Czech Republic it is possible to expect more stagnation or a slight decrease of the CAS own state budget chapter, consequently a decrease of the financial means managed by CAS. Total CAS expenditures shall mostly depend on the financial means raised by the CAS institutes themselves and collaborations (and contracts) with business enterprise research sector.

[7] See CAS Annual Report 2015, pages 25–26.

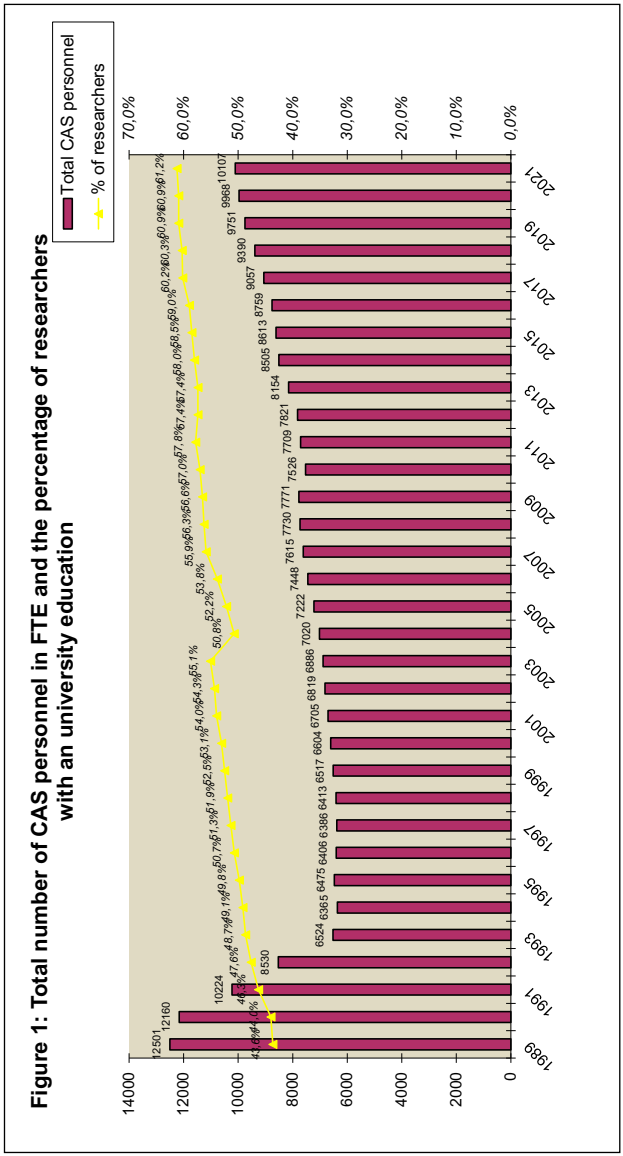
Table 1: Number of CAS Personnel in Terms of Natural Persons, as of December 31 of each year, according to scientific branches

Scientific branch	1989	1990	1991	1992	1993	Drop in 1993 against year in %		1994	1995	1996	1997
						1989 (%)	1992 (%)				
Mathematics, physics and Earth sciences	4 695	4 190	3 360	3 120	2 604	44.5	16.5	2 699	2 687	2 645	2 683
Life sciences and chemical sciences	5 231	4 773	3 871	3 608	2 926	44.0	18.8	2 956	2 959	3 074	3 117
Social sciences and humanities branches of research	2 420	2 128	1 616	1 438	1 046	56.8	27.3	1 148	1 162	1 167	1 155
Total *)	13 896	12 360	9 729	8 881	7 127	48.7	19.8	7 275	7 260	7 298	7 345

*) The total number of employees also covers personnel employed in joint and service facilities.

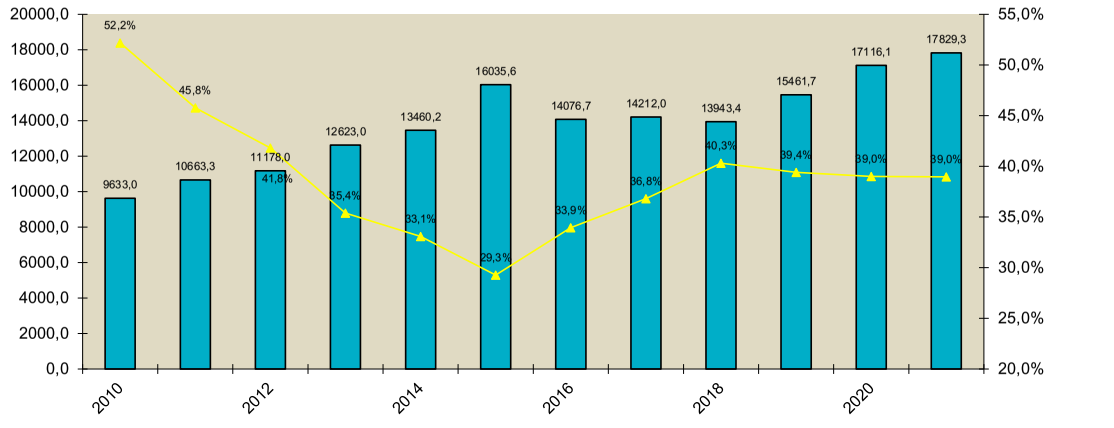
Source: Statistická ročenka Akademie věd ČR (Statistical Yearbook of the Academy of Sciences of the Czech Republic) 1989-1997 (in Czech).

Note: Since 1998 the number of employees has been recorded only in FTE (not in natural persons), so that the time series no longer continues.

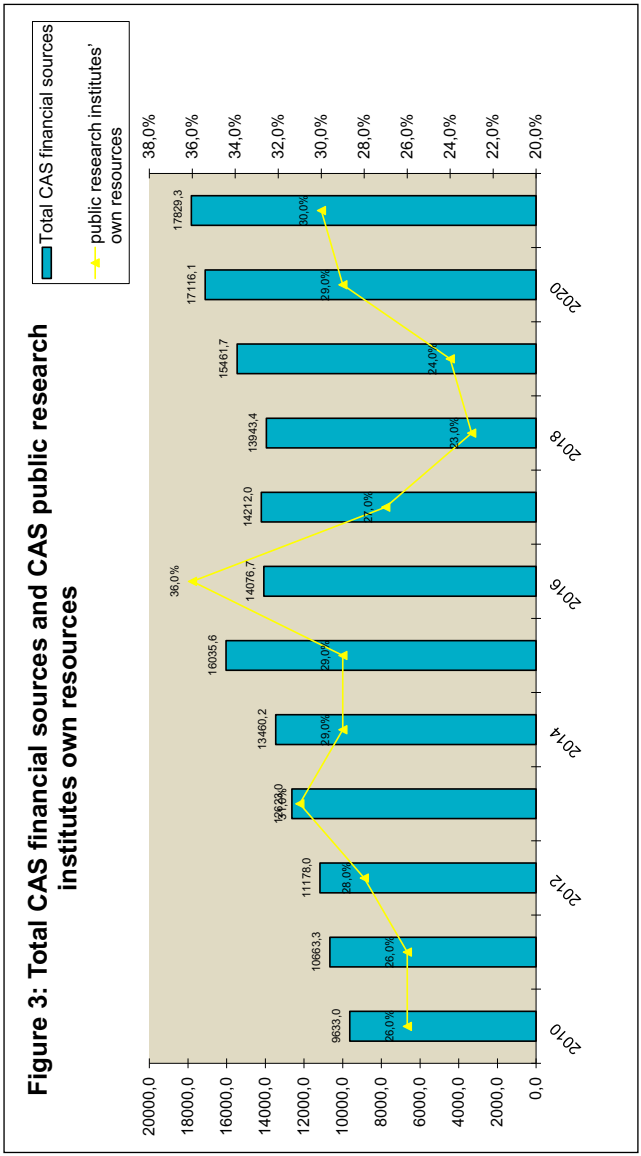


Source: CAS Statistical Yearbook and CAS Annual Reports

Figure 2: Total CAS financial sources and the percentage of CAS state budget chapter



Source: CAS Statistical Yearbook and CAS Annual Reports



Source: CAS Statistical Yearbook and CAS Annual Reports

5. Cooperation with Universities

Traditionally, cooperation of the Academy of Sciences with universities has been widespread, encompassing not only lecturing but also basic and applied research. That was also why the restructuring of the Academy of Sciences during the transformation period was also intertwined, to a large extent, with changes (institutional and personnel) in the university sector.

Unlike the post-war developments of West European universities, a specific problem facing the Czech Republic has been the fact that the country's long-standing separation of university education and training from academic research was accompanied by a general disregard for and neglect of the universally valid cultural, humanistic, and socio-critical tasks facing 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 its academic research. While correcting the current situation, efforts were also 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 universities and research centers is still 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 academic centers, the requirements for high-level university teaching and research cannot be fully met.

On the other hand, one should welcome in anticipation the actual process of differentiation in Czech university education and training. New centers of research and innovation were established, with links inside the country and abroad. And unlike the universities, where top-level research can hardly be expected, and where university education and training are likely to have different functions, universities with a distinctive research focus have been gradually developing in the Czech Republic.

Co-operation with the Academy of Sciences ranked among the specific methods of transforming university research. The past few years have witnessed a marked increase in various forms of mutual co-operation: mutual institutional mobility of university and Academy staff, mutual membership of Academy and university staff in the administration bodies of their institutions, ever more frequent cases of joint research projects and joint research centers being established. On the other hand, co-operation between univer-

sity research on the one hand and industry on the other has been falling, with contract research stagnating or decreasing.

The Academy of Sciences is known to be supporting establishment of joint research centers with universities. Their number has been constantly growing: there were 40 in 1999, while 56 such centers were successfully operating in 2013.[8] Such joint research facilities have been established out of the genuine internal needs and out of the initiative of researchers, whenever and wherever real opportunities arise, and not due to any externally imposed administrative measures. However, a serious obstacle to continued integration of research has been the different legal position of the partners (universities are public service entities and the Academy of Sciences institutes are public research institutions), which tends to complicate mutual legal and economic relations. A major form of co-operation between the Academy of Sciences and universities in recent years has been their joint participation in the Research Centers programme of the Ministry of Education, Youth and Physical Training, in which the Academy of Sciences has established or has been jointly operating as many as 21 research centers.

The Academy of Sciences institutes take part in educating and training new scientists, namely on the basis of agreements with universities that have their own accredited doctoral courses. All the institutes with the relevant faculties have concluded agreements of this kind; as a result, the Academy of Sciences institutes have become training centres for doctoral study programmes, and their researchers have become teachers and tutors of doctoral students. The Academy of Sciences also supports its own personnel in teaching in B.A. and M.A. programmes (at present more than a quarter of the Academy of Sciences university-educated personnel are involved in such projects).[9]

A case in point of the natural way of integrating the Academy of Sciences and the universities is representation of university personnel in the Academic Council, in the Scientific Board of the Academy of Sciences, in the scientific boards of its institutes as well as evaluating boards; on the other hand, this is corroborated by the representation of the Academy of Sciences personnel in similar bodies and authorities at the universities. The Academy of Sciences is also known to provide its specialized capacities for expertise and counseling services to state administration authorities in tackling topical as well as long-term issues of public interest. The Academy

[8] See Annual Report for 2013, page 22.
[9] Data and description of this educational activity may be found in Annual Reports.

of Sciences has also taken part (both in terms of methodology and in terms of expert's reports and expertise provided by its personnel) in elaborating and updating the Czech Republic's national R&D policy (including the National Research, Development and Innovation Policy for the Years 2009 to 2015, with a perspective up to 2020). For example, the Academy of Sciences experts took a lion's share in drawing up and evaluating scenarios for future developments of science and research (coordination role was entrusted to the Technology Center), focusing on the task of charting partial priority trends within the National Research Priorities. The resulting document,[10] approved by the Government of the Czech Republic by its Resolution of July 19, 2012, contains a description of the individual priority areas and subsections, presenting links between the individual areas and defining selected systemic measures.

6. Co-operation with the Industrial Research Sector

Research and development organizations in industrial research constitutes the largest component of the total research and development (R&D) sector. In 1990 these organizations employed 64% R&D personnel (i.e., 68,000 people); 88% of them were engaged in the research within an industry. In 1990 the biggest part of them was employed in the engineering industry (48%), followed by the electrical industry (15%) and the chemical industry (10%).

In 1991 the number of these employees dropped to 44,000 (to 65%) and in 1992 to about 31,000 (i.e., 45% of the original figure in 1990). Between 1995 and 1998, the number of workers was estimated at 23,000. At present, the total personnel, according to the Czech Statistical Bureau, amounts to about 13,000 in FTE, this means about 25,000 on average.

Privatization of the R&D sector (according to the voucher privatization model) in the Czech Republic was carried out within the framework of the so-called "large-scale privatization" in two waves. The first wave comprised 58 institutes with 13,000 employees and was completed in 1993. Additional 51 institutes with 14,000 employees were privatized in the following, second wave.

[10] See "Národní priority VaVaI schválené vládou," accessed December 21, 2022, http://www.vyzkum.cz/FrontClanek.aspx?idsekce=653383.

According to a survey carried out in the years 1996–1997,[11] between 1990 and 1994 top researchers were leaving the Academy of Sciences only very rarely (these were primarily individuals leaving to teach at the universities, and whole research teams being transferred mostly to branches inadequately covered by research at the universities). Departures for the sphere of applied research in the business sector were rare – this was probably caused, to a large extent, by a very complex situation in this research sector.

Generally speaking, during the personnel cuts within the Academy of Sciences the prevailing outcome of such reductions was that researchers leaving the Academy found jobs in the government and business sector, even though mostly outside the research sector. They got new jobs primarily in the state administration sector, banking, private companies (especially foreign corporations), being attracted by what was then higher certainty of keeping their jobs and higher pay. Well prepared professionally and linguistically, such people were at that time above-average computer-literate and, therefore, had no great difficulties in finding jobs.

However, looking back at the past decade, it is definitely impossible to say that the industrial sector would, in any way, be opposed to co-operation with the Academy of Sciences. Many Czech industrial plants are known to be publicly declaring this need, even though their natural existential interest lies, first and foremost, in economic effects. In this respect, industrial enterprises display relatively pragmatic behavior patterns, usually seeking and preferring research outputs leading very quickly to successful products or other innovations, while ensuring or upgrading their competitiveness. As long as the Academy of Sciences manages to provide this (mostly in applied research), then the industrial sector shows direct interest in such contacts, and its markedly growing demand may be anticipated.

7. The Concept of Research and Development in the Academy of Sciences

The Czech Republic's Academy of Sciences is a democratic and autonomous agency comprising scientific institutions that perform robust, high-quality basic and strategic applied research, promoted in keeping with the needs of the society.[12] This covers a broad spectrum of domains, ranging from

[11] Research within the grant project of the Czech Republic's Grant Agency called "Social Functions of Science and Research in the Conditions of Social Transformation and European Integration" (in Czech) in Provazník et al., *Transformace vědy a výzkumu v České republice*.
[12] See "Mission of the CAS," accessed December 21, 2022, https://www.avcr.cz/en/about-us/mission-of-the-cas.

mathematics and computer science via physical sciences, including technical sciences, then life sciences and medical sciences to social sciences and the humanities. Furthermore, the Academy of Sciences is committed to transferring its research results into practice, while living up to its educational role and enabling excellent domestic and foreign scientists to assert themselves, thus greatly influencing the intellectual, knowledge and cultural standards in the Czech Republic and cultivating and fostering moral integrity of its inhabitants.

The Academy's chief research centers are the institutes, which were founded by the Czech Academy of Sciences, and which have had, as of January 1, 2007, pursuant to Act No. 341/2005 Coll.,[13] the legal form of public research institutions. A major role has also been played by the scientific centers established by the Academy of Sciences institutes themselves, as joint facilities with other leading scientific institutions.

In its research activities the Academy of Sciences focuses on solving projects that are relevant in scientific and social terms, requiring long-term concentration of capacities (qualified researchers and financially-intensive research infrastructures) and on maintaining a stable research environment. The Academy's integration into the European Research Area, both by solving its own research topics and by being involved in individual European research projects and programmes, is currently of ever greater significance.

Periodic assessment of the Czech research centers involving international experts, with subsequent projection of the results of such an evaluation into the differentiated financing system, has grown to be an integral and long-term component of the system of management of the Academy of Sciences. The fifth independent external assessment of this kind was held in 2015–2019; its goals were:

i) to review the development of scientific and specialist performance of each research center and its scientific divisions plus related activities on the basis of the results achieved, the current trends in world science and the socio-economic preferences by means of the *peer review* system, and multi-criteria evaluation in an effort to ensure permanent accent on building competence, upgrading the quality of scientific work and promoting international competitiveness of such research-performing organizations;

[13] See "Zákony o veřejných výzkumných institucích," accessed December 21, 2022, http://www.vyzkum.cz/FrontClanek.aspx?idsekce=8321.

ii) to build an information base providing necessary background materials for strategic management of the Academy of Sciences (description of strong and weak spots of the individual research teams and centers), including feedbacks for the management of the individual centers and for the adjustment of their institutional support by applying the positively motivating principle of differentiated financial backing of those institutions that achieve excellent results.

8. Responsibility of Science and Research

Growing accent has been placed in the advanced European countries in recent years on what is called *accountability* of research, with the general public reasonably asking how and what particular social and economic needs and objectives is research really serving? What are the contributions and benefits derived from the financial resources invested in research? Mounting pressure is also being brought to bear on efficient and effective spending of the limited public funds on research. There are much greater demands on focusing mainly public research on social and economic needs, which has led many countries to redoubling their efforts in charting their own research priorities and improving their selection.

The trends that have been identified both during the selection of research priorities and evaluation of the results of science and research are aimed at expanding the number of participants in different forms of procedures. In addition to traditional representatives of the science community and officials from the state administration sector, people from the business sector and bankers as well as representatives of the civil society (for instance from civic associations) are invited to key negotiations in this field. A salient feature of this concept is *support for the involvement of the civil society*,[14] which is known to have a great say in all the stages of decision-making or rather evaluating procedures.

Responding to these pressures on science and research funding, on selecting research priorities and assessing resultant outputs, complete with their societal effects, leading European politicians as well as European science and research communities have been currently widely discussing the

[14] Czech case study is described in Adolf Filáček, "Governance of Science and Public Engagement: Czech Trends," in *Von der Informations- zur Wissensgesellschaft. e-Society – ePartizipation – e-Identität*, eds. Gerhard Banse, Robert Hauser, Petr Machleidt, and Oliver Parodi (Berlin: Trafo Verlag, 2013), 131–56.

subject of Responsible Research and Innovation (RRI). Since 2010, this particular term[15] has been frequently used in most strategic materials published by the European Commission, it appeared in the working programme for the domain "Science in Society."

The conceptual grasping of the term responsible research and development was first analyzed by Stilgoe et al.,[16] Von Schomberg[17] and EC 2012.[18] These definitions also set the stage for several European projects being solved with the funding from the 7th EU Framework Programme. The specific aspects of Responsible Research and Innovation in European countries were analyzed directly by a project called ResAGorA [19] (*Responsible Research and Innovation in a Distributed Anticipatory Governance Frame. A Constructive Socio-normative Approach*).[20] The project comprised elaboration of national case studies on RRI trends[21] in 16 selected EU countries, including the Czech Republic, and compilation of an RRI database.[22]

The outputs of the ResAGorA project were published, e.g., in *Science and Public Policy* journal,[23] where is described an overview of the status of responsibility in research and innovation (RRI) in 217 research performing and funding organizations across Europe (16 countries). The important part of the outputs is the database of the RRI trends that were studied in

[15] Discussions of the conceptual approaches to the term responsible R&D may be found in Richard Owen, Richard, Phil Macnaghten, and Jack Stilgoe, "Responsible Research and Innovation: From Science in Society to Science for Society, with Society," *Science and Public Policy* 39, no. 6 (2012): 751–60.

[16] Jack Stilgoe, Richard Owen, and Phil Macnaghten, "Developing a Framework for Responsible Innovation." *Research Policy* 42, no. 9 (2013): 1568–80.

[17] René von Schomberg, "A Vision of Responsible Research and Innovation," in *Responsible Innovation. Managing the Responsible Emergence of Science and Innovation in Society*, eds. Richard Owen, John R. Bessant, and Maggy Heintz (London: Wiley, 2013), 51–74.

[18] See "Responsible Research and Innovation," accessed December 21, 2022, https://op.europa.eu/en/publication-detail/-/publication/bb29bbce-34b9-4da3-b67d-c9f717ce7c58/language-en.

[19] See "About Rea-AGorA," accessed December 21, 2022, http://res-agora.eu/about.

[20] For detailed description of results see Ralf Lindner et al., eds., *Navigating towards Shared Responsibility in Research and Innovation: Approach, Process, and Results of the Res-AGorA Project* (Karlsruhe: Fraunhofer Institute for Systems and Innovation Research ISI, 2016).

[21] See "RRI Policies in Selected Countries," accessed December 21, 2022, http://www.rritrends.res-agora.eu/reports.

[22] See "Selected Key Documents on National RRI Policies," accessed December 21, 2022, http://www.rritrends.res-agora.eu/database.

[23] Malene V. Christensen et al., "What's in a Name? Perceptions and Promotion of Responsible Research and Innovation Practices across Europe," *Science and Public Policy* 47, no. 3 (2020): 360–70.

two rounds of expert surveys into RRI related activity in public research councils, universities, private companies, and civil society organizations.

9. Strategy CAS21 – Top Research in the Public Interest

Viewed from the perspective of the current concept of basic and applied research in the Academy of Sciences, the Academy of Sciences approach to the responsible research and innovation can be characterized as a type of research that addresses current and pressing challenges at national, European and worldwide levels, strives for excellent quality of its research results, and attempts to achieve long-term sustainability of its human potential, research infrastructure and financial resources. At the same time, this notion of responsibility also encompasses the task of evaluating the social impacts of implementation of achieved results, and respect for ethical and moral principles guiding the conduct of actors in research and innovation processes.

The Czech Academy of Sciences, being a public research-funding agency, implicitly addresses and explicitly targets some issues of the responsible research and innovation concept in its "Strategy for the 21st Century (Strategy CAS21)"[24] with its new motto "Top Research in the Public Interest."

The formulation of the Strategy CAS21 is based on the following premises:

- *Growing social relevance of scientific knowledge*. Science and technology development stimulates the society's growing anticipations of science. The principal challenges of the contemporary world include sustainable quality of life and the environment, preservation of biodiversity, reasonable utilization of natural resources, sustainability in energy, economic development, social cohesion, stability of the international financial architecture, and control of the impact of the rapid technological changes on nature, society, and the individual.
- *Globalization and acceleration of worldwide exchange of knowledge*. The processes of generating and utilizing knowledge have always transcended national or regional boundaries. The current information and communication technologies greatly contribute to the elimination of further barriers. Ever-greater amount of knowledge is generated

[24] See brochure "Strategy AV21 – Top Research in the Public Interest," CAS 2015, accessed December 21, 2022, https://admin.strategie.avcr.cz/uploads/AV_21_brozura_710b2dc8ae.pdf?updated_at=2021-12-20T03:50:55.971Z.

and made available on a worldwide scale within an ever-shorter time range. Globalization and the interconnected acceleration of worldwide exchange of information, together with an enormous growth of the volume of scientific data, are conducive to rapid development of new scientific disciplines and technologies.

- *Financial requirements of contemporary science*. Financial requirements of science research have been rising, and so has the accent on the evaluation of achieved results. Worldwide spending on research and development between 2002 and 2012 doubled, reaching almost 1,500 billion dollars.[25] At the same time, pressure has been mounting to raise the efficiency of the use of the limited public resources; that is why it is essential to focus their distribution, to a much greater extent, on the goals of the society. Seen in this light, the indicators of social relevance have been assuming ever-greater significance as a criterion of research and development funding.

The aim of the Strategy CAS21 is to address important responsible research and innovation aspects, which constitute substantial activities of the Academy of Sciences, namely:

- to strengthen the role of the CAS in science and society;
- to upgrade the quality and relevance of research;
- to use synergic effects of interdisciplinary and inter-institutional cooperation;
- to facilitate transfer of research results to the educational and application spheres;

In an effort to fulfill this vision, the Academy has begun implementing a set of coordinated detailed research programmes, utilizing interdisciplinary and inter-institutional synergy with the ultimate aim of identifying problems and challenges of the world today, and coordinating research efforts of the CAS institutes towards their solution.

The implementation of the Strategy CAS21[26] involves research programmes coordinated in all three CAS Research Areas. In 2015 were launched first 14 programmes, then other 4 programmes; some programmes

[25] OECD: Main Science and Technology Indicators (MTSI).
[26] See "Strategy AV21 – Top Research in the Public Interest," accessed December 21, 2022, https://strategie.avcr.cz/en/o-strategii.

were completed in 2019–2020 and later in 2020–2021 the new programmes began. Contemporary the following 15 research programmes are solved:

- Anatomy of European society, history, tradition, culture, identity,
- Resilient society for 21st century: crisis potentials and effective transformation,
- Sustainable energy,
- Society in motion and public policy,
- Global conflicts and local interactions: cultural and societal challenges,
- Preclinical testing of potential pharmaceuticals,
- Breakthrough technologies for the future – sensing, digitization, artificial intelligence and quantum technologies,
- Towards precision medicine and gene therapy,
- Virology and antiviral therapy,
- Foods for the future,
- Space for the mankind,
- Light at the service of society,
- Water for life,
- Land conservation and restoration,
- City as a laboratory of change: construction, historical heritage and place for safe and quality life.

Since their beginning the research programmes ensuing from the Strategy CAS21 have been open to partners at universities, the business sector and state and regional administration authorities, just as to foreign research groups and organizations. This circumstance as well as the motto "Top Research in the Public Interest" spell out the determination of the Academy of Sciences of the Czech Republic to profile itself in the future as an institution whose mission is to perform top research focused on the problems and challenges facing the contemporary society.

10. Concluding Remarks

The actual speed of the development of science, technology, and economy and of the subsequently stimulated social changes has posed a serious task of integrating this development into society, coping with its undesirable consequences, and seeking to balance quantitative economic growth and the quality of human life. Ever-greater accent is placed on sustainable development, which should satisfy the present-day needs without weakening the possibilities of the future generations to meet their own requirements.

Concurrently, there has emerged the issue of co-operation of natural sciences, the humanities, and social sciences in researching and resolving major challenges of the world today. The system of research priorities in natural sciences cannot be isolated from the global priorities, i.e., human, humanitarian, value-related and ethical priorities that assume the nature of cognitive decisions and evaluating processes.

There are no formalized procedures of public engagement (grounded in legislation or in governmental structures), focused specifically on responsible research and innovation in the Czech Republic; it is only possible to file specific petitions. Public debates (public hearings) oriented on the general public and civil organizations have not yet become part of public life in the country. However, there are initiatives stimulated from below and trying to stimulate public debates on R&D&I – e.g., Forum "Science Is Alive!"[27] Generally speaking, public engagement is an important trend influenced by examples coming from the advanced European countries and – first and foremost – stemming from regional needs.

Only a few topics in R&D&I have been discussed both in public, in the research community and in the decision-making sphere; these include: GMOs and food chain safety, consumer safety issues and, in a less structured manner, biofuels and biomass, solar and nuclear energy (and its safety) issues and the enlargement of the Czech nuclear power plants. The political stakeholders require better interconnection and coordination of science and innovation policy with other institutional strategies: educational policy, national economic policy, production strategy, marketing, PR, personnel strategies, etc., or – at the national level – coordination with the other national priorities (environmental protection, health, knowledge society).

A Eurobarometer survey (EBS340[28]) has shown that the Czech society seems to be holding an exceptionally strong belief in new technologies, a willingness to delegate decision-making to experts, and confidence in the responsibility of the industry management, while having only average knowledge of the given technologies and a below-average willingness to risk and accept personal responsibility.

[27] "Science Is Alive!" was established in response to the unexpectedly agitated situation on the Czech science and research scene in the summer of 2009. The Forum was formed by young scientists from a wide range of scientific disciplines (from the natural, technical, social sciences as well as the humanities) who had realized the need of assuming an active approach and displaying their interest in the issues of the Czech Republic's science policy.

[28] See "EBS340," accessed December 21, 2022, https://www.scribd.com/document/33440989/ebs-340-en.

The new survey in 2013 (EBS401[29]) shows public support for responsible research and innovation. Three quarters of the Czech population think that science and technology have a positive impact on society. Respondents, however, also express concern over the risks posed by new technologies, such as risks to human health and the environment. They want research and innovation to be carried out with due attention to ethical principles (82%) and gender balance (84%), but only 34% of the respondents are interested in developments in science and technology (in comparison with 53% average in the EU), and a majority of them do not feel informed enough (69%). More than three quarters (79%) of the respondents in the survey think that scientists working at universities or in government laboratories are best qualified to explain the impact of science and technology developments on society, and this group is also most likely to be seen (86%) as trying to behave responsibly towards society.

As for its current focus, the Strategy CAS21 is in full accordance with the views expressed by the Czech public as well as the strategic goals of building the European Research Area, while respecting the concept of responsible R&D. The structure of the programme of this top research in the public interest is focused, inter alia, on the Czech Republic's energy future, health of its population and quality of public policies as well as other topical issues and challenges.

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