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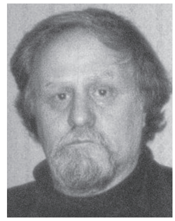

How Russian science is being reconstructed? (The historical-sociological analysis of reforms for the last 20 years)

The paper looks at the path traveled by Russian science in the last two decades from the concrete-historical and sociological perspective. Reform of science is explored, concrete data of empirical sociological polls conducted by the Centre for Sociology of Science and Science Studies, St. Petersburg branch of the Institute for the history of science and technology named after Sergey I. Vavilov, Russian Academy of Sciences, as well as results of an annual monitoring of the Academy institutions' work are provided. Development of science in Russia is summed up, conditions of its functioning that could secure Russia's innovative future are formulated.

Keywords: reform of Russian science, historical-sociological analysis, transformation of science, academic personnel, scientists' adaptation to socio-economic changes, mobility of scientists, problems of scientists' reproduction.

Introduction

The problem of reform in Russian science — its aims, tasks, ways, outcomes and long-term prospects — was in the focus of many publications in the last two decades. The dominant — several years ago — negative judgments of the situation in Russian science caused by changes that had started in the early 1990s were gradually replaced by more optimistic declarations from the government and leadership of the scientific community. Nevertheless, there has been up to now big differences in emphasis. The Ministry of science and education launches more and more new reform projects, whereas the scientific community is more discreet referring not only to the brilliant achievements of the Soviet science but also to the three-century old traditions of the academic community that was founded by Peter I and that allegedly has preserved its original form up to now. There is a popular saying by academician L. A. Artsimovich about immutability of two Russian institutions: the Russian Orthodox Church and the Academy of sciences.

Nevertheless, even a perfunctory glance at the history of the Russian Academy of Sciences reveals how far these beliefs from reality (Летопись Российской академии наук, 2003). Since its inauguration on August 1, 1726 the academic community has remained a major feature of the Russian state, but not only has it changed its social functions and priorities during dramatic changes of the political systems but it has also undergone profound structural, institutional, financial, personnel, and sometimes even moral-ethical and value-normative changes.

The Soviet science in 1991 was a product of a lengthy adaptation of scientists to the socio-political conditions in the Russian empire and the USSR that were themselves in constant socio-political and economic transformations. Thanks to flexibility of the academic community in their relations with government and society, not only did it manage to create but also to increase Russia's scientific potential, overcoming various crises that were seen once and again in the 18th century, to say nothing of the stormy 20th century full of tragic events.

The Soviet model of science, as it existed in the mid 1940s, refuted the myth that political freedom was necessary for successful scientific work. It turned out that science produced significant results even under a totalitarian regime, but it dies out soon without a governmental support.

The scientific community and the authorities were united by a shared belief that science could solve all the global problems and secure social progress. Within this symbiosis, the authorities wished to use scientists to build up economic and military power, to justify their policies ideologically, to raise their international prestige. Scientists were engaged as experts in taking important economic and techno-scientific decisions. Along with education, science constituted a single system that governed reproduction of intellectual resources for the Soviet Union, the whole of its infrastructure, including the management system, health care, economy, and so on.

Scientists, in their turn, learned how to use the authorities in solving their own problems, securing a numerical growth of their community, institualization of their research. They made the authorities believe that their work was of tremendous importance for the state that as the only project customer provided huge material, financial and human resources to science. That symbiosis gave fairly good yields as it ensured priority in the main areas of the scientific-technological progress, made advanced military equipment, in space exploration, and so on. Under the rigid party-and-government control, science was virtually the only island where one could freely implement his or her creative ideas. Science attracted gifted and ambitious youth, enjoyed a social prestige, provided better pay compared with other job careers. Science was the field with the real competition between research institutions, teams, and persons.

The academic system in the USSR was to provide research across nearly the whole range of fundamental sciences and to maintain the lead position in the world. The number of scientists and the volume of government financing in the Soviet Union exceeded sometimes those in all other countries. Since the Great Patriotic war leaders of the scientific community in the USSR were part of the ruling elite and enjoyed all the attendant privileges. At the same time, the situation was not so serene, as many scientists recall now. The party interference in science led to lagging behind the world leaders in many scientific fields, first of all in biology, electronics, stagnation in social sciences and humanities. The standard of living of researchers and university teachers — their salaries had not changed since the late 1940s — was inevitably going down at the background of a creeping inflation. A huge number of scientific developments lay idle for decades until their commercialization. The vertical and horizontal mobility of scientists was low.

The late 1960s saw growing dissatisfaction of the scientific community at their situation, which led to sympathy with the dissident movement, the symbol of which was A. D. Sakharov. Basically, scientists supported actively the perestroika. The overwhelming majority of them believed that it was of vital importance to abandon as soon as possible such postulates in the Soviet academia like centralization, militarization, isolation from the global scientific community, ideologization and politization in humanities and social sciences. They hoped that they would preserve their position in the society, and their scientific work would be prestigious as before. But instead of the long-awaited improvement the academia fell in a crisis — the gravest since the time of the October revolution — provoked, first of all, by the collapse of the USSR by the end of 1991, and a shock transition to market economy in 1992. The transition stretched out for almost two decades, and one cannot see its completion so far.

It would be reasonable to analyze the road covered by Russian science in the last twenty years from the concrete-historical and sociological perspectives. In the late 1990s to early 2000s, researchers at the St Petersburg branch of Institute for the history of science and technology named after Sergey I. Vavilov, Russian Academy of Sciences (SPb IHST) carried out a big international project that included a historical-comparative analysis of crisis situations in science in a number of countries starting from England at the time of the 17th century bourgeois revolution to the PRC during the cultural revolution (Наука и кризисы, 2007). Since 1992, the Centre for Sociology of Science and Science Studies, SPb IHST, has monitored transformations in St Petersburg's scientific community. As a rule, results have been published in collected papers entitled "Problems of activities of scientists and scientist teams" (St Petersburg, 1995–2008). The findings make possible to look at the reforms in the present-day Russian science in the light of the general algorithms of how academia in different countries overcame the crisis that was provoked by a break-up of the existing state structures and that affected the basics of relationship between a state and academia, as well as its position in a society.

Based on this research and also using data from other sources we are going: 1) to examine the main stages and trends in the transformations Russian science saw between 1991 and 2012; 2) to look at dynamics of how St Petersburg's scientific community responded to these changes; 3) to draw conclusions and outline prospects of the science reform.

The reforming period of Russian science may be defined by stages as crisis (1991 to 1996), transformation (1996 to 2001), stagnation (2002 to 2005), a new phase of reforms (2006 to 2012). The transformations which occurred during each period are lighted up in the article in detail.

The Crisis Stage of Russian Science 1991–1996

In the early 1990s the situation in Russia's science was especially tense and ambivalent. Science was obviously in social and organizational crisis that was caused by a number of factors. Emergence of market economy from scratch as a result of political, institutional and economic reforms, persistent economic crisis, recession, business insolvency, decrease in the internal market, the growing budget deficit, all these contributed to a failure to maintain the funding of R&D at the previous level. The post-Soviet reform years saw a dramatic drop in the state allocations for science from 2.03 % to 0.4–0.5 % of GDP (Дежина, 2007: 35). According to the most pessimistic evaluations in that period, some years saw the funding fall to one eighteenth or to one twentieth (Юсупов, 2002: 22–39).

The dissolution of the USSR's Academy of Sciences as a united administrative organization and the break-up of scientific and innovative relations following the collapse of the Soviet Union, the change of an ideological paradigm, unstable political situation, all this exerted a negative influence on development and implementation of strategic and tactical solutions including science and technology policies.

Cuts in the general funding of science led to a sharp deterioration of the living standards of those employed in science and engineering.

Such a funding situation in the Russian Academy's science had a negative impact on the technical support of research institutions. Expenses on equipment and instruments in the Russian Academy science fell about tenfold over the period of 1991 to 1995. Not only there was no money to buy equipment, chemical reagents and compounds, but to pay for electricity, mail, heating, scientific journals and literature. Most academic and technical staff had to survive in the literal meaning of the word. That was how the shock therapy worked.

The Russian society, scientists included, faced social and psychological changes that were dangerous for science. The prestige of science kept on falling in the public perception as well among academics themselves.

The years 1990 to 1995 are judged to be a stage in science called the "employment collapse" (Аллахвердян, Агамова, 2006: 71). According to data of Centre for Science Research and Statistics of the Ministry of Education and Science of the Russian Federation for 1991 to 1994 the number of researchers dropped by 40.2 percent compared with 1991 (Science of Russia in figures, 1996: 26). The number of postgraduate students went down: more than by 15.6 % only in the Russian Academy of Sciences (RAS) over 1991 to 1992 (Поиск, 1994).

Scientists left academic institutions in two ways: they moved to other activities or went abroad. Evaluating the quantitative scale of the post-Soviet brain drain has been a controversial issue.

According to the data from the passport and visa department of the Russian ministry of internal affaires 4,576 people employed in science and education emigrated from the country in 1992, 5876 in 1993 (Лебедев, Миленин). The total of those emigrated amounts to five percent of the total reduction in the number of employed in science and research (Китова, Кузнецова, Кузнецов, 1995: 41–56). According to foreign experts, in 1990–1992, 10–15 % of the total number of scientists and engineers who have left the scientific sphere, emigrated from Russia (Научно-техническая и инновационная политика, 1993).

The leaders in the scientist emigration were largely physicists and mathematicians, with biologists, chemists and Earth scientists half as many. The flows of humanities and social scientists were the least numerous. Geographically, the biggest brain drain was from the main science centers: Moscow, St Petersburg and Novosibirsk (Дежина, 2007: 140).

The internal scientist migration — moving to other jobs, especially business — became widespread.

The quantitative reduction in the human capital among scientists was accompanied by its demographic degradation. The average age of Russian scientists went up: it was 38.5

in 1960, and 43.2 in 1992. The proportion of researchers above the age of 60 grew from 9 % to 22 %, while the share of the most active and inventive age groups of 30–39 and 40–49 year-olds dropped sharply (Волков, 1999). The inflow to science of young graduates fell significantly: more than 3,500 graduates from universities and polytechnic colleges were hired by the RAS in 1989, but only 1,000 in 1992 (Поиск, 1993).

Russian science was unable to function normally in such a severe crisis. Russian scientists faced a lot of troubles. The situation needed an urgent reform of academic and research institutions. However, government could offer only bureaucratic alterations, changing endlessly the name of ministries that were in charge of science. There appeared numerous obstacles to real improvements, for instance, allocation of funding through competition. The Russian Humanities Foundation and the Russian Foundation for Basic Research were able to provide not more than 5 to 6 percent of total funding for the civil science. The declared restructuring of the RAS turned into the primitive sackings.

A federal law "On science and the state policies on science and technologies" adopted in 1996 provided for allocation of 4 percent of the budget expenses for science, although it was cynically not fulfilled for years. The maximum proportion never exceeded 1.58 %, and even with the start of financial stabilization this figure kept on falling.

Transformation of the Academy's Science, 1996–2001

The next decade of Russian science is often called the "transformation period"[1]. The transformation involved self-organization of the scientist community, emergence of individual and collective practices of scientists' adaptation.

The following transformations took place at this stage:

- stabilization, increase in activities, growing financing from Russian science foundations (the Russian Humanities Foundation and the Russian Foundation for Basic Research), emergence of funding through competition;
- decentralization of administration, growing independence of departments, teams, institutions;
- foundation of small businesses and innovation centers;
- free communication between Russian and foreign scientists; more joint projects;
- more ties between the Academy institutions and universities; formulation and implementation of programs to integrate science and education;
- more scientific papers by Russian scientists, more book publishing;
- establishment of the Academy's new institutions (over 100) in promising scientific fields;
- adoption of new IT and Internet;
- the rate of redundancies became slower (10–20 %);
- the scientist's average salary went up.

Whatever improvements in funding the Academy section of science, it should be noted that the state support of the basic research and development remained insufficient. Though in 2000, the state funding rose by 10.7 % compared with 1996. What was important in that period was a bigger activity of the science foundations which led to more extensive grant

[1] The data of science study research "Transformation of the academic science" under grant INTASS-RFFI (1999–2001).

funding based on competition. The first foundation, the Russian Foundation for Basic Research was established in 1992, and the Russian Humanities Foundation in 1994.

Since expansion of the foundations proceeded at the background of the crisis in science, their first priority was to help science to survive and only after that, during the transformation period, to assist in developing and reforming it (Аллахвердян, Дежина, Юревич, 1996).

The grants proved to be the only factor for many scientists to keep on working. They helped to adapt and to maintain working conditions. The foundations encouraged the world integration of Russian science.

The transformation stage saw changes in the forms of scientific organizations and the system of financing: decentralization for institutions' administration, more autonomy for departments and branches of Moscow's institutions in other regions, foundation of new teams within institutions (innovation centers and small businesses) that were more independent economically from the umbrella organization (Олимпиева, 2001).

Emergence of innovative businesses within the Academy institutions was one of mechanisms to adapt scientists to social and economic changes both in the country and in the RAS. Small innovation business is an additional source to finance the institutions attached to the St Petersburg Research Center, RAS. This source provides the Academy institutions with new investments from the state, foreign customers, industry sector (Дежина, 2007: 162–168). Innovation firms provided additional jobs for specialists and young employees which facilitated the process of reproduction in science.

The number of employed in science continued to fall during the transformation period, but the rate was lower than in the previous crisis stage. The years 1995 to 1998 are defined as the stage of "moderate redundancies" in the number of scientist staff (Аллахвердян, Агамова, 2008: 136).

These years saw grave distortions in demography: the average age of scientists was rising. Unlike the early 1990s with a dramatic rise in the pathological mobility, exodus of scientists from science, mass emigration, the scale of emigration at the transformation stage was not so impressive. But still it was going on and the role of social and economic motivation prevailed (The data of science study research, 1999–2001).

During the transformation stage, the issue of staff reproduction stood high on the agenda of the Academy institutions. As of 1996, the number of young scientists at the age below 30 dropped by 30 percent, the number in the group of 30 to 40 year-olds fell by 40 %, whereas the total number of researchers went down by 20 % over the same period.

Various types of cooperation between ministries, universities and the Academy were created to attract young graduates to science: one state-run program "The state support to integration of the higher education and the basic science" ("Integration", 1996–2006) and two programs based on funding from Russian and foreign sources.

However, the programs brought tangible benefits to higher education only: universities thanks to cooperation with the Academy research institutions succeeded in improving the training conditions of undergraduates, and the Academy's scientists got the opportunity for training young specialists for themselves.

During the transformation period, access to information resources became wider, the number of IT users among academics went up.

Stagnation or stabilization in academic science (2002–2005)?

The transformations in science were followed by a period of stagnation. At the background of reforms in economy and political life, science hardly saw any improvements at that stage. The administration of leading academic institutes and laboratories in R&D highlighted signs of stagnation in science at that time. According to the Center's data in the spring of 2005, the poll in the form of interview yielded the following distribution of replies to the question: "What changed in science over the last four years?" 63.6 % of respondents saw no significant changes, 27.2 % saw the only improvements in the fact that scientists used their own initiative more often.

When discussing the projects — revealed since the autumn of 2004 — of how to radically reorganize the academic community, it became clear that there was no normal dialogue between scientists and the authorities, and the relationship of partnership was lacking.

Nevertheless, on closer inspection, certain stabilization trends in the Russian science were visible in that period. In 2002, the Security Council approved the science development program until the year 2010 worked out by the President's council for science and high technologies with active participation of scientists themselves. For the first time, the development of science and technologies was listed among Russia's top national priorities, and the growth of the Russian economy in 2002 to 2003 allowed for an increase in financing science. Expenses on science rose more than threefold and amounted to about 2 billion dollars in 2005.

The relative salary in the sector "Science and science support" became stable. According to official statistics, in 2003 the average salary in Russia's science sector was 7,187 rubles or $256. In April 2005 the average salary in the science sector amounted to 10,102 rubles or about $360. Nevertheless, inflation was higher than increases in salaries. Remuneration for work in science was low given the high initial salaries of graduates in the trades other than science and engineering. An opinion poll in 2004 found out that 70 percent of respondents considered their conditions "a bit better than poverty", 9 % replied "poverty" and only 19 % "relatively satisfactory".

That period saw a boom in publishing books, growing number of publications and citations of works by Russian authors, the number of innovation centers and technoparks rose.

In 2003 there was an attempt to solve a recruitment problem in science. At the government level, the Ministry for industry, science and technologies was in charge of working out the Guidelines for preserving the workforce potential in the science-and-technology complex, as well as the Federal draft program "Scientists' workforce in the Russian Federation" for the period of 2004 to 2009.

All these efforts yielded only one result — young PhDs who were the winners of a special competition for young scientist got bigger remuneration, and the presidential and state awards went up. Opinion polls suggested that young researchers found it important not only salaries, but also the working conditions (modern equipment, involvement in contracts, etc), and career path in science. Those organizations that took into consideration these factors and made the appropriate provisions were successful in recruiting young talents for scientific positions.

So the government was not efficient enough in recruiting young researchers because their measures were local and inconsistent, they were not supposed to root out the underlying causes that had generated the workforce shortages in science (Дежина, 2002).

Academics themselves were aware of the need for a reform but had no clear-cut idea of its strategy and basic concepts. Not only scientists but the government also had no thought-out plan of reforms.

The new stage of the science reform (2006–2012)[2]

Exploring the six-year stage of the Russian academia's development it is possible to identify three mega projects of reforms in Russia's science:

1. The pilot project on improvement of the payment system for scientists and chief executives of research institutions, as well as academic staff at science centers of the Russian Academy of Sciences (implementation by stages between 2006 and 2008).

2. The federal target program "Academic human resources of the innovation Russia" for the period of 2009 to 2013.

3. *The Innovation Russia 2020* strategy.

A major event in reforming the Russian academia was decree N 236 issued on April 22, 2006 by the Russian government on implementation from 2006 to 2008 of the pilot project on improvement of a payment system in the Russian Academy of Sciences. (Постановления президиума РАН, 2006). In the period of 2006 to 2008 the following measures were taken: 1) a departmental payment system was introduced to raise the average salary to the level of $1,200–1,400 (2008) which was to be 1.2–1.4 times higher than the national average; 2) the Academy's staff was cut by 20 %, though without consideration of each institution's work by themes, number of publications, participation in conferences, and so on; 3) rather insignificant measures were taken to recruit young graduates; 4) government programs were drawn up for priority areas (nanotechnologies, atom energy, health care, and so on) for the years 2007 to 2012.

The fundamental research programs for the state-run academies of sciences for the period of 2008 to 2012 with a budget of 254.5 billion rubles gave an illusion of growing allocation to the academic field. In 2008 under this program the Russian Academy of Sciences received more than 38 billion rubles (Программа фундаментальных научных исследований государственных академий наук на 2008–2012 годы) that is a bit more than $ one billion which certainly did not solve the problem of providing the Academy institutions with advanced equipment. Only 9.1 % of respondents said that equipment in their institute corresponded to the world level.

At the new stage of the Russian science reform (2006–2008) a new system was adopted to evaluate scientists' performance in the academic area. Now the scientist's pay consisted of a basic salary, extra for academic degree, as well as stimulating premiums calculated on the basis of the coefficient of the scientific efficiency indicator (SEI) (Онищенко). As a result, since July 2008 the range of a researcher's monthly salary varies from 11,500 rubles (345$) for a junior researcher to 27,100 rubles (833$) for head of a scientific team.

It was of interest to find out how scientists judged the new pay system and downsizing. Replies to the question "Is the increase in salary felt by you?" suggest a relative improvement in the financial situation for a number of researchers (40 %). A rather big proportion did not notice clear changes (26.7 %) or noticed insignificant ones (33.3 %) (See Fig. 1)

Only 30 % of respondents believed that the lay-off did not affect their teams, one third of the scientists said that those measures would cause in future serious problems at the institute. At the same time, essential changes could be seen in the last three years in the scientists'

[2] Assessment of the new reform stage on the basis of content analysis of the normative acts and documents, national and departmental statistics and sociological data of polling scientists at the institutions of the Saint Petersburg scientific center conducted under the SPSC's program in 2008, 2011. The goal of this study was to identify judgments of scientists themselves on changes in academia, and efficiency of scientists' adaptation mechanisms to the situation in 2006–2012.

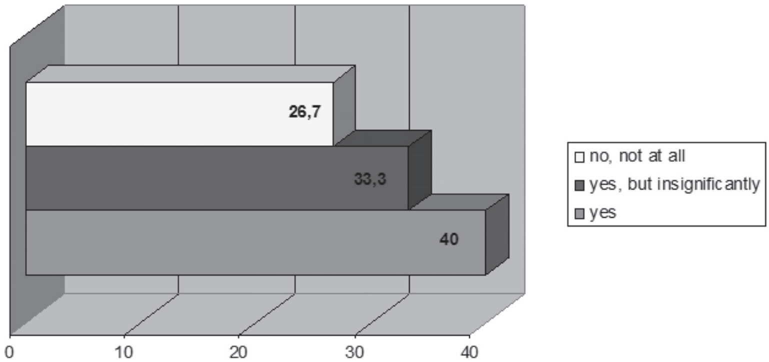

Fig. 1. Distribution of replies to the question "Is the increase in salary felt by you?" (%)

attitude to emigration. Replying to the question: "Do you contemplate emigration in order to work as a researcher or professor abroad?" 71.4 % of academics noted that they would work in Russia's academia. Nevertheless, mobility of the Academy staff in St Petersburg remains rather weak, professional links scarce and concentrated mainly in Russia (see Fig. 2). This has a negative influence on the indicators of Russian scientists' integration into the global scientific community.

Significant reduction of the entire scientific community in Russia is accompanied by even quicker drop in the share of young scientists in the most productive age. For example, the proportion of youth under 35 at institutions of the Saint Petersburg scientific center, RAS (SPSC) is 20 %, the middle-aged group 36 to 39 is 6 %, aged 40–49 is 13 %, older age groups are about 40 %. In the period between 2000 (7 %) and 2011 (19 %) the number of researchers aged above 70 at the Academy institutes grew nearly threefold. Layoffs of scientists affected the age group of 40 to 49 (see Fig. 3).

The problem of generation change is a complex problem that requires analysis of the causes of a weak recruitment of young people to academia, as well as the causes of why young scientists leave research institutes (see Fig. 4). The main reason why so few young people choose scientist careers remains, as before, the low prestige of scientific work in the

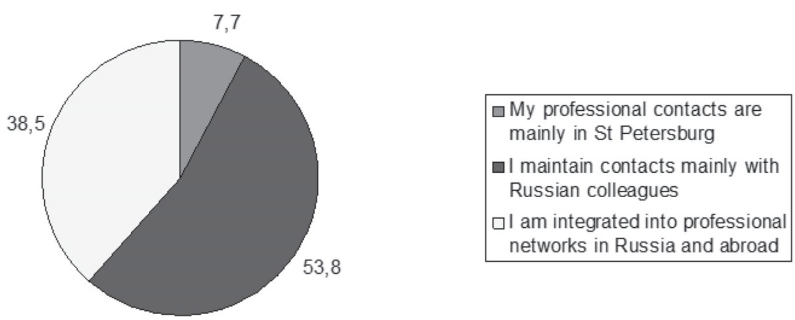

Fig. 2. Distribution of replies to the question:
"How could you evaluate your network of professional contacts?" (%)

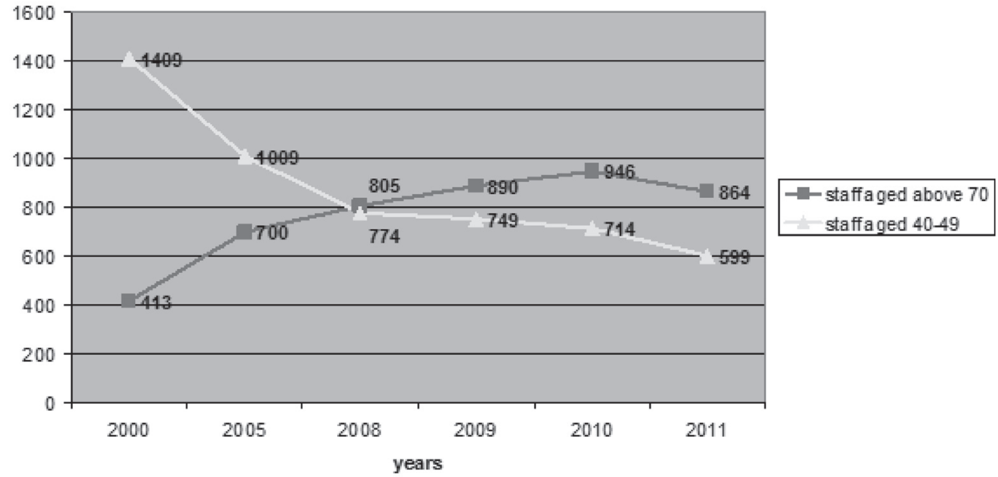

Fig. 3. Dynamics of staff at Saint Petersburg scientific center's institutions of Russian academy of sciences by years and age groups

Russian society. In the mid 1960s the occupational rating in the USSR placed a physicist job on the first place, with radio engineer on the second, whereas today this rating puts science on the ninth place only, and lawyers, businessmen, politicians, programmers, and journalists stand higher.

One of the strong causes — though not primary — of the weak recruitment of young people is the public image of a scientist that does not correlate absolutely to the idea of

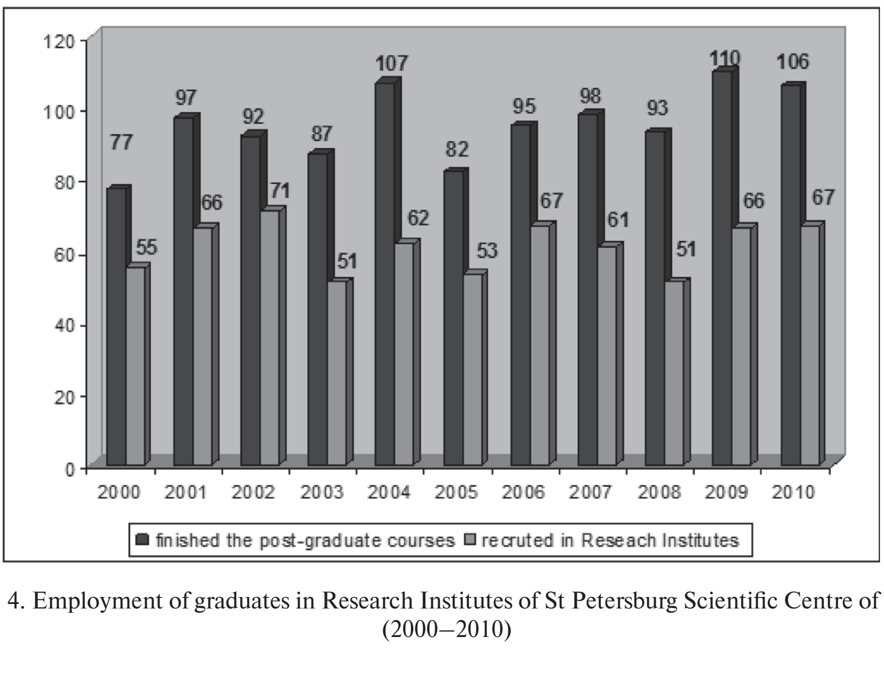

Fig. 4. Employment of graduates in Research Institutes of St Petersburg Scientific Centre of RAS (2000–2010)

a successful person. Today's labor market makes lucrative offers to the youth which worsens the human resource situation in academia. Until now an initial salary is low (for interns, junior researchers), especially in comparison with financial opportunities on the market. Nevertheless, the number of postgraduates in Russia has grown over the last decade, and in 2009 the postgraduate schools taught 154,470 people (Центр исследований и статистики науки). In St Petersburg there were 14,859 postgraduates in 2009, and 15,447 in 2010 (Петростат). But the Russian Academy of Sciences sees a decrease in the number of students in the last decade. The number of postgraduates is low, and the Saint Petersburg scientific center's institutions had only 468 people in 2011 (see Fig. 5).

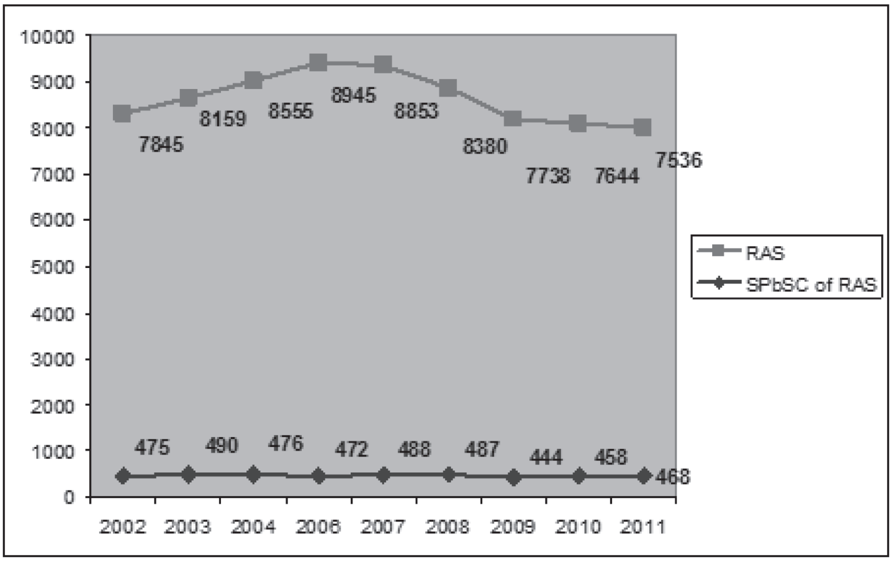

Fig. 5. Number of postgraduates in Russian academy of Sciences (RAS) and St Petersburg Scientific Centre of Russian Academy of Sciences (SPbSC of RAS) institutions (distribution by years)[3]

The weak inflow of the youth is aggravated by a significant exit of young scientists from academia. Which obstacles can see the youth on their road? The main reasons for young scientists to leave academia are equipment that does not correspond to the world level and a weaker position of scientific schools of thought in academia. Now many Russian academics are overloaded with work, sometimes even with several jobs, a lot of time is spent on traveling. Pension-aged scientists often do not work at the world level and are not integrated into the global scientific community. That produces a negative effect on supervision of postgraduate students, and on expert consultations given to young scientists. At some institutes young scientists say about lacking scientific guides for them to achieve world standards.

Higher academic positions do not have age limits which also plays a negative role. The system of professional motivations in young people has changed in the 21st century.

[3] Data from the Saint Petersburg scientific center human resource department for academics and postgraduates as of 01.12.2011 (Fokichev Yu. N.).

Young people of talent especially those who did internship in the West and who can compare the academic age structure and working conditions consider their career progress to be it important.

A young scientist's low salary is one of the essential factors that lead to departures. With the new salary system, a young researcher, in a lucky situation, may expect 30,000–35,000 rubles a month. But it requires to work about 7–10 years at an academic institution.

Young scientists' participation in the grant system has also its difficulties. It is rather trying to get an investigator-initiated grant from the Russian foundations (Russian Foundation for Basic Research, Russian Humanities and Social Sciences Foundation), because experts follow the well-known Matthew effect. These foundations do not have programs to support young researchers' internship at the leading international centers. A further problem is that despite the available programs for young scientists funded from the federal budget (Russian President's grants, the *Education* national project, Federal target science and technology program, Federal education agency's program, international programs), non-government foundations for young scientists (V. Potanin foundation, Foundation for advancement of Russian science, the Dynasty foundation for nonprofit programs, and so on), young researchers are unable to make sense of them. Postgraduates' tutors are sometimes unaware of specific programs that could raise a postgraduate's monthly stipend, as well a tutor's income.

To solve the human resource problem, the Federal target program (FTP) *Academic staff in the innovation Russia* was worked out for the period of 2009–2013 (Рудь). Governmental special projects to attract scientists from abroad and to deal with the Russian diaspora are being implemented and funded. In 2009–2010 a competition was held for researches conducted by teams headed by scientists invited from abroad; a mega grant competitive program was introduced to invite leading scientists who lived abroad to Russian universities (Постановление № 220, 2010). Nevertheless, the number of the projects supported is not big: a competition for researches conducted by teams headed by scientists invited from abroad amounted in 2009 to 110, and to 100 in 2011; a mega grant competitive program secured 40 in 2010 and 39 in 2011. It is absolutely unclear what criteria were used in taking final decisions and whether the winners were real leaders in the world science.

In 2011, the Russian Ministry of education and science paid a special attention to undergraduates and postgraduates' academic mobility programs. The Ministry of education and science's program for 2011 implemented along with the RASA (Russian-Speaking Academic Science Association)[4] — President's stipends for undergraduates and postgraduates — is in operation. The program aims at development of priority modernization areas and provides for training under guidance of professors — fellow countrymen — how to organize a scientific process, new experimentation methods, including in the International Refresher Training Center laboratory. In 2011, the President's administration and the Russian government developed a project — funded from the federal budget — to train for a master's degree as well as in postgraduate school up to 500–1,000 students each year. Upon coming home, these scientists are to occupy important positions both in Russian business and higher learning. But the number of stipends to train abroad is small: they amount to 40 stipends for students only, 60 stipends for postgraduates. Even if all of them return home, they will not be able to change the academia situation.

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[4] The center that unites scientists — our country fellows — from 12 academic groups in Europe and the USA headed by Russian expatriates.

A status differentiation of universities was conducted based on the National priority in the development of Russian science — support to science in Russia's higher learning. The national (Moscow, St Petersburg), federal (South, Siberian, North (Arctic), Kazan, Ural, Far Eastern, and North-Eastern) and national research universities were identified (29 in total). But the criteria of the university gradation aren't clear and objective enough. In 2011, the federal expenses for education grew by 28 % and amounted to about 500 billion rubles. It is planned in 2011—2013 to continue the annual additional funding of the leading Russian universities to the amount of 30 billion rubles, which was started in 2010, but on the whole it will not even make up for inflationary loss. New trends can be seen in the activities of the science foundations which were generated by introduction of non-scientific criteria of project assessment. If in the Russian Humanities and Social Sciences Foundation "before 2009 50—55 % of projects were carried out by the RAS researchers and only 25—30 % by university researchers, then in 2009 the proportion of projects conducted by universities was 38.5 %, and as high as 42.2 % in 2010. The share of projects conducted by RAS institutions dropped to 33.3 % in 2009, and 25.9 % in 2010" (*Булгакова, 2011*). Eventually, funding was allocated on the basis of internal departmental criteria and the quality of the projects funded started to deteriorate steadily, because since Soviet times, universities ranked below the Academy in quality and quantity of basic research. There is no evidence that there was a significant increase in research and publications at universities. Moreover, the situation at St Petersburg university is quite contrary. All research institutes were closed there, instead of elected deans all financial and faculty matters are run by appointed pro rectors in appropriate disciplines.

There is nothing odd that Russia has been more and more lagging behind in indicators that characterize the level of integration of a particular country into the world science: weak participation of Russian researchers in joint projects, in international scientific conferences, symposia; insignificant number of joint publications with foreign colleagues, international grants and awards obtained, a low citation index. We believe that the underlying reasons for that can be found in arbitrary decisions by the Ministry of science and education that do not have a well-thought-out science reform program based on Russian and international experience.

Findings

On the whole, the science crisis in Russia over the past two decades and the ways of solving it are similar to an ordinary scenario of crisis situations in other countries. Adapting to new socio-political and economic conditions, Russia's scientific community went through tremendous transformations. Despite endless reorganization of academia administration bodies, a consistent science-and-technology policy has not been properly articulated. Up to now the ruling circles hold different views on how to reform academia.

Unfortunately, Russia adopted the strategy of transferring science to universities and institutes that is the new configuration of research that we believe to be erroneous for several reasons.

First, the historically conditioned division of research and education was not taken into consideration. Science was done in the Academy institutes, universities educated. Research and educational potential of the Russian Academy of Sciences remains underestimated.

Second, dissimilarity of research potential in universities and department chairs is clearly seen. Education is a conservative environment and science will not emerge in several years in places where it has never existed.

Thirdly, the staff problem. The structure change: overall staff ageing, constantly diminishing middle-aged scientist group, young scientists leave the research institutions, more intensive departure of the staff that assist research process, low mobility, brain drain rather than brain circulation. The number of scientists who return home or those who come to study, internship, or work in Russian academia is small. The most active and promising scientists keep on leaving to continue their academic careers abroad.

Small innovation business continue to function in academia as an additional source of funding the RAS institutes providing the Academy institutes with new financial investment from the government, foreign customers, industries. The innovation business plays an important role in the Academy structure: it raises innovation activity in Russia which gives real opportunities of attracting private capital to science, establishing an elaborate network of small and mid-sized specialized firms capable of adopting high technologies over a short period of time, bringing them to Russian and foreign markets. The innovation business needs several conditions for better work in the academic sector: industrial demand, industry should abandon its raw materials orientation, financial and legislative support from the government, assistance from sponsors, a more developed network of innovation sector foundations. However, our findings suggest that many venture companies have to literally survive; this fighting for survival lowers optimism of their staff, changes the psychological climate in their teams. The main source of income in the RAS innovation firms remains profits from selling high-tech products, commercialization, one-off highly profitable jobs.

As early as in 1998–1999 the Saint Petersburg scientific center, RAS and the Techno-scientific council under the governor of St Petersburg collected data on the main research institutions in the city, including the Academy institutes, and published a book "Science to the city" that consisted of about 600 proposals from the city's research teams. Revised versions of the book "Science to the city" were prepared and submitted to the city government in 2001 and 2003. However, most of these proposals did not attract investors. The gap between science and industry has remained. Science is neglected as before, with the national economy based on supply of raw materials to foreign countries.

Business, on the whole, proved to be incapable of implementing its own post-university program of specialist training. This must be done by the Academy institutes, as well as by the higher learning system. Though postgraduates' low stipends and the lack of decent payment for academic tutors makes it hard to solve this problem. Nevertheless, according to our data, many Academy institutes made progress in solving this problem by way of founding their own elite schools, colleges, universities attached to the Academy institutes. This makes it possible to alleviate the human resource crisis.

Academics themselves when looking in general at the situation in science, their institutes' status, and their own circumstances, form their judgments that are basically different. A significant part of the scientific community believes that Russian academia managed, on the whole, to survive in the new environment. At the same time, a lot of scientists did not put up with the loss of the previous social status, with research jobs turned into an occupation devoid of the social prestige; so they continue to perceive the situation as crisis. They find it difficult to reconcile themselves to the fact that results of their work are ignored by society in general, and industries in particular, and that the high tech manufacturing is weak until now.

International experts give a rather critical assessment of the innovation advancement in Russia. The OECD experts' main conclusion is: "On the whole, one can see imbalance between government resources allocated to knowledge production and results observed in the innovation field". The conclusion is underpinned by statistical data on innovation-oriented companies, high tech exports, scientific publications (OECD, 2011).

The cause of this harmful and protracted inefficiency of the National innovation system cannot be found now in the consequences of the Soviet model's break-up only. It lies in the government's inefficient innovation and science policy.

Nonetheless, thanks to collective and individual adaptation practices it was possible to preserve Russia's scientific potential, to work out new forms of cooperation between science, education and industry, generated by the scientific community itself. The present situation points to the necessity of a deeper dialogue between academia and the authorities and a stronger partnership. Today's geopolitical situation and socio-economic conditions in Russia require creation of the science system as soon as possible that could ensure the innovation way of development.

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