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RUSSIAN R&D IN TRANSITION

1. Introduction

In the contemporary world the level of science and technology development becomes the most important prerequisite for the economic development of a given country and the wealth of its population. The Russian R&D sector had been forming during decades and historically its existence was most closely connected with the governmental intervention into its evolution. Respectively, abatement of the government's attention to issues of S&T policy in Russia unavoidably entails negative trends in R&D.

Exactly from these positions we shall examine the actual problems of science and innovation policy in Russia. The initial years of transition to a market economy in the country demonstrated panic confusion of government officials and the scientific community about the prospects of the development of science. Fortunately, at present there are signs of regained understanding of the fact that science and innovations are devoted to be the main strategic factor shaping society and the economy.

In present Russian S&T policy the key problems, the solution of which will enable to rescue science from the grip of crisis and to lead it to the state of a more or less steady development, have been outlined rather clearly. These are a sufficient increase in the share of non-government expenditure on R&D from different sources and rational use of budget funds, changes in the institutional structure of R&D, suppression of negative trends in reproduction of R&D personnel, and creation of a favourable innovation climate.

2. Organisational structure of the Russian R&D

The principal element of the organisational structure of Russian R&D is independent institutions performing research and development, as well as appropriate units of higher education institutions, industrial enterprises, and organisations in other sectors of the economy.

The organisational mechanism of elaboration and realisation of scientific policy and government regulation of R&D of the first years in new Russia is characterised by considerable dissociation between departments. The corresponding functions are divided among the structures of federal authorities as follows.

The general outline of science and technology policy is reflected in decrees of the President.

The legislative bodies – the State Duma and the Federation Council – have the right of initiating laws on science and technology issues. In both chambers the following committees are operating: the Committee of the State Duma on Education, Culture and Science and the Committee of the Federation Council on Science, Culture and Education.

The main body co-ordinating the activities of ministries and departments concerning science and technology is the Government Commission on Science and Technology Policy, headed by the Chairman of the Government.

An active role in elaboration of government policy is performed by the Russian Academy of Sciences and the branch scientific academies, both immediately determining the strategy of the academy sector and participating in councils, commissions, and working groups on issues of S&T and innovations.

According to statistical data, by the beginning of 1998 there were 4,137 R&D institutions in Russia (1). Since 1990, their number had decreased by 11 per cent, first of all due to the reduction of the industrial R&D sector and especially design and project organisations performing R&D.

As mentioned above, the main form of R&D organisation in Russia now as before is research institutes isolated from higher education institutions and enterprises. The share of independent research and design organisations accounts for 70 per cent of all R&D institutions (in 1990 — 58 per cent), whereas the shares of higher education institutions and industrial enterprises (dominating in R&D in developed market economies) accounts for 10 and 7 per cent, respectively (2).

In accordance with the classification adopted in the OECD Member countries, four main sectors are singled out in the structure of Russia's R&D establishment: the government, business enterprise, higher education, and private non-profit ones. The increase in 1990-97 in the number of R&D institutions in the government sector is caused by both emergence of some new institutes in the system of state administration (research institutes of federal ministries and departments et al.) and establishment of new and division of some already existing academy institutes. Contrary to the countrywide tendency towards reduction in the population of R&D institutions, their number in the academy sector grew from 535 in 1990 to 804 in 1997, of which in the Russian Academy of Sciences (RAS) — from 297 to 443. As a result, the share of the RAS already comprises 11 per cent of Russia's total of R&D institutions in comparison with 6 per cent in 1990. Institutes of the RAS, many of which keep being major basic research centres of world-wide importance, are now incorporated in 18 branch departments, 3 regional departments, and 5 independent research centres (3).

The business enterprise sector comprising market-oriented R&D institutions, including R&D units of industrial enterprises, by the beginning of 1998, consisted of 2,336 organisations primarily specialised in performing applied R&D. The changes in the composition of the business enterprise sector are connected with sectoral trends of industrial production and the privatisation process that has entailed sufficient shifts in the structure of R&D institutions property.

On the whole, by the beginning of 1998, 18 per cent R&D institutions were in joint (combined) ownership of the government and other Russian legal entities, 7.3 per cent were private property. Their employment makes up almost one-fourth of Russia's R&D personnel. The major part of privatised institutions falls on the business enterprise sector; nevertheless, in our estimate, approximately 56 per cent of R&D institutions within it stay being state property.

A new important component of the current S&T policy in Russia has been found in the formation of a network of State Research Centres (SRC). This status is granted by a decree of the Government of the Russian Federation to particular research institutes, enterprises, and higher education institutions, which have unique experimental equipment and highly qualified personnel, and have obtained scientific results internationally recognised. Such institutions are considered as R&D units of the federal importance, with peculiar forms of support to their activities. Granting an institution with the status of SRC does not entail a change of its organisational and legal status. The activities of SRCs are performed in accordance with programmes that meet priority objectives of S&T development, approved by concerned ministries (departments) and agreed with the Ministry of Science and Technology of the Russian Federation. The Ministry also ensures the goal-oriented financing of SRCs according to plans of basic and strategic research and programmes of applied R&D, approved by it. Parallel to priority allocations of budgetary funds for financing of SRC programmes and development of their experimental bases, they are granted with privileges in taxation, tariffs on communal and communications services, etc. (2)

By the beginning of 1998, the number of State Research Centres of the Russian Federation reached 58, with the employment of more than 80,000 people, which makes about 9 per cent of all those engaged in R&D in the country. Among them there are large research institutions holding leading positions in a number of priority fields of S&T development (nuclear physics, power generation, chemistry and

new materials, aircraft, machinery, medicine, biology and biotechnology, informatics, instrument-making, optics, electronics, robotics, etc.)

3. Overview of R&D in Russia

The present structure of the Russian R&D sector is formed under the impact of a number of economic, social, institutional, and political factors. They often contradictorily affect the trends of its development.

The situation in the Russian R&D sector during recent years is characterised by a drastic fall of the main indicators of the R&D input and output.

In 1990–97, R&D expenditure in Russia, at current prices, grew from 13 billion rubles to 24.4 trillion rubles. At the same time, its nominal increase for this period did not compensate for the negative influence of the strengthening inflation. This has been combined with considerable deterioration of the financial situation, sharpening of the budget deficit and, consequently, decline of the growth rate of budgetary allocations on R&D, difficulties to find additional financial reserves for these purposes from the funds of branch ministries and departments, and reduction in industrial demand for R&D. These processes have led to 4-fold decrease in R&D expenditure at constant prices in 1990–97 (3).

The trends in R&D expenditure were sufficiently behind the change of the main macroeconomic indicators. As a result, the share of GERD in GDP fell from 2.03 to 0.41 per cent. If in 1991 Russia still was on a same level with the OECD average, later it has fallen into the group of countries with minor R&D potentials, such as Iceland, Ireland, Spain, and New Zealand. Such comparisons are a troubling indicator of the low level of R&D financing in Russia (3).

The process of transition to a market economy entails gradual changes in the character of R&D institutions' activities, conditioned by their attempts to adjust to the new situation and survive under difficult financial conditions. Such changes

sufficiently affect the trends in particular R&D sectors. As the analysis shows, the Russian R&D is dominated by the business enterprise sector; its share in the structure of R&D expenditure, gradually rising, has reached by the beginning of 1998 66 per cent.

In recent years the government sector's share of the R&D expenditure total stays stable within 26-28 per cent. However, this share is more than twice higher than the average for the OECD member countries, which is due to the role of academy institutes in R&D performance in Russia (3).

The growth rates of R&D expenditure in the Russian Academy of Sciences, at current prices, was outstripping those in other R&D sectors in Russia. As a result, the share of the RAS in the total R&D expenditure in the country somewhat increased during recent years: from 8 per cent in 1990 to 12 per cent in 1997. Thus, the state of matters in RAS institutes on the average can be characterised as more prosperous in comparison with that in the industry R&D units and higher education institutions.

The continued support of the Academy from the federal budget, with basic research as its principal objective, leads to an outstripping rise of its value in R&D institutes of the Academy in comparison with the total value of R&D.

Under conditions of decrease in the solvent demand for applied studies, these trends have caused not only the above-mentioned rise of the RAS share in the total value of R&D by almost 4 points in 1990–97, but also an increase in the share of basic research in the national R&D total almost to 18 per cent. As regards the basic research share in R&D expenditure, Russia comes close to the level of the leading industrial nations, which makes up 13 per cent in the United Kingdom and Japan, 14 per cent in the United States, 19 per cent in Germany, and 23 per cent in France (National Science Board, 1991). At the same time, one should not forget that the increase in is only relative. If measured at the 1990 prices, the value of basic research in the RAS is only 32 per cent of the 1990 level (3).

The contribution of the higher education sector to the performance of R&D is reducing at an outstripping rate. Its share in R&D expenditure by the beginning of 1998 was 5.4 per cent. To the greatest extent the reduction affected the value of applied R&D by contracts with enterprises, thus strengthening the dependence of the higher education R&D sector on budgetary support.

The R&D trends in Russia are immediately connected with changes in the structure of their financing.

By 1995 certain shifts in the structure of R&D financing displayed themselves. The earlier (in 1992) established non-budgetary funds for financing sectoral and intersectoral R&D, formed due to allocations made by enterprises in the amount of 1.5 per cent of their sales, became by that moment a sufficient enough source of finance. Their share in the structure of R&D expenditure in 1994–97 reached 6–7 per cent.

As to budget appropriations for R&D, their value in 1997, expressed at constant prices, made up approximately one-fourth of the 1991 level:

The decline of actual values of budgetary financing considerably outstri pped the possible rates of transformation of the institutional structure of R&D on the basis of market principles. Moreover, non-fulfilment of the planned values of financing became chronic in 1994-98, in despite of the situation in 1997 was significantly better.

As the analysis shows, in spite of the trends of recent years, budgetary funds still stay being the most important source of financing R&D in Russia. In the structure of budget appropriations for these purposes the central place is occupied by the federal budget, whereas the contribution of regional budgets is very insignificant:

The budget of civil R&D is co-ordinated by the Ministry of Science and Technology of the Russian Federation. In its structure the following kinds of budget appropriations are to be distinguished (2):

1. Funds intended for the so-called basic financing of R&D institutions. They are distributed by ministries and departments among the subordinated R&D institutions, proceeding from the number of staff, requirements for allocations to be spent on maintenance of buildings and equipment and for provision of other necessary expenditures.

A considerable part of those funds in the recent years is being distributed in the framework of purpose-oriented federal programmes sti pulating performance of R&D:

2. Grants of goal-oriented budget funds, distributed on the tender basis (the Russian Foundation for Basic Research, the Russian Foundation for Research in Humanities, the Foundation for Promotion of Small Enterprises in S&T).

3. Financing of R&D by priority objectives. Such funds are goal-oriented and distributed (usually on the tender basis) by the Ministry of Science and Technology of the Russian Federation, and, by passing ministries and departments, directly reach R&D institutions for performance of concrete research projects.

Changes in the character of activities of R&D institutions belonging to different sectors to a considerable extent make clear the recent trends in R&D employment, which at first sight seem to be paradoxical. Thus, given the decrease in R&D expenditure in 1990–97 by 400 per cent (in constant prices), the employment in R&D reduced for the same period by 52 per cent:

The uneven reduction of R&D personnel has led to a change in its distribution by sector.

The decline in R&D personnel was far ahead of that in other occupations:

The reduction of employment in R&D is immediately connected with the trends in the labour market. The main factor in it has come to be the outflow of R&D

professionals, in particular the qualified ones, to the business sphere. Its wide opportunities enable highly-qualified scientists to easily find well-remunerated and promising jobs; as a result, many managers of banks, joint ventures, and other large business entities have advanced scientific degrees. However, specialists with lower qualifications, confronting difficulties in employment, often return to lower-paid jobs in budget-supported institutions, thus replenishing the supporting and other auxiliary staff (3).

The outflow from the R&D sector to a considerable extent is caused by the low level of remuneration. Approximately 71 per cent of scholars who leave their jobs have selected this factor as decisive for their motivation. Unfortunately, the low salaries in domestic R&D contributed to decline of the prestige of research work, its attractiveness for higher education graduates and post-graduates.

4. Key issues of the Russian S&T policy in transition

In the initial years of radical economic transformation the measures of governmental control over R&D were irregular and isolated. They were dictated not as much by a comprehended long-term need for the development of scientific potential as by the necessity to comfort to some extent the difficult situation of millions of people employed in R&D and preserve a minimum of the country's necessary image in the world community.

The economic crisis of 1998 dispelled many illusions concerning relative prosperity of the country at the expense of exporting fuel and raw material resources, possibility of stimulating innovative processes predominantly by market self-regulation, as well as increase in the technological level of production mainly as a result of imported developments and involving foreign investment. On the other hand, the capacities of existence of the Russian R&D sector due to the potential created in the Soviet period are on the edge of exhaustion. Therefore, further lack of effective

demand for R&D output is fraud with an irreversible degradation of most areas of research.

As far as under the existing circumstances the main factor of revival of Russia's economic potential can be found only in increasing the real sector of the economy, it is necessary, not forgetting the imperishable value of free scientific search, to pay an especial attention to evaluation of the immediate contribution that S&T can make to the quantitative and qualitative rise of production.

The answer to the question on the role of science in restoration of Russia's economic potential is at the same time obvious and extremely difficult. In fact, the world economic science has proved that the input of scientific achievement in GDP increase is above 50 per cent. However, under the conditions of the most acute deficit of finance that has formed in Russia, an analysis of a supposed effect from investment in R&D is very complicated.

The central place is occupied by vital problems of transferring the economy to an intensive path of development. While declaring innovation the basis of economic development, it would be an unpardonable mistake to ignore the still existing powerful Russian scientific potential and not to use domestic developments that often are less expensive and at the same time better adapted to Russia's specific circumstances in comparison with foreign analogues (4).

The Russian R&D sector is capable to offer quite a number of technologies, whose further development and introduction promise large-scale and sufficiently quick economic advantages.

Commercialisation of advanced Russian technologies will enable to sufficiently increase competitiveness of domestic goods and services. It is important to emphasise that, as a rule, contemporary scientific developments enable to save expensive and rare resources, including natural ones.

Under conditions of intensification of innovative processes, a strong influence on the sphere of production is made by the choice of priority areas of science and technology. The priorities once chosen determine the technological structure of the economy for quite a long term - at least for 5-10 years. It should be minded that the economic efficiency of scientific developments is actualised not only in the sectors for which they are intended but also is multiplied through intersectoral links. Therefore, while choosing priorities, it is important to envisage the development of macrotechnologies (goals of coupled technologies), which could be critical knots of economic breakthrough.

It should be noted that progressive movement of the contemporary economy is based on not only technological but also organisational innovations. In this respect, science is also intended to say its loaded word. Expenditure of internationally leading corporations on R&D only amount to a value of about 5-10 per cent. With account of expenditure on introduction of innovations, the share of innovative component in expenditure is still higher. In Russia as well, it is important to ensure integration of sectoral R&D in the forming large business structures. There are already examples of establishment of financial and industrial groups around high-technology industries with a well-developed research and experimental base.

Within their number there are the financial and industrial groups Formash, Avant-garde, The Russian Aviation Consortium, and High-Speed Fleet.

Large-scale reserves of demand for science in Russian society are hidden in a greater orientation of research to regional needs. Dissemination of R&D output over the country’s territory could not only contribute to changing the socio-economic character of the regions, forming high-technology production clusters by concentrating the innovative potential, but also consolidate the indivisible national economic space of Russia. For these purposes it is supposed to form a network of

innovative infrastructure. The creation of innovative technological centres intended to provide a basis for the national innovative system has already begun.

Basing on S&T, the real sector will be capable of not only satisfaction of current innovative demand but also rational strategic development.

The choice of priorities in science and technology in many respects is correlated with the room that Russia is capable to occupy in the international labour division in the field of high technology. The intellectual potential available in the country creates prerequisites not only for a appreciable presence of Russia in the world trade in science-intensive products but also for an active participation in more advanced forms of co-operation, integration in international research and production complexes.

Specific features of the present economic situation as well as the traditions of relationship between science and society enabled a conclusion that in the forthcoming years a sufficient part in efforts to support science will be as now and before belong to the State. For this reason, primary attention should be attached to improving the State's science and technology policy.

Among the objectives of science and innovation policy in the forthcoming years the following ones could be selected:

–Periodic correction of priorities of S&T development with account of change of socio-economic demands and trends in cognition processes;

–Formation of large research and industrial complexes. They will not only serve for integration of science and production but will also enable transition from the linear to an iterative model of the science and innovation cycle;

–Establishment of federal centres for science and high technology. It will become a form of actualisation of State priorities in science and technology and concentration of the S&T potential on solution of the most urgent problems;

–Incentives for investment by business entities in science and innovation (e.g., a possibility of introducing governmental guarantees for private investment in science-intensive areas);

–Intersectoral and interregional co-ordination of S&T and innovative activities.

The extent of practical implementation of measures on turning science and innovation activities into the basis of economic development will in many respects determine the future of Russia for forthcoming years and decades.

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