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STATE SCIENTIFIC AND TECHNICAL POLICY OF THE USSR IN THE MID-1950S

Bodrova Elena Vladimirovna (a), Kalinov Vyacheslav Viktorovich (b),
Sulumov Zelimkhan Khasambekovich (c)*
*Corresponding author

(a) Federal State Budgetary Educational Institution of Higher Education "MIREA - Russian Technological University", Central Federal District, Prospekt Vernadskogo, 78, Moscow, 119454, Russia, evbodrova@mail.ru
(b) Federal State Autonomous Educational Institution of Higher Education "Gubkin Russian State University of Oil and Gas (National Research University)", 65 Leninsky Prospekt, Building 1, Moscow, 119991, Russia, kafedra-i@yandex.r
(c) Federal State Budgetary Educational Institution of Higher Education "Chechen State Pedagogical University" FGBOU VO ChSPU, North Caucasus Federal District, Subry Kishieva st., 33, Grozny, 364037, Chechen Republic, zsulumov@mail.ru

Abstract

On the basis of archival documents, which have now become available, the problem of the organisation of scientific and research work in the USSR in the mid-1950s is studied. Reports sent to the CPSU Central Committee by the leadership of the USSR Academy of Sciences and the State Committee for New Technology of the USSR Council of Ministers allow us to assess, to a greater degree of reliability, the state of the scientific and technical complex of the country in the mid-1950s, to analyse the conclusions and recommendations of leading scientists, to identify the factors that determined the technological lag in a number of very important areas of the Soviet Union. The authors of the documents, which were classified, stated not the lagging behind of the Soviet Union in this period, but the potential advantages of the Soviet structure, which, however, were not sufficiently utilised. The country in the period under study had a powerful scientific and technological complex, and the achievements were very significant, but the organisation of research and development work, especially the process of introducing R&D into civilian production, was not efficient enough. The conclusion is formulated that a number of reasons for the inhibition can be rightfully attributed to the flaws of planning, failure to provide the declared indicators with sufficient material and human resources, lack of a coordination between industries.

Keywords: Implementation, organisation, R&D, scientific and technical potential, technology gap

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1. Introduction

The acquisition of technological sovereignty is one of the most important conditions for further development of the Russian Federation. In this regard, it is extremely relevant to study the Soviet experience in the development and implementation of the state science and technology policy in the USSR in the 1950s. Domestic researchers assess its results in different ways. Some believe that the extremely high rates of economic growth and world-famous achievements in space, rocket science and others allow us to speak of a true flowering of science and technology (Khanin, 2002). Others argue that the crisis of the mobilisation model began already in the 1950s, with technical and technological borrowings only masking the USSR's progressive lagging behind the advanced countries of the West (Shestakov, 2006). Bratchenko and Senyavsky (2007) insist on the conclusion that the Soviet model turned out to be the most adequate form of the Russia's transition to an industrial and urban society. However, as the national economic complex expanded, the planned-directive mechanism gave rise to inhibition mechanisms primarily due to the growing autonomy of departmental structures and absolutization of their interests.

2. Problem Statement

At present, declassified archival documents allow us to assess, to a greater degree of reliability, an accuracy of priorities chosen by the authorities at that time and measures taken to intensify scientific and technological progress in the country, a position of leading scientists and their recommendations (Dokuchayeva et al., 2024; Tang & Yang, 2024).

3. Research Questions

The subject of the study is the process of development and implementation of the state science and technology policy of the USSR in the period under study. The task is to analyse the reports and recommendations of leading specialists for a more reliable assessment of the state of the scientific and technological complex of the country and to determine the feasibility of the approved plans (Lipich & Balahura, 2024; Regnerová et al., 2024; Shumilina & Antsiferova, 2024).

4. Purpose of the Study

The aim of the study is to determine main results of the USSR state science and technology policy implemented in the 1950s, to identify the factors of the emerging slowdown in this area.

5. Research Methods

The methodological basis of the study was the principles of historicism, objectivity and reliability. The modernisation theory was adopted as the basic one.

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6. Findings

To achieve the goal of the study, archive documents are also of great importance, in which leading scientists, heads of various structures responsible for a scientific and technical sphere, tried to draw the attention of the authorities to the importance of certain areas, an importance of effective organisation of research work. Therefore, on 21 November 1955, based on instructions of the Chairman of the Council of Ministers, N.A. Bulganin, the leadership of the USSR Academy of Sciences and the State Committee of the USSR Council of Ministers for New Technology (Gostekhnika), drafted a report note known as "The organisation of research work in the USSR and in the main capitalist countries", sent to the Secretary of the CPSU Central Committee, N.S. Khrushchev. The document is of considerable interest, as it contains a comparative analysis of the state of affairs in certain areas of science in the USSR by the mid-1950s in a concise form (Ahmad et al., 2024; Singh et al., 2024; Waite, 2024).

On the basis of numerous examples, the conclusion was formulated that in various fields of science many ideas appeared and were developed for the first time in our country, while their refinement and practical implementation was carried out mainly abroad and earlier than in the USSR. Leading scientists had to fix this inhibition and draw the attention of the country's leadership to the consequence: they had to rely on foreign research and designs for practical implementation. For example, basic principles of constructing modern television systems in the Soviet Union were proposed and published somewhat earlier. It took a very long time to finalise them to practical application. As a result, the equipment for the Moscow Television Centre was purchased in 1936 in the USA.

The authors of the report referred to a universally recognised fact: Russia was the birthplace of metallography, a science created by D.K. Chernov and developed by his students. However, practical application was limited in the 1950s to metal for armaments production. As for such steels as stainless steel, manganese steel, high-speed cutting tool steel and many others, the USSR in this period borrowed them entirely from foreign practice.

Our country gave the world both an ore process of an open-hearth conversion of pig iron into steel and the hydraulic theory of metallurgical furnaces developed by the Goryainov brothers and V.E. Grum-Grzhimailo. Having started the introduction of oxygen into metallurgy earlier than anyone else has, the USSR lagged behind the USA at that time. Despite the fact that the first oxygen purging of open-hearth pig iron was performed in our country and showed a full possibility of obtaining steel, its application in practice was delayed. A considerable number of such cases were listed in the report. These examples could not but convince the addressees of the correctness of the conclusions.

Such direction as the organisation of scientific and industrial research, which was not paid the necessary attention in the USSR, was noted as significant. The authors rightly believed that modern highly organised mass production for its improvement and for introducing changes should have a perfect system of organisation of implementation, connected with production, but at the same time independent of it.

The study of foreign experience and an expansion of relations with foreign scientific institutions were considered very important. In addition to the purchase of foreign literature, it was recommended to

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increase the number of business trips and internships of young scientists for up to 3 years to improve promising, but insufficiently developed fields of science.

The authors were also forced to point out the shortage of equipment. Even the Academy of Sciences of the USSR experienced an acute shortage of instruments and materials necessary for the fulfilment of the Government's assignments. From year to year, the demand of the USSR Academy of Sciences for imported equipment and instruments was not satisfied, and the volume of their receipt was decreasing. The minimum demand was met within 20–25%.

At the same time, the heads of the Academy of Sciences and State Machine Building Industry referred to examples when the correct organisation of scientific work and the timely application of its results by industry gave a great national economic effect. For example, the application of the high-frequency heating of metal, developed by V. I. Vologdin, a Corresponding Member of the USSR Academy of Sciences, made it possible to accelerate sharply the operation of product hardening and heating for pressure treatment. This increased labour productivity many times, allowed creating an in-line, highly mechanised forging and heat treatment shop. The report formulated an absolutely accurate and still relevant conclusion that science, relying on the national economy, "would lead it and look far ahead, and was not at the mercy of industry". Qualitative growth of science is incomparably more important, as it provides the introduction of new methods and new ideas usually from neighbouring areas of science. But the authors of the report had to state that, compared with the processes observed in foreign science, such enrichment with new methods of research, borrowed mainly from physics, occurred much faster abroad. And our country in this respect was characterised by great inertia. "In modern conditions, the development of production is absolutely unthinkable without intensive scientific research. Moreover, there is a continuous and rapid process of interpenetration of science and production", concluded the authors of the report.

Another document sent on the same day to N.S. Khrushchev, a Secretary of the CPSU Central Committee, is of no less interest for the study of the topic. The report note was prepared by the same authors. It defined the most important tasks of science development in the 6th Five-Year Plan. Let us note that the authors also referred to the experience of pre-revolutionary Russia, to the discoveries made at that time, to the relationship between science and teaching in universities, which, the report argued, was the strength of science, as a reliable way to grow promising scientific personnel. While recognising that in 38 years, Soviet science had grown into an extremely powerful force (development of artificial rubber and the setting up of the world's first industrial production of it, a prediction and discovery of huge oil deposits by geology, a successful exploration of uranium ores, a creation of a whole new science of biogeochemistry, etc.). At the same time, the scientists pointed to the small number of major discoveries: "A narrow connection with practice was not enough to fertilise science". They suggested that in order to catch up with Western science, one should use "...other people's scientific reserve. Having caught up with it, we have to rely on our own scientific reserve. Such, for example, is already the situation in the field of atomic energy and nuclear physics and in a limited number of other important areas". In the 6th Five-Year Plan, it seemed necessary to sharply increase the share of scientific work, scientific reconnaissance in unknown areas and promising scientific work, with a view to uncover new phenomena, establish new links, develop new scientific methods. The report named specific "points of growth" in certain scientific

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areas. Among them, there were plans to create an artificial satellite of the Earth within the next 2-3 years, to make the first space interplanetary flights to the Moon for the purpose of its overflight, photography and observation of its back side. The plan was to establish industrial semiconductor energy: a direct conversion of heat and light energy into electric energy (with efficiency of 10% and more). Soviet Scientists planned to create fast computing and control machines of discrete action on the basis of germanium and silicon triodes, ferrite, contactless and other elements, nodes of these elements. The development of a new type of a digital machine M-20, whose speed was 20000 arithmetic operations having 2000 tubes, was also included in the list of perspective directions. The first sample of the machine was to be ready in 1956. In the years of the 6th Five-Year Plan, it seemed important to have at least 50 such machines. In addition, it was necessary to scale up the work on the creation of digital machines to control automated production processes primarily in power engineering, metallurgy, flow production, for unique machine tools, in chemical.

At the same time, the document stipulated certain organisational, personnel and material conditions, without which the presented programme could not be implemented. In particular, it was a question of organising a system for the introduction of scientific achievements into industry "no worse than it is done abroad", a flexible system for the development of fundamental scientific findings up to the stage of use in industry. It was proposed to create a system of pilot plants and production facilities, not connected with the plan, capable of quickly using new proposals (experimental workshops at factories and even experimental plants working on the technology of the future). The number of leading scientists should be increased, as this is the only way to combat monopoly in science. Among other things, research activities in universities should be intensified for this purpose. The authors rightly pointed out that in the USA, universities were the main force in developing the fundamental foundations of science. To this end, it was proposed to tighten the requirements for the qualifications of university professors, to create material conditions for scientific work in a large part of universities, to exempt scientists of universities "from school hours of teaching (800 hours of workload per year leave no time for science)".

The report formulated a conclusion about the need for unified planning, if not of entire scientific work conducted in the country, but at least of specific major scientific tasks requiring comprehensive development, and the creation of scientific centres in the periphery. A sharp increase in capital investment in the construction and equipment of technical universities and research institutes, the Siberian Branch of the Academy of Sciences and academies of the Union Republics, engaged in scientific and technical research in the field of physics, chemistry, mechanics, technical sciences, biology at the expense of the relevant sectors of the national economy, seemed necessary.

It was recommended to organise a supply of research institutes with equipment, devices and materials, both planned and funded, in order to quickly obtain the equipment and materials from the warehouses of sales organisations of ministries, the need for which arose in the course of scientific research. Separately, the need to create a more powerful and flexible industry of scientific instrumentation was mentioned. On a large scale, the situation in the USSR required to develop an industry of chemical reagents, to create laboratories to manufacture substances with labelled atoms on orders of researchers. Such conditions forced to sharply increase the number of scientific journals, pages and circulation, so that

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scientific articles were published in 3–4 months, not 1.5–2 years. Finally, it seemed necessary to expand international relations.

Such recommendations were extremely relevant in the context of the rapidly unfolding scientific and technological revolution. It seemed that the Soviet Union was developing at a pace corresponding to the requirements of the time. The list of achievements is world famous. However, the scientific elite of the country thought otherwise. Speaking on 28 December 1956 at the General Meeting of the USSR Academy of Sciences, its President, Academician A. N. Nesmeyanov, gave a very negative assessment of the state of Soviet science. In particular, he spoke about the diminishing role of scientific and engineering societies, about the lack of a proper large revolutionary shift in the development and production of computer technology.

Academician A. F. Ioffe agreed with this conclusion and emphasised the problem of radio engineering and semiconductor devices, since in this field the USSR was about five years behind western countries. And this gap did not shrink in the course of time, but it rather grew. At the same time, he noted the success, ahead of competitors in a less significant in volume but equally promising area, made in the field of semiconductor energy. The scientist asked himself a question that worried many people at that time: why is it impossible to catch up with the capitalist countries and, first of all, with the USA in the field of semiconductor devices technology? The Soviet Union spared no expense and effort to ensure this. The physical institutes of the Academy of Sciences did a lot of work, but such industry was never created. The academician noted the only way out to master foreign samples in order to reproduce them, while abandoning the tried and tested way: direct borrowing. In the academician's opinion, only developing the physical base allowed finding new ways and, without repeating the West, catching up, maybe overtaking the West, in any case, evolving their own technology in a worthy way: *"*...Our task is not to pluck flowers and fruits of foreign technology, but to grow, if you will, our own garden with the roots of trees, on which would grow these or those fruits, not necessarily the same".

The management of the USSR Academy of Sciences requested that measures be taken to accelerate the introduction of completed scientific research into industry. The report was accompanied by a list of 56 studies prepared for implementation. Of particular concern was the development of semiconductor devices. The report pointed out that it was necessary to intensify diodes and triodes production in our country, referring to the experience of the USA, producing hundreds of thousands of germanium diodes and triodes every month. 1150 thousand pieces were sold in 9 months of 1954, while in the USSR these devices were produced in very small batches and not by the industry. But the Ministry of the Radio Engineering Industry delayed this work. As a result, the whole process of creating diodes and triodes by serial production took 4 years, whereas with proper labour organisation, according to the conclusion of experts, it could have been done in 1.5–2 years.

7. Conclusion

In conclusion, the authors can state that documents which have now become available allowed assessing, to a greater degree of reliability, the state of the country's scientific and technological complex in the mid-1950s, analysing conclusions and recommendations of leading scientists, and identifying factors that determined the technological lag in very important industries. The authors of the reports that were sent to the Central Committee of the CPSU did not claim that the Soviet Union was lagging behind. They asserted that the potential advantages of the Soviet structure were not sufficiently utilised. The country had a powerful scientific and technical complex, but the organisation of research and development work, especially the process of introducing R&D into production, was not effective enough. The list of reasons determining the slowdown rightly includes planning defects, failure to provide the declared indicators with sufficient material and human resources, the prevalence of departmental interests over the national ones. Another reason is ignoring the recommendations of the scientific community and international experience, ineffective measures to stimulate scientific and technical activity in production and universities. This involves declarative nature of some programmes, lack of integration of science, education and production.

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