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STATE REGULATION OF FUNDAMENTAL SCIENCE WITHIN THE CONTEXT OF INNOVATIVE DEVELOPMENT

*T. V. Nikeienko, senior teacher, State Higher Education Institution «National Mining University»,
rodgrym@gmail.com*

Theoretical bases of fundamental science functioning as bases of innovative production are considered, global experience investigation regarding this sphere is conducted. Ways to change priorities of government control in this sphere are offered.

Keywords: fundamental science, innovations, innovative cycle, government control of innovative development.

Statement of problem. Activization of innovative activity is the main imperative of development of modern Ukraine as there during the period of independence has not been created effective mechanisms of innovative development. Despite constant increase in investment injections in the Ukrainian economy, specific weight of innovations does not exceed 14–16 % of total amount of investments. In the developed countries this indicator steadily keeps at

the level of 50–60 % [1, p. 4]. These figures testify that innovations are not today's priority in domestic business.

Realities of economic development are such that without innovations and technological updating of economy the country cannot reach competitiveness in the world markets, as well as integrate into the structure of the modern world economy as equal. The possibilities of gross domestic product building and increase of

living standard depend on the productive force development level and especially on their technical and technological component. Therefore, activation of innovative activity is necessary to ensure stable development of economy in Ukraine.

Analysis of recent papers. Understanding of the huge importance of the problems connected with innovative development intensified scientific research in this perspective. Today a large number of papers are devoted to this or that issues of innovations. On the territory of the former Soviet Union the most significant of them are works of such Russian scientists as S. Glazyev (development of the concept of technological ways) [2]; B. Kuzyk and Y. Yakovets (problems of cyclic dynamics on an innovative basis, the theory of the innovative breakthrough) [3–4]; N. Ivanov (research of national innovative systems) [5–6]. In scientific and practical aspect the research of such Ukrainian scientists as Y. Bazhal (the theory of technological changes) [7]; A. Galchinsky and V. Geets (the strategy of innovative development of the Ukrainian economy) [8]; V. Fedorenko (the problems of innovative activity) [9], L. Fedulov (the concept of technical and technological changes) [10] and others are equally interesting.

Fundamental works of such prominent foreign scientists as P. Druker, J. Keynes, N. Kondratyev, S. Kuznets, G. Mensh, M. Porter, N. Tugan-Baranovsky, E. Hansen, and Y. Shumpeter became theoretical bases of the innovation related researches.

Giving particular attention to regularities of technological development and innovative updating of national economy, nature and mechanisms of innovative cycles, governmental activity in the innovative sphere, a number of questions are far from being solved. This may refer to insufficient degree of a number of theoretical and methodological aspects of innovative activity research, and also the question of the market and the state interaction mechanism in the solution of innovative development problems. No less important is the justification of state and business sector forms of participation in financial support to innovative process also is important. The ambiguity in definition of regulation approaches and methods of innovative activity considerably complicates for-

mation of effective Ukrainian innovative development model. All aforesaid demands further development of the innovation theory and its regulation. As appears from experience of both developed and successful in innovative development countries the most important role in activation of innovative activity belongs to the state. Despite the fact that plenty of researches are devoted to problems of its participation in formation and development of the innovative sphere, we would like to dwell on very important problem concerning the state activity in the sphere of development of fundamental science without which no innovations can be carried out.

Aim of the paper. The purpose of this article consists in studying technical and technological development of the developed countries experience, and on its basis allocating the most effective forms and methods of state regulation of fundamental science as bases of innovative activity, developing the adaptation of this experience for economy of Ukraine.

Materials and methods. The innovative activity is directed at practical use of scientific and technical result and intellectual potential for the purpose of receiving social and economic effect. The latter may be maximising profit for the enterprises, raising competitive advantages for the separate enterprise, and society as a whole, increasing the possibility to supply a sufficient number of population goods and services, improving social infrastructure functioning. Such wide coverage of the purposes of innovative activity testifies special importance of this sphere in the society development as innovations are aimed at increasing return on the enclosed resources. However, providing operating conditions of the innovative sphere appears to be a big problem.

The matter is that new ideas and knowledge first of all are necessary for development of innovative activity. This activity is represented by data unknown before on the nature, the person, society, equipment, technology, which became available to mankind owing to purposeful scientific activity. Such data get a form of the scientific result uniting both objects of intellectual property, and ways, principles, ideas, discoveries, data of experiments and supervision. These results can be applied in the innovative sphere.

Actually «not discoveries but inventions which realise them are a starting point of innovations» [4, p. 97]. Scientific results are born in the sphere of fundamental science where the emergence of new knowledge takes place. This knowledge then is used in innovative activity as a new way of their realisation in production. Thus, the scientific sphere acts as some kind of an intellectual product supplier to the innovative sphere. The innovative sphere acts as the direct innovation producer, transferring innovative products to the production sphere for replication and mass production.

The above mentioned suggests the innovative cycle represents parallel-serial passing of certain stages of research, scientific and technical and innovative activity. In other words, it represents passing of stages from emergence of an idea to its development and distribution. Figure 1 schematically represents these stages.

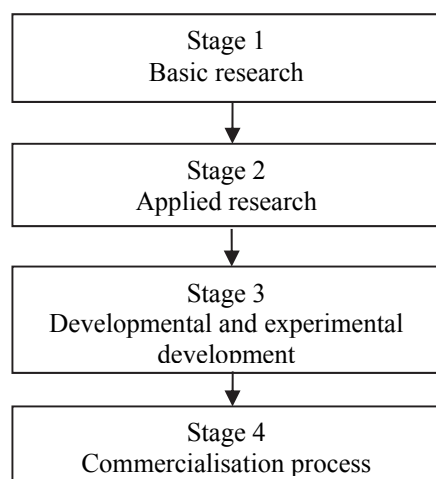


Fig. 1. Scheme of an innovative cycle

At the first stage of an innovative cycle basic research is carried out. It is carried out at the academic institutes, higher educational institutions and branch specialised institutions, laboratories. At the second stage applied research is carried out. It is done in all scientific institutions and financed both at the expense of the state budget (state programs), and at the expense of customer means.

At the third stage development and experimental works are carried out. They are led as in specialised laboratories, design offices, pilot productions, and in research-and-production divisions of the large companies. The fourth stage is connected with commercialisation of

innovations. Thus, a foremost necessary condition of innovative development activity is fundamental science development.

However the fundamental science is not connected with obtaining commercial benefit. It is only area of knowledge reception and generation, which is the public benefit. And at the stage of fundamental knowledge reception about the knowledge itself and possibilities of its use by economic practice founders, as a rule, there is very uncertain information. Therefore, worldwide basic research was carried out and stimulated by the state. However, forms and methods, as well as aiming of such stimulation, had different character. Taking into account historical experience of innovative development in the European countries and the USA it is possible to allocate, at least, some stages in state's policy concerning fundamental science and realisation of its scientific and technical and innovative policy.

We connect the first stage with emergence of rudimentary elements of scientific and technical systems in a number of the states. For instance, they are public financing of research, and also creation of their own research structures by leading corporations at the beginning of the 20th century. These are the research centres of the large chemical industry giants in Germany, scientific laboratories of such known American companies, as «Dupont», «General Electric», «Kodak» and ATT. The associates of leading universities actively began to be involved for work in these laboratories and that was the first attempt of financing of fundamental researches by business.

At the second stage in days of the Second World War the state began to co-operate with business and the academic science more actively, creating joint scientific centres, making the state orders for researches of military character to leading national universities and the companies on a contract basis. Later cold war dramatically strengthened arms race that considerably deepened process interaction of the state and fundamental science.

The scientific and technological system of that time provided regular and increasing state financing of the basic scientific research, which was carried out at universities by the ministries and departments of the governments of the developed countries. Expansion of scien-

tific subject on the area, which had no immediate return in the market was their special distinctive feature. In spite of its mainly military character, the commercial component of such research was obviously illusory. In this regard we should remember enormous investments of the USA Department of Defence into space exploration and electronics branches. At the same time these investments did not act only as payment for delivery of orders for specific armament systems. The federal internationalisation programs of scientific research and development financed a wide range of long-term defence research project. In the 50s and 60s of the 20th century military research led to the scientific and technological achievements, which created new commercial commodity markets and services from computer equipment to aircraft.

In this regard one more important circumstance should be noted: having joined in armament race the government of the leading European countries, the USA and Japan invested considerable amount of money to provide universities with the new scientific equipment, promoted expansion of educational programs and creation of new research centres. All this made leading American, European and Japanese universities the world scientific leaders. At the same time, academic science does not seem to be involved into the industry. Mostly it has been connected only with the state.

The following third stage in development of fundamental science relationship and the state is connected with the completion of cold war and strengthening of the international competition. During this period the state starts to refuse, firstly, from fundamental science financing priority for the sake of development the science itself and, secondly, from aiming at maintenance of research of exclusively defensive character. Formation of the world economy, dramatic increase in the international competition, a problem with deficiencies of the state budgets in a number of countries, and also explosive nature of science and technologies development gave more importance to research and development in strengthening the national economy competitiveness. Therefore the governments have concentrated on stimulation of strategic branches competitiveness and support to key technologies.

Keeping financing fundamental science, the state promotes transformation of fundamental knowledge into the technologies already having applied importance. Such task is assigned to universities. Within the last ones special specialised organizational isolated divisions, which were engaged in management and transfer of technologies began to be formed with active financial support of the state. In the USA alone by the mid 70-s there were about 40 technical institutions financed by both firms and federal government. Creation of one such institution on federal funds in the State of Illinois aimed at stimulation of less industrially developed agriculture area. By financing such work the state tried to achieve business interest in investment into problem zones through access to the technologies developed by universities [11, p. 127].

Many similar technical institutions still remain an important source of building regional research-and-production potentials. One of the examples is the station at the Texas agricultural and technical university in the College Station city that has a network of branches around the state. Moreover, large scientific and industrial parks have grown further on the basis of such structural university formations.

The turn of the century represented the fourth stage of relationship between the state and fundamental science: there were cardinal changes in approaches, making out and development of scientific and technical policy in the leading West European states, the USA and Japan. Unlike the previous periods, today increase of competitiveness is not the purpose any more, but acts as a factor that raises contribution of science in technologies and economic growth in job growth and innovation distribution. Such reorientation is connected with reconsideration of the meaning of innovative cycle and principles of support of the research and development sphere from the state that took place in recent years.

First of all, in modern conditions there was a withdrawal from ideas of the innovative cycle scheme linearity that consists of the following chain: basic research – applied research – engineering development – commercialisation process. Explosive character of discoveries and the reduced cycles of research and development obliterated distinctions between types

of scientific activity. The process of research and development began to be considered as uniform system with close interrelations between the separate elements, which do not allow to make their division depending on prospective impact on market situation. Within the basic research, it was possible to receive the results applied for commercial purposes, and applied research and development began to provide new scientific knowledge.

Thus, under present-day conditions there was an increase of interdependence of various phases of an innovative cycle. As a result the principle of primary encouragement of basic research by the state and applied research and development by private business began to be forced out by a new approach. Such approach gives preference to the stimulation of state and private business efforts cooperation for the purpose of scientific and technical policy productivity measures, and also economic use and an effective wide circulation of innovations. According to American experts, a share of federal capital investments in the research and development, that reached almost 70 % in the early sixties, decreased to 30 % in the late nineties of the 20th century [12, p. 151]. Thus, innovations start to get double measurement – on the one hand, technical, and on the other hand – social and economic.

Joint research and development of universities and separate firms became the very first form of such kind of cooperation. They, as a rule, it pursues the specific purpose initially established by partners. One or several companies act usually as a customer payer, and a university – as the performer. Such cooperation very often gets forms of consortia and associations. These organizational structures reflect qualitatively new stage of scientific and technical cooperation on which there is an integration of capacities of corporations and the higher school with the assistance of the state at all levels of their interaction. The latter eliminates direct financing of fundamental science, concentrating on the key directions and promoting science and production cooperation at the expense of indirect methods.

Conclusion. Concerning the experience of developed countries it may be concluded that the role of the state in the creation of the conditions for innovative activity, which concerns

ensuring development of fundamental science has changed. If in the first post-war thirty years the state policy was aimed at assistance to development of the science and the defensive industry, in the subsequent period it evolved into two interconnected directions: stimulation of strategic branches competitiveness and support of key technologies. Today the state promotes cooperation of private business and scientific institutions to increase productivity of scientific and technical policy measures and a wide circulation of technologies.

Such experience of the innovative sphere management and, respectively, approach to ensuring functioning of fundamental science as bases of innovations is important to domestic economy. Considering limited possibilities of direct budgetary financing of science and education, and also partial loss of that scientific and technical potential which Ukraine used to have at the beginning of its independence, cooperation of business and science can become a powerful source of innovation development. Therefore while creating programs of scientific and technical development of the country it is necessary to change priorities of participation of the state in the basic research sphere regulation. The state should assist integration processes in business and science, creating conditions for effective functioning of such alliances.

Achievement of the goal is provided at the expense of the tax legislation. It should contain the norms, that allow to eliminate the taxation for the means which provide financing joint scientific and technical programs with scientific institutions, as well as the profit gained from realizing such projects. Significant importance in this question has partial weakening of requirements to the antitrust law concerning vertical and horizontal merges. It will allow to get the official right to join together efforts in the research sphere. Creation of the intermediary centre network at universities supported by the state should become another direction, which could perform basic research, carry out examination of technical ideas and projects, be engaged in training, provide passing on technology patents and licences to the industry, participate in joint research programs with business. As it seems, reorganisation of the state influence in these directions can essentially change functioning of the innovative sphere

towards increase of its efficiency.

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У статті розглянуто теоретичні засади функціонування фундаментальної науки як бази продукування інновацій, проведено дослідження світового досвіду підтримання даної сфери. Запропоновано напрями зміни пріоритетів державного регулювання фундаментальних досліджень.

Ключові слова: фундаментальна наука, інновації, інноваційний цикл, державне регулювання інноваційного розвитку.

В статье рассмотрены теоретические основы функционирования фундаментальной науки как базы продуцирования инноваций. Проведено исследование мирового опыта поддержки данной сферы. Предложены направления изменения приоритетов государственного регулирования данной сферы.

Ключевые слова: фундаментальная наука, инновации, инновационный цикл, государственное регулирование инновационного развития.

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