**Kurmanov A.M.,**
Director General of the Republican Research Institute for Occupational Safety and Health, Candidate of Economic Sciences

# SCIENCE AND INDUSTRY: UNITY OF GOALS AND INNOVATION OUTCOMES

It is difficult to overestimate the importance of innovation and research in the modern world for achieving sustainable development and social progress. Global competition among the world's largest powers for leadership is closely linked to significant technological changes and innovations. Competitive advantage is achieved through the implementation of a knowledge economy and breakthrough technologies in a context of limited resources. All major multinational corporations, including Apple, Microsoft, and Amazon, have achieved exponential growth thanks to innovation. Among the top 100 companies in the world by market capitalization growth, according to PwC's analysis, high-tech players dominate, with the United States, Saudi Arabia, and China leading in country rankings. It is worth noting that in 2023, the top 20 leaders included major corporations in information technology, telecommunications, energy, and healthcare, all of which traditionally make extensive use of artificial intelligence[1].

Kazakhstan, with its unique natural resources and advantageous geopolitical position, objectively possesses significant innovation potential. The «National Development Plan of the Republic until 2029» identifies as a priority the «rebooting of the national science model,» including a focus on «increasing the share of commercialized projects,» **«engaging business in science»**, fostering collaboration with industry and business, and «strengthening partnerships between research institutes, universities, and leading global scientific centers[2]. At a meeting with the academic elite at the «Center of science» center, the Head of State emphasized that **«a country that relies solely on raw materials has no future»**, as in geopolitical economic competition, **«innovation will be of decisive importance»**[3].

The need for a radical shift in approaches to state science and technology policy led to the adoption of a new legislative act that integrates scientific research and technological advancements - the Law of the Republic of Kazakhstan **«On Science and Technology Policy»** (2024), which previously had been addressed in separate documents[4].

The new edition of the Law introduces concepts that enhance the applied, practice-oriented significance of scientific research, such as «implementation (use) of the results of scientific and/or scientific-technical activities», «commercialization of the results of scientific and/or scientific-technical activities», «grant for the commercialization of the results of scientific and/or scientific-technical activities», «center (office) for the commercialization of the results of scientific and/or scientific-technical activities», «intellectual property results in the field of commercialization of scientific and/or scientific-technical activities», and a fundamentally new term – «industrial-scientific technological consortium». The emphasis, as is evident, is on the implementation of scientific and technical developments and the achievement of commercial outcomes. This focus applies not only to applied research but also to fundamental science, which is expected to set the trend in the development of science and technology.

Additionally, in the Code of the Republic of Kazakhstan dated October 29, 2015, No. 375-V «Entrepreneurial Code of the Republic of Kazakhstan», Article 241-1, «Concept and Content of

[1] *https://www.pwc.com/gx/en/audit-services/publications/top100/pwc-global-top-100-companies-2023.pdf*
[2] *https://adilet.zan.kz/rus/docs/U2400000611*
[3] *https://www.akorda.kz/ru/vystuplenie-glavy-gosudarstva-kasym-zhomarta-tokaeva-na-vstreche-s-uchenymi-v-centre-gylym-ordasy-314218*
[4] *The Law «On Science» (2011) and the Law «On State Support for Industrial and Innovative Activities» (2012)*

Innovation Activity», introduces the concept of a «full-cycle project». This refers to «a complex of coordinated scientific and scientific-technical works carried out by entities engaged in scientific and/or scientific-technical activities, aimed at creating products with scientific content (goods, works, services)»[5]. In other words, the legislator emphasizes the need for integrating scientific research and scientific-technical activities to drive the **innovative development of the national economy**.

The practice-oriented research focus directly forms the foundation and direction of activities at the Republican Research Institute for Occupational Safety and Health (RRIOSH) under the Ministry of Labor and Social Protection of the Population.

Today, the Institute has reached a 20-year milestone in its activities, achieving significant results. As a leading research institution in the theory and practice of occupational safety and health, the Republican Research Institute for Occupational Safety and Health conducts scientific and practical research on a wide range of issues related to occupational safety and hygiene. This includes financial, economic, and organizational-legal support for creating safe working conditions, developing and establishing a system for preventing occupational risks, and other studies aimed at improving the quality of life for workers in our country.

The Institute's research focuses on addressing modern socio-economic problems and developing proposals for their resolution. Notably, this includes topics such as «Risk-Oriented Organizational and Economic Mechanisms for Ensuring Safe Work in Modern Kazakhstan», «Systematic Modeling of the Processes of Formation and Implementation of Statistical Observations on Occupational Safety in the Republic of Kazakhstan» and ongoing research to be completed this year on «Economic Problems of Safe Work and Institutional Transformations of the Insurance Mechanism in the Republic of Kazakhstan».

Currently, new scientific projects have been launched, including «Transformation of the State Mechanism of Social Guarantees for Those Working in Hazardous Conditions in the Modern Context» and «Working Conditions and Occupational Risks: Classification, Categories, and Criteria for Grouping in the Transition to a Green Economy». The research and scientific developments that form the core of RRIOSH 's activities are always aligned with contemporary developments.

The progressive development of the national economy requires the effective use of existing resources and the enhancement of the innovation potential of scientific organizations, as well as the creation of a mechanism for constructive interaction with business structures and organizations. To achieve this, it is necessary to establish an institutional infrastructure for the commercialization and dissemination of innovations, foster an innovation-friendly climate, encourage participation, and create the organizational conditions for innovative activities.

It is important to note that innovations are always the result of intellectual activity, achieved through the implementation of research and experimental activities, and are fundamentally different from existing objects. Innovations should enhance efficiency in social, economic, production, and management spheres, whether at the organizational or industry level, as well as contribute to the economic advancement of a region or the country as a whole[6].

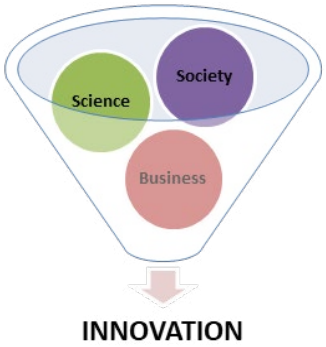


Figure – Creating innovations

[5] *Law of the Republic of Kazakhstan dated July 1, 2024 No. 104-VIII «On Amendments and Additions to Certain Legislative Acts of the Republic of Kazakhstan on Science and Technology Policy, Platform Employment and State Control»*

[6] *Strategic imperatives and determinants of the economy of modern Russia: a monograph/ S.N. Glagolev, Yu.A. Doroshenko, A.Ya. Arkatov et al./ under the general ed., Yu.A. Doroshenko. Belgorod: BSTU Publishing House, 2014. – 239 p., p.117*

**Obstacles** to innovation often include reduced budgetary funding for projects, insufficient material and scientific-technical resources, and, in some cases, **resistance to change**. An established organizational structure, a focus on existing markets, the dominance of immediate interests, and an emphasis on short-term profitability are among the factors that can **limit innovative activities**. Reengineering a research organization will lead to an elevated status for scientific staff, changes in their roles, increased qualification requirements, a restructuring of established methods, breaking behavioral stereotypes and traditions, and eliminating routine tasks. Overcoming internal resistance and achieving radical organizational renewal can be facilitated by attracting young, talented researchers and identifying potential leaders and innovators. An essential condition for active innovation is the development of an innovation strategy that outlines the goals of innovative activities, determines the means to achieve them, identifies funding sources, and sets directions for commercialization.

Innovative activity relies on an appropriate infrastructure, which encompasses a set of divisions, a system of connections and interactions between them, a mechanism for regulating activities, and an evaluation of the effectiveness of their functions. Within this innovation infrastructure, the following entities can operate[7] [1, c.19] scientific and educational divisions that serve as initiators of innovations; entities that support innovative activities and are responsible for the commercialization and transfer of innovations; as well as external economic entities involved in the development of innovative activities.

In the development of innovative activities, scientific-educational and scientific-industrial clusters traditionally play a significant role as generators of innovation. Clustering occurs when the interests of science and business align, fostering collaboration between scientific-educational centers and industry. External influence or intervention through state regulation can create additional administrative barriers. Entrepreneurial initiative offers a more constructive approach to addressing funding challenges. The formation of technology and innovation markets is driven by the needs and initiatives of the business sector.

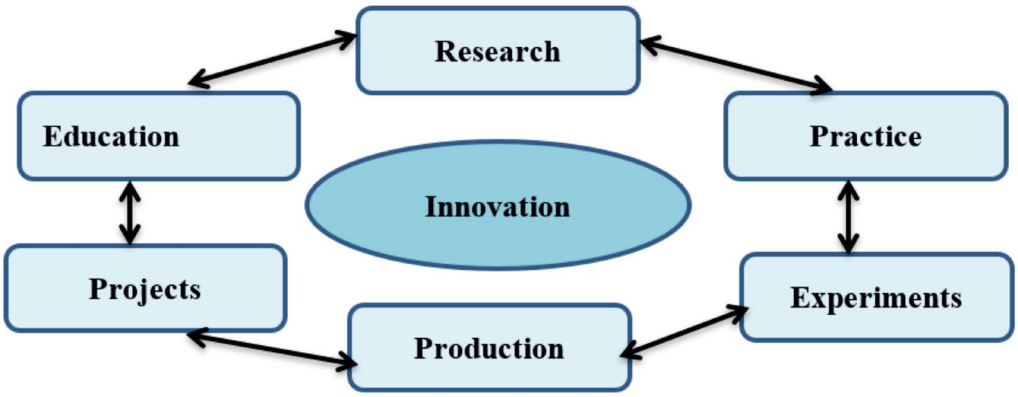


Figure – Institutional innovation infrastructure

Global examples of revolutionary technological breakthroughs illustrate the success of alliances between science and business. Recognized leaders in high technology, such as the Massachusetts Institute of Technology (MIT), Harvard University, Stanford University, and the California Institute of Technology (Caltech), base their research on private donations and investments. The implementation of innovative activities is facilitated by scientific and industrial infrastructure entities, such as technoparks, prototyping offices, and engineering centers, which establish connections with industry and business. Research divisions are integrated with consumers - business structures - forming fundamentally new business ideas and commercializing their developments.

In general, the formation of an innovation structure depends, first of all, on the tasks that are defined in the innovation strategy. Based on this, there are the following approaches to its formation: software, hardware, brainware[8]. **Software** – information and communication support for current innovation activities. **Hardware** – innovative infrastructure is seen as the foundation of its strategic development,

[7] *Vodolazhskaya E.L., Ostanina S.Sh., Kuramshina K.S. The effectiveness of small innovative enterprises' tools for the implementation of innovative development ideas within the framework of the scientific infrastructure of the University: monograph. – Kazan: CJSC «New Knowledge», 2012. – 84 p., p. 19*

[8] *Innovative activity of the university/ ed. V.G. Tronin. – Ulyanovsk: GU St., 2013. – 269s., P. 253*

the tasks of software are joined by the formation of its own production base, the establishment of direct long-term cooperation with industry. **Brainware** – building an innovation process management system is added to the existing «software» and «hardware» approaches.

An important factor in the development of innovation infrastructure is the human resources potential and corporate culture. **Corporate culture** integrates the production of new values and their accumulation (knowledge economy), regulates and assesses employee behavior based on the principles of corporate culture, and shapes employees' worldview, personal values, moral potential, and system of mutual understanding and interaction. It also involves establishing effective communication channels among employees.

In addition to strengthening issues related to the commercialization of scientific research, one of the legislative novelties is the possibility for local executive bodies to place **government orders** with «entities of scientific and (or) scientific-technical activity based on a contract for performing research work funded by budgetary funds»[9]. Collaboration between government bodies, scientific, and scientific-educational organizations affects the level of socio-economic development of a region, contributes to the formation of a regional innovation environment, and can have a synergistic effect. Support for science from central and local government authorities will stimulate the attraction and training of **qualified personnel in the region**, primarily in the research and experimental development sectors, as well as the emergence of **business-angels** and venture funds that can participate in innovation activities, assume the risks of financing, and facilitate the creation and implementation of innovations.

The effectiveness of collaboration between research entities and businesses is of particular importance. To facilitate cooperation between science, business, and government, network organizations can be established. These organizations would integrate industry-specific research institutes, sectoral universities, key industrial enterprises, corporations, and complexes to develop scientific experimental bases, c**ollective information centers**, equipment, search for innovative ideas, implement joint innovation strategies, enhance staff qualifications, and prepare the workforce.

RRIOSH closely collaborates with a number of industrial enterprises on issues such as workplace certification, conducting safety and occupational health seminars, and assessing workplace professional risks. The Institute, with its extensive network of branches across Kazakhstan, is able to work with regional authorities, universities, and local enterprises in these areas. Despite the existing interactions with representatives from the industrial and educational sectors, there is a need for further development of these relationships and the establishment of closer contacts. In the future, the Republican Research Institute for occupational safety and health plans to actively involve specialists from the scientific and industrial elite of the regions through consortium agreements with research, educational, and industrial institutions to advance fundamental and applied research in occupational safety and the protection of workers' health in our country.

This will, as defined in the Law on Science and Technological Policy, constitute an industrial-scientific technological consortium. The primary goal of such a consortium can be to create favorable conditions for the commercialization of innovative projects based on the integration of the scientific, educational, innovative, and technological potential of the consortium member organizations. Additionally, the consortium can be open to the inclusion of other organizations.

One of the organizational forms of the innovation structure could be a **cluster** based on the partnership between research and educational institutions, employers, and executive authorities. The aim would be to jointly utilize scientific, educational, production, resource, and infrastructural potential, as well as to attract administrative resources to ensure the socio-economic development of the regions.

Cluster policy is characterized by a central focus on strengthening the interconnections between economic entities within the cluster. Such integrative formations can be:

- Industry Clusters: These consist of centers for generating and transferring scientific knowledge that produce high-tech products based on advanced technologies.
- Science-Education Clusters: These are collections of geographically localized, interrelated institutions of science and education, connected through partnership relationships with each other and industry enterprises.
- Strategic Partnerships: Based on bilateral and multilateral agreements between universities, research institutions, and industry-specific enterprises. Participants in strategic partnerships can be spatially distributed, with business typically represented by large companies.

One of the most striking examples of the cluster approach is the collaboration between universities and companies in Silicon Valley, USA. This area is home to approximately 87,000 companies, several

[9] *https://adilet.zan.kz/rus/docs/Z2400000103*

dozen research centers, and several major universities, along with 180 venture firms and about 700 banks. An integral part of the cluster program is the presence of grant-holding organizations or grant-creating funds[10].

To define the national innovation system, scholars G. Ickovits and L. Leydesdorff (1997) proposed the «Triple Helix» model, which reflects the process of innovation development as a balanced interaction between science, industry, and government[11].

Interaction between the government, business, and scientific-educational complexes can be complemented by financial institutions. Such an alliance can emerge through the mechanism of public-private partnerships. This connection allows for defining the balance between applied and fundamental research and creating conditions for the implementation and dissemination of innovations.

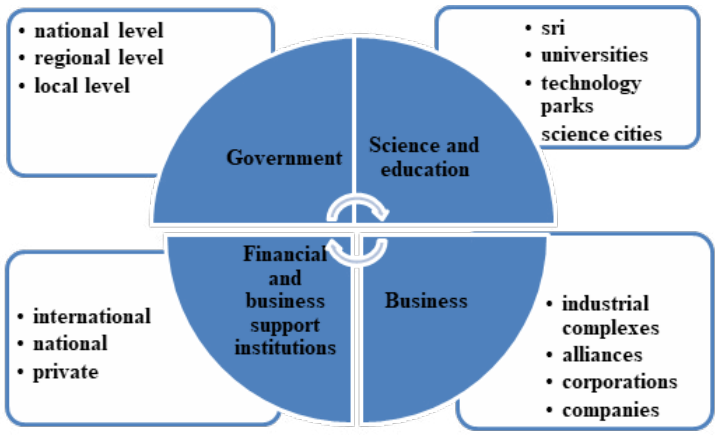


Figure – The model of interaction between science, education, business and the state

The model assumes mutual interest in collaboration. However, there are some issues reflecting the current state of national science. Firstly, there is a certain disconnect between science and production. Scientific and technical developments may lag behind the needs of production, and conversely, the technical and technological conditions of production may be insufficient for the implementation of modern scientific developments. Secondly, the primary source of funding for science remains budgetary funds, **with private financial** initiatives being less significant in this area. Thirdly, the scientific research conducted does not fully meet the interests of business. Fourthly, there is a fragmentation among the entities involved in scientific research and experimental development. There is no productive and effective integration in this sector. These problems hinder innovative development both for the country as a whole and for its regions in particular.

Thus, there is a pressing need for coordination and interaction between the state, science, education, and business to achieve a competitive advantage for Kazakhstan. This issue is not specific to any single institute, university, or enterprise; it is of national significance and requires resolution at the state level. To some extent, it can be addressed through strategic planning and spatial development of the country. State stimulation, based on creating investment-friendly conditions, can facilitate the establishment of scientific-industrial hubs in regions with developed scientific, educational, and production infrastructure. This will create future «points» of innovation development and economic growth, ensuring the sustainable development of both regional and national economies overall.

[10] *Innovative activity of the university/ ed. V.G. Tronin. – Ulyanovsk: GU St., 2013. – 269s., P. 253*
[11] *https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3404823*