

DOI 10.52260/2304-7216.2026.1(62).30
UDC 332.1(574)
SRSTI 06.54.31

A. Amerkhanova, PhD, associate professor¹
J. Seitkhozina, к.е.с., associate professor¹
M. Daurbaeva, к.е.с., senior lecturer²
A. Yersultankyzy*, PhD student¹
L.N. Gumilyov Eurasian National University,
Astana, Kazakhstan¹
M. Aueзов South Kazakhstan University,
Shymkent, Kazakhstan²
* – main author (author for correspondence)
e-mail: kraunplaza@mail.ru

MODEL OF SMART INNOVATIVE DEVELOPMENT IN THE CONTEXT OF HIGHER EDUCATION DIGITALIZATION

The article examines the current trends in the development of innovation activity in the Republic of Kazakhstan. The key indicators characterizing the dynamics of innovation costs, the volume of innovative products and their contribution to the country's economy are analyzed. Changes in the effectiveness of innovation activity in the context of increasing investment activity are identified.

It is found that the increase in costs for product and business process innovations is not accompanied by a corresponding increase in the volume of innovative products and their sales. The decrease in the share of innovative products in the gross domestic product is observed, which indicates the presence of an imbalance between investments and their economic returns.

The regional structure of innovation activity is analyzed; a high degree of differentiation and spatial asymmetry is revealed. Groups of regions with different levels of innovation activity are identified, and the dominance of industrially developed territories and large cities in the formation of innovation potential is shown. Regions with a low level of innovation activity and negative dynamics have been identified, which indicates the presence of structural limitations and dependence on raw materials specialization.

A conceptual model of the smart development of an innovation system is considered, reflecting the relationship between education, science, industry and government regulation. It is shown that the key role in the formation of innovative potential belongs to human capital and the education system, which ensure the generation of knowledge and the development of competencies. It is determined that effective interaction between the scientific sector and business contributes to the commercialization of innovations and an increase in their economic impact. It is revealed that government support and the institutional environment are a system-forming factor ensuring the coordination and sustainability of innovative development.

Keywords: innovation, innovation activity, regional differentiation, innovation efficiency, innovation policy, technology commercialization, national innovation system.

Кілт сөздер: инновация, инновациялық қызмет, аймақтық саралау, инновацияның тиімділігі, инновациялық саясат, технологияларды коммерцияландыру, ұлттық инновациялық жүйе.

Ключевые слова: инновации, инновационная деятельность, региональная дифференциация, эффективность инноваций, инновационная политика, коммерциализация технологий, национальная инновационная система.

Introduction. In modern conditions, innovation activity is considered as a key factor in ensuring sustainable economic growth, increasing competitiveness and technological modernization of the national economy. Improving the efficiency of the national innovation system is of particular importance for the Republic of Kazakhstan, which is implementing a strategy of diversification and transition to an innovative development model. Despite the ongoing government programs and support measures, problems remain related to the insufficient effectiveness of innovation activities, weak commercialization of developments and significant regional differentiation.

The relevance of the study is due to the need for a comprehensive assessment of the current trends in innovative development in Kazakhstan and the identification of key factors limiting the effectiveness of using innovative potential. Special attention should be paid to the analysis of the relationship between the volume of investments in innovations and their final results, as well as the spatial distribution of innovation activity across the country's regions.

The purpose of the study is to identify key trends in the development of innovation in Kazakhstan and its regions, as well as to substantiate the directions for improving the efficiency of innovation processes.

To achieve this goal, the following tasks have been solved:

- the analysis of the dynamics of the main indicators of innovation activity is carried out;
- the efficiency of using investment resources has been assessed;
- the features of regional differentiation of innovation activity are identified;
- problem areas and directions for improving innovation policy are determined.

The methodological basis of the research consists of systematic and comparative approaches, as well as methods of economic and statistical analysis. The official data of the Bureau of National Statistics of the Republic of Kazakhstan and the materials of national reports on science were used as an information base. The data were processed using dynamic and comparative analysis, comparative analysis and grouping methods, which ensures reproducibility and reliability of the results obtained.

Thus, the conducted research is aimed at forming a holistic view of the state of Kazakhstan's innovation system and identifying key areas for its further development.

Literature review. Modern research on the innovative development of Kazakhstan forms a theoretical and methodological basis for the analysis of the national innovation system, including institutional mechanisms, the role of human capital and the features of regional differentiation. In the works devoted to the implementation of the smart specialization strategy, the need for the formation of regionally oriented innovation systems ensuring the effective use of local competitive advantages is substantiated [1]. At the same time, considerable attention is paid to the development of competencies within the framework of the concept of open innovation and education 4.0, which is considered as a key factor in increasing innovation activity and adapting the economy to digital transformations [2].

A number of studies have focused on the problems of commercialization of scientific research results, where institutional barriers have been identified that limit technology transfer and the interaction of science and business [3]. Additionally, it is shown that the level of scientific productivity in developing economies, including Kazakhstan, depends on the quality of the research environment and financing mechanisms, which directly affects innovation performance [4]. An important contribution to the analysis of innovative development was made by works devoted to the functioning of medium- and high-tech enterprises, which identified key factors of their sustainability and competitiveness [5].

In the broader context of sustainable development, the relationship between economic growth, energy consumption and employment has been established, which makes it possible to consider innovation as a system-forming factor in the long-term development of the economy [6]. Official statistical sources confirm the positive dynamics of individual indicators of innovation activity, but at the same time record significant interregional differentiation and a limited contribution of innovation to GDP [7].

Despite a significant amount of research, a number of unresolved issues remain. In particular, the problem of the effectiveness of innovation activity, expressed in the discrepancy between the growth of costs and results, has not been sufficiently studied. In addition, existing works take limited account of the spatial aspect of innovative development and do not fully reveal the causes of regional asymmetry. There is a contradiction between the declared growth of innovation activity and the actual decrease in its economic impact. This necessitates further research aimed at identifying factors of innovation effectiveness and developing approaches to equalize regional disparities, which determines the choice of the topic of this study.

Main part. The modern development of innovation activity in Kazakhstan is characterized by ambiguous trends, reflecting both increased investment activity and the presence of structural constraints affecting the final results of innovation. For a comprehensive assessment of the current state and dynamics of the innovation system, it is advisable to consider key macroeconomic indicators characterizing the scale of financing, the volume of production of innovative products and their contribution to the country's economy.

In this regard, Table 1 shows the dynamics of key indicators of innovation activity in Kazakhstan for 2022-2024.

Table – 1

Dynamics of key indicators of innovation activity in Kazakhstan

| Indicators | 2022 | 2023 | 2024 | Change, 2024/2022 | |
|--|------------|-----------|-----------|-------------------|-------|
| | | | | +/- | % |
| Costs of product and business process innovations in industry, million KZT | 1132848,02 | 1527067,5 | 2056284 | +923435,98 | +81,5 |
| The volume of innovative products (goods, services), million KZT | 1879123,1 | 2399758,1 | 1838998,4 | -40124,7 | -2,1 |
| Volume of innovative products (goods, services) sold, million KZT | 1739822,8 | 2381167,5 | 1718971,6 | -20851,2 | -1,2 |
| The share of innovative products (goods, services) in GDP, % | 1,81 | 2,00 | 1,35 | -0,46 p.p. | - |

* compiled from the source [8]

An analysis of the data presented in Table 1 shows that in the study period there was a significant increase in the cost of product and business process innovations in industry, which increased from 1,132,848.02 million tenge in 2022 to 2,056,284 million tenge in 2024, which is an increase of 923,435.98 million tenge or 81.5%. This trend indicates the intensification of the investment policy of enterprises and increased attention to the technological renewal of production processes. At the same time, despite a significant increase in funding, indicators characterizing the results of innovation activities show the opposite trend.

Thus, the volume of innovative products decreased by KZT 40,124.7 million (-2.1%), and the volume of innovative products sold decreased by KZT 20,851.2 million (-1.2%). This indicates a decrease in the effectiveness of the transformation of investment resources into final innovative results.

The share of innovative products in the gross domestic product deserves special attention, which decreased from 1.81% in 2022 to 1.35% in 2024, i.e. by 0.46 percentage points. This trend reflects the weakening role of the innovation sector in shaping economic growth and indicates an imbalance between rising costs and their economic impact.

Thus, the paradox of innovative development has been revealed, in which an increase in investment activity is not accompanied by an adequate increase in performance. This may be due to institutional constraints, an insufficient level of commercialization of developments, as well as weak integration of science and production. For a deeper understanding of the identified trends, it is necessary to consider the spatial differentiation of innovation activity, since the regional aspect plays a key role in shaping the national innovation system.

In this regard, Table 2 shows the level of innovation activity in the regions of Kazakhstan for 2022-2024.

Table – 2

The level of innovation activity in the regions of Kazakhstan, in %

| Region | 2022 | 2023 | 2024 | Change, 2024/2022 |
|------------------|------|------|------|-------------------|
| Abai | 8,1 | 9,3 | 8,6 | 0,5 |
| Akmola | 6,0 | 5,9 | 5,2 | -0,8 |
| Aktobe | 13,5 | 14,9 | 14,1 | 0,6 |
| Almaty | 5,3 | 7,5 | 8,1 | 2,8 |
| Atyrau | 6,7 | 5,0 | 3,7 | -3,0 |
| West Kazakhstan | 4,7 | 4,2 | 3,9 | -0,8 |
| Zhambyl | 5,4 | 6,1 | 8,5 | 3,1 |
| Zhetysu | 10,8 | 12,0 | 12,6 | 1,8 |
| Karaganda | 15,1 | 16,2 | 15,0 | -0,1 |
| Kostanay | 9,2 | 9,4 | 10,7 | 1,5 |
| Kyzylorda | 13,2 | 13,9 | 14,0 | 0,8 |
| Mangystau | 5,0 | 6,2 | 4,5 | -0,5 |
| Pavlodar | 13,2 | 15,3 | 18,4 | 5,2 |
| North Kazakhstan | 15,2 | 9,7 | 13,6 | -1,6 |

| | | | | |
|------------------------|------|------|------|------|
| Turkestan | 9,0 | 10,2 | 11,4 | 2,4 |
| Ulytau | 8,4 | 7,8 | 6,1 | -2,3 |
| East Kazakhstan | 8,8 | 10,3 | 7,7 | -1,1 |
| Astana city | 14,8 | 15,2 | 15,4 | 0,6 |
| Almaty city | 13,2 | 14,6 | 15,0 | 1,8 |
| Shymkent city | 5,2 | 6,3 | 5,2 | 0,0 |
| Republic of Kazakhstan | 11,0 | 11,7 | 11,9 | 0,9 |

* compiled from the source [8]

An analysis of the regional differentiation of innovation activity in Kazakhstan reveals a significant heterogeneity in the development of innovation processes, which indicates the formation of an asymmetric spatial structure of the national innovation system. In 2024, the average national level of innovation activity was 11.9%, an increase of 0.9 percentage points compared to 2022, but this growth is limited and does not reflect the uniform development of the regions.

For a more accurate interpretation, a conditional clustering of regions by the level of innovation activity (2024) was carried out:

1. A group of leaders (above 14%). This group includes Pavlodar region (18.4%), Astana (15.4%), Karaganda region (15.0%), Almaty (15.0%), Aktobe region (14.1%) and Kyzylorda region (14.0%). These regions are characterized by a high level of industrialization, a developed production base and a concentration of scientific and technical potential. The Pavlodar region stands out in particular, where the maximum growth was recorded (+5.2 percentage points), which indicates the high effectiveness of the regional innovation policy and the availability of sustainable technology implementation mechanisms.

2. The group with an average level (10-14%). This category includes Turkestan (11.4%), Kostanay (10.7%), Zhetisu region (12.6%) and North Kazakhstan region (13.6%). These regions demonstrate moderate development dynamics, but their innovation activity is largely fragmented. Despite the positive dynamics in a number of regions (for example, Zhetysu +1.8 percentage points), dependence remains on individual projects rather than systemic development factors.

3. The low-activity group (below 10%). This group includes Almaty (8.1%), Zhambyl (8.5%), Abai region (8.6%), East Kazakhstan (7.7%), Akmola (5.2%), Mangystau (4.5%), West Kazakhstan (3.9%), Atyrau (3.7%) regions and Shymkent (5.2%). The most pronounced stagnation or decrease in innovation activity is observed here. The most critical situation is recorded in Atyrau region (-3.0 percentage points) and Ulytau region (-2.3 percentage points), which indicates the limited innovation base and dependence on the raw materials sector.

From the point of view of regional dynamics, three key trends can be distinguished:

Firstly, there is a polarization of the innovation space, in which growth is provided by a limited number of leading regions, while a significant part of the territories demonstrates stagnation or a decrease in indicators.

Secondly, the gap between industrially developed and raw-material regions is growing. Regions with a diversified economy (Pavlodar, Karaganda, cities of national significance) demonstrate stable positive dynamics, while oil and gas regions (Atyrau, Mangystau) are characterized by a decrease in innovation activity.

Thirdly, there is instability of innovation activity in certain regions, which is manifested in significant fluctuations in indicators (for example, the North Kazakhstan region: a sharp decline in 2023 and a partial recovery in 2024). This indicates the lack of sustainable institutional mechanisms to support innovation.

Thus, the analysis suggests the formation of an uneven model of innovative development in Kazakhstan, in which innovation activity is concentrated in a limited number of regions, while a significant part of the territories remains on the periphery of innovation processes. This situation requires the development of a differentiated regional policy aimed at equalizing the innovation potential and stimulating the technological development of lagging regions.

In order to systematize the factors determining innovative development, Figure 1 presents a conceptual model of the smart development of the innovation system in Kazakhstan.

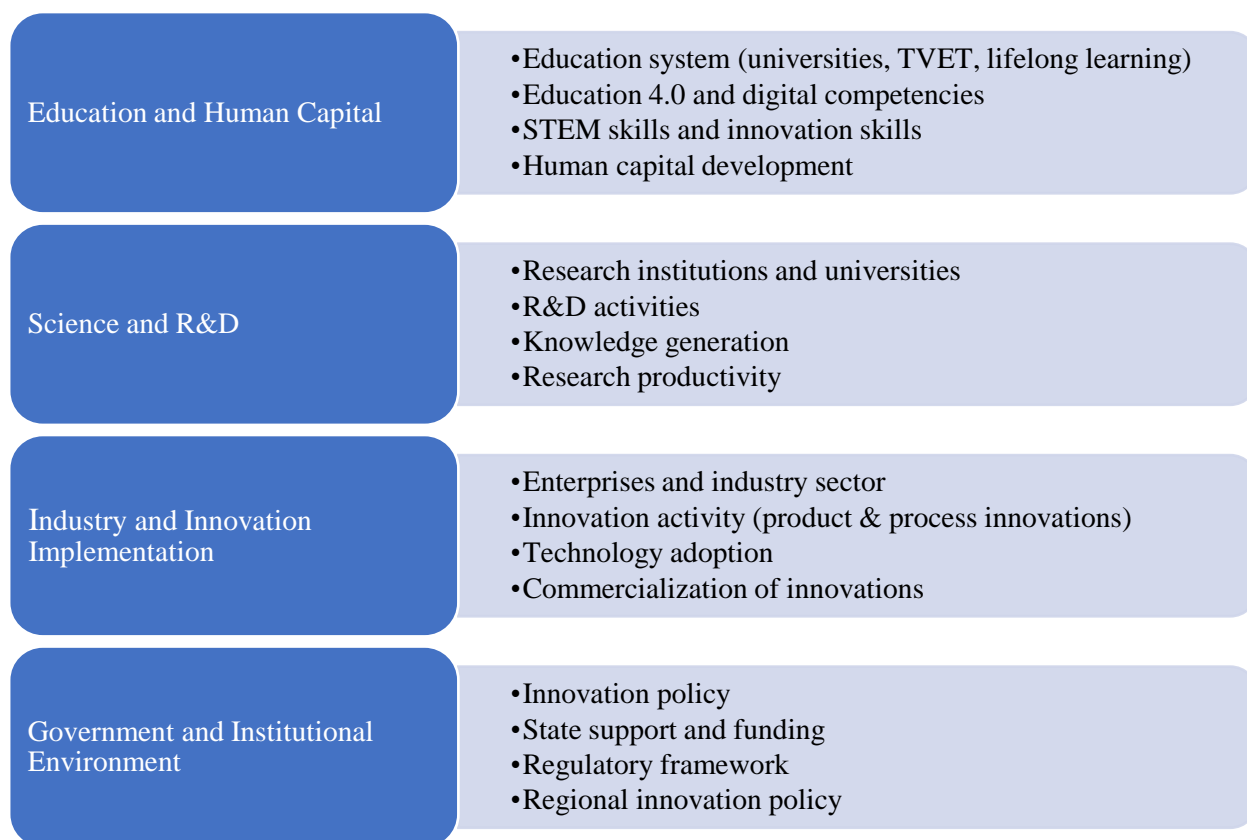


Figure – 1. **Conceptual Model of Smart Innovation Development in Kazakhstan***

**compiled by the authors*

The proposed model reflects the interrelation of key elements that ensure the formation and implementation of innovative potential. The basic element is the education and human capital block, which includes the system of higher and professional education, the development of digital and STEM competencies, as well as the formation of innovation skills. This unit provides training for qualified personnel and forms the basis for knowledge generation.

The next element is the science and research block, within which the production of new knowledge, the development of scientific research and the increase of research productivity are carried out. The interaction of education and science ensures the continuity of the process of knowledge formation and transfer.

The industry and innovation block reflects the processes of practical application of scientific developments, including technological renewal of enterprises, the introduction of product and process innovations, as well as the commercialization of research results. It is at this stage that knowledge is transformed into economic results.

The system-forming role is played by the block of state and institutional regulation, which covers the instruments of innovation policy, mechanisms of state support, financing and the regulatory framework. This block has an impact on all elements of the system, ensuring coordination and stimulating innovation activity. The model is cyclical in nature and assumes the presence of feedback loops, within which the needs of the real sector of the economy form a request for the development of educational programs and scientific research. This ensures the adaptability of the innovation system and its ability to respond to changes in the external environment.

Thus, the presented model allows us to comprehensively reflect the institutional and economic logic of innovative development and substantiates the need to integrate education, science, business and the state to increase the effectiveness of innovation processes.

Conclusion. The study made it possible to comprehensively assess the current state and dynamics of innovation activity in Kazakhstan at both the national and regional levels. The analysis revealed that the increase in innovation costs is not accompanied by an adequate increase in the volume of innovative products and their contribution to GDP, which indicates a decrease in the efficiency of using investment

resources. The presence of a structural imbalance between financial investments and the final results of innovation activities has been established.

Additionally, it is determined that innovation activity in the regions of Kazakhstan is characterized by a high degree of differentiation and spatial asymmetry. It is shown that the key role in the formation of innovation potential belongs to industrially developed regions and large cities, while a significant part of the territories demonstrates a low level of involvement in innovation processes. The scientific novelty of the study is to identify the paradox of innovative development, which manifests itself in a mismatch between rising costs and declining performance, as well as in substantiating the spatial heterogeneity of innovation activity.

The practical significance of the results obtained lies in the possibility of their use in the development of a regional innovation policy aimed at improving the efficiency of innovation processes and leveling interregional differences. In the future, it is advisable to deepen research in the assessment of factors affecting the effectiveness of innovation, including institutional conditions, the level of digitalization and mechanisms for commercialization of developments, as well as to develop economic and mathematical models for forecasting the innovative development of the regions of Kazakhstan.

REFERENCES

1. Баксултанов Д.Е., Курманов Н.А., Гордеева Е.А., Темирбаева Д.М. Развитие инновационных систем в контексте реализации стратегии «Смарт специализация RIS3» // Вестник Казахского университета экономики, финансов и международной торговли. – 2024. – №3(56). – С. 205–2013.
2. Akimov N., Kurmanov N., Uskelenova A., Aidargaliyeva N. Components of education 4.0 in open innovation competence frameworks: Systematic review // Journal of Open Innovation: Technology, Market, and Complexity. – 2023. – №9(2). – 100037 p. – DOI: 10.1016/j.joitmc.2023.100037
3. Kenzhaliyev O., Ilmaliyev Z., Tsekhovoy A., Triyono M., Kassymova G., Alibekova G., Tayauova G. Conditions to facilitate commercialization of R & D in case of Kazakhstan // Technology in Society. – 2021. – №67. – 101792 p. – DOI: 10.1016/j.techsoc.2021.101792
4. Narbaev T., Amirbekova D. Research productivity in emerging economies: empirical evidence from Kazakhstan // Publications. – 2021. – №9(4). – 51 p. – DOI: 10.3390/publications9040051
5. Kurmanov N., Zhagalbayev B., Feng W., Seitzhanov S., Rakhimbekova A., Aliyev U. Medium and High-Tech Enterprises of Kazakhstan: Factors of Organization and Development of Innovation // Montenegrin Journal of Economics. – 2022. – №18(3). – P. 7–22. – DOI: 10.14254/1800-5845/2022.18-3.1
6. Kurmanov N., Kenzhin Z., Aldabergenov N., Satbayeva A., Mussabalina D. Sustainable Development Challenges in Central Asia: Empirical Evidence on the CO2-Growth-Energy-Employment Nexus // International Journal of Energy Economics and Policy. – 2025. – №15(6). – P. 371–380. – DOI: 10.32479/ijeep.21322
7. Национальный доклад по науке. – Астана – Алматы. – 2024. – 268 с.
8. Бюро национальной статистики Агентства по стратегическому планированию и реформам Республики Казахстан. Статистика образования, науки и инноваций. Динамические таблицы. – URL: <https://stat.gov.kz/ru/>

REFERENCES

1. Baksultanov D., Kurmanov N., Gordeeva E., Temirbaeva D. Razvitie innovacionnyh sistem v kontekste realizacii strategii «Smart specializacija RIS3» [Development of innovative systems in the context of the implementation of the Smart Specialization RIS3 strategy] // Vestnik Kazahskogo universiteta jekonomiki, finansov i mezhdunarodnoj trgovli. – 2024 – №3(56). – S. 205–2013. [in Russian]
2. Akimov N., Kurmanov N., Uskelenova A., Aidargaliyeva N. Components of education 4.0 in open innovation competence frameworks: Systematic review // Journal of Open Innovation: Technology, Market, and Complexity. – 2023. – №9(2). – 100037 p. – DOI: 10.1016/j.joitmc.2023.100037
3. Kenzhaliyev O., Ilmaliyev Z., Tsekhovoy A., Triyono M., Kassymova G., Alibekova G., Tayauova G. Conditions to facilitate commercialization of R&D in case of Kazakhstan // Technology in Society. – 2021. – №67. – 101792 p. – DOI: 10.1016/j.techsoc.2021.101792

4. Narbaev T., Amirbekova D. Research productivity in emerging economies: empirical evidence from Kazakhstan // Publications. – 2021. – №9(4). – 51 p. – DOI: 10.3390/publications9040051

5. Kurmanov N., Zhagalbayev B., Feng W., Seitzhanov S., Rakhimbekova A., Aliyev U. Medium and High-Tech Enterprises of Kazakhstan: Factors of Organization and Development of Innovation // Montenegrin Journal of Economics. – 2022. – №18(3). – P. 7–22. – DOI: 10.14254/1800-5845/2022.18-3.1

6. Kurmanov N., Kenzhin Z., Aldabergenov N., Satbayeva A., Mussabalina D. Sustainable Development Challenges in Central Asia: Empirical Evidence on the CO2-Growth-Energy-Employment Nexus // International Journal of Energy Economics and Policy. – 2025. – №15(6). – P. 371–380. – DOI: 10.32479/ijeep.21322

7. Nacional'nyj doklad po nauke. [National Science Report] – Astana – Almaty. – 2024. – 268 s. [in Russian]

8. Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan. Statistics of education, science and innovation. [Education, science and innovation statistics] Dynamic tables. – URL: <https://stat.gov.kz/ru/> [in Russian]

Амерханова А.Б., Сейтхожина Д.А., Даурбаева М.У., Ерсұлтанқызы Ә.

ЖОҒАРЫ БІЛІМДІ ЦИФРЛАНДЫРУ ЖАҒДАЙЫНДАҒЫ СМАРТ-ИННОВАЦИЯЛЫҚ ДАМУ МОДЕЛІ

Андатпа

Мақалада Қазақстан Республикасындағы инновациялық қызметті дамытудың заманауи үрдістері қарастырылған. Инновация шығындарының динамикасын, инновациялық өнім көлемін және олардың ел экономикасына қосқан үлесін сипаттайтын негізгі көрсеткіштер талданды. Инвестициялық белсенділіктің өсуі жағдайында инновациялық қызмет нәтижелілігінің өзгеру ерекшеліктері анықталды. Бизнес-процестердің өнімі мен инновацияларына шығындардың ұлғаюы инновациялық өнім көлемінің және оны сатудың тиісті өсуімен қатар жүрмейтіні анықталды. Жалпы ішкі өнімдегі инновациялық өнім үлесінің төмендеуі көрсетілген, бұл инвестициялар мен олардың экономикалық қайтарымы арасындағы теңгерімсіздіктің болуын көрсетеді. Инновациялық белсенділіктің аймақтық құрылымы талданды, дифференциация мен кеңістіктік асимметрияның жоғары дәрежесі анықталды. Инновациялық белсенділік деңгейі әртүрлі өңірлердің топтары анықталды, инновациялық әлеуетті қалыптастыруда индустриалды дамыған аумақтар мен ірі қалалардың үстемдігі көрсетілді. Инновациялық белсенділік деңгейі төмен және теріс динамикасы бар аймақтар анықталды, бұл құрылымдық шектеулердің болуын және шикізаттық мамандануға тәуелділікті көрсетеді. Қазақстанның инновациялық жүйесі дамудың біркелкі развтиястігімен және ресурстарды пайдаланудың шектеулі тиімділігімен сипатталатыны көрсетілген. Коммерцияландыру тетіктерін жетілдіруді, өңірлік инновациялық саясатты дамытуды және өңіраралық диспропорцияларды төмендетуді қоса алғанда, инновациялық қызметтің тиімділігін арттырудың түйінді бағыттары айқындалды.

Білім, ғылым, өнеркәсіп және мемлекеттік реттеу арасындағы байланысты көрсететін инновациялық жүйенің смарт-дамуының тұжырымдамалық моделі қарастырылды. Инновациялық әлеуетті қалыптастырудағы шешуші рөл білім генерациясы мен құзыреттілікті дамытуды қамтамасыз ететін адами капитал мен білім беру жүйесіне тиесілі екендігі көрсетілген. Ғылыми сектор мен бизнестің тиімді өзара іс-қимылы инновацияларды коммерцияландыруға және олардың экономикалық қайтарымын арттыруға ықпал ететіні анықталды. Мемлекеттік қолдау мен институционалдық орта Инновациялық дамуды үйлестіру мен орнықтылықты қамтамасыз ететін жүйе құраушы фактор болып табылатыны анықталды.

Амерханова А.Б., Сейтхожина Д.А., Даурбаева М.У., Ерсұлтанқызы А.

МОДЕЛЬ СМАРТ-ИННОВАЦИОННОГО РАЗВИТИЯ В УСЛОВИЯХ ЦИФРОВИЗАЦИИ ВЫСШЕГО ОБРАЗОВАНИЯ

Аннотация

В статье рассмотрены современные тенденции развития инновационной деятельности в Республике Казахстан. Проанализированы ключевые показатели, характеризующие динамику затрат на инновации, объемы инновационной продукции и их вклад в экономику страны. Выявлены особенности изменения результативности инновационной деятельности в условиях роста инвестиционной активности.

Определено, что увеличение затрат на продуктовые и инновации бизнес-процессов не сопровождается соответствующим ростом объемов инновационной продукции и ее реализации. Показано снижение доли инновационной продукции в валовом внутреннем продукте, что свидетельствует о наличии дисбаланса между инвестициями и их экономической отдачей.

Проанализирована региональная структура инновационной активности, выявлена высокая степень дифференциации и пространственной асимметрии. Определены группы регионов с различным уровнем инновационной активности, показано доминирование индустриально развитых территорий и крупных городов в формировании инновационного потенциала. Выявлены регионы с низким уровнем инновационной активности и отрицательной динамикой, что свидетельствует о наличии структурных ограничений и зависимости от сырьевой специализации.

Рассмотрена концептуальная модель смарт-развития инновационной системы, отражающая взаимосвязь образования, науки, промышленности и государственного регулирования. Показано, что ключевая роль в формировании инновационного потенциала принадлежит человеческому капиталу и системе образования, обеспечивающим генерацию знаний и развитие компетенций. Определено, что эффективное взаимодействие научного сектора и бизнеса способствует коммерциализации инноваций и повышению их экономической отдачи. Выявлено, что государственная поддержка и институциональная среда выступают системообразующим фактором, обеспечивающим координацию и устойчивость инновационного развития.

