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## Development of regional economic infrastructure based on innovation

### Abstract

**Object:** The purpose of this article is to consider the development of regional innovation activity: principles, objectives, operational elements, and approaches to managing the development of innovation activity at the regional level.

**Methods:** The research uses methods of statistical analysis, comparative analysis, and graphs.

**Findings:** The key results of the study are summarized in the following conclusions:

- 1) The study examines the main factors of competitiveness, their impact, and relevance to increasing competitiveness in the regional socio-economic system.
- 2) The study shows that the region has difficulty accepting and developing innovations and that the level of innovation is not yet at the proper level.
- 3) It was presented that innovation and logistics have a huge impact on the competitiveness of the region.
- 4) The growth rates of the number of innovative products and the growth rates of the share of large and medium-sized companies using digital technologies in the industry have been determined.

**Conclusions:** A detailed description of innovations in the region makes it possible to compare the levels of development of the innovation sphere in the region. The detection of the dependence of the subjects of economic relations on the conditions proposed in the study makes it possible to establish the characteristics of innovative interaction together with the external and internal components of the innovation process of the regional economy.

**Keywords:** development, spatial economic systems, regional economy, regional systems, infrastructure, traditions, innovations, economic sectors.

### Introduction

Innovations serve as the cornerstone for shaping the infrastructure of the regional economy. The expansion of regional production and its sustainable growth necessitate continuous infrastructure enhancements, which are regarded as inherent prerequisites. Infrastructure stands out as a pivotal factor in propelling the development of the regional economy itself. For instance, the inadequate development of financial services, particularly in banking, and the inefficiencies in their management within the region pose significant hurdles to sectoral progress. Hence, financial institutions must promptly devise and implement various mechanisms to

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enhance their operational efficiency, serving as both direct and indirect influencers in this domain. Over the past decade, to mitigate risks, enterprises, governmental bodies, and regional communities have meticulously explored opportunities and distinctive attributes associated with innovative infrastructure development.

The integration of novel advancements into the infrastructures of regional financial systems and local markets across all tiers and sectors, alongside the operational domains of economic entities, constitutes a process of accumulating, fortifying, implementing, and shaping their capabilities. These innovations delineate the efficacy of technical and technological operations, coordination mechanisms, administrative frameworks, socio-economic structures, institutional frameworks, and other regional paradigms. Consequently, a notable infusion of innovation within the frameworks and infrastructures governing the operations of primary economic entities in both the tangible and financial realms of state economics exerts significant competitive pressures, underscoring the imperative to harmonize middle and lower-tier innovation across diverse sectors and facets of the regional economy.

Innovation infrastructure emerges as a specialized sector grappling with the imperatives of advancing innovative progress within the region. Aligned with the framework of establishing innovation systems at both national and regional scales, innovation infrastructure should comprise two inseparable components: dissemination infrastructure and societal innovation infrastructure. Furthermore, the former component places considerable emphasis not only on disseminating innovations but also fostering cooperation and partnerships among stakeholders engaged in the innovation ecosystem within the region. A crucial auxiliary role of innovation infrastructure lies in its potential to catalyze innovative development within the region and serve as a mechanism for cultivating a contemporary innovation culture within the regional innovation milieu.

### *Literature Review*

The rapid pace of technological advancement has exerted a profound influence on the landscape of business and economics. These transformations have not only bolstered overall economic performance but have also revolutionized the operational paradigms of various businesses. A fresh perspective on business practices has emerged, emphasizing the creation of novel channels for job creation and market expansion, particularly through online and e-commerce platforms.

Technical innovations catalyze a qualitative overhaul of existing systems. A.P. Ndesaulwa and J. Kikula (2016) coin the term “Technovation”, amalgamating technology and innovation, underscoring their pivotal role in driving impactful changes in the global economy and enhancing market productivity. According to their viewpoint, the bedrock of innovation lies in research and development, meticulous business planning, and the proactive inclination of corporate management towards innovation integration. Sustaining competitiveness within a dynamic market and economic milieu necessitates continual innovation and targeted enhancements across critical business domains.

L. Mirani (2013) asserts that while advanced technological progress is indispensable, the effective coordination of existing business technologies and processes is equally crucial for attaining competitive advantages and maximizing productivity. As Peter Drucker (1985) aptly observes, “Innovation is an action that provides resources with new opportunities for wealth creation”. This underscores the pivotal role of innovation in generating and harnessing resources. Indeed, resources only attain economic value when they are utilized and leveraged effectively.

Drawing from the insights of M.E.B. Herrera (2015), an innovative approach systematically streamlines the procedures, guidelines, strategies, and practices involved in the adoption and utilization of innovations. Actively engaging in these processes not only broadens the scope of knowledge but also cultivates avenues for its effective application.

To effectively regulate economic development within regions, it becomes imperative to establish infrastructure while concurrently nurturing the educational standards and competencies of the populace. This creates an environment conducive to generating new knowledge and propelling technological advancements, thereby fostering the development and commercialization of creative concepts (Khanin et al., 2021).

Omelianenko and Yurchenko shed light on the primary services offered by prevalent institutional forms of innovation infrastructure, notably emphasizing the development of technology parks and various other facets (Omelianenko, Yurchenko, 2022).

The transformative effects stemming from alterations in the structure of innovation models within regions yield favorable outcomes on economic performance. These observations are grounded in the findings of rigorous research efforts.

Capello and Lenzi (2019) delved into the transformations within innovative models, noting their positive repercussions on economic metrics across the European Union. These insights hold potential for refining and advancing innovation policies not solely within the EU but also for fostering knowledge exchange among diverse regions to optimize innovation practices (Capello, Lenzi, 2019).

Exploring China's regional development disparities, Dai et al. (2022) and Luo et al. (2023) underscore the imperative of resource allocation efficiency for research and green innovation. Feng (2023) observes that technological innovation, coupled with governmental support, facilitated regional economic convergence in China post-2006. Hence, technological innovations can serve as catalysts for aligning economic development levels across disparate regions, potentially enhancing productivity, fostering new market creation, and sustaining competitiveness (Feng et al., 2023).

Many scholars highlight the pivotal role of cluster development in bolstering regional innovation infrastructure. By fostering a conducive innovation milieu and regulating conditions for innovation entities and clusters, governments stimulate their autonomous growth and facilitate the expansion of the service sector across diverse regions, thereby shaping a cohesive innovation infrastructure nationwide (Kniazevych et al., 2021).

In their research, Yu, W., Hong, J., Zhu, Y., Marinova, D., & Guo, X. affirm the influence of Creative Industries Clusters (CIC) on regional innovation and economic growth in China (Yu et al., 2014).

The efficacy of economic innovation demonstrates a positive correlation with sustainable development innovation effectiveness. This suggests that objectives in both economic and sustainable development innovation realms can be concurrently achieved (Rauter, 2019).

Hence, innovations assume a pivotal role in regional development, exerting significant influence on economic, social, and technological landscapes. They contribute to the emergence of new industries, business paradigms, and employment opportunities, while also shaping innovative infrastructure and clusters. Regions actively embracing innovations are poised to enhance their competitiveness in the global market, attracting investments and yielding business advantages. This proactive stance towards innovation not only propels regional growth but also fosters resilience in the face of evolving global dynamics. By continuously adapting and integrating innovative solutions, regions can stay ahead in the competitive landscape, attracting talent, investment, and opportunities. Moreover, the ripple effects of innovation extend beyond economic prosperity, influencing societal well-being and technological advancement.

### ***Methods***

The focus of investigation lies within the East Kazakhstan Region, with data drawn from regional statistics pertaining to research themes, legislative frameworks, and regulatory landscapes. The innovation potential, comprising various elements of innovation activity such as susceptibility and engagement in innovation initiatives, stands as a fundamental precursor to effective innovation management. It serves as a cornerstone in establishing mechanisms that facilitate the realization of innovative opportunities. Consequently, innovation represents the degree of innovation integration, serving as a primary indicator of industry's innovative propensity. Hence, susceptibility to innovation delineates a system's capability to adeptly and efficiently navigate innovation implementation, crafting requisite organizational frameworks and conducive conditions — a true gauge of an entity's innovative stature.

The selection of appropriate measurement tools assumes paramount importance, as the quality, competence, and objectivity of these instruments significantly impact outcomes and subsequent managerial decisions. Evaluating regional innovative development poses a dual challenge: structuring evaluation criteria, which entails delineating logical frameworks for indicator groups that align with the essence, goals, and objectives of the evaluated processes, and justifying and leveraging diverse indicators for assessing regional innovative progress. These twin challenges are intricately intertwined, necessitating comprehensive research and concerted efforts for resolution.

### ***Results***

In the contemporary phase of societal advancement, innovative processes stand as paramount drivers for enhancing production efficiency and addressing critical socio-economic challenges. Innovative development emerges as the predominant thrust of both state policies and economic strategies. Particularly crucial for regions endowed with requisite industrial and intellectual capacities, innovations serve as potent catalysts for economic expansion. However, regional progress is contingent not only upon scientific and technological advancements and the adoption of modern methodologies but also on avenues for local self-governance.

Economic resources within a region constitute pivotal structural elements of the regional economy, wielding significant influence on the trajectory of innovative development. Exploring the determinants of innovative progress facilitates the identification of effective strategies for regional systems. Hence, elucidating the factors of innovative development, grounded in their impact on existing innovation potentials and contributions to regional innovation endeavors, holds promise for guiding policy formulation and strategic planning.

Assessing the landscape of innovation activity necessitates delineating key performance indicators. The Methodology for compiling statistics of research, development, and innovation, as endorsed by the Chairman of the Committee on Statistics of the Republic of Kazakhstan on October 6, 2016, specifies essential indicators including internal and external research and development expenditures, sources of financing for internal research and development, the number of research units, and the count of personnel engaged in research and development endeavors.

A scrutiny of the innovation landscape within the region reveals that the innovative activity of companies has reached 6.3% in the period spanning 2021 to 2022, with 108 innovative enterprises operational within the region. Table 1 showcases the key innovation metrics pertinent to the region.

Table 1. The main indicators of innovation activity in the region

Indicator	2018	2019	2020	2021	2022
Internal R&D costs, million tenge	209,6	236,3	224,4	180,2	185,2
GRP by production method, million tenge	749 879,0	795 551,2	837179,9	918 236,9	1085922,9
Share of domestic expenditures to GDP (in % of GRP)	0,028%	0,030%	0,027%	0,020%	0.017%
Number of respondents	1 047	1 001	1 047	1 049	1 023
Number of innovative and active enterprises	114	116	111	119	115
The level of activity in the field of innovation, %	10,89	11,59	10,60	11,34	11,24
The number of employees who performed research and development	312	229	182	135	93
The volume of innovative products, million tenge	16 028,0	16 500,4	11 753,8	11 312,8	13 804,9
Costs of technological innovations, million tenge	12 852,4	10 701,8	16 248,0	16 233,9	21 548,6

*Note – compiled by the author on the basis of data from the Bureau of National Statistics*

Drawing from the latest available statistical data, an analysis is conducted on the indicators spanning the years 2018 to 2022. The tabulated data reveals a noteworthy trend in internal research and development (R&D) expenditures during this period. Specifically, internal R&D expenditures experienced a decline of 11.6% from the year 2018, amounting to 209.6 billion tenge.

Internal research and development costs denote the tangible financial outlays incurred in the pursuit of research and development activities within the country. In the year 2019, there was a notable surge in internal development costs, witnessing a spike of 12.74%, equivalent to 26.7 million tenge. However, subsequent years saw a downturn in R&D expenditures. In 2020, there was a 5% decrease, resulting in expenses totaling 224.4 million tenge. This downward trajectory persisted into 2021, with expenses plummeting by 19.7%, culminating in internal expenditures amounting to 180.2 million tenge. In 2022, there was a marginal uptick in expenses, recording an increase of 2.77%, albeit attributed to a reduction in the number of employees. Consequently, expenses stood at 185.2 million tenge for the year.

Regarding the Gross Regional Product (GRP) within the region, internal expenditures exhibited a downward trend over the study duration. For instance, in 2018, internal costs accounted for 0.028% of the GRP, a figure that dwindled to 0.017% by the conclusion of 2022. In 2019, internal costs constituted 0.03% of the GRP, signaling a slight uptick before subsequent declines ensued. In 2020, the proportion of internal costs stood at 0.027%, further diminishing to 0.020% in 2021. Meanwhile, the aggregate R&D expenditures across the republic amounted to 0.13% by 2022. Notably, the share of domestic R&D expenditures within the total government research spending structure reached 0.27%. Figure 1 illustrates the correlation between internal costs and research and development endeavors.

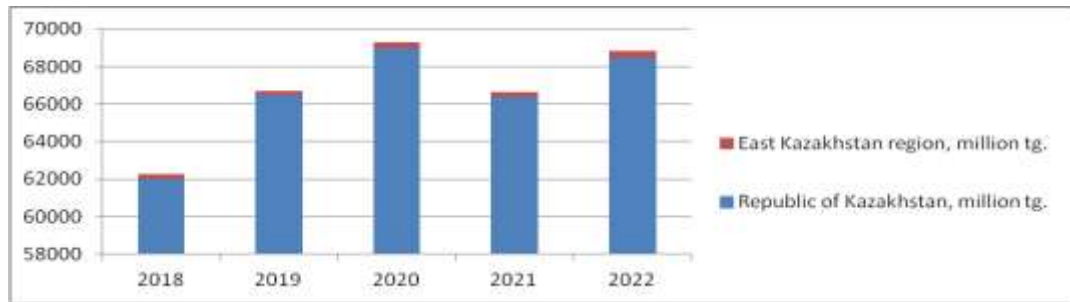


Figure 1. Ratio of internal R&amp;D costs

Note – compiled by the author on the basis of data from the Bureau of National Statistics

The degree of innovation activity within organizations is contingent upon the interplay among involved entities, with the number of respondents serving as a determinant factor. Interestingly, despite fluctuations in organizational dynamics, there were no substantial shifts in innovation activity indicators during the observed period. For instance, while the activity level stood at 10.89% in 2017, it marginally increased to 11.24% by 2022. Figure 2 visually portrays the trajectory of innovation activity over the designated period.

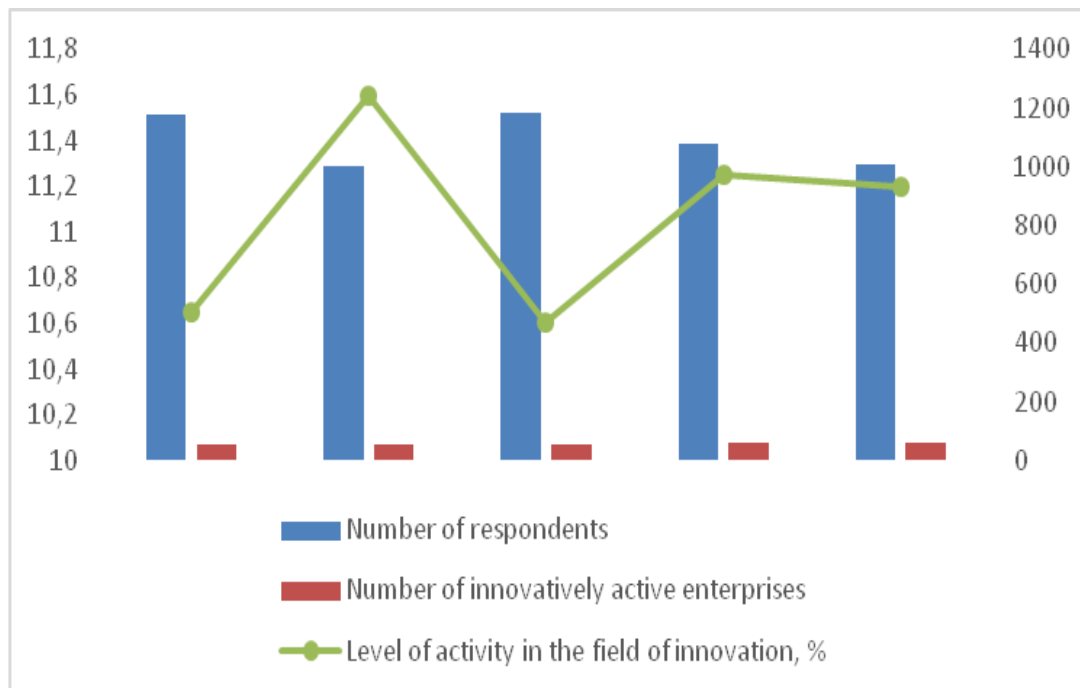


Figure 2. Innovative activity of enterprises

Note – compiled by the author on the basis of data from the Bureau of National Statistics

The diminished competitiveness of intelligent products coupled with their subpar technological efficiency precipitates a decline in the demand for innovations and market viability. The challenges plaguing the scientific and technical configuration of the innovation complex stem from various factors, including an excessive degree of production specialization, concentration within antiquated industrial hubs, and the prevalence of traditional and technologically lagging manufacturing sectors. These issues collectively impede the effective integration and diffusion of innovative solutions, hindering overall industrial advancement and economic growth.

### Discussions

Within this overarching trend, regions characterized by high production specialization face heightened vulnerability to fluctuations in market conditions and economic downturns. Addressing these challenges necessitates the establishment of institutions fostering robust collaboration between the state and the private sector, facilitating seamless integration between scientific research and production processes. Primarily, the creation of effective information infrastructure is imperative to accurately gauge the actual demand for tech-

nologies and innovative products. This entails conducting comprehensive marketing and technological research to inform decision-making processes effectively. The delineation of the architecture of indicators for regional innovative development is elucidated in Table 2, laying the foundation for strategic planning and targeted interventions aimed at fostering sustainable innovation ecosystems.

Table 2. Formation of the architecture of indicators of innovative development of the region

Innovative development of the region			
Goal: to achieve a balanced state of innovation			
Tasks: formation and development of innovative potential			
- activation of innovative activity of the enterprises of the region			
- increase of efficiency and effectiveness of innovative activity			
- actualization of support for innovation activities in the region			
Criteria			
Formation and development of innovative potential		Activation of Innovation Activity	
1. Formation and development of education in the region	2. Formation and development of the scientific potential of the region	3. Efficiency of innovative activity of enterprises and organizations of the region	4. The effectiveness of innovative activities of enterprises and organizations in the region
5.1. Support of regional educational programs, supporting universities, and competitions	5.2. Support of scientists and scientific institutions, regional grants, competitions and awards	5.3. Regional financing of innovative projects, activation and support of innovative projects	5.3. Regional financing of innovative projects, activation and support of innovative projects
<i>Note – compiled by the author</i>			

Moreover, fostering innovative activities requires the development of legal frameworks and regulations that incentivize enterprises engaged in relevant technical advancements while facilitating synergies between scientific research and industrial operations.

Consequently, addressing the imperative of enhancing the mechanism for innovative regional development necessitates the development of methodological and analytical tools tailored to account for territorial and economic intricacies, the region's developmental stage, and the technological landscape. This holistic approach aims to enhance the overall competitiveness of the regional economy.

To propel further advancement in the innovation sphere, informed by insights into the initial conditions and structural facets of regional innovation potential, a plethora of tools must be leveraged to regulate the transfer process of scientific and technical outputs. The process of technology transfer, fundamental to innovation, facilitates the conversion of knowledge and technology into tangible new products and services, thereby driving economic growth and meeting societal demands.

Furthermore, innovation processes play a pivotal role in bolstering competitiveness and accelerating socio-economic progress within regions. The evolution towards an innovative economy should be aligned with productive forces and industrial relations, ensuring harmony and efficacy (Bayadilova et al., 2020).

This comprehensive approach to innovation financing underscores the importance of strategic planning and resource allocation in driving sustainable innovation ecosystems within regions. By forecasting innovation trajectories, optimizing financing channels, and instituting flexible mechanisms for financial adjustment, regions can effectively catalyze innovation-driven growth and maximize the socio-economic benefits derived from innovative endeavors.

In essence, the convergence of legal, methodological, and financial frameworks forms the bedrock of a conducive environment for innovation. By fostering synergies between science, industry, and governance, regions can unlock their innovation potential, driving economic diversification, job creation, and societal progress.

### **Conclusion**

In summary, the identified imperfections and challenges in the innovative development of the region underscore the imperative of devising targeted measures to bolster innovation. These measures will be delineated by regional programs underpinning the strategy for scientific, technical, and innovative advancement. The execution of innovation policy necessitates a multifaceted approach, leveraging market dynamics, insti-

tutional frameworks, and managerial strategies. It is imperative to implement both financial and innovation policy measures, including:

- Creating avenues to incentivize and fund innovation endeavors by diverse investors, including national and regional authorities, as well as extrabudgetary funds.
- Facilitating close collaboration between legislative bodies, executive authorities, and the scientific community to govern innovation activities, ensuring researchers' involvement in key decision-making processes across all management tiers.
- Establishing mechanisms to provide incentives to companies adopting and commercializing innovative products.
- Promoting the adoption of medium-term loans with reduced interest rates.
- Introducing state-backed insurance for bank loans granted to implement innovative projects.
- Developing innovation infrastructure such as information centers, technology parks, and venture funds, alongside offering state assistance.
- Enhancing the legislative and regulatory framework for innovation.
- Elevating education and skill levels to master the theoretical and practical aspects of technology commercialization, intellectual property protection, and innovative project management, fostering an innovation-oriented culture.
- Implementing measures for intellectual property protection and enhancing the quality of issued patents.
- Upgrading informational resources in line with scientific and technical research and the requirements of companies for scientific and technical products.
- Developing strategies for commercializing the outcomes of scientific and technical research and their integration into production, along with initiating projects for economic support based on applied developments and their industrial implementation.

Investing in research and development (R&D) infrastructure, fostering partnerships between academia and industry, and nurturing a supportive regulatory environment are essential components of a robust innovation strategy. These efforts can spur breakthrough discoveries, facilitate technology transfer, and accelerate the commercialization of innovations, driving economic growth and job creation.

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**Ж.А. Абылкасимова, Л.С. Гумурзакова, Д.М. Акишева, Д.К. Саржанов, Ж.А. Амангельдиева**  
**Инновациялар негізінде аймақ экономикасының инфрақұрылымын дамыту**

**Аңдатпа:**

**Мақсаты:** Мақаланың мақсаты аймақтық инновациялық дамуды қарастыру, атап айтсақ: принциптері, мақсаты, міндеті, функционалдық элементтері, аймақтық деңгейде инновациялық дамуды басқару тәсілдері.

**Әдісі:** Зерттеуде статистикалық талдау, салыстырмалы талдау және графика әдістері қолданылды.

**Қорытынды:** Зерттеудің негізгі нәтижелері келесі тұжырымдарда қорытындыланған:

1. Зерттеуде аймақтық әлеуметтік-экономикалық жүйеде бәсекеге қабілеттілікті арттыру мақсатында бәсекеге қабілеттіліктің негізгі факторларын, олардың әсері мен өзектілігін қарастырады.
2. Зерттеу көрсеткендей, аймақта инновацияны енгізу мен дамытуда қиындықтар бар, ал инновация деңгейі әлі тиісті деңгейде емес.
3. Аймақтың бәсекеге қабілеттілігіне инновациялар мен логистика сияқты факторлардың жоғары дәрежеде әсер ететіні көрсетілген.
4. Инновациялық өнім санының өсу қарқыны және осы салада цифрлық технологияларды пайдаланатын ірі және орта компаниялар үлесінің өсу қарқыны анықталды.

**Тұжырымдама:** Аймақтағы инновациялардың егжей-тегжейлі сипаттамасы аймақтағы инновациялық саланың даму деңгейлерін салыстыруға мүмкіндік береді. Экономикалық қатынастар субъектілерінің зерттеуде ұсынылған жағдайларға тәуелділігін анықтау аймақтық экономиканың инновациялық процесінің сыртқы және ішкі компоненттерімен бірге инновациялық өзара әрекеттесудің сипаттамаларын анықтауға мүмкіндік жасайды.

**Кілт сөздер:** даму, кеңістіктік экономикалық жүйелер, аймақтық экономика, аймақтық жүйелер, инфрақұрылым, дәстүрлер, инновациялар, экономика секторлары.

**Ж.А. Абылкасимова, Л.С. Гумурзакова, Д.М. Акишева, Д.К. Саржанов, Ж.А. Амангельдиева**  
**Развитие инфраструктуры региональной экономики на основе инноваций**

**Аннотация:**

**Цель:** Целью данной статьи является рассмотрение развития региональной инновационной деятельности: принципы, задачи, оперативные элементы и подходы к управлению развитием инновационной деятельности на региональном уровне.

**Методы:** В исследовании использованы методы статистического анализа, сравнительного анализа и графики.

**Результаты:** Ключевые результаты исследования обобщены в следующих выводах:

1. В исследовании рассмотрены главные факторы конкурентоспособности, их воздействие и актуальность с целью повышения конкурентоспособности в региональной социально-экономической системе.
2. Исследование показывает, что регион с трудом принимает и развивает инновации, и уровень инноваций еще не находится на должном уровне.
3. Было представлено, что инновации и логистика оказывают огромное воздействие на конкурентоспособность региона.
4. Определены темпы роста количества инновационных продуктов и доли крупных и средних компаний, использующих цифровые технологии в отрасли.

**Выводы:** Детальная характеристика инноваций в регионе дает возможность сравнить уровни развития инновационной сферы в регионе. Обнаружение зависимости субъектов экономических взаимоотношений от предложенных в исследовании условий дает возможность установить характеристики инновационного взаимодействия вместе с внешними и внутренними компонентами инновационного процесса региональной экономики.

**Ключевые слова:** развитие, пространственные экономические системы, региональная экономика, региональные системы, инфраструктура, традиции, инновации, секторы экономики.