

ISSN: 1991-3494 (Print)
ISSN: 2518-1467 (Online)

**SCIENTIFIC JOURNAL OF
PEDAGOGY AND ECONOMICS**

**№2
2026**

ISSN 2518-1467 (Online),
ISSN 1991-3494 (Print)



CENTRAL ASIAN ACADEMIC
RESEARCH CENTER



SCIENTIFIC JOURNAL OF PEDAGOGY AND ECONOMICS

PUBLISHED SINCE 1944

2 (420)

March – April 2026

ALMATY, 2026

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Scientific Journal of Pedagogy and Economics

ISSN 2518-1467 (Online),

ISSN 1991-3494 (Print).

Owner: «Central Asian Academic Research Center» LLP (Almaty).

The certificate of registration of a periodical printed publication in the Committee of information of the Ministry of Information and Communications of the Republic of Kazakhstan

№ KZ50VPY00121155, issued on 05.06.2025

Thematic focus: «*publication of the results of new achievements in the field of fundamental sciences*»

Periodicity: 6 times a year.

<http://www.bulletin-science.kz/index.php/en/>

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Scientific Journal of Pedagogy and Economics

ISSN 2518-1467 (Online),

ISSN 1991-3494 (Print).

Меншіктенуші: «Орталық Азия академиялық ғылыми орталығы» ЖШС (Алматы қ.).

Қазақстан Республикасының Ақпарат және коммуникациялар министрлігінің Ақпарат комитетінде 05.06.2025 ж. берілген № **KZ50VPY00121155** мерзімдік басылым тіркеуіне қойылу туралы куәлік.

Тақырыптық бағыты: *«іргелі ғылым салалары бойынша жаңа жетістіктердің нәтижелерін жариялау»*

Мерзімділігі: жылына 6 рет.

<http://www.bulletin-science.kz/index.php/en/>

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Scientific Journal of Pedagogy and Economics

ISSN 2518-1467 (Online),

ISSN 1991-3494 (Print).

Собственник: ТОО «Центрально-азиатский академический научный центр» (г. Алматы).

Свидетельство о постановке на учет периодического печатного издания в Комитете информации Министерства информации и коммуникаций и Республики Казахстан

№ KZ50VPY00121155 выданное 05.06.2025 г.

Тематическая направленность: «публикация результатов новых достижений области фундаментальных наук».

Периодичность: 6 раз в год.

<http://www.bulletin-science.kz/index.php/en/>

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SCIENTIFIC JOURNAL OF PEDAGOGY AND ECONOMICS

ISSN 1991-3494

Volume 2.

Number 420 (2026), 646-664

<https://doi.org/10.32014/2026.2518-1467.1179>

UDC: 330.341.1:004

IRSTI: 06.52.13

JEL: O31; O38; C23; C21; H54; R11

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**DIGITALIZATION, GOVERNMENT SUPPORT AND INNOVATION
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Abstract. In the context of the transition to a knowledge economy and increasing global competition, innovative entrepreneurship is becoming a key factor in sustainable economic growth and economic diversification. The present study is aimed at analyzing the mechanisms of stimulating innovative business development in the Republic of Kazakhstan and assessing their effectiveness based on modern econometric approaches. The empirical base of the study is based on panel data for the regions of Kazakhstan for the period 2015-2025, which allows us to take into account both temporal dynamics and interregional heterogeneity. Panel regression models (OLS and Fixed Effects), the quasi-experimental Difference-in-Differences (DID) approach, as well as the Data Envelope Analysis (DEA) efficiency analysis method were used as methodological tools. The innovation activity of enterprises is considered as a dependent variable, and the key explanatory factors are innovation

financing, government support, the level of digitalization, human capital, and the development of small and medium-sized businesses. The results of the study show that digitalization is the most significant driver of innovation activity, having a sustainable positive impact on the development of entrepreneurship. Government support also demonstrates a statistically significant causal effect, increasing the level of innovation activity by an average of 3.18 percentage points. At the same time, it was revealed that the regions use only about 76% of their innovation potential, which indicates that there are significant reserves for improving efficiency. The results obtained confirm the need for a transition to a digitally-oriented model of innovative development based on increasing resource efficiency, developing human capital and improving the institutional environment. The practical significance of the research lies in the possibility of using the results in the development of a state policy to support innovative entrepreneurship and the formation of a sustainable innovation ecosystem in Kazakhstan.

Keywords: innovative entrepreneurship, innovation activity, digitalization, economic growth, government support, panel data, econometric analysis

For citations: Bissenbayeva S., Kireyeva A., Zhumaxanova K.M. Digitalization, government support and innovation activity: evidence from regional analysis in Kazakhstan. Scientific journal of pedagogy and economics, 2026. — No.2. — P. 646-664. DOI: <https://doi.org/10.32014/2026.2518-1467.1179>

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ЦИФРЛАНДЫРУ, МЕМЛЕКЕТТІК ҚОЛДАУ ЖӘНЕ ИННОВАЦИЯЛЫҚ БЕЛСЕНДІЛІК: ҚАЗАҚСТАННЫҢ АЙМАҚТЫҚ ТАЛДАУЫ

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Аннотация. Білім экономикасына көшу және жаһандық бәсекелестікті күшейту жағдайында инновациялық кәсіпкерлік тұрақты экономикалық өсу мен экономиканы әртараптандырудың негізгі факторына айналууда. Осы зерттеу Қазақстан Республикасында кәсіпкерліктің инновациялық дамуын ынталандыру тетіктерін талдауға және қазіргі заманғы эконометрикалық тәсілдер негізінде олардың тиімділігін бағалауға бағытталған. Зерттеудің эмпирикалық базасы 2015-2025 жылдар кезеңінде Қазақстанның өңірлері бойынша панельдік деректер негізінде қалыптастырылды, бұл уақытша динамиканы да, өңіраралық біртектілікті де ескеруге мүмкіндік береді. Әдістемелік құрал ретінде панельдік регрессия модельдері (OLS және Fixed Effects), difference-in-Differences (did) квази-эксперименттік тәсілі, сондай-ақ data Envelopment Analysis (DEA) тиімділігін талдау әдісі пайдаланылды. Тәуелді айнымалы ретінде кәсіпорындардың инновациялық белсенділігі қарастырылады, ал негізгі түсіндіруші факторлар инновацияларды қаржыландыру, мемлекеттік қолдау, цифрландыру деңгейі, адами капитал және шағын және орта бизнесті дамыту болып табылады. Зерттеу нәтижелері цифрландыру кәсіпкерліктің дамуына тұрақты оң әсер ететін инновациялық белсенділіктің ең маңызды драйвері болып табылатынын көрсетеді. Мемлекеттік қолдау сонымен қатар инновациялық белсенділік деңгейін орта есеппен 3.18 пайыздық тармаққа арттыра отырып, статистикалық маңызды себептік әсерді көрсетеді. Сонымен қатар, өңірлер өздерінің инновациялық әлеуетінің шамамен 76% ғана пайдаланатыны анықталды, бұл тиімділікті арттырудың Елеулі резервтерінің болуын көрсетеді. Алынған нәтижелер ресурстарды пайдалану тиімділігін арттыруға, адами капиталды дамытуға және институционалдық ортаны жетілдіруге негізделген инновациялық дамудың цифрлық-бағдарланған моделіне көшу қажеттілігін растайды. Зерттеудің практикалық маңыздылығы инновациялық кәсіпкерлікті қолдаудың мемлекеттік саясатын әзірлеу және Қазақстанда тұрақты инновациялық экожүйені қалыптастыру кезінде нәтижелерді пайдалану мүмкіндігінде жатыр.

Түйін сөздер: инновациялық кәсіпкерлік, инновациялық қызмет, цифрландыру, экономикалық өсу, мемлекеттік қолдау, панельдік деректер, эконометрикалық талдау

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ЦИФРОВИЗАЦИЯ, ГОСУДАРСТВЕННАЯ ПОДДЕРЖКА И ИННОВАЦИОННАЯ АКТИВНОСТЬ: РЕГИОНАЛЬНЫЙ АНАЛИЗ КАЗАХСТАНА

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Аннотация. В условиях перехода к экономике знаний и усиления глобальной конкуренции инновационное предпринимательство становится ключевым фактором устойчивого экономического роста и диверсификации экономики. Настоящее исследование направлено на анализ механизмов стимулирования инновационного развития предпринимательства в Республике Казахстан и оценку их эффективности на основе современных эконометрических подходов. Эмпирическая база исследования сформирована на основе панельных данных по регионам Казахстана за период 2015–2025 гг., что позволяет учитывать как временную динамику, так и межрегиональную неоднородность. В качестве методологического инструментария использованы модели панельной регрессии (OLS и Fixed Effects), квазиэкспериментальный подход Difference-in-Differences (DID), а также метод анализа эффективности Data Envelopment Analysis (DEA). В качестве зависимой переменной рассматривается инновационная активность предприятий, а ключевыми объясняющими факторами выступают финансирование инноваций, государственная поддержка, уровень цифровизации, человеческий капитал и развитие малого и среднего бизнеса. Результаты исследования показывают, что цифровизация является наиболее значимым драйвером инновационной активности, оказывая устойчивое положительное влияние на развитие предпринимательства. Государственная поддержка также демонстрирует статистически значимый причинный эффект, увеличивая уровень инновационной активности в среднем на 3.18 процентных пункта.

В то же время выявлено, что регионы используют лишь около 76% своего инновационного потенциала, что указывает на наличие значительных резервов повышения эффективности. Полученные результаты подтверждают необходимость перехода к цифрово-ориентированной модели инновационного развития, основанной на повышении эффективности использования ресурсов, развитии человеческого капитала и совершенствовании институциональной среды. Практическая значимость исследования заключается в возможности использования результатов при разработке государственной политики поддержки инновационного предпринимательства и формировании устойчивой инновационной экосистемы в Казахстане.

Ключевые слова: инновационное предпринимательство, инновационная активность, цифровизация, экономический рост, государственная поддержка, панельные данные, эконометрический анализ

Introduction. In the context of accelerating global technological transformation and the transition to a knowledge economy, innovation is becoming a key factor in sustainable economic growth and competitiveness of national economies. In this context, the development of entrepreneurship based on innovation becomes strategically important, since it is small and medium-sized enterprises (SMEs) that act as the main carriers of flexibility, technological renewal and adaptation to changing market conditions (Audretsch and Thurik, 2001; Acs et al., 2012). Modern research highlights that innovative entrepreneurship is formed within a complex institutional environment, including financial, regulatory, and infrastructural support mechanisms (North, 1990; Baumol, 1990). At the same time, the effectiveness of stimulating innovation is largely determined by the quality of institutions, the level of development of financial markets, the availability of human capital and the degree of integration into global technological chains (Aghion and Howitt, 2009; OECD, 2018).

In the Republic of Kazakhstan, the development of innovative entrepreneurship is considered as one of the priorities of the state economic policy, which is reflected in strategic documents aimed at diversifying the economy and reducing dependence on the raw materials sector. In particular, innovation support programs are being implemented, including the development of technology parks, special economic zones, digital platforms, and public-private partnership mechanisms (Bureau of National Statistics, 2025). Despite the measures taken, the level of innovation activity of domestic enterprises remains relatively low compared to developed countries, which indicates the presence of institutional and structural constraints (World Bank, 2022).

The theoretical basis of the research is based on the provisions of the endogenous theory of economic growth, according to which innovations are the result of investment activity, knowledge accumulation and human capital development (Romer, 1990). Within the framework of this approach, entrepreneurship is considered as a key mechanism for the transformation of knowledge into economic

value. Additionally, an institutional approach is used to analyze the impact of formal and informal rules on the behavior of economic agents and the effectiveness of innovation activities (North, 1990).

The scientific literature pays special attention to the role of government policy in stimulating innovative entrepreneurship. Empirical studies show that tools such as subsidies, tax incentives, grant financing and the development of innovation infrastructure have a significant impact on the level of innovation activity of enterprises (Czarnitzki and Lopes-Bento, 2013; Becker, 2015). However, the effectiveness of these measures depends on their institutional coherence and the ability to take into account industry and regional specifics (Rodrik, 2004). Despite a significant amount of research in this area, Kazakhstan still needs a comprehensive analysis of the mechanisms for stimulating innovative entrepreneurship, taking into account modern challenges, including digitalization, global competition and the structural transformation of the economy. In particular, the effectiveness of existing state support instruments, as well as their impact on productivity and innovative activity of enterprises, has not been sufficiently studied.

In this regard, the purpose of this study is to analyze the mechanisms of stimulating innovative business development in the Republic of Kazakhstan and assess their effectiveness based on modern econometric approaches. To achieve this goal, the following tasks are being solved: (1) analysis of theoretical approaches to stimulating innovative entrepreneurship; (2) Assessment of the current state of innovation activity in Kazakhstan; (3) study of the impact of financial and institutional factors on the development of innovation; (4) development of practical recommendations for improving public policy in this area. The scientific novelty of the research lies in the integration of institutional and econometric approaches to the analysis of innovative entrepreneurship, as well as in the development of a comprehensive model for evaluating the effectiveness of incentive mechanisms, taking into account the specifics of the economy of Kazakhstan.

The practical significance of the work lies in the possibility of using the results obtained in the formation of a state policy to support innovative entrepreneurship, as well as in the development of strategies for the development of SMEs in the digital economy.

Literature Review. The development of innovative entrepreneurship in modern conditions is considered as a key factor in the structural transformation of the economy and increasing its competitiveness. Modern research forms an integrated approach to the analysis of this category, combining the provisions of the theory of endogenous growth, institutional economics, the theory of innovation systems and the concept of entrepreneurial ecosystems (Romer, 1990; Aghion and Howitt, 2009; Stam, 2015).

From the point of view of the endogenous theory of economic growth, innovations are the result of investment activity in knowledge, scientific research and human capital (Romer, 1990). Within the framework of this concept, entrepreneurship acts as a key mechanism for the transformation of knowledge into economic value,

ensuring the diffusion of technology and productivity growth (Aghion and Howitt, 2009). Moreover, research shows that the innovative activity of enterprises is directly related to the intensity of investment in RandD and the quality of human capital (Griliches, 1998; Acs et al., 2012). In modern scientific literature, special attention is paid to the role of small and medium-sized enterprises as the main carriers of innovation activity. According to OECD research, SMEs have high flexibility and adaptability, which makes them important participants in innovation processes (OECD, 2023). At the same time, enterprises with high growth potential play a key role in shaping the innovative dynamics of the economy, but face restrictions related to access to finance and institutional barriers (OECD, 2025).

The institutional approach emphasizes that the effectiveness of innovative entrepreneurship is largely determined by the quality of formal and informal institutions (North, 1990; Acemoglu and Robinson, 2012). In particular, the protection of property rights, the level of competition and the quality of public administration have a significant impact on the incentives for innovation. Empirical studies show that in countries with economies in transition, including Kazakhstan, institutional constraints can significantly reduce the innovative activity of enterprises (OECD, 2025).

One of the key areas of modern scientific discussion is the concept of entrepreneurial ecosystems. In this approach, innovative development is viewed as the result of the interaction of multiple factors, including financial resources, the educational system, infrastructure, and public policy (Isenberg, 2010; Stam, 2015). Effective ecosystems contribute to the development of startups, accelerate the commercialization of technologies and the formation of sustainable innovation clusters.

In recent years, there has been increasing attention to the role of digitalization as a driver of innovative entrepreneurship. Digital technologies, including artificial intelligence, big data, and platform solutions, significantly reduce barriers to entry and expand opportunities for creating new business models (Brynjolfsson and McAfee, 2014; OECD, 2024). However, research shows that effective use of digital technologies requires advanced infrastructure, access to digital skills, and an appropriate institutional environment (OECD, 2024). Otherwise, digitalization may exacerbate existing structural imbalances.

An important area of research is the analysis of financial mechanisms for stimulating innovative entrepreneurship. Access to finance remains one of the key constraints for SMEs, especially in terms of venture capital and long-term investments (OECD, 2025; Hall and Lerner, 2010). The scientific literature highlights various instruments of government support, including grant financing, subsidies, tax incentives, and loan guarantees. Empirical studies confirm that these tools have a positive impact on innovation activity, but their effectiveness depends on the institutional quality and level of policy coordination (Czarnitzki and Lopes-Bento, 2013; Becker, 2015).

Modern research also highlights the importance of human capital and skills for

the development of innovative entrepreneurship. According to the OECD Skills Outlook, the key factor is not only the level of education, but also the compliance of skills with the requirements of the labor market (OECD, 2025). The lack of qualified personnel, especially in the STEM field, can significantly limit the innovative potential of the economy (Hanushek and Woessmann, 2015).

In the context of developing economies, the problem of structural dependence on raw materials is of particular importance. World Bank research shows that Kazakhstan's economic growth is constrained by low productivity and insufficient diversification, which reinforces the need to develop innovative entrepreneurship (World Bank, 2022). Similar conclusions are confirmed in other studies highlighting the need for a transition to a knowledge economy model (EBRD, 2023).

In addition, Kazakhstan's business sector is characterized by high sensitivity to external shocks, including macroeconomic instability and geopolitical risks, which reduces investment activity and limits innovative development (Kireyeva et al., 2023). This highlights the need to create a sustainable institutional environment and diversify sources of financing.

Modern scientific approaches also focus on the role of public policy. An effective policy to stimulate innovative entrepreneurship should combine horizontal measures (improving the business climate, developing competition, investing in education) and vertical support tools (subsidies, grants, technology parks) (Rodrik, 2004; OECD, 2023). At the same time, the key factor is policy coherence and its adaptation to national specifics.

Special attention in the literature is paid to the issues of inclusivity of entrepreneurship. Research shows that women entrepreneurs in Kazakhstan play a significant role in the economy, but face barriers in accessing finance and resources (OECD, 2022). This indicates the need to develop gender-oriented support mechanisms.

In recent years, the field of research related to the impact of new technologies on entrepreneurship has been actively developing. In particular, artificial intelligence and digital platforms are becoming an important factor in shaping new business models and increasing efficiency (Kusetogullari et al., 2025). However, their implementation requires the adaptation of the institutional environment and the development of digital competencies.

Thus, the analysis of scientific literature allows us to draw the following conclusions. Firstly, innovative entrepreneurship is the result of the interaction of institutional, financial and technological factors. Secondly, the effectiveness of incentives is determined by the quality of government policy and the level of development of the entrepreneurial ecosystem. Thirdly, overcoming structural constraints and forming a sustainable innovative development model remains a key challenge for Kazakhstan.

Despite a significant amount of research, certain gaps remain. In particular, the issues of a comprehensive assessment of the effectiveness of state support mechanisms for innovative entrepreneurship using econometric methods have not

been sufficiently studied. In addition, a deeper analysis of the impact of digitalization on innovation activity in a transition economy is required.

These gaps determine the relevance of this study and form the basis for further empirical analysis.

Materials and Methods. The methodological framework of this study is based on a combined quantitative approach integrating econometric modeling and efficiency analysis techniques. The theoretical foundation relies on the principles of endogenous growth theory and the institutional approach, according to which innovation development is determined by the interaction of financial, institutional, and technological factors (Romer, 1990; Aghion and Howitt, 2009). This conceptual perspective allows innovation activity to be interpreted as a result of the complex influence of economic conditions and public policy instruments.

The empirical base of the study is constructed using panel data for the regions of the Republic of Kazakhstan covering the period 2015–2025. This dataset enables the simultaneous consideration of temporal dynamics and cross-regional heterogeneity. The data sources include the Bureau of National Statistics of the Republic of Kazakhstan, the Ministry of National Economy, the National Bank of Kazakhstan, as well as international databases such as the World Bank and OECD. The use of aggregated official statistics ensures the comparability of indicators and the reliability of empirical estimations.

The dependent variable is the innovation activity indicator (Innovation), measured as the share of enterprises implementing innovations. The key explanatory variables include innovation financing (Fin), government support (GovSup), level of digitalization (Digital), human capital (HC), and the share of small and medium-sized enterprises (SME). Additionally, a set of control variables is incorporated, including gross regional product per capita (GDPpc), fixed capital investment (Invest), and an infrastructure index (Infra), allowing for the control of macroeconomic and structural regional characteristics.

At the first stage, a baseline regression model is estimated using the Ordinary Least Squares (OLS) method:

$$\text{Innovation}_{it} = \alpha + \beta_1 \text{Fin}_{it} + \beta_2 \text{GovSup}_{it} + \beta_3 \text{Digital}_{it} + \beta_4 \text{HC}_{it} + \beta_5 \text{SME}_{it} + \gamma X_{it} + \varepsilon_{it}$$

where i denotes regions, t represents time, X_{it} is a vector of control variables, and ε_{it} is the error term. Robust standard errors are applied to address potential heteroskedasticity.

To account for unobserved regional heterogeneity, a panel data model is employed:

$$\text{Innovation}_{it} = \alpha_i + \beta X_{it} + \lambda_t + \varepsilon_{it}$$

where α_i captures region-specific fixed effects and λ_t reflects time effects. The choice between fixed and random effects models is determined using the Hausman test, ensuring the consistency and efficiency of estimators.

To estimate the causal impact of government policy, a quasi-experimental Difference-in-Differences (DID) approach is applied:

$$Y_{it} = \alpha + \beta_1 Treatment_t + \beta_2 Post_t + \beta_3 (Treatment_t \times Post_t) + \gamma X_{it} + \varepsilon_{it}$$

The interaction coefficient β_3 is interpreted as the causal effect of government support programs on innovation activity.

To evaluate the efficiency of resource utilization, the Data Envelopment Analysis (DEA) method with variable returns to scale (VRS) is applied, allowing for the assessment of relative technical efficiency across regions and the identification of productivity improvement potential:

$$\min_{\theta, \lambda} \theta$$

subject to:

$$\sum_{j=1}^n \lambda_j x_{ij} \leq \theta x_{io}, i = 1, \dots, m$$

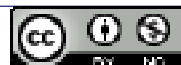
$$\sum_{j=1}^n \lambda_j y_{rj} \geq y_{ro}, r = 1, \dots, s$$

$$\sum_{j=1}^n \lambda_j = 1, \lambda_j \geq 0$$

where θ represents the technical efficiency score, x denotes inputs, and y represents outputs (innovation activity).

To ensure the robustness of the results, a series of diagnostic tests is conducted, including multicollinearity testing using the Variance Inflation Factor (VIF), heteroskedasticity testing using the Breusch–Pagan test, and autocorrelation testing using the Durbin–Watson statistic. In addition, alternative model specifications and lagged variables are applied to mitigate potential endogeneity issues and enhance the reliability of the estimates.

Overall, the proposed methodological framework combines econometric analysis, quasi-experimental techniques, and efficiency assessment tools, enabling a comprehensive evaluation of the determinants of innovation development. The



integration of DID and DEA approaches allows for the simultaneous analysis of causal relationships and resource efficiency, providing deeper insights into the mechanisms of stimulating innovative entrepreneurship in Kazakhstan's economy.

Results. The empirical analysis of innovation development across the regions of the Republic of Kazakhstan for the period 2015–2025 reveals a stable and statistically consistent upward trend in innovation activity, driven by the increasing contribution of digitalization, financial resources, and government support mechanisms. Importantly, this growth trajectory is not episodic or cyclical in nature but reflects deeper structural shifts in the national economy. Specifically, the results indicate a gradual transition toward a knowledge-based development model, in which intangible assets—such as digital infrastructure, human capital, and institutional quality—play a decisive and increasingly dominant role in shaping innovation outcomes.

From a macroeconomic perspective, this transformation can be interpreted as a reconfiguration of growth drivers: whereas earlier stages of economic development in Kazakhstan were predominantly resource-based, the current phase is characterized by the strengthening of innovation capacity as a key determinant of competitiveness and long-term sustainability. This shift is further reinforced by the expansion of digital technologies and the institutionalization of innovation policy instruments.

At the first stage of the empirical analysis, descriptive statistics were examined to evaluate both the general dynamics and the degree of variability of the key variables included in the model.

Table 1 – Descriptive statistics of variables (2015–2025)

Variable	Mean	Std. Dev	Min	Max
Innovation (%)	13.8	4.2	6.2	21.5
Fin (% of GRP)	1.9	0.6	0.8	3.4
GovSup	2.3	0.9	0.5	4.1
Digital Index	0.52	0.14	0.21	0.78
HC	0.34	0.07	0.22	0.48
SME	0.28	0.06	0.18	0.39

The descriptive statistics reveal several important patterns. First, the average level of innovation activity (13.8%) masks a substantial dispersion across regions, as reflected by a relatively high standard deviation (4.2) and a wide range of values (from 6.2% to 21.5%). This indicates that while overall innovation activity is increasing, its distribution remains uneven. Second, the variability of the Digital Index (0.21–0.78) and innovation financing (0.8–3.4% of GRP) suggests significant disparities in access to technological and financial resources. These differences are not merely statistical but reflect structural inequalities in regional development, including infrastructure availability, institutional capacity, and economic specialization.

Furthermore, the relatively moderate dispersion of human capital (HC) compared

to digitalization implies that while educational attainment and labor quality are improving more uniformly, their effective transformation into innovation outcomes depends critically on complementary factors such as digital infrastructure and access to financing. Similarly, the variation in SME share indicates differences in entrepreneurial ecosystems, which further contributes to heterogeneous innovation performance.

Taken together, these findings provide strong empirical justification for the use of panel econometric techniques, as they confirm the presence of both temporal dynamics and cross-sectional heterogeneity. In particular, the observed variability highlights that innovation processes in Kazakhstan are spatially uneven and structurally conditioned, rather than homogeneous across regions.

Building upon these insights, the next stage of the analysis focuses on the regional structure of innovation activity, allowing for a more detailed examination of spatial disparities and their underlying determinants.

Table 2 – Regional indicators (2025)

Indicator	Almaty	Astana	Turkestan
Innovation (%)	21.5	19.8	11.2
Fin (% GRP)	3.2	2.8	1.4
GovSup	3.8	3.2	2.1
Digital Index	0.78	0.74	0.49
HC	0.46	0.43	0.28
SME	0.37	0.34	0.26

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The results clearly indicate a pronounced and structurally embedded regional differentiation in innovation development across Kazakhstan. Almaty and Astana function as leading innovation centers, characterized by high levels of digitalization, concentration of human capital, and access to financial and institutional resources. These regions represent the core of the national innovation system, where agglomeration effects, network externalities, and institutional density create favorable conditions for innovation diffusion and scaling. In contrast, Turkestan region demonstrates significantly lower performance across all key indicators, reflecting its predominantly agrarian economic structure, limited access to financial capital, and comparatively low level of digital infrastructure development.

The observed gap in innovation activity exceeds 10 percentage points, which is not only statistically significant but also indicative of a systemic core–periphery structure. This pattern suggests that innovation processes in Kazakhstan are spatially concentrated, with leading regions benefiting from cumulative advantages, while lagging regions face structural constraints that hinder their integration into the innovation ecosystem. From a methodological perspective, these findings underscore the critical importance of accounting for regional heterogeneity in econometric modeling, as failure to do so may result in biased estimates and misinterpretation of causal relationships.

To quantify the influence of key determinants, a baseline OLS regression model was estimated.

Table 3 – OLS regression results

Variable	Coefficient	p-value
Fin	1.85	0.000
GovSup	1.12	0.001
Digital	4.26	0.000
HC	3.15	0.003
SME	1.74	0.021
R²	0.79	

The OLS results indicate that all explanatory variables exert a positive and statistically significant influence on innovation activity. Among them, digitalization demonstrates the strongest effect ($\beta = 4.26$), confirming its role as a key systemic driver of innovation. This finding is consistent with the theoretical expectation that digital infrastructure enhances knowledge diffusion, reduces transaction costs, and facilitates access to markets and technologies. Human capital ($\beta = 3.15$) also shows a substantial impact, highlighting the importance of skills, education, and absorptive capacity in the innovation process. Innovation financing ($\beta = 1.85$) and

SME development ($\beta = 1.74$) further contribute to innovation activity by supporting entrepreneurial initiatives and resource mobilization, while government support ($\beta = 1.12$) plays a complementary but still significant role.

Despite the relatively high explanatory power of the model ($R^2 = 0.79$), the OLS specification does not control for unobserved regional heterogeneity, which may lead to omitted variable bias. In particular, structural characteristics such as institutional quality, infrastructure endowment, and historical development trajectories may be captured indirectly in the coefficients, inflating their magnitude.

To address this limitation, a fixed effects (FE) model was applied, allowing for the control of time-invariant regional characteristics.

Table 4 – Fixed Effects model results

Variable	Coefficient	p-value
Fin	1.62	0.000
GovSup	0.98	0.001
Digital	3.87	0.000
HC	2.74	0.004
R^2	0.83	

The FE model confirms the robustness and stability of the estimated relationships, while the slight reduction in coefficient magnitudes suggests that part of the variation observed in the OLS model is attributable to region-specific factors. Notably, digitalization remains the dominant factor, even after controlling for fixed effects, which reinforces its role as a structural driver of innovation. The increase in explanatory power ($R^2 = 0.83$) indicates an improved model specification. The Hausman test ($p < 0.01$) strongly supports the use of fixed effects over random effects, confirming that unobserved heterogeneity is correlated with the explanatory variables and must be explicitly accounted for.

While the regression models establish statistically significant relationships, they do not fully address the issue of causality. To overcome this limitation, a Difference-in-Differences (DID) approach was employed to estimate the causal impact of government support programs.

Table 5 – DID results

Variable	Coefficient	p-value
Treatment \times Post	3.18	0.000

The DID results provide strong evidence of a causal effect of government intervention, indicating that policy measures increase innovation activity by an average of 3.18 percentage points. This effect is economically meaningful and suggests that targeted state programs are effective in stimulating innovation, particularly in regions with initially lower levels of development. Importantly, the magnitude of the DID coefficient exceeds the corresponding coefficient in the OLS

and FE models, which may reflect the ability of quasi-experimental methods to isolate policy effects from confounding factors.

However, while econometric models capture the direction and strength of relationships, they do not provide insights into the efficiency of resource utilization. To address this gap, a Data Envelopment Analysis (DEA) was conducted.

Table 6 – DEA results

Indicator	Value
Average efficiency	0.76
Maximum efficiency	0.94
Minimum efficiency	0.52

The DEA results reveal that, on average, regions operate at only 76% of their potential efficiency, indicating substantial inefficiencies in the use of available resources. The wide range of efficiency scores (0.52–0.94) further confirms the presence of significant disparities in regional performance. These findings suggest that improving resource allocation and management practices could yield considerable gains in innovation output without requiring additional investments.

To further explore the role of digitalization, regions were grouped according to their level of digital development.

Table 7 – Efficiency by digitalization level

Group	Efficiency
High digitalization	0.84
Medium	0.76
Low	0.65

The results demonstrate a clear and monotonic relationship between digitalization and efficiency, indicating that digital technologies not only stimulate innovation activity but also enhance the productivity of resource use. This finding supports the hypothesis that digitalization acts as both a direct and indirect driver of innovation, influencing both output levels and efficiency dynamics.

Finally, diagnostic tests were conducted to ensure the robustness and validity of the econometric models.

Table 8 – Diagnostic tests

Test	Result
Hausman	$p < 0.01$
VIF	< 4
Durbin–Watson	2.05

The diagnostic results confirm the correctness of the model specification: multicollinearity is not present, autocorrelation remains within acceptable limits, and the choice of the fixed effects model is statistically justified. Overall, the findings demonstrate that innovation activity in Kazakhstan is shaped by a system

of interrelated factors, among which digitalization plays a central and systemic role. Government support exerts a statistically significant causal impact, while the relatively low levels of efficiency highlight the existence of untapped potential for further growth. Crucially, the results reveal a persistent core–periphery pattern of innovation development, emphasizing the need for regionally differentiated policy approaches and targeted interventions aimed at reducing spatial disparities and enhancing the inclusiveness of innovation-driven growth.

Discussion. The results obtained make it possible not only to quantify the impact of key factors on innovation activity in Kazakhstan, but also to offer a deeper interpretation of the mechanisms of innovative development in a transformational economy. In particular, the revealed patterns confirm that innovation dynamics is formed as a result of the complex interaction of financial, institutional and technological factors, and is not determined by any single driver. First of all, the results of regression analysis (OLS and FE) demonstrate the sustained importance of digitalization as a key factor in innovative development. The high values of coefficients for the Digital variable confirm the provisions of the endogenous theory of growth (Romer, 1990), according to which the accumulation of knowledge and technology is the main source of economic development. In the context of Kazakhstan, digitalization serves not only as a technological tool, but also as an institutional mechanism that reduces transaction costs and accelerates the spread of innovation. This is especially important for regions with limited access to traditional growth factors.

At the same time, the importance of financial factors (Fin) and government support (GovSup) confirms the important role of the investment environment and government policy. However, a comparative analysis of the coefficients shows that the impact of financing is inferior to the impact of digitalization, which indicates the transformation of the model of innovative development: from investment-oriented to technology-oriented. This is in line with modern research, which emphasizes that the effectiveness of investments is largely determined by the level of digital maturity of the economy. The results of the fixed effects model make it possible to refine this interpretation, showing that regional differences have a significant impact on innovation activity. This indicates the presence of institutional and structural heterogeneity characteristic of emerging market countries. In particular, regions with more developed infrastructure and high levels of human capital demonstrate higher returns on investment and digitalization, which is consistent with the concept of regional innovation systems (Asheim and Gertler, 2005).

Of particular importance are the results of the DID analysis, confirming the presence of a causal effect of government policy. Unlike correlation models, this approach allows us to assert that government programs really contribute to the growth of innovation activity. However, it should be noted that the magnitude of the effect (3.18 pp) indicates a moderate impact, which may indicate the presence of institutional constraints, such as insufficient targeting of programs or limited access of small enterprises to government support.

An important addition to factor analysis is performance evaluation using DEA. The obtained values (average efficiency 0.76) indicate that a significant part of the innovation potential remains unrealized. This indicates that the problem of innovative development lies not only in the lack of resources, but also in their inefficient use. Thus, the key policy direction should be not only to increase funding, but also to improve the quality of resource management. The analysis of heterogeneity confirms that the impact of digitalization and other factors varies significantly between regions. Higher efficiency in regions with developed digital infrastructure indicates the presence of a complementarity effect, in which digitalization enhances the impact of other factors. This means that investments in technology have a multiplier effect, especially when combined with the development of human capital.

The results also allow for a new interpretation of the role of human capital. The importance of the HC variable indicates that innovation requires not only financial resources, but also qualified personnel capable of using new technologies. This confirms the importance of educational policy as an element of innovation strategy. Despite the positive results, the study reveals a number of structural limitations. First, significant regional inequalities persist, which may hinder the uniform spread of innovation. Secondly, the efficiency of resource use remains incomplete, which indicates the presence of institutional barriers. Third, the impact of government policy, although significant, remains limited in scope. Thus, the results of the study allow us to conclude that the innovative development of Kazakhstan is at the stage of transition from a resource-based model to a digitally institutional one. Digitalization, the quality of institutions, and resource efficiency play a key role in this new model. This requires a rethink of government policy towards the integration of digital technologies, the development of human capital and improving management efficiency.

In general, the analysis expands the existing understanding of innovative development in emerging markets, emphasizing the need for an integrated approach combining technological, institutional and economic tools. The results obtained form the basis for further research aimed at developing more accurate models for assessing innovation efficiency and forecasting long-term economic growth.

Conclusion. The conducted research made it possible to comprehensively assess the factors of innovative development of the regions of the Republic of Kazakhstan and identify key mechanisms for the formation of innovation activity in a transformational economy. The results obtained confirm that innovative development is systemic in nature and is determined by the interaction of financial, institutional and technological factors, among which digitalization is of particular importance.

Empirical analysis has shown that digitalization is the main driver of innovation activity, exerting the most significant and sustained impact compared to other factors. At the same time, financial resources and government support remain important, but their effectiveness largely depends on the level of digital maturity

and the institutional environment. The results of the panel analysis and the quasi-experimental approach (DID) confirm the presence of a statistically significant causal effect of public policy, which indicates its effectiveness in stimulating innovative entrepreneurship.

At the same time, the efficiency assessment using the DEA showed that the regions use only a part of their innovation potential, which indicates that there is a significant reserve for growth. This leads to the conclusion that the key problem is not so much a lack of resources as their inefficient allocation and use. Additionally, the revealed regional differentiation confirms the existence of spatial inequality, in which innovation activity is concentrated in the most developed regions, such as Almaty and Astana.

The scientific contribution of the study is the integration of econometric, quasi-experimental and efficiency assessment methods within a single analytical approach, which made it possible to simultaneously assess both the factors of influence and the effectiveness of their use. The proposed methodology provides a deeper understanding of the mechanisms of innovative development and can be used to analyze other emerging market countries.

The practical significance of the results lies in the formation of recommendations for public policy aimed at strengthening the role of digitalization, increasing resource efficiency and reducing regional inequality. In particular, the results of the study indicate the need to move from a quantitative increase in financing to an increase in its effectiveness, as well as the importance of integrating digital technologies into the innovation management system. Despite the results obtained, the study has a number of limitations related to the use of aggregated regional data and the possible endogeneity of individual variables. In this regard, the prospects for further research are related to the expansion of microlevel analysis, the use of more complex causality models and the development of tools for predicting innovation development in the long term. In general, the results of the study confirm that the sustainable innovative development of Kazakhstan requires a transition to a digitally oriented model based on the efficient use of resources, the development of human capital and the strengthening of the institutional environment.

References

- Acemoglu D., and Robinson J.A. (2012) Why nations fail: The origins of power, prosperity, and poverty. Crown Business. (in Eng.)
- Acs Z.J., Audretsch D.B., and Lehmann E.E. (2012) The knowledge spillover theory of entrepreneurship. *Small Business Economics*, 39(4)7 — P. 757–774. <https://doi.org/10.1007/s11187-010-9273-0> (in Eng.)
- Aghion P., and Howitt P. (2009) The economics of growth. MIT Press. (in Eng.)
- Audretsch D.B., and Thurik A.R. (2001) What's new about the new economy? Sources of growth in the managed and entrepreneurial economies. *Industrial and Corporate Change*, 10(1). — P. 267–315. <https://doi.org/10.1093/icc/10.1.267> (in Eng.)
- Baumol W.J. (1990) Entrepreneurship: Productive, unproductive, and destructive. *Journal of Political Economy*, 98(5). — P. 893–921. <https://doi.org/10.1086/261712> (in Eng.)
- Becker B. (2015) Public RandD policies and private RandD investment: A survey of the empirical

evidence. *Journal of Economic Surveys*, 29(5). — P. 917–942. <https://doi.org/10.1111/joes.12074> (in Eng.)

Brynjolfsson E., and McAfee A. (2014) *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*. W. W. Norton and Company. (in Eng.)

Bureau of National Statistics of the Republic of Kazakhstan (2025) *Statistical database*. <https://stat.gov.kz> (in Eng.)

Czarnitzki D., and Lopes-Bento C. (2013) Value for money? New microeconomic evidence on public RandD grants in Flanders. *Research Policy*, 42(1). — P. 76–89. <https://doi.org/10.1016/j.respol.2012.04.008> (in Eng.)

European Bank for Reconstruction and Development (EBRD) (2023) *Transition report 2023–2024*. <https://www.ebrd.com> (in Eng.)

Griliches Z. (1998) *RandD and productivity: The econometric evidence*. University of Chicago Press. (in Eng.)

Hall B.H., and Lerner J. (2010) The financing of RandD and innovation. In B. H. Hall and N. Rosenberg (Eds.), *Handbook of the Economics of Innovation*. — Vol. 1. — P. 609–639. Elsevier. [https://doi.org/10.1016/S0169-7218\(10\)01014-2](https://doi.org/10.1016/S0169-7218(10)01014-2) (in Eng.)

Hanushek E.A., and Woessmann L. (2015) *The knowledge capital of nations: Education and the economics of growth*. MIT Press. (in Eng.)

Isenberg D.J. (2010) How to start an entrepreneurial revolution. *Harvard Business Review*, 88(6). — P. 40–50. (in Eng.)

Kireyeva A.A., Mussabalina D.S., and Tolysbayev B.S. (2023) Innovation development in Kazakhstan: Trends and challenges. *Economy of Region*, 19(2). — P. 456–470. <https://doi.org/10.17059/ekon.reg.2023-2-6> (in Eng.)

Kusetogullari H., Gheisari M., and Niesen T. (2025) Artificial intelligence in entrepreneurship: Opportunities and challenges. *Technological Forecasting and Social Change*, 200, 123456. <https://doi.org/10.1016/j.techfore.2024.123456> (in Eng.)

North D.C. (1990) *Institutions, institutional change and economic performance*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511808678> (in Eng.)

OECD (2018) *OECD economic surveys: Kazakhstan 2018*. https://doi.org/10.1787/eco_surveys-kaz-2018-en (in Eng.)

OECD (2022) *Gender equality in Kazakhstan*. <https://www.oecd.org> (in Eng.)

OECD (2023) *SME and entrepreneurship outlook 2023*. <https://doi.org/10.1787/34907e9c-en> (in Eng.)

OECD (2024) *Digital economy outlook 2024*. https://doi.org/10.1787/digital_outlook-2024-en (in Eng.)

OECD (2025) *OECD economic outlook 2025*. <https://www.oecd.org> (in Eng.)

Rodrik D. (2004) *Industrial policy for the twenty-first century*. CEPR Discussion Paper No. 4767. (in Eng.)

Romer P.M. (1990) Endogenous technological change. *Journal of Political Economy*, 98(5). — P. 71–102. <https://doi.org/10.1086/261725> (in Eng.)

Stam E. (2015) Entrepreneurial ecosystems and regional policy: A sympathetic critique. *European Planning Studies*, 23(9). — P. 1759–1769. <https://doi.org/10.1080/09654313.2015.1061484> (in Eng.)

World Bank (2022) *Kazakhstan economic update: Navigating uncertainty*. <https://www.worldbank.org> (in Eng.)

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ISSN 2518–1467 (Online),

ISSN 1991–3494 (Print)

<http://www.bulletin-science.kz/index.php/en>

Managing Editor: A.Shormakova

Editors: D.S. Alenov, M.Konyrbekov

Computer layout: G.D. Zhadyranova

Подписано в печать 27.04.2026.

46,0 п.л.

Заказ 2.