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ВЕСТНИК

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NAS RK is pleased to announce that Bulletin of NAS RK scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of Bulletin of NAS RK in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential multidiscipline content to our community.

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НАН РК сообщает, что научный журнал «Вестник НАН РК» был принят для индексирования в Emerging Sources CitationIndex, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Вестника НАН РК в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному мультидисциплинарному контенту для нашего сообщества.

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DIFFUSION OF INNOVATIONS, KNOWLEDGE SPILLOVERS AND ECONOMIC GROWTH OF THE REGIONS OF KAZAKHSTAN: MUTUAL IMPACT

Abstract. In the transition from the raw material orientation of the economy to industrial development, an increase in innovative activity is of great importance. Diffusion of innovation and the knowledge spillovers between regions can play an active role in this. To stimulate innovative activity, which plays a decisive role in the transition from the raw material orientation of the economy to industrial development, diffusion of innovations and the knowledge spillovers between regions are important. The flows of technological innovations, stimulating the processes of creating new products and technologies, contribute to increasing the rate of regional economic growth.

The purpose of the study is to quantify the impact of costs on R&D and technological innovation, their flows in space on the economic growth of the regions of Kazakhstan.

The authors verified the models of endogenous growth for Kazakhstan, built a social filter, and calculated two specifications of the econometric model with fixed effects. Model calculations confirmed the hypothesis about the positive impact of technological innovation costs on regional economic growth rates. At the same time, the regions need to pursue their own innovation policy in order to maintain absorption capacity, which is a prerequisite for an effective flow of knowledge.

The results of the study can be used by public authorities in the formation of the regional innovation policy of the Republic of Kazakhstan.

Key words: innovative development, diffusion of innovations, regional economic growth, R&D, econometric models

Introduction. The latest economic studies of the theory of evolutionary and endogenous growth indicate a decisive role of knowledge and technology in the development of economic systems. An analysis of the nature of the accumulation of knowledge allows not only to explain the existing gaps in productivity between individual countries and types of economic activity (as well as within them), but also to predict their further expansion in the context of an increase in the "difference of knowledge potentials". Thus, the processes of knowledge creation and accumulation largely determine the future status of the national economic system in a rapidly changing global economy.

This problem is of particular relevance for Kazakhstan. The economy of Kazakhstan is largely dependent on the extraction and sale of minerals, and the share of high technology in the economy is low. At the same time, Kazakhstan has an innovative potential expressed in a high level of the educated population, a high proportion of highly qualified specialists, as well as a large number of resources for the implementation of industrial and innovative projects. However, the insufficient scale and low speed of distribution of innovations characterize the country's modern innovation policy.

Kazakhstan is a country with a relatively large territory and uneven development of regions. The rather high importance of the innovative component of modernization for the regions of Kazakhstan is determined by such factors as global competition, uncertain and sudden change in consumer preferences,

labor migration, and other factors inherent in the modern world economy. Regions are becoming active participants in the processes of competition, while the importance is given to the development of R&D and innovation, information technology, which is understandable.

The purpose of the study is to quantify the impact of diffusion of knowledge, innovations and technologies, their flows in space on the economic growth of the regions of Kazakhstan.

In post-Soviet countries, there are still very few approaches, in contrast to developed economies, to assess the impact of R&D on innovative development. In this regard, this study of the relationship of economic growth of the regions of Kazakhstan with innovation is relevant.

Literature review. Scientists-economists began to approach the study of the diffusion mechanisms of innovative processes, similar to the physical phenomenon of diffusion in various environments, in the middle of the last century. The concept of "diffusion" (corresponds to the Latin "Diffusio" - spill, spread, leakage) was studied in detail by Gabriel Tarde. In his book “The laws of imitation” G. Tarde describes the basic elements that ensure progress. The scientist, being interested in the laws of the distribution of innovations in society, called them the laws of imitation [1]. The concept of the "law of imitation" had a strong influence on the further development and improvement of diffusionism ideas. Later, E. Mansfield [2], C. Wissler [3], B. Ryan and N. Gross [4] confirmed this concept, the essence of which is that initially the idea is perceived by a small number of people, then their number increases, and subsequently - slows down due to the emergence of other ideas.

The spatial system necessarily develops along with diffusion processes. This is evidenced by numerous basic research [5,6,7]. However, despite the fact that each of the directions of research is based on the fundamental concepts of diffusionism, the main principles of different theories do not contradict each other. The Oslo Manual defines the term "diffusion" as the way in which innovations are distributed through market and non–market channels from their initial location to different consumers-countries, regions, industries, markets and enterprises (OCDE, 2005). The Oslo Manual emphasizes that without diffusion, innovation has no economic value [8].

Along with the classical problems of economic growth, the problems of empirical modeling of regional growth based on innovations have recently attracted the attention of many scientists [9, 10]. The theory of diffusion of innovations and knowledge spillovers is important in itself as a section of the general theory of the relationship between economic growth and innovation activity and as a section of modern economic theory. The theory of diffusion of innovations and knowledge spillovers aims to explain the speed and breadth of distribution of various product and process innovations in society [11]. Of particular interest is the study of A.I. Yablonsky, in which the author, describing mathematical models in the study of science, suggested the possibility of using S-shaped curves for modeling the processes of technological development [12]. This assumption became the basis for a series of studies on modeling innovative development. A.Grubler in conducting an experimental study focused on the fact that the diffusion process, expressed in the form of the share of output of a certain technological level, or the share of firms that have mastered the market of new products, is described by the logistics curve [13].

The study of the problems of innovative development and its relationship with significant regional growth is contained in the diffusion models of F. Agillon and P. Howitt [14]. P.Romer theoretically justified the influence of endogenous factors on economic growth [15]. His works contain generalizations of localization effects that positively affect innovation. An analysis of the impact of innovation in the form of R&D on the economic growth of countries and regions over the past decade has become widespread. The positive role of knowledge flows on the economic growth of regions and countries is recognized [16]. In general, the research results show a link between knowledge spillovers and economic growth for a group of countries (for example, the EU), as well as for regions within one country (US states, Spanish provinces, and subjects of the Russian Federation).

As for Kazakhstan, regions of Kazakhstan are characterized by strong uneven socio-economic development. But in accordance with the modern requirements, regions become active participants in the processes of competition, with the main emphasis placed on the field of R&D and innovation, information technology [17]. Issues of innovation development and its management are actively studied in Kazakhstan [18].

In this study, the authors relied on recent studies devoted to the study of the relationship between R&D results and regional growth, performed, in particular, by G.A. Untura and M.A. Kaneva [19]. Scientists emphasize the inverse relationship between the intensity of flows and exchanges of knowledge and distances, since the possibility of direct communication and flows of implicit knowledge decreases with distance.

Methodology. It is obvious that the real socio-economic conditions of the region are characterized by many specific parameters determined by the context of the territory. It is the specific regional context (the structure of human and social capital, institutional and socio-cultural environment, conditions for access to financing, infrastructure) that has a decisive impact on innovative development [20]. This is especially true for Kazakhstan, where regional features of innovation activities differ significantly.

The formulation of the basic model of this study corresponds to traditional models of catching up endogenous growth [21]. To calculate the model, the annual data Of the Committee on statistics of the MNE of the Republic of Kazakhstan of the time period from 2005 to 2018 were used. The geographical units of analysis and the object on the example of which this study is carried out are the regions of Kazakhstan.

The Arellano-bond method, according to the formulation of the model [22] allows to overcome the problem of endogeneity in the model. Adding spatial variables to the regression equation changes the picture to some extent. Thus, the use of the GMM (Generalized Method of Moments) model confirmed the statement about the convergence of regions, made earlier on the basis of the results of panel regression with fixed effects. It was shown that not only regions with lower GRP per capita in the past period grow faster, but also those regions that grew at a lower rate in the past periods.

This result is supported by most empirical studies. For example, this dependence, also based on the GMM model, was previously confirmed for Russian regions [23]. Kazakhstan, as is known, is similar in some respects to Russia in some respects: it has a rich resource base and the raw material nature of the economy. Model calculations confirmed the hypothesis about the positive impact of technological innovation costs on regional economic growth rates. Accordingly, the flows of technological innovations have intensified the processes of creating new products and technologies and contributed to increasing the economic growth rates of the regions of Kazakhstan.

Results. The solution to the problem is carried out step by step.

Stage 1. Calculation of the input data of the model

For the development of the object of study it is necessary to analyze the specifics of Kazakhstan. The authors calculated the input variables of the regression equations. When calculating the dependent variable - the growth rate of GRP per capita at comparable prices (growth), we used the national GDP deflators, presented in table 1. The formula for calculating growth is presented as follows:

$$growth_t = \frac{realGRPpc_t - realGRPpc_{t-1}}{realGRPpc_{t-1}} \quad (1)$$

Table 1 – National deflators of GDP of Kazakhstan (base year 2004)

Year	Deflator by 2004	Deflation index
2005	121.5	1.215
2006	140.333	1.403
2007	169.802	1.698
2008	177.783	1.778
2009	212.629	2.126
2010	252.815	2.528
2011	264.950	2.650
2012	290.121	2.901
2013	306.948	3.069
2014	312.780	3.128
2015	355.318	3.553
2016	377.703	3.777
2017	390.7	3.907
2018	415.5	4.155
Source: data of the Committee on Statistics of the Republic of Kazakhstan and the authors' calculations.		

By formula (1), recalculations of the growth variable were performed. The variable lnyt1 was added to the database - "the natural logarithm of GRP per capita with a lag of 1 year" (that is, a shift backward in time by one period). The calculation of knowledge spillovers formulas was carried out, the spillgrppc variable was added to the database - "GRP per capita flow".

Stage 2. Calculation of the social filter of the endogenous growth model

The flow of knowledge is the process of dissemination of once mastered innovations in new conditions. In this regard, to predict the patterns occurring under the influence of certain factors, it is necessary to take into account the socio-economic conditions of the region into which knowledge flows. This is a direct analogue of the effects of the most important socio-economic conditions in the region on other regions. According to our definition, a social filter is a set of factors related to the demographic structure of a region and the level of development of human capital, which is crucial for innovative development [24].

Variables used to calculate the social filter (variable *sf1*) were added to the database. These are the variables: university graduates,% of the total employed population (*grad_l*); the unemployment rate in the region,% (*unemp*); the proportion of the population under 30 years employed in the region's economy, % (*young*); the share of the population employed in agriculture in the region, of the total employed population,% (*agri_l_n*). Table 2 presents the components of the social filter *sf1* and their weight in the index.

Table 2 – Indicator coefficients for factor 1 (component score coefficient matrix) of the variable "social filter"

Variable	Coefficients (shares in the social filter)
grad_l	0,7246
Unemp	0,1305
Young	-0,0088
agri_l_n	-0,6766
Note: The principal component method (*pca* command in Stata) was used to calculate the weights of the social filter components.	

The social filter index was based on a factor analysis of the four indicators listed above, and the index itself corresponds to the first factor identified in the process of factor analysis, with an eigenvalue greater than 1 (1,481). The first factor accounted for 37% of the overall variation.

The variable overflows of the social filter *spillsf1* was also added to the database. Descriptive statistics of model variables are presented in table 3.

Table 3 – Descriptive statistics of variables used in the analysis

Variable	Number of observations	Average	Standard deviation	Min	Max
growth	192	5.237	13.050	-26.880	40.430
lnyt1	192	13.155	0.703	11.790	14.785
rd_mk	192	0.135	0.141	0.007	0.709
rd_spill_mk	192	0.129	0.040	0.071	0.318
inno_tot	192	0.994	2.340	0.000	26.327
spill_inno_tot	192	0.980	0.810	0.126	4.928
sf1	192	-13.957	11.140	-36.151	6.938
spillsf1	192	-14.240	3.344	-22.222	-6.399
spillgrppc	192	654920.400	145433.900	330502.900	1024939.000

As follows from the calculations, the regions of Kazakhstan are significantly differentiated by the rate of economic growth: the minimum value of the growth rate of GRP per capita was recorded for the Kyzylorda region in 2015, while the maximum value was reached in 2011 for the Pavlodar region. R&D costs ranged from 0.007% to 0.709% during the study period, but the costs of research and development were higher than the costs of R&D, reaching a maximum of 26.3% for Astana in 2013.

Stage 3. Verification of endogenous growth models

The authors calculated two models with fixed effects based on new data. Before calculating the model, a correlation matrix of all variables used in the analysis was constructed (table 4).

According to the correlation matrix, in both cases, high correlations between the variables were found. Firstly, this is the correlation between the flows of the social filter and the flows of GRP per capita (0.728). This correlation is the result of multiplying the original indicators by the same distance matrix when calculating the accessibility index. The correlation between the social filter and the natural logarithm of GRP per capita with a lag of one year is also high. Alternative social filter options *(sf2* - components *grad_l, rd_l, young, agri_l_n* and *sf3* - components *grad_l, rd_l, unemp, agri_l_n*) were calculated, but no significant reduction in correlation was achieved.

Table 4 – Correlation matrix of variables in endogenous growth model

	growth	lnyt1	rd_mk	rd_spill _mk	inno _tot	spill_ inno_tot	sf1	spillsf1	Spill grppc
growth	1								
lnyt1	-0.164	1.000							
rd_mk	-0.044	0.305	1.000						
rd_spill_mk	-0.007	-0.476	-0.132	1.000					
inno_tot	0.052	-0.004	-0.057	-0.102	1.000				
spill_inno_tot	0.021	0.088	-0.079	-0.337	0.099	1.000			
sf1	-0.104	0.816	0.541	-0.443	-0.011	0.136	1.000		
spillsf1	-0.198	0.043	-0.386	-0.202	0.161	0.421	-0.079	1.000	
spillgrppc	0.038	0.227	-0.329	-0.312	0.067	0.206	0.012	0.728	1.000

To account for the problem of endogeneity in the model, between the dependent variable and the set of independent variables in terms of the reversecausality problem, all independent variables were lagged.

The authors calculated two specifications of the model. The first specification included the costs of R&D and their flows, the second – the costs of technological innovations and their flows. Specifications are presented in table 5.

Table 5 – Panel regression with fixed effects, dependent variable growth rate of real GRP per capita for the regions of Kazakhstan

Independent variables	Specification 1 The number of observations = 176	Specification 2 The number of observations = 176
The natural logarithm of GRP per capita with a lag of 2 years	-0.693 (4.958)	15.460 (10.029)
R&D costs as% of GRP with a lag of 1 year	-10.397 (12.074)	
Cost of technological innovation as% of GRP with 1 year lag		2.290 (0.807)
Social filter with 1 year lag	-0.480 (0.276)	-0.602 (0.155)
R&D flows with a lag of 1 year	-321.277 (83.278)	
Flows of technological innovation with a lag of 1 year		13.493 (3.993)
The flow of socio-economic conditions with a lag of 1 year	0.156 (0.338)	-0.605 (0.706)
Flow of GRP per capita	-0.000118 (0.00002)	-0.0000638 (0.00001)
Constant	129.949 (64.261)	-186.215 (140.095)
Fisher test for the significance of coefficients to zero regression coefficients	F(6.79)=13,67 [0.0000]	F(6.15)=13.72 [0.0000]
R^2	0.1411	0.1564
Note: robust standard errors of the regression coefficient are indicated in parentheses.		

Analyses showed that, the second specification is more adequate, has a higher R2 (15.6%) and indicates a positive effect of investments in technological innovations on the rate of regional growth. The marginal effect of the *inno_tot* variable is 2.290. The negative and significant value of the social filter indicates that among the variables of the social filter, an increase in unemployment (resulting in *sf1* growth) reduces GRP per capita. The growth of per capita GRP is also caused the growth of people employed in agriculture, which means that in Kazakhstan, economic growth is still dependent on the agricultural sector.

The positive and significant coefficient in the variable flows of costs for technological innovations confirmed the assumption about the significance of the spatial structure and knowledge spillovers on the economic growth of regions. Thus, the costs of IT in neighboring regions stimulate an increase in the growth rate of GRP per capita in the region. At the same time, the regions need to pursue their own innovation policy in order to maintain absorption capacity, which is a prerequisite for an effective flow of knowledge.

Conclusion. Summarizing the results of the tested models, we can conclude that the hypothesis of the importance of knowledge flows on the economic growth of regions and their ability to overcome administrative boundaries and spread beyond one region, stimulating the growth of GRP per capita in the neighboring regions and nearby territories is partially fulfilled. This result allows us to conclude that knowledge is distributed between regions with similar rates of growth and development of technological platforms, and the efficiency of their flow depends on the absorption capacity of the regions

The results of the study can be used by public authorities in the formation of a regional innovation policy in the Republic of Kazakhstan, in particular: substantiation of strategic national priorities in the modernization of the regional economy; justification of the proposal on the STP public administration system; the formation of a basic innovation infrastructure, which includes universities, technology parks, innovation and technology centers, business incubators, centers of expertise, technology transfer, clustering, etc.

Further work in this scientific direction should be focused on the development of theoretical and methodological foundations for the study of regional innovation systems. The implementation of this study will reveal the patterns of innovative development and the specifics of innovative processes in different Kazakhstan regions. In the future, on this basis, it is possible to develop mechanisms for diffusion of innovations, which in turn will contribute to sustainable innovative development of Kazakhstan's regions.

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ҚАЗАҚСТАН ӨҢІРЛЕРІНІҢ ИННОВАЦИЯЛАР ДИФФУЗИЯСЫ, БІЛІМ АҒЫНЫ ЖӘНЕ ЭКОНОМИКАЛЫҚ ӨСУІ: ӨЗАРА ӘСЕРІ

Аннотация. Экономиканың шикізаттық бағытынан индустриалды дамуға көшуде шешуші рөл атқаратын инновациялық қызметті ынталандыруда инновациялардың таралуы және аймақтар арасындағы білім ағынының маңызы зор. Білімді жинақтау сипатын талдау жекелеген елдер мен экономикалық қызмет түрлері арасындағы (сондай-ақ олардың ішіндегі) өнімділіктегі бар олқылықтарды түсіндіріп қана қоймай, сонымен бірге «білім потенциалдарының айырмашылығының» артуы жағдайында олардың әрі қарай кеңеюін болжауға мүмкіндік береді. Әдетте білімді құру және жинақтау процестері тез өзгеретін әлемдік экономикадағы ұлттық экономикалық жүйенің болашақ күйін анықтайды.

Жаңа өнімдер мен технологияларды құру процестерін ынталандыратын технологиялық инновациялар ағындары аймақтық экономикалық өсу қарқынының өсуіне ықпал етеді. Бұл мәселені шешу Қазақстан үшін өте маңызды. Қазақстан экономикасы негізінен пайдалы қазбаларды өндіруге және сатуға байланысты, ал экономикадағы жоғары технологиялардың үлесі төмен. Сонымен бірге республиканың білімді тұрғындарының жоғары деңгейінде, жоғары білікті мамандардың едәуір бөлігінде, сондай-ақ индустриалды-инновациялық жобаларды іске асыру үшін көптеген ресурстарында көрінетін инновациялық әлеуеті бар. Алайда инно-

вацияларды таратудың жеткіліксіз ауқымы мен төмен жылдамдығы елдің қазіргі заманғы инновациялық саясатын сипаттайды.

Зерттеудің мақсаты – шығындардың ҒЗТКЖ мен технологиялық инновацияларға, олардың кеңістіктегі ағындарының Қазақстан аймақтарының экономикалық өсуіне әсерін бағалау.

Осы зерттеудің негізгі моделін тұжырымдау эндогенді өсудің дәстүрлі үлгілеріне сәйкес келеді. Үлгіні есептеу үшін Қазақстан Республикасы Ұлттық экономика министрлігі Статистика комитетінің 2005-2018 жылдардағы жылдық деректері пайдаланылды. Зерттеудің географиялық бірлігі және объектісі – Қазақстанның аймақтары.

Әлбетте, аймақтың нақты әлеуметтік-экономикалық жағдайлары аумақтың контексімен анықталатын көптеген нақты параметрлермен сипатталады. Бұл инновациялық дамуға шешуші әсер ететін фактор – нақты аймақтық контекст (адам және әлеуметтік капиталдың құрылымы, институционалдық және әлеуметтік-мәдени орта, қаржыландыруға қол жеткізу шарттары, инфрақұрылым). Бұл, әсіресе, инновациялық қызметті жүзеге асырудың аймақтық ерекшеліктері айтарлықтай ерекшеленетін Қазақстанға қатысты. Есептеулерден көрініп отырғандай, Қазақстан Республикасының өңірлері экономикалық өсу қарқынымен айтарлықтай ерекшеленеді: жан басына шаққандағы ЖӨӨ-нің өсу қарқынының минималды мәні 2015 жылы Қызылорда облысы үшін тіркелді, ал 2011 жылы Павлодар облысы үшін ең жоғары мәнге қол жеткізілді. Зерттеулер мен әзірлемелерге жұмсалған шығындар зерттеу кезеңінде 0,007 %-дан 0.709 %-ға дейін болды, бірақ ғылыми-зерттеу және тәжірибелік-конструкторлық жұмыстар ҒЗТКЖ шығындарынан жоғары болды, 2013 жылы Астана үшін ең жоғары көрсеткіш 26,3 %-ды құрады.

Авторлар Қазақстан үшін эндогендік өсу модельдерін тексерді, әлеуметтік сүзгі құрастырды, панельдік модельдің екі сипаттамасын белгіленген эффектілермен есептеді және республиканың аймақтарына эконометрикалық үлгіні салу мүмкіндігін талдады. Модельдік есептеулер технологиялық инновациялардың шығындары аймақтық экономикалық өсу қарқынына оң әсер етеді деген болжамды растады. Технологиялық инновациялық шығындардың ауыспалы ағымы бар оң және маңызды коэффициент – кеңістіктік құрылым мен білім ағындары аймақтық экономикалық өсу үшін маңызды деген болжамды растады. Сонымен қатар өңірлер білімнің тиімді ағымының алғышарты болып табылатын сіңіру қабілетін сақтау үшін өздерінің инновациялық саясатын жүргізуге міндетті.

Зерттеу нәтижелерін мемлекеттік органдар Қазақстан Республикасындағы аймақтық инновациялық саясатты қалыптастыруда қолдана алады, атап айтқанда:

- аймақтық экономиканы модернизациялаудағы ұлттық стратегиялық басымдықтарды негіздеу;
- ғылыми-техникалық прогресті мемлекеттік басқару жүйесі туралы ұсыныстың негіздемесі;
- университеттер, технопарктер, инновациялық және технологиялық орталықтар, бизнес-инкубаторлар, сараптама орталықтары, технологиялар трансферті, кластерлеу және т.б. кіретін базалық инновациялық инфрақұрылымды қалыптастыру.

Осы ғылыми бағыттағы жұмыс одан әрі аймақтық инновациялық жүйелерді зерттеудің теориялық және әдістемелік негіздерін дамытуға бағытталуы керек. Осы зерттеуді іске асыру инновациялық дамудың заңдылықтарын және Қазақстанның әртүрлі аймақтарындағы инновациялық процестердің ерекшеліктерін ашады. Кейіннен осы негізде инновацияларды тарату тетіктерін жасауға болады, бұл, өз кезегінде, Қазақстан аймақтарының тұрақты инновациялық дамуына ықпал етеді..

Түйін сөздер: инновациялық даму, инновациялардың таралуы, аймақтық экономикалық өсу, ҒЗТКЖ, эконометрикалық модельдер.

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ДИФФУЗИЯ ИННОВАЦИЙ, ПЕРЕТОК ЗНАНИЙ И ЭКОНОМИЧЕСКИЙ РОСТ РЕГИОНОВ КАЗАХСТАНА: ВЗАИМНОЕ ВЛИЯНИЕ

Аннотация. В стимулировании инновационной активности, играющей решающую роль в переходе от сырьевой направленности экономики к индустриальному развитию, немаловажное значение отводится диффузии инноваций и перетоку знаний между территориями. Анализ характера накопления знаний позволяет не только объяснить существующие разрывы в производительности между отдельными странами и видами экономической деятельности (а также внутри них), но и спрогнозировать их дальнейшее

расширение в условиях нарастания «разности знаниевых потенциалов». Как правило, процессы создания и накопления знаний в значительной степени определяют будущий статус национальной экономической системы в быстроменяющейся глобальной экономике.

Перетоки технологических инноваций, стимулируя процессы создания новых продуктов и технологий, способствуют повышению темпов регионального экономического роста. Решение этой проблемы очень важно для Казахстана, экономика которого в значительной степени зависит от добычи полезных ископаемых, а доля высоких технологий в ней невысока. При этом республика располагает инновационным потенциалом, выраженным в высоком уровне образованного населения, значительной доле высококвалифицированных специалистов, а также необходимыми ресурсами для реализации индустриально-инновационных проектов. Однако недостаточные масштабы и низкая скорость распространения нововведений характеризуют современную инновационную политику страны.

Цель исследования состоит в количественной оценке влияния затрат на НИОКР и технологические инновации, их перетоков в пространстве на экономический рост регионов Казахстана.

Формулировка базовой модели, представленной в работе, соответствует традиционным моделям догоняющего эндогенного роста. Для расчета модели использовались ежегодные данные Комитета по статистике МНЭ РК временного периода с 2005 по 2018 годы. Географическими единицами анализа и объектом, на примере которого выполнено данное исследование, стали регионы Казахстана.

Совершенно очевидно, что реальные социально-экономические условия того или иного региона характеризуются множеством специфических параметров, определяющихся контекстом территории. Именно конкретный региональный контекст (структура человеческого и социального капитала, институциональная и социокультурная среда, условия доступа к финансированию, инфраструктура) оказывает решающее влияние на инновационное развитие. Это особенно актуально для Казахстана, где региональные особенности осуществления инновационной деятельности имеют существенные различия. Как следует из проведенных расчетов, регионы РК значительно дифференцированы по темпам экономического роста: минимальное значение темпов прироста ВРП на душу населения было зарегистрировано для Кызылординской области в 2015 г., в то время как максимального значение было достигнуто в 2011 г. для Павлодарской области. Затраты на НИОКР варьировались от 0,007% до 0,709% в исследуемый период, тогда как затраты на технологические инновации были выше затрат на НИОКР, достигнув максимального значения в 26,3% для Астаны в 2013 г.

Авторами проведена верификация моделей эндогенного роста для Казахстана, построен социальный фильтр, проведены расчеты двух спецификаций панельной модели с фиксированными эффектами и проанализирована возможность построения эконометрической модели для регионов республики. Расчеты по моделям подтвердили гипотезу о положительном влиянии затрат на технологические инновации на темпы экономического роста регионов. Положительный и значимый коэффициент при переменной перетоков затрат на технологические инновации подтвердил предположение о значимости пространственной структуры и перетоков знаний для регионального экономического роста. Однако это не снижает важности проведения регионами собственной инновационной политики с целью поддержания своей абсорбционной способности, являющейся обязательным условием эффективного перетока знаний.

Результаты исследования могут быть использованы органами государственной власти при формировании региональной инновационной политики Республики Казахстан, в частности, при:

- разработке стратегических национальных приоритетов модернизации региональной экономики;
- обосновании предложений по совершенствованию системы государственного управления НТП;
- формировании базовой инновационной инфраструктуры, включающей университеты, технопарки, инновационно-технологические центры, бизнес-инкубаторы, центры экспертизы, трансфера технологий, кластеризации и другие объекты.

Дальнейшая работа по данному научному направлению должна быть ориентирована на разработку теоретико-методологических основ исследования региональных инновационных систем. Реализация данного исследования позволит выявить закономерности инновационного развития и специфику инновационных процессов в различных казахстанских регионах. В последующем на этой базе представляется возможной разработка механизмов диффузии инноваций, что, в свою очередь, будет способствовать устойчивому инновационному развитию казахстанских регионов.

Ключевые слова: инновационное развитие, диффузия инноваций, региональный экономический рост, НИОКР, эконометрические модели.

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