# *INNOVATIVE PROCESSES IN THE REPUBLIC OF KAZAKHSTAN: REGIONAL BREAKDOWN*

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As the experience of the economically developed countries shows, innovation requires its targeted regulation and management. This is especially true for Kazakhstan, where the formation of the national innovation system is in initial stage and needs an effective innovation management. In our view, in our country there is no sufficient methodology and assessment of the outcomes of the innovation process, in connection with what hindered the analysis of the effectiveness of financial and intellectual resources to ongoing at this stage, innovative projects. Based on the above updated the question of the development of a methodology for measuring the effectiveness of innovation at the regional level, which will reveal the challenges to realize their innovative potential.

Research Methodology - It consists of several stages. At the initial stage of the analysis of existing methodologies for assessing the effectiveness of innovation, both domestic and foreign literature. Further, the technique of an estimation of efficiency of innovative activity, using e-atlas, which is the most useful for Kazakhstan. The final stage - evaluation of regional development of innovation activities in Kazakhstan.

The results, scientific contribution, the findings - the proposed information system «Electronic Map InnoMap.Kz» is operational, monitoring and analysis tool that allows not only to see the current state of development of innovations in all regions of the country, but also to identify the problems and obstacles at every stage of the life cycle innovation in order to develop measures to address them.

Application of the results - at the national level to assess the regional development of innovation and the effectiveness of measures to increase efficiency of Regions.

Restrictions / directions for future research - the proposed method may be supplemented by other indicators in future studies, including for the calculation of R & D intensity of production in the regions.

***Key words:*** innovative development of Kazakhstan, the effectiveness of innovative development, innovation, innovation, innovation, performance, innovative regional economy, regional development, e-card, assessment methodology

**INTRODUCTION**

Today, innovations allow us to be the first in a tough economic competition, to receive solid financial dividends and ensure high rates of economic development. Today this is an alternative way of survival in the conditions of global competition not only of individual economic entities, but of national economies in general.

Kazakhstan, having started implementation of the majority of innovative projects and programs, aspires not only to achieve an ambitious goal to enter the top thirty of the most developed countries of the world, designated by the President of the Republic of Kazakhstan N.A. Nazarbayev, but to resolve a whole range of problems associated with a departure from the raw material orientation of the national economy and its modernization in the context of new global trends.

Despite the conceptually correct innovation emphasis in the strategic development of Kazakhstan, the growth of the national economy is mainly ensured through the use of natural resources, while the intellectual potential is not being realized to the proper extent, and new knowledge does not bring real revenues. It would seem that the country has the potential and opportunities for an innovative

breakthrough, however, the "Kazakhstani economic miracle" has not yet occurred. In this connection, this work is an attempt to find an answer to such an important question for Kazakhstan: "What should be done to make the innovation component the main driving force of economic development?"

**THEORY**

The emergence of the domestic economy on market lines leads to the inevitability of increasing the effectiveness not only of production, but also of other spheres of activity, namely: market research and customer satisfaction, innovation, personnel and financial management, and environmental protection [1-3]. In other words, the efficiency of all subsystems and the business entity as a whole must be effective, which in the conditions of the market is obliged to provide the management system. Consequently, in our opinion, under the effective management of innovation processes, one should understand such an impact on the management object that ensures the effectiveness of innovations and positive changes in the economic entity as an integral system in the transforming external environment. Obviously, the more effective the innovation activity, the more efficiently its management system operates. How to measure the results of innovation?

Evolution of the theory of measuring the effectiveness of innovation can be divided into four stages, which are gradually becoming more complex and meaningful. [4]. Figure 1 illustrates the development of these stages.

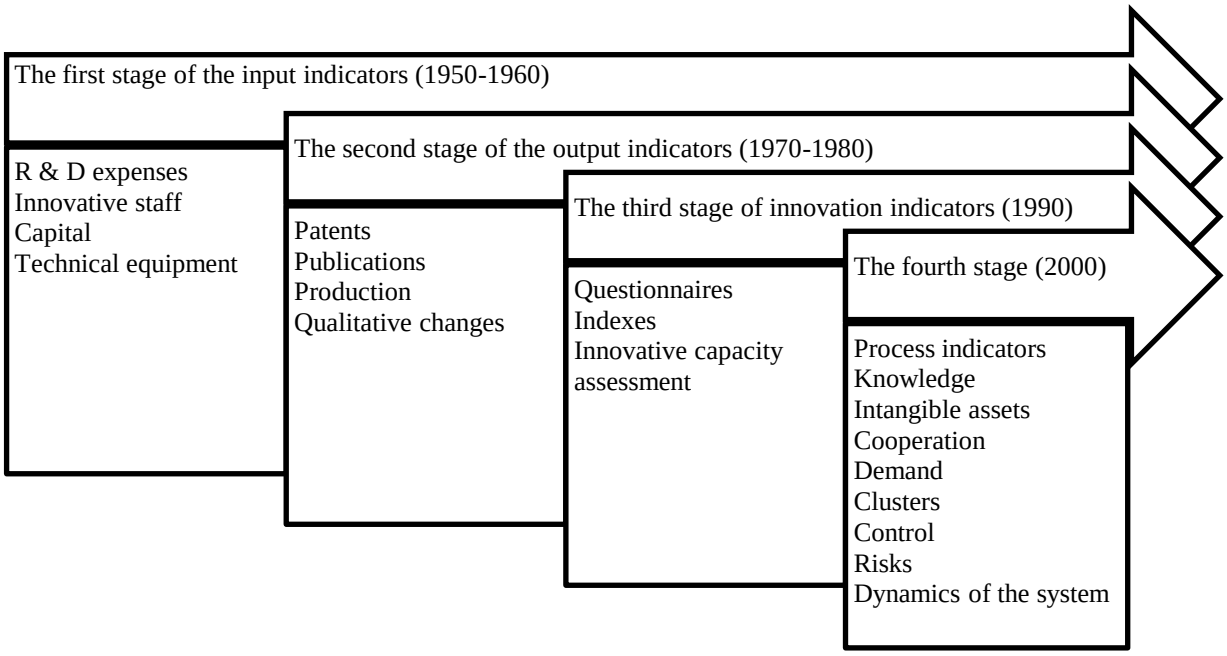


Figure 1- Evolution of the evaluation of innovation efficiency

NOTE - Compiled by the authors on the basis of data [5-17]

*The first stage of the evaluation* reflects the linear concept of innovation with a focus on *costs*, such as research and development, investment, education expenses, capital expenditures, education, scientific personnel, university graduates, technological intensity and the like.

The second stage is supplemented by input parameters by taking into account *the interim results* of research activity. Typical examples include the number of patents, scientific publications, the counting of new products and processes, high-tech products.

The third phase focuses on a wide range *of innovative indicators and indices* based on the reviews and the integration of public statistics. The main emphasis is on benchmarking and the nation's potential for innovation. The difficulty of using criteria is to compare international data in assessing the effectiveness of innovation (where the process is a product).

Relevant indicators *of the fourth stage* is currently in its infancy and include:

*Indicators of assessing the use of knowledge.* This indicator takes into account what underlies the creation of innovation and its diffusion. The complexity of the assessment of knowledge lies in the fact that it can only be measured by indicators of the system, which may include the performance of investment spending on education, as well as the efficiency of their use.

*Indicators of the integration of science and business.* This indicator is associated with a feature of modern innovation that is, it is unlikely that any organization can innovate alone. Most innovations are created thanks to cooperation. This is typical for most science-intensive, high-tech technologies. Therefore, this indicator can only be measured using an indicator system that includes the evaluation of contractual agreements such as strategic partnerships, licensing of intellectual property, as well as informal cooperation and knowledge sharing, for example, workers 'and managers' attitudes. And so cooperation Which can be not only regional, but also have a national, or even global.

*Indicators of development of innovative infrastructure.* The economic situation, government policies, infrastructure, social and cultural factors are of great importance for the creation of successful innovations.

Since the early 1960's. The OECD and the EU actively stimulated the development of the system of indicators of science and technology. As a result, today in Europe there are more than 100 different indicators published on a periodic basis for the evaluation of innovation activity.

The methodology developed by the Committee on Statistics of the Ministry of National Economy of the Republic of Kazakhstan uses a generalized scheme for calculating the results of innovation activities, reflecting mainly the innovative activity of enterprises, regions and the country and calculated as a share of innovative products in the total output.

In general, the following indicators are used to estimate innovations in the Republic of Kazakhstan:

- Level of innovative activity in the field of innovation;
- Costs for technological innovation by forms of ownership;
- Costs for technological innovation in industry;
- share of innovative products in relation to GDP in%;
- Internal current costs of research and development by industry, by type of work and by area.

In our opinion, the methodology applied in our country is not sufficiently focused on evaluating the final results of the innovation process, in connection with which it is difficult to analyze the effectiveness of using financial and intellectual resources in the innovative projects being implemented at this stage.

On the basis of the above, the question of developing such a methodology for measuring the effectiveness of innovation activity at all levels of the economic hierarchy (country, region, enterprise) is being updated, which will allow assessing the innovative contribution of each specific subject to the country's GNP, as well as identify problems that impede the realization of their innovative potential . We believe that the methodology proposed by us should solve the following main tasks:

- Orient to a specific result, which is necessary for solving specific national and regional problems;
- Take into account the level of use of financial and intellectual resources;
- To reflect problems and obstacles of innovative development of subjects of innovations;
- Identify the main driving forces and challenges at each stage;
- Identify priority trends in innovative development, including identifying leading and lagging sectors of the economy.

**DATA AND METHODS**

The proposed methodology for the effectiveness of innovation should be based on the following principles:

- Systematic, allowing you to track and adjust the results of innovation at different stages of its life cycle: at the stage of research and development, at the stage of commercialization, as well as at the stage of innovation, both at the level of individual enterprises and at the level of industries and regions;
- the comparability of the results of monitoring the implementation of innovative development programs companies, industry and Regions from Similar Indicators Foreign countries;
- Integration into the system of strategic innovative development of the country.

To improve the efficiency of innovative process management system in the Republic of Kazakhstan, we have also made an attempt to create **«InnoMap.Kz»** interactive electronic atlas. The goal of developing an electronic atlas is to improve the tools and methods of innovation management in the Republic of Kazakhstan on the basis of calculating the effectiveness of innovation activities in the regions using the proposed system of indicators.

The electronic map allows to solve the following tasks:

1. In electronic form, monitor and promptly provide information on the level of innovation development.
2. Automate the processes of managing the innovative development of regions (industries).
3. To raise the level of regional awareness of own level of innovation activity development in comparison with other regions.
4. Manage the key indicators of the development of research and innovation activities in the regions of the country in order to stimulate it and create an environment of competition between regions.
5. Provide archival storage of the history of innovative development of regions (industries) and recommendations for further enhancement of it with the purpose of analyzing the dynamics of innovation processes.

The algorithm for calculating the values of the indicator of innovative development of the regions of Kazakhstan is based on the following stages:

1. For each indicator, official statistics were collected for the last available year. Since innovative processes in the Republic of Kazakhstan are not as dynamic, and there are also a lack of a statistical database, the calculation of indicators by regions was carried out in 2012.

2. The calculation of indicators for all regions has been made.

2.1. The calculation of the efficiency index of research activities for the region contains the following categories of data: region, number of patents, number of scientific publications with Impact Factor (IF), number of scientists

2.2. The calculation of the efficiency of knowledge transfer to the economy contains the following categories of data: region, number of sold (commercialized) research works (R & D), number of R & D

2.3. The calculation of the effectiveness of implemented innovation projects contains the following categories of data: region, volume of innovative products, costs for technological innovation.

3. Next, the calculation was conducted with Independent user values of parameters used with pre-normalization. Smoothed data were normalized by the method of linear scaling to bring their values to the range from zero to one. Values for each of the indicators are normalized according to the principle:

$$\tilde{X}_i^j = \frac{X_i^j - X_{min}^j}{X_{max}^j - X_{min}^j} \quad (1)$$

where - the smoothed value of the index j to region i;

- *the minimum value of the indicator j for the year under consideration*
- *the maximum value of the indicator j for the year under consideration.*

4. For calculation of the indicator of innovative regions of the Republic of Kazakhstan, the values of the indicators were averaged by the simple average method. Thus, the formula for calculating the final indicator is as follows:

$$I_i = \sum_{j=1}^{n} \widetilde{X_i^j} \quad (2)$$

where - the *value of the indicator for the innovative development of the region i;*

N - the total number of indicators for which the indicator was calculated

(N = 3).

**RESULTS**

The proposed information system "InnoMap.Kz» is operational, monitoring and analysis tool that allows not only to see the current state of development of innovations in all regions of the country, but also to identify the problems and obstacles at every stage of the life cycle of innovation in order to develop measures to address them .

Using the information system "InnoMap.Kz" allowed to make a detailed analysis of innovative development of the regions.

The indicator of the effectiveness of research activities by region is presented in Table 2.

*Table 2* - **Analysis of the effectiveness of research activities by region in 2012**

| Region name | Number of patents, pcs. | Number of published scientific articles (Web of Knowledge), pcs. | Number of scientists, persons | Total calculation of the indicator |
|---|---|---|---|---|
| West Kazakhstan | 184 | 7th | 516 | 0.37 |
| Pavlodar | 87 | 4 | 292 | 0.31 |
| Mangistau | 111 | 3 | 569 | 0.20 |
| Kyzylorda | 16 | 9 | 192 | 0.13 |
| Zhambyl | 39 | 4 | 350 | 0.12 |
| Astana | 97 | 254 | 3024 | 0.12 |
| Aktobe | 12 | 7th | 172 | 0.11 |
| Kostanay | 21 | 4 | 268 | 0.09 |
| Karaganda | 93 | 15 | 1189 | 0.09 |
| Akmola | 64 | 18 | 936 | 0.09 |
| South Kazakhstan | 73 | 14 | 994 | 0.09 |
| Almaty | eleven | 21 | 415 | 0.08 |
| Almaty city | 102 | 318 | 8644 | 0.05 |
| Atyrau | 17th | 4 | 605 | 0.03 |
| North-Kazakhstan | 5 | 4 | 325 | 0.03 |
| East Kazakhstan | 24 | 7th | 1913 | 0.02 |
| Note - Compiled by the authors | | | | |

Leaders in the level of development of research and development (Figure 2) are the following regions (more than 101% of the average, in brackets is the percentage of the average value of the integral index for the regions of Kazakhstan): Western Kazakhstan (125%); Pavlodar region (119%); Mangistau oblast (108%); Kyzylorda Oblast (101%).

These regions demonstrate a relatively good result in the first indicator due to the availability of patents, but the number of publications in high-ranking journals remains low. In the West Kazakhstan region, there are 36 patents per 100 scientists, or almost every third scientific worker in 2012 received a patent. In Pavlodar region, every fourth scientist in 2012 received a patent.

The East Kazakhstan region showed the lowest result of only 1.62%. So, in this region only 80 employees have a patent or a scientific publication in a high-ranking journal. In the North-Kazakhstan region - every 40 researchers.

Despite the fact that the largest number of persons engaged in research are concentrated in Almaty (8644) and Astana (3024), the effectiveness of scientific workers remains substantially low. In Almaty, every 20 employees received a patent or published an article in a high-ranking journal, and in Astana - every 11.

In general, this indicator in the country is equal to 8.09%, or every 12 scientists received a patent or wrote an article that was included in a high-ranking journal. Germany, the country-leader in innovative development, here the figure is 28%, that is, every 4 employees involved in research received the result.

The analysis of the effectiveness of research activities allows us to draw the following conclusions:

1. Performance indicator of research activity remains well below the global importance.
2. High efficacy results of scientific and innovative activity in some regions due to the presence of research centers in the region or with the higher productivity of researchers (West Kazakhstan, Kyzylorda oblast ).
3. The lag in many areas due to the obsolescence of the scientific and technical base.
4. Inefficient procedure of allocation of research funding. For example, grant funding of the Ministry of Education and science of the Republic of Kazakhstan at mainly produced major universities

of the country , which focused at g . Astana and Almaty , however, the data regions show a significant lag not only from the world of values , but and from other regions of Kazakhstan .

5. International cooperation at the field of scientific research significantly influences on the development of science at regions . West - Kazakhstan region , where concentrated a huge amount of foreign scientists and researchers , on this indicator exceeded the average national results .

6. The subjects of research, as a whole, the country is not relevant, this is evidenced by the number of top-rated publications.

The next indicator "effective transfer of knowledge to the economy" is presented in Table 3 and Figure 3.

Leaders percentages "The effectiveness of knowledge transfer to the economy" are the following regions (over 106% of the average value in brackets indicates the percentage of the average value of the integral index of the regions of Kazakhstan): Aktobe region (336%), Karaganda region (151%), Almaty region (139%), Atyrau (155%), Kyzylorda region (111%), Akmola region (111%), Pavlodar region (109%), Atyrau (106%)

Table 3 - Analysis of the effectiveness of knowledge transfer in economy

| region | Number of commercialized R & D units | Number of R & D units | The result of the calculation of the transfer of knowledge into the economy index,% |
|---|---|---|---|
| Aktobe | 39 | 12 | 325,00 |
| Karaganda | 131 | 94 | 139.36 |
| Almaty | 14 | eleven | 127.27 |
| Akmola | 64 | 64 | 100.00 |
| Kyzylorda | 16 | 16 | 100.00 |
| Pavlodar | 85 | 87 | 97.70 |
| Atyrau | 16 | 17th | 94,12 |
| East Kazakhstan | 20 | 24 | 83.33 |
| Astana | 75 | 97 | 77.32 |
| Almaty city | 78 | 102 | 76.47 |
| Zhambyl | 24 | 39 | 61.54 |
| North Kazakhstan | 2 | 5 | 40,00 |
| Mangistau | 34 | 111 | 30.63 |
| Kostanay | 5 | 21 | 23.81 |
| South Kazakhstan | 17th | 73 | 23.29 |
| West Kazakhstan | 31 | 184 | 16.85 |
| Note - Compiled by authors | | | |

Indicator of knowledge transfer to the economy in the Aktobe region amounted to 325%. The presence of mineral deposits in this area and their industrial processing, operations research structures of industrial enterprises are the main prerequisite for the formation of industrial innovation center.

West Kazakhstan region ranked last on the list "The effectiveness of the transfer of knowledge into the economy." The main reason for this phenomenon is that mining companies do not produce the required deductions from their income on Kazakh scientific research and experimental development (R & D) because there is no authority in the country, which allows the conclusion that these developments really such. Technopark costs on average four times higher than the income of the 120 projects have received funding for only 5 percent.

Analysis of indicators of knowledge transfer efficiency in the economy leads to the following conclusions:

1. Low rate of commercialization due to the fact that, in general, across the country there is a low demand for the manufacturing sector of the economy to the new domestic developments.

2. In some regions (Aktobe and Karaganda region), there is a trend of commercialization of R & D abroad.

3. In some regions, a low result is due to an insufficient number of patent services and skilled personnel. In West Kazakhstan region is absent center of technology commercialization.

4. Disinterest developers authors research received under government contracts, to ensure the legal protection of their results is one of the reasons for low efficiency index.

5. Patents no centralized monitoring system for subsequent commercialization.

Efficiency Analysis implemented innovative projects examined in Table 4 and Figure 4.

The leaders in terms of " Effectiveness of implemented innovative projects " are the following regions (over 145% of the average value in brackets indicates the percentage of the average value of the integral index of the regions of Kazakhstan): Pavlodar region (1700%); Karagandy (290%); West Kazakhstan (179%); South Kazakhstan (145%).

*Table 4* - **Analysis of the effectiveness of implemented innovative projects**

| region | The volume of innovative products, thous. Tenge | Expenditure on technological innovation, tys.tg | The result of the calculation of an indicator of efficiency of implemented innovative projects |
|---|---|---|---|
| Pavlodar | 97 620.0 | 5 197.3 | 1878.28 |
| Karaganda | 29 769.7 | 6 722.9 | 442.81 |
| West Kazakhstan | 30 891.5 | 9 319.2 | 331.48 |
| South Kazakhstan | 99 332.1 | 33 393.2 | 297.46 |
| Mangistau | 22 588.7 | 11 208.2 | 201.54 |
| Akmola | 19 902.1 | 10 356.4 | 192.17 |
| Almaty city | 12 579.1 | 8 345.4 | 150.73 |
| East Kazakhstan | 4 399.3 | 3 053.3 | 144.08 |
| Zhambyl | 19 181.2 | 18 853.8 | 101.74 |
| Almaty | 13 288.0 | 14 971.9 | 88.75 |
| Kostanay | 3 645.0 | 4 558.2 | 79.97 |
| North Kazakhstan | 6 098.3 | 13 985.0 | 43.61 |
| Kyzylorda | 3 609.0 | 9 138.4 | 39.49 |
| Atyrau | 4 772.2 | 15 838.9 | 30.13 |
| Aktobe | 6 542.4 | 56 039.6 | 11.67 |
| Astana | 4 787.0 | 104 657.6 | 4.57 |
| Note - Compiled by authors | | | |

In 2012, the Pavlodar area named a leader for the production of innovative products. The region accounts for 26 percent of all the innovative technologies produced in Kazakhstan. In Pavlodar region in 2012, the Ministry of Industry and Trade has approved 34 innovative projects. In this area also are investing overseas investment, such as construction project on the border of Pavlodar and Akmola oblasts of wind power capacity of 50 megawatts, became interested in China Development Bank. Within the framework of the memorandum concluded China has undertaken to finance the construction cost of 15 billion tenge.

According to this rating, Astana has lagged behind in all regions. This is due to the fact that most of the costs for innovations in related to social projects. In addition, in Astana n ew technology and scientific advances are being implemented within the framework of large-scale project SMART-Astana. Total realized 8 projects totaling more than 110 million tenge.

We emphasize that all of these projects are very expensive, are aimed at improving the enabling environment for the residents of the city, as well as long-term and not immediately give economic effect.

The analysis of the indicator " to effectively implement innovative projects ," leads to the following conclusions:

1. The high efficiency of innovative projects implemented in some regions due to the fact that the regional authorities incorrectly interprets the concept of innovative products. For example, the project "Production of urea-formaldehyde resin and its products deep processing" is not considered to be innovative.

2. High enough to effectively implement innovative projects in some regions due to the fact that the region attracts foreign technologies. For example, running Cardiosurgical Center in Pavlodar. Technology operations borrowed from the Novosibirsk Institute of Cardiosurgical.
3. Existing R & D funding for the program in general, cover virtually the entire flow of new projects, but the product can be considered innovative only for the country.
4. In some regions of innovative projects are very costly and generate little revenue (Astana, Aktobe region, Atyrau region and Kyzylorda region).
5. In general, in Kazakhstan, compared to previous years, the number of innovative projects has increased significantly due to the fact that the beginning of the program of the Industrialization Map.

Using the information system "InnoMap.Kz" allows you to update the data for the analysis of the effectiveness of innovative activity of regions of Kazakhstan in the online mode.

According to the results of the integral index we can say that the leaders in terms of innovation development at the end of 2012 are Pavlodar, Karaganda and West Kazakhstan region. The aggregate rating of all three indicators presented in Table 5.

Table 5 - Cumulative rating of all three indicators

| Region | The smoothed data in terms of "Effectiveness of research activities' | The smoothed data in terms of "Effective-ness of knowledge transfer to the economy" | The smoothed data in terms of "Effectiveness of implemented innovative projects" | Aggregate Index-tion of innovative development of the region |
|---|---|---|---|---|
| Pavlodar | 0.83 | 0.26 | 1.00 | 2.10 |
| Aktobe | 0.27 | 1.00 | 0.00 | 1.27 |
| West Kazakhstan | 1.00 | 0.00 | 0.17 | 1.17 |
| Karaganda | 0.21 | 0.40 | 0.23 | 0.84 |
| Mangistau | 0.52 | 0.04 | 0.11 | 0.67 |
| Kyzylorda | 0.32 | 0.27 | 0.02 | 0.61 |
| Almaty | 0.17 | 0.36 | 0.04 | 0.58 |
| Akmola | 0.20 | 0.27 | 0.10 | 0.57 |
| Zhambyl | 0.30 | 0.15 | 0.05 | 0.50 |
| Astana | 0.28 | 0.20 | 0.00 | 0.48 |
| South Kazakhstan | 0.20 | 0.02 | 0.16 | 0.38 |
| Almaty city | 0.09 | 0.19 | 0.08 | 0.36 |
| Atyrau | 0.05 | 0.25 | 0.01 | 0.32 |
| East Kazakhstan | 0.00 | 0.22 | 0.07 | 0.29 |
| Kostanay | 0.22 | 0.02 | 0.04 | 0.28 |
| North Kazakhstan | 0.03 | 0.08 | 0.02 | 0.13 |

As a result, the efficiency of e-card Innovative Development of Kazakhstan as follows:

* - *The effectiveness of research activities*
* - *The effectiveness of knowledge transfer to the economy*
* - *The effectiveness of implemented innovative projects*

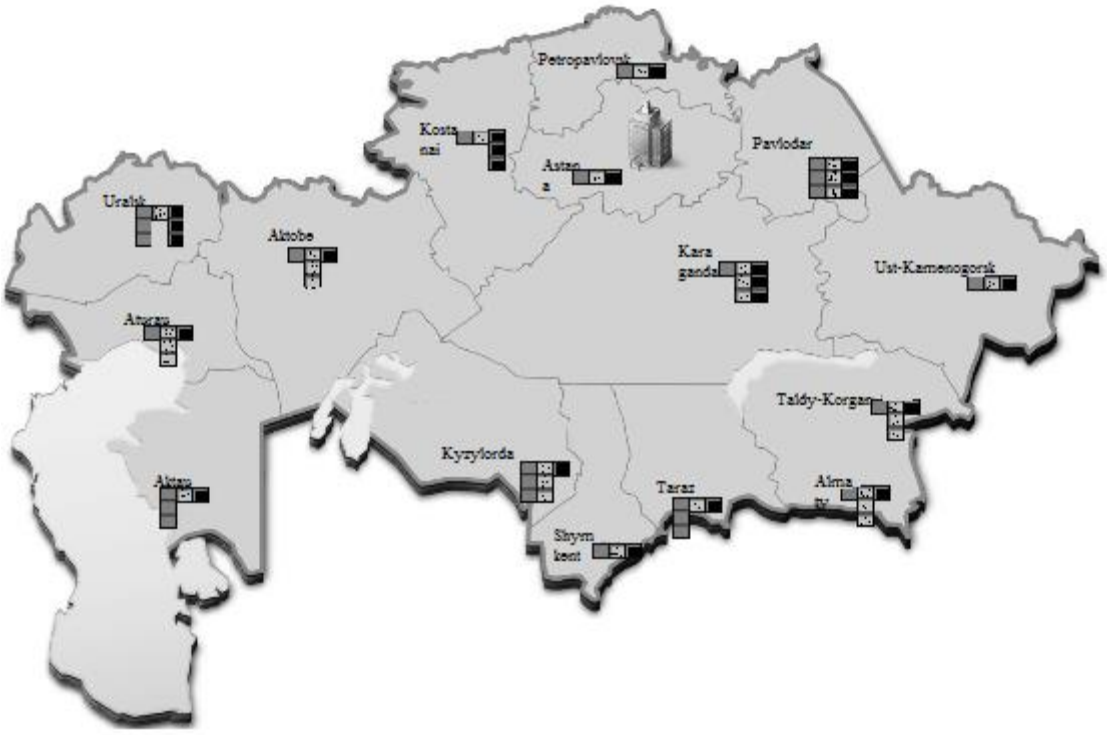


Figure 1 - Map of Innovative Development of Kazakhstan for 2012.

To find the average value of the indicator, we used the median. Thus, the average value of the integral index was 2,305. All regions that received a value less than this value are considered outsiders, and above this value - the leaders.

Regions Leaders: Pavlodar region, Aktobe region, West Kazakhstan, Karaganda region, Mangistau region, Kyzylorda oblast.

Regions Outsider: Almaty region, Akmola oblast, Zhambyl oblast, Astana, South Kazakhstan, Almaty, Atyrau, East Kazakhstan region, Kostanay, North Kazakhstan region.

Regions leaders and outsiders areas identified as a result of our analysis, does not coincide with the official adoption of statistical indicators, because we are talking about the impact of ongoing labor and financial costs. We see real value of research activities of employees, the commercialization of patents and financial resources.

conclusion

In general, a generalized analysis of the results of innovative activity of the Republic of Kazakhstan, allows you to make the following conclusions:

1. Indicator of the effectiveness of R & D in the country lags behind the global importance;
2. Is mainly foreign commercialization of innovations, there is practically no transfer of domestic R & D from the scope of research and development in the market environment. In general, the transfer of knowledge in the economy is non-systemic;
3. Funded and implemented projects many foreign developers , who are new only in the national economy of the Republic of Kazakhstan .

Thus, in the Republic of Kazakhstan innovation is focal and patchy, there is no coherent national innovation system capable of continuous transmission of new knowledge in the real economy. Therefore, innovation is not yet become a driving force for diversification and modernization of the national economy.

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