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ARTIFICIAL INTELLIGENCE IN THE INDIAN JUDICIARY: A ASSESSMENT OF REGIONAL INNOVATION ACTIVITY

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A B S T R A C T

The purpose of the article is to assess innovation activity taking into account the role of innovation in the economic development of the region. As the object of the study, the authors took 10 economic regions, grouped according to their economic characteristics on the territory of Azerbaijan.
This paper reviewed international experience in assessing innovation activities taking into account regional characteristics. In the article, as a result of the analysis of the factors determining innovative activity, factors suitable for Azerbaijan were selected. The region's innovative activity was assessed taking into account international criteria for calculating the innovation index.
As a result, it can be used when calculating the innovation index of the Republic of Azerbaijan, when assessing regional economic development based on the innovation factor.

1. INTRODUCTION

The importance of moving the economy to the path of innovation development, maintaining and increasing the scientific and technical potential of the regions is based on the urgency of creating the regional innovation infrastructure in the sustainable development processes of the country's economy (Wang et al. 2023).
Significant differences in the levels of socio-economic development, resources, personnel, production and other potentials of the regions, the activity of innovative activity and the effectiveness of innovative processes necessitate a comprehensive study of the issues of managing the innovative development of the territories (Saleh et al. 2020).
Today, the improvement of the scientific-technical and innovation policy in the regions is one of the important elements in the formation of Regional Innovation Systems (RIS) (Stryabkova & Ladygina 2021).

The initial state of the region and the main trends of its development should be taken into account when evaluating the results of the regional innovation system (Yao, Li, & Li 2020). The main difficulty here is to assess its situation with any indicator in the conditions of the conflicting effects of external factors and the processes taking place in the region. World experience shows that it is necessary to use a complex assessment set in a specific regional situation. The process of creation of the regional innovation system is not a one-time act, it consists of several long-term independent stages. In this regard, taking into account the establishment of the state national innovation system, its legal base should be adapted to the situation, monitoring should be carried out, and the state's impact on the development of the region should be evaluated and analyzed (Liu & Zhou 2021).
Significant differences (differentiation) in terms of indicators such as territorial size and potential of the regions, field structure of the economy, efficiency of

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production processes, financial provision, formation of market infrastructure, population and standard of living complicate the issues of increasing their competitiveness and ensuring sustainable economic development.

The development of innovative processes at the regional level requires detailed research. Therefore, it is important to create conditions for the sustainable development of regional economic systems, especially to evaluate their innovation activity (Fernandes et al. 2021).

The article aims to correctly guide the innovative development of the regions by evaluating the level of innovation activity of the regions.

It was concluded that the innovative development carried out through the activation of innovation activities in the region is at the same time a tool for solving socio-economic development issues and is an integral part of this development.

2. ASPECTS OF REGIONAL INNOVATION SYSTEM FORMATION

The integration and globalization of world economic processes oriented towards modern competitive knowledge, science, technology and production conditions the involvement of regions in the processes and their impact on the global economy. The transition of the economy to the path of innovation development, the importance of maintaining and increasing the scientific and technical potential of the regions, and the strengthening of market relations in the country is based on the urgency of creating the regional innovation infrastructure.

The concept of a regional innovation system is quite new and was first used by Cook (2007).

It should be noted that there is a concept of a national innovation system with fairly clear terminology adopted in the documents regulating the innovation activities of the European Union.

However, in contrast to this, it is confirmed by most researchers that there are no theoretical and practically accurate concepts that explain issues such as the management of regional innovation systems (RIS), the importance of the regional level in increasing innovation activity, etc.

An important goal of the regional socio-economic policy is the creation of conditions for innovation activity as a basis for the establishment of strategic competitive advantages, as well as for the development of training systems. The main definitions of regional innovation systems are given in Table 1.

Table 1. Definitions of the regional innovation system (Chung 2002).

Definition	Authors
A collective network based on regional regulation characterized by reliable, trustworthy, information sharing and cooperative interaction	P. Cook, M. Gomes Uranga, G. Etxebarria (1997)
Knowledge creation and use consists of subsystems that interact with each other, as well as with other regional, national and international knowledge creation systems.	Gardeazabal, et al, (2023).
In the process of creating and using knowledge, a cooperative is a network of public and private enterprises, institutions and other organizations that interact based on formal and informal agreements.	Purbasari, Muhyi & Sukoco (2020).
It is the institutional infrastructure that supports innovation in the production process of the region	Sandulli et al. 2022
It is a wide network of organizations and institutions that support training and innovation processes in the region	Lund, & Karlsen (2020).

In general, the regional innovation system is understood as a system of relations between state, public and private organizations in the field of creation, use and transfer of new knowledge and technologies.

The theoretical-methodological basis of ideas about the regional innovation system is the study of the national innovation system, a number of provisions that can be used at the regional level. At the same time, unlike the national innovation system, the regional innovation system is mainly focused on the goals that are important for a certain region.

The goals and tasks of the regional policy, taking into account the establishment of RIS, are management activities for the realization of regional interests, and they can be grouped: strategic (on the main directions of socio-economic development), long-term (on various areas and objects of the region), medium term (field and functional type), tactical (a specific issue on the development of various services and objects of the regional economy).

The initial situation of the region and the main trends of its development should be taken into account in the evaluation of the results of the RIS activity. The main difficulty here is to assess its situation with any indicator in the conditions of the conflicting effects of external factors and the processes taking place in the region. World experience shows that it is necessary to use a complex assessment set in a specific regional situation.

The process of RIS formation is not a one-time act, it consists of a number of long-term free stages. In this regard, the state, taking into account the establishment of the Central Innovation System, should adapt its legal framework to the situation, conduct monitoring, evaluate and analyze the state's impact on the development of the region.

3. FACTORS AFFECTING THE INNOVATION DEVELOPMENT OF THE REGION

The condition for the transition to innovation development of the region is such an objective situation that the transition of the economy is impossible without it. At the same time, in order to ensure the innovative development of the region, appropriate measures should be taken by the relevant government organizations on the socio-economic system of the region.

However, during the development and implementation of these measures, it is necessary to take into account that the regional system is affected by various negative and positive factors. These factors should be considered.

It is possible to reduce the impact of negative factors on the balance of the regional economy and strengthen the activity of positive factors. This will speed up the process of formation of innovation development of the economy in the region.

Those that have a special place among the transition factors to the innovation development of the region are given in Table 2.

Table 2. Innovation development factors of the region (Szopik-Depczyńska et al. 2020)

	Factors	The role of factors
1	Political-legal	Based on the development of the legal framework of the innovation development strategy of the region, there should be state regulation of the socio-economic processes of regional development.
2	Education	In the economic system, education is the main generator of the productive power of society.
3	Ecological	The presence and maintenance of the region's natural resources, the size of its territory and the characteristics of its geographical situation characterize the initial conditions for ensuring the region's ecological and economic interaction.
4	Innovation-technological	Only the development of high-tech products in the region and the effective implementation of the regional innovation system as a mechanism for the implementation of the innovation economy, the application of efficient resource-saving technologies ensure the improvement of production.
5	Structure	Changing the sectoral structure of the region's economy.
6	Financial and economic	It ensures the implementation of an efficient system of regulation of financial and economic instruments of the innovation process in the region.
7	Statistics	It is to ensure the registration of regional development indicators of the economy in the direction of innovation. This allows to give a certain direction and stability to the economy of the region.
8	Information	The role of regional information agencies is important. Thus, increasing the level of information awareness of consumers is an important point in ensuring economic growth.
9	Social	Increasing the role of social groups of the population during the transition of the economy to innovation development (mainly growing and economically active population, private sector)
10	Remanufacturing	Optimizing the process of reproduction and renewal of basic funds in the region in order to ensure the innovativeness of regional development
11	Risk factor	It is necessary to implement an effective regional policy on man-made, innovative, commercial and other risk management. Risk management is an important part of the region's sustainable development strategy. Thus, both modern development and most of the innovations have a regional character.
12	Globalization factor	Globalization, on the one hand, is a factor of unstable regional development, and on the other hand, it can act as a means of overcoming it (through the exchange of scientific and technical progress achievements between countries (regions) that stimulate the development of the economy)
13	Organizational-institutional	Creation of relevant institutions for the implementation of sustainable and innovative development strategy in the region. These institutions are designed to ensure the activation of all factors that help ensure development, as well as create conditions for production and economic activity in the territory of the region.

4. PRE-ENGINEERED BUILDING (PEB)

Theoretically, there are two approaches to the development of innovation processes in economic systems. It is possible to buy licenses and know-how of well-known technologies, product types and trademarks of large foreign companies. When producing these products, the system follows a consumption strategy. The development of the system depends entirely on the emergence of new technologies and patents in the market. As a result of the application of that approach, the acquisition of innovative products requires large costs and the payback period of funds is long.

Another way to develop innovation processes in economic systems is to rely on one's own scientific and technical potential, which is in great demand by local industry today, and the development of local innovation processes. This approach is considered more promising,

but it is accompanied by many financial and organizational barriers.

We can consider the innovation process from the point of view of the chain model. In this case, it can be said with certainty that the active stimulation of the development of innovation processes in the region leads to the change of all components of the economic system, accompanied by the subsequent change of the environment interacting with it.

As a result, the development strategy, goals and priorities of the economic system change, the priorities of markets, distribution of economic processes, and dependencies between production and consumption phases are transformed, and the production process is distributed.

An increase in the income of the economic system, an increase in the competitiveness and financial stability of the economy, complex economic security, social welfare, an increase in the standard of living of the population, etc. are the results of the effective implementation of innovation processes.

Management, regulation, and stimulation play an important role in the development of economic systems. Management, regulation and stimulation of innovation processes at the regional level - occur through the development and implementation of innovation policy capable of solving state issues aimed at increasing the competitiveness and stability of the economy.

The main goal of RIS is to create conditions for the continuous emergence and successful development of new innovative projects aimed at realizing the competitive advantages of the region.

Table 3. Features of research on regional innovation systems (Tartaruga, Sperotto & Carvalho 2024)

Researches	The object of the research	The purpose of the research	Main results
Regional innovation systems: shaping the future (REGIS)	11 European regions (Baden-Württemberg, Wallonia, Brabant, Tampere, Lower Silesia, Basque Country, Friuli, Styria, Wales)	To study the theoretical bases and directions of measuring the efficiency of RIS activity	The innovative potential of the regions is described in detail, and strong and weak regions are highlighted
European Innovation Survey of Regions (ERIS)	11 European regions (Vienna, Stockholm, Barcelona, Alsace, Baden, Lower Saxony, Girona, South Holland, Saxony, Slovenia, South Wales)	To determine the qualitative and quantitative characteristics of the innovation potential of the region, to create interaction between the participants of the innovation processes	Innovation activity is the result of mutual network activity. Innovation policy should be aimed at increasing the effectiveness of such interaction.
Regional measurement of innovation and policy for small and medium-sized enterprises (SMEPOL)	11 European regions (Upper Austria, Wallonia, Jutland, Lombardy and Apulia, North and South-West Norway, Valencia, London Boroughs and Harfordshire)	Conducting a comparative study of regional innovation policy instruments for small and medium-sized enterprises in Europe	Innovation policy should be aimed at increasing the efficiency of interaction between small and medium-sized enterprises, collective training
Scandinavian SMEs and regional innovation systems	13 regions in Scandinavia and Northern Europe (Oslo, Stockholm. Helsinki, Gothenburg, Malmö, Aalborg, Linkoping, Yuvyaskyla, etc.)	An examination of similarities and differences between regional clusters of small and medium enterprises in Northern Europe and Scandinavia	It has been found that knowledge transfer systems through informal relationships are particularly successful.
Regional cluster innovation in Canada	9 regional clusters	To study the phenomenon of concentration of companies in different fields in regions	Two types of cluster formation are identified: in regions with strong innovative potential and in regions that require the acquisition and distribution of new knowledge (often through transfer from other regions).
A study of regional innovation clusters	10 European regional clusters	The feasibility of the cluster approach in innovation policy is a problem	Regional clusters in each country (region) have their own characteristics. They can spread the results of innovation activities outside countries and regions. This is important for the formation of innovation policy.

In recent years, foreign scholars have conducted comparative studies aimed at studying and highlighting the specific characteristics of regional innovation systems. The characteristics of the most popular studies are given in Table 3.

In the process of activation of innovation activity, the participation and close cooperation of state administration bodies, commercial structures, financial and credit institutions, as well as public organizations at the regional level is necessary.

5. METHODOLOGICAL ASPECTS OF EVALUATION OF INNOVATION DEVELOPMENT OF REGIONS

Currently, there is growing interest in the socio-economic development of regions based on innovation activity. In the conditions of the technological reconstruction of the world economy, innovation development and technological modernization of the economy are of particular relevance. In this case, the innovative development path requires multifaceted development of regions and the formation of new zones of advanced

development. Increasing the innovation potential of the region is one of the important issues for European countries. They adopt a suitable action plan in this area (Hervas-Oliver et al. 2021).
Today, there are many approaches to the assessment of the innovation development of the region: the assessment is differentiated by subjects and objects, according to the institutional environment, goals and tasks, indicators, the information base of the assessment, etc.
Therefore, it is necessary to review and analyze local and foreign methodological approaches to the assessment of regional innovation development.

First of all, let's explain the concept of innovation development in the region.
The innovation development of the region is a system of factors and conditions influencing the innovation processes, being a set of interconnected processes of creating and applying a complex balanced development-oriented innovation that takes into account the needs of all interested parties of the region (government organizations, population, etc.) (Cherednichenko. Dorofeev & Dovgot'ko 2022).

Table 4. Approaches to the assessment of innovation development in the region

Approach	URL
The Global İnnovation İndex	https://www. globalinnovationindex.org
Global İnnovation Barometer	https://www. ge.com/stories/innovation-barometer
European İnnovation Scoreboard	http://ec.europa.eu/DocsRoom/documents/25101
Regional İnnovation Scoreboard	http://ec.europa.eu/docsroom/ documents/23881
İnnobarameter	https://ec.europa.eu/growth/industry/innovation/facts-figures/ innobarometer_en
Community İnnovation Survey	http://ec.europa.eu/eurostat/web/microdata/community-innovation-survey
İnnovation Cities İndex	https://www.innovation- cities.com/indexes
Eco-İnnovation Scoreboard	https://ec.europa.eu/environment/ecoap/indicators/index_en

Let's explain each of the approaches to the assessment of innovation development of the region given in Table 4.
Below are the methodologies for evaluating the innovation development of the region:

The Global Innovation Index. The global innovation index (GII) consists of two sub-indices: input and output. The input sub-index reflects the conditions and factors necessary for the creation of innovation and consists of 54 indicators characterizing the country's innovation potential (institutions, human capital, research, infrastructure, sustainable market and business). The output sub-index summarizes the results of innovation activity and consists of 28 indicators characterizing the efficiency of using potential based on creativity, scientific and creative results. GII is equal to the average value of the "Input" and "Output" sub-indices. For this, 57 quantitative indicators reflecting official statistical data, 20 composite indicators of authorized institutes and organizations, and survey data are used. The method of determining the index consists of the result obtained from the use of the potential and the study of the innovation potential of the region. The degree of subjectivity of the GII is higher since survey data and indexes of various organizations are used for certain indicators.

Global Innovation Barometer. The methodology is directed to the analysis of innovation views of the business community, production application of innovation, state support. During the research, the attitude of business leaders around the world to innovation and the impact of this attitude on the company's business strategy are determined. The survey is conducted in 25 countries based on a telephone survey. During the survey, contact is made with executives of 3,100 companies with approximately 1,200 employees. During the survey, indicators such as: protection of intellectual property, state regulation, taxation, quality of infrastructure, state purchases of advanced technologies, transition to technologies, number of patents per 1000 jobs, etc. are evaluated.

European Innovation Scoreboard. The methodology is aimed at the comparative evaluation of the research results and innovations of the European Union countries, and the identification of the strengths and weaknesses of their research and innovation systems. In this methodology, the scoring method is used. The assessment is based on 27 indicators, including the number of people with PhD degrees; the Number of population with higher education aged 25-34; number of more cited publications; expenditure on research and development (R&D) in the state and business sphere; number of patent applications; innovation costs etc. Results are calculated for each indicator. This methodology has been applied since 2001.

Regional Innovation Scoreboard. This is a slightly modified version of the European Innovation Scoreboard. Most of the indicators used in this methodology are similar. Exceptions are only indicators related to regional statistics. The reviewed methodology is aimed at studying the innovation development of regions. The evaluation is carried out in 220 regions of 22 countries of the European Union.

Innobarameter. This methodology is similar to the Global Innovation Barometer methodology. Thus, this methodology is aimed at the application of the business community to innovation and production, the application of existing state support and barriers. The research also covers other areas: the type of companies that innovate;

the specific weight of innovation in the turnover of the company and the part of the turnover invested in innovation activity; and barriers to commercialization of innovative products and services. In this methodology, types of state support for the commercialization of products or services; the role of the use of advanced technologies in production; participation in public purchases and the role of innovation in this process is also evaluated. A telephone survey of company managers is used (14,000 companies in 28 countries of the European Union).

Community Innovation Survey. The research is carried out by means of a questionnaire survey with enterprise managers in the European Union countries over a period of 2 years. Participation in the survey is voluntary. The result is given for each country and region. The survey includes innovation products, their level of release, application to production, production area, financing of innovation products, involvement of state funding, income from product implementation, etc. For example, in 2014, the survey was conducted in enterprises with approximately 75 employees and covered Germany (6098 enterprises), Spain (2314 enterprises), Austria (2082 enterprises), and Italy (1991 enterprises). This methodology is directed to the application of the innovation product to the production and the income obtained from the market access of the innovation product.

İnnovation Cities İndex. The methodology involves the analysis of the creation of the innovation, its application to the city, and the cost and income arising from its use. Starting from 2007, research on quantitative and qualitative indicators of innovation in cities has been conducted. This methodology uses 162 standard indicators divided into 3 groups (cultural assets, human infrastructure and network markets), 31 segments (law, food, environment, trade, economics, etc.). Cities are grouped into 4 categories according to their innovative development and competitiveness: nexus, concentrated city, sister city, and emerging city. In 2016-2017, a study was conducted on the innovation development of 500 large cities, as a result of which Baku was ranked 426th, London 1st, and Moscow 43rd. As of 2018, Tokyo is in first place, London is in second place, Moscow is in the 48th place, and Baku is in the 410th place. Baku advanced 16 places.

Eco-İnnovation Scoreboard. The methodology covers innovations in the field of ecology and is a tool for evaluating the efficiency of eco-innovation in the European Union countries. Indicators covering economic, ecological and social fields united in 5 thematic groups are evaluated. It belongs to 5 thematic groups:

- contribution to eco-innovation (total cost of green investments at the first stage);
- eco-innovation activity (enterprises applying innovation for environmental benefits);
- eco-innovation results (eco-innovation patent);
- results of efficient use of resources (water use);
- socio-economic results (export of products from eco-areas, export, etc.).

In this methodology, point evaluation is used during the analysis. Countries are divided into 3 groups: eco-innovation leaders, countries with an average level of innovation and countries striving for eco-innovation. In 2017, Sweden (144) was the leader among 28 countries in the assessment of this methodology, followed by Finland (141), and then Germany (139). Bulgaria finishes the overall list with 38 points.

Human capital and innovativeness. Evaluation and classification of European Union regions by human capital and level of innovation is carried out. 18 indicators are used. This includes the number of students in higher education institutions; the share of labour resources in the field of science and technology; employment in skilled services; R&D overhead etc. The evaluation methodology is focused on the costs of education, employment in the field of science and scientific research. This methodology is designed to assess the social composition of innovation development in the region.

Approaches to the assessment of innovation development in the Republic of Azerbaijan are shown below.

To evaluate the sustainable development of innovation and to evaluate the level of development of innovation subjects in the region (Omri 2020). In the methodology, the barriers to innovation in our country and its regions are divided into external and internal parts. External barriers include underdeveloped infrastructure, lack of existing field knowledge, outdated legislation, and general neglect of talent in society. Internal barriers include strict organizational requirements and procedures, conservatism, lack of outlook, interest in maintaining the old order, refusal to accept other people's ideas, lack of desire and motivation to take risks.

Different indicators and system indicators are used in individual countries to assess the sustainable development of innovation. They evaluated their generalized classification with 15 indicators by giving conventional quantitative names in 7 directions.

In addition to the mentioned indicators, it is recommended to use 4 groups of 10 indicators to evaluate the development level of innovation subjects in the region.

Regional innovation index. The "European Scale of Innovation" methodology, which we take as a basis, determines the information source, the composition of criteria and indicators, organizational ways, and general rules for the analysis and evaluation of the scientific and technical complex based on the innovation index.

This methodology took into account the national and specific characteristics of Azerbaijan, statistical indicators in this field, information that can be collected and processed, and innovation potential of regions and fields. On this basis, the system of indicators has been refined, changed and calculated for Azerbaijan.

Based on the applied methodology, the general structure of the indicators of the evaluation and comparative

analysis of the changed scientific-technological and innovation activity in Azerbaijan is given in the figure.

5.1. General methodology of evaluation of innovation development of regions

As we mentioned earlier, there are different approaches to the RIS structure. Approaches are conventionally grouped in two main directions:

- RIS is viewed as a system consisting of interrelated and interacting elements.
- RIS is viewed as a process of interrelated stages of innovation activity.

In fact, since RIS has a very complex structure, RIS should be studied from both directions.

Thus, the innovation system of the region is a consistent process that implements various stages of innovation activity by economic entities that are elements of this system and interact with each other (Fig. 1).

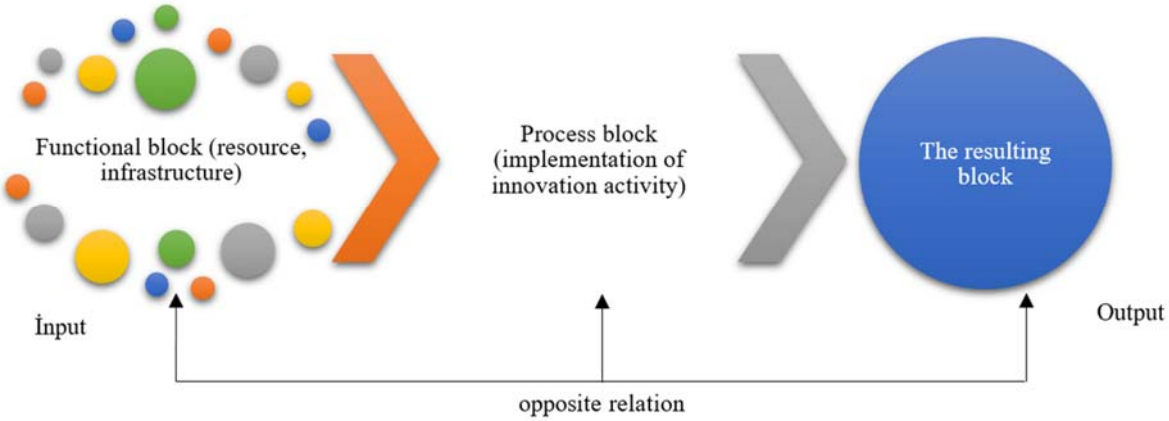

Figure 1. Regional innovation system block

According to this approach, the RIS conceptual model is based on the stages of the innovation process located in different blocks. In this way, the mechanism of interaction of the structural elements of the innovation system was given. Here, the functional block reflects the potential viewed as "RIS generation possibilities" and "System input".

Another "Process block" reflects the stage of direct implementation of innovation activity. The leading element here is scientific research associations and the business sector. These elements ensure the creation, verification, and commercialization of innovations in close cooperation.

The active participation of the state, which forms the basis of cooperation, the quality of the formed institutional environment, and the innovation environment of development affect the speed and effectiveness of the innovation process.

The "resultant block" reflects the effects of RIS. In other words, it reflects the improvement of the standard of living of the population due to sustainable economic growth on the basis of increasing the sectoral competitiveness of the region. The effects received in RIS are used as a reserve (basis) of directions for strengthening the potential of the system and a new stage of its development.

Taking the RIS model given in Figure 1 as the basis for the development of the approach to the assessment of the RIS development level, let's use the more widespread foreign and local approach as the methodological basis of the RIS assessment.

What prevents the application of existing methodologies in Azerbaijan is the lack of primary indicators reflecting the state of RIS in local statistics. Local calculations are also based on indicators available in official statistics.

In the structure of the innovation index, which determines the development level of RIS, the sub-indices of the innovation potential of RIS and its efficiency should be calculated separately. Because the effectiveness of RIS is the main factor of its efficiency. Therefore, the indicators characterizing the effectiveness should be calculated separately and should have a large weight in the structure of the index.

In evaluating the innovation development of the region's economic system, the following main directions should be taken into account:

- The composition of the first indicators reflecting the state of RIS should be redefined;
- Grouping indicators in the sub-index under the condition that the potential and efficiency indicators of RIS are transferred to different groups;
- Determining the weight of the sub-index in terms of the importance of the resulting indicators.

The structure of the innovation development index of the region should consist of 4 sub-indices reflecting the state of RIS (Figure 2).

The "Innovation opportunities" subindex reflects the initial formation opportunities and conditions of the innovation system. It refers to the indicators characterizing the potential of RIS: human potential, scientific, production-technological situation, and degree of informatization of the economic subject.

Indicators characterizing the activity of innovation processes in the region, the quality characteristics of innovative economic entities, and the publishing activity of researchers are included in the "Innovation Activity" subindex. Here, the quality of research, the interaction of scientific associations and the business sector of the economy, the number of applications for patents and inventions, etc. should be taken into account.

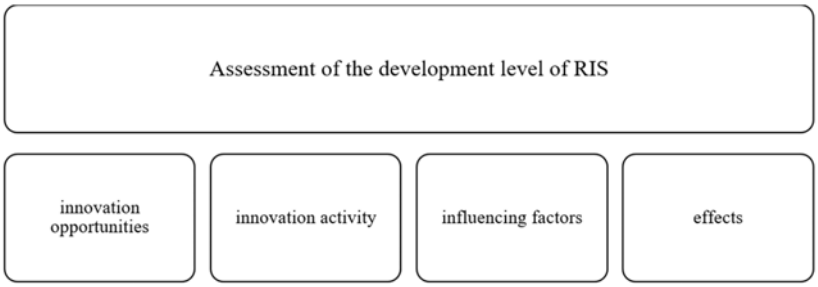

Figure 2. Assessment of RIS development level

The "Effect" sub-index reflects the efficiency of the innovation system in the region and the effectiveness of innovation activities in creating innovative products, services and technologies.

RIS refers to the list of indicators reflecting the effectiveness: the amount of money obtained from the export of innovation work, and indicators reflecting the quality of life of the population.

The assessment of the innovation development of regional economic systems allows to determination of the efficiency of the formed RIS, and the analysis of the dynamics of the data allows the development of organizational and management decisions on increasing their efficiency.

It is a pity that the evaluation of RIS with this methodology is facing some difficulties in Azerbaijan. Because there are no statistics of indicators included in each of the 4 presented sub-indices in Azerbaijan.

Now let's consider the general characteristics of approaches to the assessment of innovation development of regions.

Most of the methodologies that evaluate the innovation development of regions are conducted based on the request of the management of the enterprise. It helps to know the attitude of business associations towards innovation and its application. Often this situation is regulated by the use of statistical data of the Council of Europe. In general, the considered methodologies are adapted to the creation of an institutional environment in developed countries with regional nature, and economic and social characteristics of the country.

The general characteristics of methodical approaches for evaluating the innovation development of regions are given in Table 5.

Table 5. General characteristics of methodical approaches for evaluating innovation development of regions

Features	***Explanation***
Purpose	Research in the field of innovation development of the region
Position	Evaluating the region's innovation development, creating a ranking of regions for comparison, determining their weak and strong aspects of the region's innovation development
Viewed object	A region bounded by certain administrative boundaries (city, cluster, region, regional group country)
Evaluation factors	Factors affecting the innovation development of the region (industrial, economic, complex, social, ecological-economic)
Primary data used	Statistical data, enterprise and international organization data, sociological survey data
Applied methods	Quantitative and qualitative methods of assessment
Indicators	The number varies depending on the methodology, indicators are grouped in certain blocks
Weighting factors applied	In special cases

Most of the methodical approaches for evaluating the innovation development of regions are based on a complex approach that takes into account economic, social, and institutional indicators and reflects a certain picture of innovation development. Even most of the approaches are based on the economic approach. This is explained by the costs incurred by society for the development of innovation and the income received from its application to the economy and life activities of the population. Other researchers are focused on the use of performance data of large enterprises. They do not take into account small business activity and data of regional characteristics.

In addition, the reviewed methodologies are not used in the evaluation of regions with specific characteristics. Foreign scientists propose to take into account the natural and democratic factors affecting the economy in the evaluation of the innovation development of the region.

Others suggest taking into account cultural traditions, traditional economic activities and the external environment affecting them in regions inhabited by small peoples.

5.2. Evaluation of innovation activity of regions

Today, the formation of the innovation structure in the regions in Azerbaijan is still at the initial stage. The evaluation of the regional innovation system (RIS) is still in the formative stage. Various scientists (A. Huseynova, and T. Aliyev) investigated and evaluated the methods of regional innovation activity assessment in the republic in their works.

The existence of many approaches to the assessment of RIS is due to the complexity of its structure. A special system of indicators should be developed in order to reveal the internal structure of the region's innovation-oriented economic system and evaluate the interaction mechanisms of its main elements.

The main goal is to identify a more effective regional innovation system by conducting an evaluation.

The "European Scale of Innovation" methodology, which we take as a basis, determines the information source, the composition of criteria and indicators, organizational ways, and general rules for the analysis and evaluation of the scientific and technical complex based on the innovation index.

In the evaluation and analysis of the regional innovation index in Azerbaijan, the evaluation methodology of A.D. Huseynova was taken as the basis (Huseynova & Mazanova 2023).

This methodology has been refined taking into account the national and specific characteristics of Azerbaijan, statistical indicators in this field, information that can be collected and processed, and the innovation potential of regions and fields, the system of indicators has been changed and calculated for Azerbaijan. The general structure of the indicators of evaluation and comparative analysis of the modified innovation activity in Azerbaijan according to the applied methodology is given in Figure 2.5.

The "European Scale of Innovation" methodology, which we take as a basis, determines the information source, the composition of criteria and indicators, organizational ways, and general rules for the analysis and assessment of innovation potential based on the innovation index. This methodology consists of 4 stages (Fig. 4).

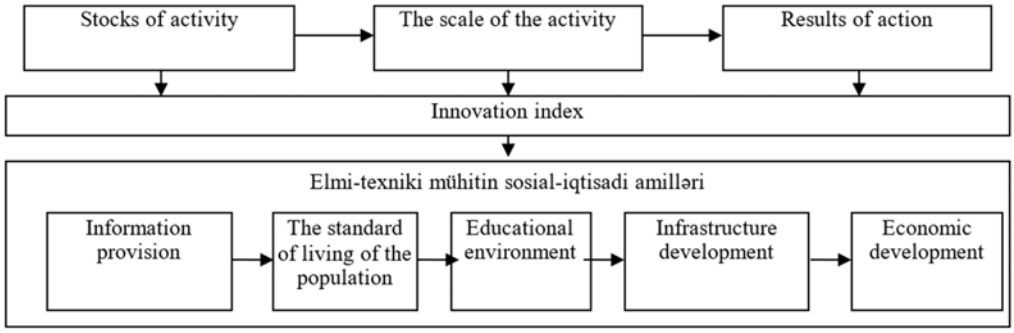

Figure 3. Indicator system of innovation activity

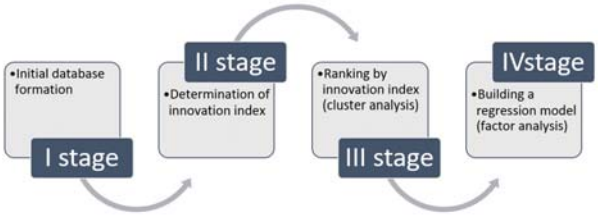

Figure 4. Stages of the methodology

Let's explain each stage separately.

In the first stage, the selection and collection of indicators necessary to calculate the innovation index are carried out. As we mentioned before, the indicators are grouped according to their characteristics.

In the second stage, indexes are calculated and summed up according to each group of indicators.

In the third stage, regions are ranked based on the value of the innovation index, and similar regions are selected according to the level of scientific and technical development based on cluster analysis.

The fourth stage is the construction of a regression model that determines the influence of socioeconomic environment factors on the formation of the innovation index.

In our case, regions are taken as objects. In fact, we can take states, ministries, organizations, research institutes, universities, etc. as objects. It depends on the issue at hand.

As mentioned, the system of indicators characterizes the innovation potential and socio-economic environment of the region. All indicators correspond to the statistical system. During the development of the methodology, the development of innovation, indicators of the socio-economic environment, their interrelationship and complex compatibility, evaluation and analysis methods with the application of the proposed system of indicators and indicators were taken into account.

The tool of this methodology is the multivariate statistical method. We used the SPSS 17 statistical package and MS Excel spreadsheet as economic modelling tools. First of

all, the used indicators are made comparable, in other words, a single scale of indicators is created.

Normalization of indicators is carried out by the linear scaling method:

$$Gnor=(Gi-Gmin)/(Gmax-Gmin) \quad (1)$$

Where: Gnor – the normalized value of the indicator; Gi – initial price, Gmin və Gmax – is the smallest and largest value, respectively.

The linear transformation procedure scales the data. All quantities are in the interval [0; 1]. Such data is easy to interpret. The normalization procedure does not affect the results of the analysis, since our goal is a qualitative assessment based on the examination of numerical indicators.

The normalized values of the indicators are combined in the first-level indicators corresponding to their functional structure. For example: first, the average value of the normalized indicators for subgroups is determined, and then a special index for the group is determined. In other words, the special index of the group ("Reserves") is calculated according to the average value of the normalized indicators of the "Labor resources" and "Materials and technical base" subgroups of the "Reserves" group.

Group averages (G^-_j, j=1,2,3 shows groups) are calculated using the following formula:

$$G^-_j=(\sum_{i=1}^{n} G_i)/n \quad (2)$$

Where: Gi - is the i-th indicator included in the group, n- is the number of indicators. It forms the basis of the resulting ranking and cluster analysis. Special indexes obtained by groups allow to determine the innovation index. The innovation index (I) is calculated as a numerical average:

$$I=(G^-_1+G^-_2+G^-_3)/3 \quad (3)$$

Where: G^-_j- j=1,2,3 is the average price for groups.

The analysis of the division of objects according to the system of indicators selected on the basis of the reports on the standardization of indicators is carried out.

Based on the ranked set of economic zones, they are grouped into clusters.

The cluster method is a multivariate statistical procedure. This method arranges the objects in groups according to relatively similar characteristics based on the available information.

The cluster analysis method consists of several steps:

1. Algorithm selection.
2. The choice of the cluster method, which determines the strategy of the process of merging objects into clusters (merging signs).
3. Selection of the method of calculating the inter-cluster distance, which determines the different aspects of objects united in clusters.
4. Determining the number of clusters.

In our case, since the number of objects is small, the hierarchy algorithm Ward method is chosen. The method of analysis allows to analyze the factors. Here, too, indicators are initially normalized. Then they are checked.

Socio-economic factors can have both positive and negative effects on the environment. Therefore, they should be divided into two groups accordingly. The initial data prepared in this way can be used in the construction of the regression model. After that, it is necessary to build a correlation model to determine the influence of the factor indicators on the final symptoms.

In the modelling process, the indicators that are important for the final signs are determined. The structure given for economic zones is divided into stages corresponding to the functional structure of the factor indicator. In the first stage, the influence of the education level on the innovation index; the level of provision of information infrastructure elements of the region; the standard of living; the parameters of the regression equation reflecting the level of economic development etc. are calculated. The next stage of modelling is the calculation of the coefficient of variance and determinant for each factor characteristic. Based on these coefficients, a decision is made to include special indicators in the regression model, and a pair regression model is built for each cluster. This model allows predicting the value of the innovation index, which depends on the change in the values of the factor indicators.

Calculations were made according to two main methods: evaluation of innovation development of regions and methods of factor analysis of innovation development of regions. Both methodologies are based on the system of indicators characterizing the internal and external environment and socio-economic factors of RIS. The proposed methods use widely used tools in the international world. In order to evaluate the regional innovation system, an innovation index was formed based on internationally accepted principles. According to the comparative evaluation of the innovation potential of Azerbaijan, the innovation index was calculated for each region.

This methodology was refined taking into account the national and specific characteristics of Azerbaijan, statistical indicators in this field, information that can be collected and processed, the innovation potential of the regions, the system of indicators was changed and calculated for Azerbaijan. Calculations were made on 2 blocks (reserves and activity scale), 4 groups and 14 indicators. The special index indicator is denoted by Gijl, where i=1, 2; j = 1, 2; And l depends on the number of indicators in each group.

Table 6. Distribution of the system of indicators (Huseynova & Mazanova 2023)

Block	Group	Distribution of the system of indicators
Reserves	Labor resources	4
	Material-technical base	2
Scale	Scientific activity	6
	Innovation activity	1

Data were collected and calculated according to the methodology we mentioned. The calculation results are not much different from previous years. This is proof that there was no great progress in this field in the regions, the situation has not changed. The obtained results are given in the table.

Table 7. Innovation index by region according to innovation development

Regions	By reserve group I_1	By scale group I_2	Regional Innovation Index I
Baku	0,36	0,41	0,38
Nakhchivan	0,25	0,23	0,24
Mountainous Shirvan	0,31	0,05	0,18
Absheron	0,12	0,24	0,18
Ganja-Kazakh	0,11	0,23	0,17
Lankaran	0,14	0,13	0,14
Guba-Khachmaz	0,09	0,17	0,13
Aran	0,12	0,11	0,11
Sheki-Zagatala	0,04	0,15	0,09

As can be seen from the table, Baku is progressing in all groups.

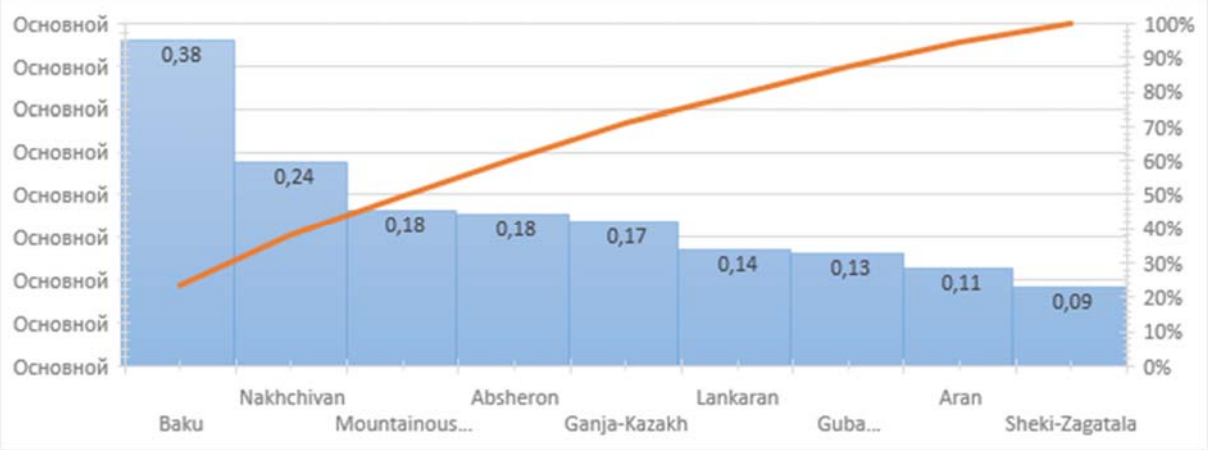

Figure 5. Innovation index for economic zones

The regional innovation system consists of 3 subsystems: regional policy, scientific-innovation policy, and regional socioeconomic policy.

According to the methodology we mentioned above, Huseynova A.D. presented the methodology for evaluating the impact of the socio-economic environment on the innovation development of regions. The assessment was conducted on 4 factors (innovation development level, education level, population welfare level and infrastructure development level).

Table 8. Factor index (Huseynova & Mazanova 2023)

No.	Regions	Innovation development level index	Education level index	Population welfare level index	Infrastructure development level index
1	Baku	0,91	1	1	0,75
2	Absheron	0,50	0,28	0,21	1
3	Nakhchivan	0,28	0,24	0,20	0,41
4	Ganja-Kazakh	0,26	0,20	0,25	0,33
5	Aran	0,18	0,03	0,17	0,36
6	Mountainous Shirvan	0,17	0,03	0,13	0,33
7	Lankaran	0,16	0,04	0,18	0,27
8	Sheki-Zagatala	0,16	0,03	0,17	0,27
9	Guba-Khachmaz	0,14	0,02	0,15	0,24

As can be seen from the table, Baku is again sharply ahead.

The field of science and technology in Azerbaijan should be improved today. During the development of the national innovation system in the country, the development of scientific and technical potential and innovation in the regions is one of the main issues.

Let's analyze the indicators of science in Azerbaijan.

Table 9. The main indicators of science in the regions of the Republic of Azerbaijan

Regions	The number of scientific research organizations	Number of scientific and research workers (people)	The volume of scientific and technical works performed during the year (thousand manats)	Total scientific research costs (thousand manats)	Internal expenses for scientific research (thousand manats)	Cost of basic resources used in scientific research (million manats)
Azerbaijan	137	20 580	124 545,4	132 340,0	129 871,8	157,4
Baku	102	16292	93 745,5	108 212,0	106 042,6	137,2
Absheron	8	758	13 072,5	13 408,7	13 408,7	8,6
Ganja-Kazakh	8	2 364	3 016,4	3 712,5	3 712,4	1,2
Sheki-Zagatala	1	89	457,6	457,6	457,6	0,4
Lankaran	3	93	284,6	284,8	284,8	0,1
Guba-Khachmaz	2	140	759,2	759,2	759,2	1,3
Aran	3	6	51,1	51,1	51,1	0,5
Mountainous Shirvan	2	156	1 124,0	1 124,0	825,3	-
Nakhchivan	6	682	2 272,8	4 330,1	4 330,1	8,1

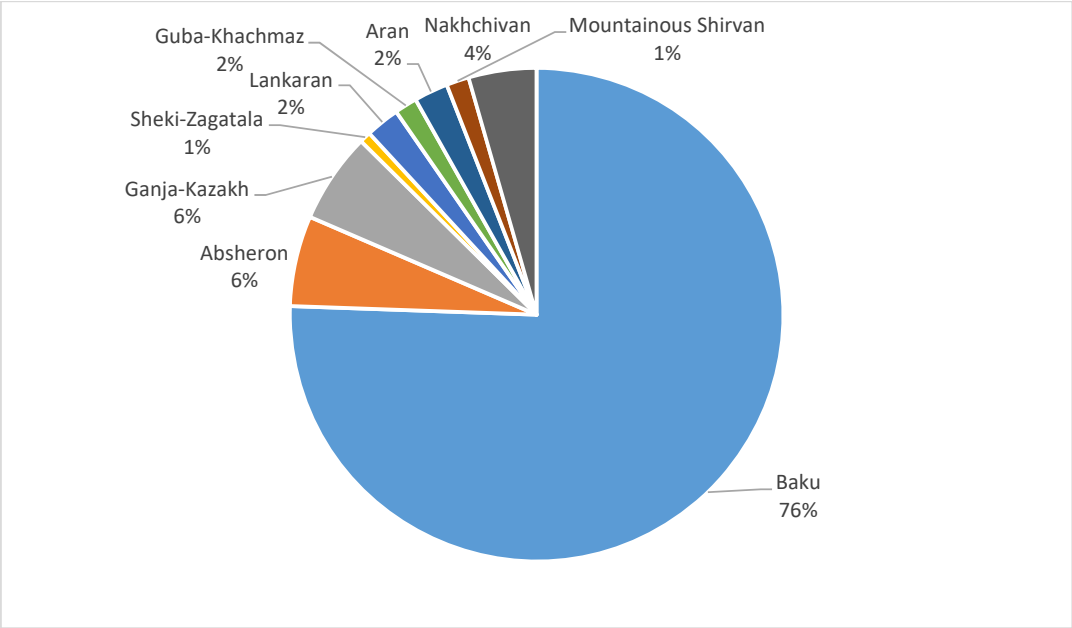

Figure 6. Organizations engaged in science by regions of the Republic of Azerbaijan

Analyzing the indicators of science in Azerbaijan, we see that 76% of scientific research organizations are located in Baku.

To calculate the science index, it is necessary to bring the indicators given in Table 9 to the same unit of measurement.

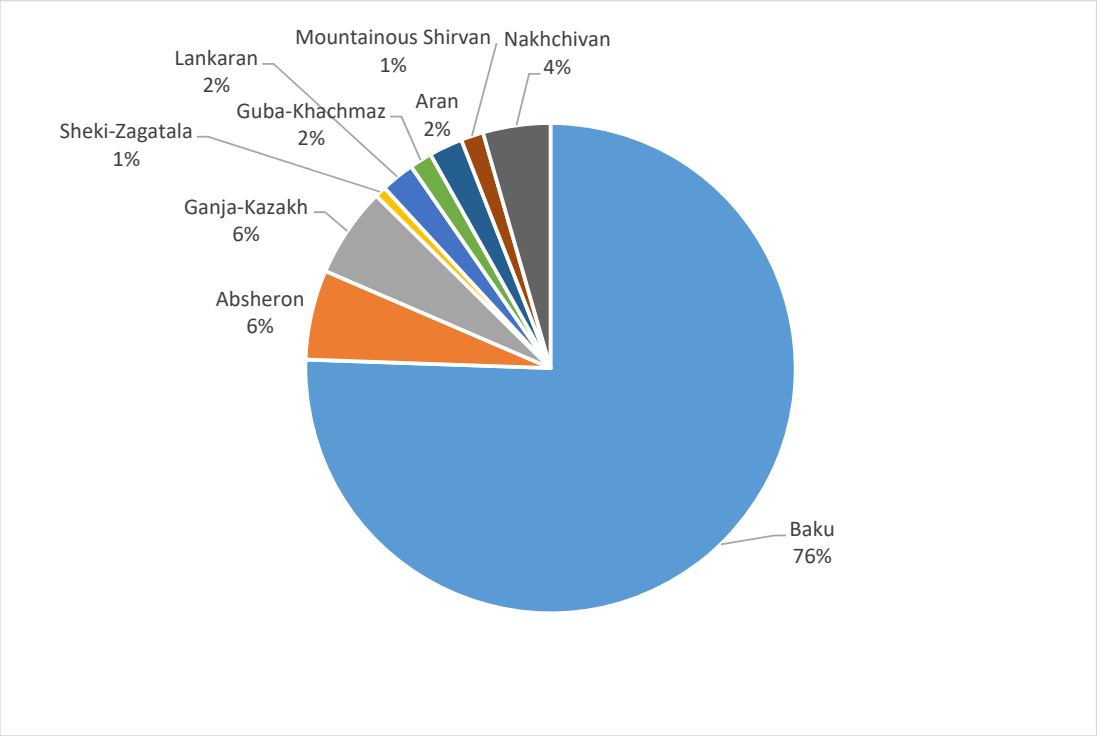

Figure 7. Number of scientific research workers

In other words, let's normalize the indicators and calculate the science index based on the average value of the normalized values of these indicators (Lindén et al. 2021).

Eİ=(∑_(i=1)^n▒〖Eİ〗 _i)/n (4)

where EIi is the i-th indicator included in the group, n is the number of indicators.

Table 10. Normalized values of science and science index by region

Regions	The number of scientific research organizations	Number of scientific and research workers (people)	The volume of scientific and technical works performed during the year (thousand manats)	Total scientific research costs (thousand manats)	Internal expenses for scientific research (thousand manats)	Cost of basic resources used in scientific research (million manats)	Scientific index (EI)
Baku	1	1	1	1	1	1	1
Absheron	0,069307	0,046175	0,138977	0,123497	0,126025	0,062682	0,094444
Ganja-Kazakh	0,069307	0,144787	0,031649	0,033851	0,034543	0,008746	0,053814
Sheki-Zagatala	0	0,005096	0,004339	0,003758	0,003835	0,002915	0,003324
Lankaran	0,019802	0,005342	0,002492	0,002161	0,002205	0,000729	0,005455
Guba-Khachmaz	0,009901	0,008228	0,007558	0,006547	0,006681	0,009475	0,008065
Aran	0,019802	0	0	0	0	0,003644	0,003908
Mountainous Shirvan	0,009901	0,00921	0,011451	0,009919	0,007304	0	0,007964
Nakhchivan	0,049505	0,041508	0,023712	0,039561	0,040371	0,059038	0,042283

Note: Developed by the author

If we look at the table, we will see that according to the science index, Baku has advanced sharply.

Such an uneven distribution of science in the republic, and the low volume of scientific and technical works performed by regions during the year is a negative trend that affects the low share of innovation in the development of the economy of the regions of Azerbaijan.

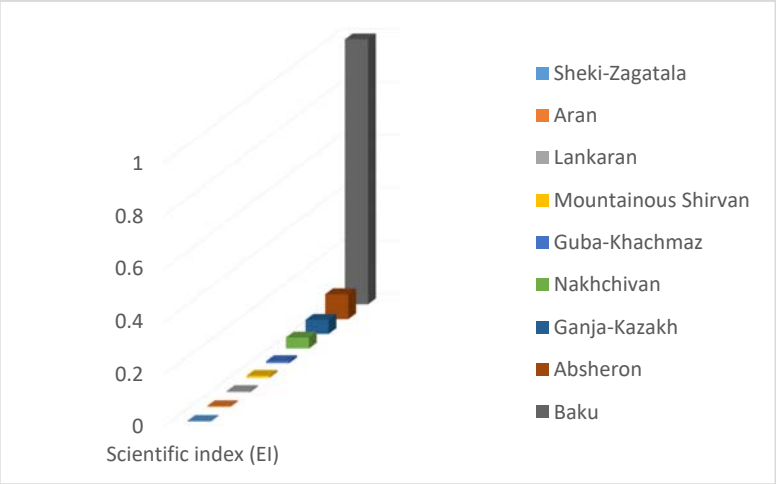

Figure 7. Science index by region

At the next stage, regression models showing the dependence between indicators included in different factor groups of innovation activity are built. As a result, equality was obtained for all blocks. As we know, regression analysis determines the relationship between dependent and independent variables.

SPSS software was used to construct the regression equations. Here, the factor variable is given with the outcome variable in the input. And in the output:

1. Correlation matrix;
2. Coefficients of regression equations;
3. Coefficients of R squared equations;
4. Values that determine the level of importance of the model.

The obtained regression equations and statistics are given in Table 4.3. A linear regression model was constructed for the following indicators (Lindén et al. 2021):

- G13 – Number of students per 1000 people;
- G23 – unemployment rate, %;
- G41 – Number of mobile phone subscribers per 1000 people.

Table 11. Linear regression equations for a group of factors

A group of factors	A linear regression equation	Determination coefficient R	Darbin-Watson coefficient DW
Education level	$I=0,15+0,80I_{təh}$	$R^2=0,93$	1,575
The level of welfare of the population	$I=0,11+0,82I_{rif}$	$R^2=0,76$	0,831
Level of infrastructure development	$I=0,03+0,60I_{inf}$	$R^2=0,56$	1,530

Note that the coefficient of determination is completely dependent on the indicator of the innovation index. Since the Darbin-Watson coefficient is less than 2, it means that the autocorrelation for the indicators involved in the equation is adequate. The coefficients of determination in the models of the dependence of the innovation index on the level of education, the level of welfare of the population, and the level of infrastructure development show that the innovation index depends on the indicators included in the model: the most on the level of education (93%), and the least on the level of infrastructure development (56%).

A multivariate regression model was given. Here, the dependence of the innovation index with the indices calculated by factor groups is established:

$$I = 0,337I1+ 0,332I2+0,329I3 +0,01 \quad (5)$$

Ii is the index of factor groups, ai is their coefficient.

DW=2; R2=1

When the coefficients of this equation are calculated, it is obtained that since the Darbin-Watcon coefficient is equal to 2, autocorrelation is not possible for the indicators involved in the equation. So this model cannot be a worker. We get that there is no general dependence of the innovation index on the whole group of factors.

Let's build the model using stepwise regression. In this model, variables are entered into the equation one by one. As a result of the first step regression model at each stage, the coefficient of determination is higher than R2=0.93.

$$I=0,15+0,80Itəh \quad (6)$$

Here Iteh is the elements of education.

In the multivariate regression model, education items appear to be key. Thus, 93% of the change in the innovation index depends on the educational elements of the region.

From what has been said, we can conclude that the field of science and technology in Azerbaijan should be improved today. The development of innovation potential and innovation in the regions is one of the main issues during the development of the national innovation system in the country. The formation of the national

innovation system requires the development of regions. As a result of the research, two methodologies were adapted to Azerbaijan and calculations were made: evaluation of innovation potential development and factor analysis methodologies of innovation potential development. Both are based on a system of indicators that characterize the internal and external environment and factors of innovation potential. The proposed methods use widely used tools in the international world. To justify the indicators, studies conducted in the international world based on inter-country and inter-regional comparison were studied. Based on those models, a system of characteristic indicators for Azerbaijan was selected and calculated.

The innovation index was formed based on the principles accepted in the international world for the assessment of innovation potential. According to the comparative evaluation of the innovation potential of Azerbaijan, an innovation index was found for each region. Zones were ranked according to this index and cluster analysis was conducted.

The selected system of indicators allows us to evaluate the level of innovation development in different areas and analyze the factors affecting the innovation index in the regions.

6. RESULTS

A methodical approach to the assessment of regional economic systems was proposed. The proposed approach takes into account the shortcomings of local experience. At the same time, it can be the basis for the preparation of management decisions related to the innovation development and efficiency improvement of the economic system.

In the study, local and foreign methodological approaches to the assessment of regional innovation development were reviewed and analyzed. Also, the general directions and general features of methodical approaches to the assessment of regional innovation development were determined, and the innovation index was calculated for each region according to the comparative assessment of the innovation potential of Azerbaijan.

The methodology applied in the work was refined taking into account the national and specific characteristics of Azerbaijan, statistical indicators in this field, information that can be collected and processed, and the innovation potential of the regions, the system of indicators was changed and calculated for Azerbaijan. As a result of the conducted research, proposals were made to determine the role and competitiveness of the regions in the development of the republic's economy.

The following results were obtained according to the results of the analysis of methodical approaches to the evaluation of the innovation development of the regions:

- the issue of evaluating the innovation development of the region should be developed by developing complex indicators and a necessary data collection system;
- In the assessment of innovation development of the region, a comprehensive approach is appropriate, including expert assessment, taking into account quantitative and qualitative indicators;
- it is necessary to take into account the natural, demographic and economic characteristics of the region. In regions with a majority of small nations, the impact of innovation on traditional lifestyles and traditional economic activities should be analyzed.
- it is necessary to take into account the natural, demographic and economic characteristics of the region. In regions with a majority of small nations, the impact of innovation on traditional lifestyles and traditional economic activities should be analyzed.

Thus, a comprehensive assessment of the innovation development of regions should be developed. The results of this evaluation can be the basis for the improvement mechanism of the state policy.

This proposed model is an efficient tool for the analysis of RIS. It allows assessing the origin and structure of resource flows and predicting the risks that occur during the operation and development of the system under the influence of external factors. Creates profiles of the region's innovation development to determine the individual characteristics of the territories.

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