Management of the Development of the Innovative Potential of the Region

Kateryna Andriushchenko [1], Anastasiia Liezina [1], Svitlana Vasylchak [2], Mykhailo Manylich [3], Tetiana Shterma [3], Uliana Petrynyak [4]

[1]*SHEE "Kyiv National Economic University named after Vadym Hetman", Department of Economics and Entrepreneurship, Peremogy str., 54/1, Kyiv, 03057, Ukraine*
[2] *Lviv State University of Physical Culture named after Ivan Boberskyj, Department of Economics and Business Management, 11, Kostiushka Str., Lviv, 79000, Ukraine*
[3] *Private Higher Educational Institution "Bukovinian University", 2A, Darvina street, Chernivtsi, 58000, Ukraine*
[4] *Oles Honchar Dnipro National University, 72 Gagarin Avenue, Dnipro, 49000 Dnipropetrovsk Region, Ukraine*

Abstract **- The purpose of the study is to develop tools for managing the innovation potential of the region based on the use of the mapping process. The methodological basis of the study were the following methods: abstract and generalized; general-logical and historical; logical method. According to the results of the research, a scheme of forming a roadmap for the development of innovation potential of the region was developed, which includes a SWOT-analysis of the development of innovation potential of the region, as well as an algorithm for assessing regional innovation potential.**

Keywords **- management, innovation potential of the region, mapping, clusters, territories, transfer.**

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Corresponding author: Kateryna Andriushchenko,
SHEE "Kyiv National Economic University named after Vadym Hetman", Department of Economics and Entrepreneurship, Peremogy str., 54/1, Kyiv, Ukraine.
Email: katya373@i.ua

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1. Introduction

The relevance of the research topic is determined by the fact that the innovative path of economic development in modern conditions is one of the priority areas for both business entities and for large socio-economic systems, including regions. Innovation, scientific and technological progress and the intensification of the national economy are becoming integral components of sustainable economic growth in any country. Innovations determine the development of productive forces, contribute to the growth of social welfare, improve the quality of life, the level of education. The use of the latest technologies saves up to 80% of natural resources, raw materials, fuel, from mining and complex processing to use in production.

The main condition for innovative development is the presence of innovative potential, without which currently can not do without any economic system that seeks to gain a leading position among similar systems [1], [2], [3].

However, the current state of innovation potential in the region, as well as in the country as a whole, faces serious problems that hinder its development, including: acute shortage of financial resources; insufficient development of the basis for determining the economic mechanism of innovation activity and the specifics of the implementation of innovation potential in the regions; lack of methodological developments that allow the region to assess its innovation potential and formulate priority ways of its development. Finally, the formation and development of innovation potential also requires purposeful efforts on the part of the regional authorities [4], [5].

It is these reasons that determined the need to develop tools to manage the process of formation and development of innovation potential of the region.

2. Literature Survey

According to Barnes T., Peck J. and Sheppard E. [6], today the concept of modernization in relation to the state is interpreted mainly in three different meanings:

- as the internal development of Western Europe and North America, relating to the European New Age;
- catching up modernization, which is practiced by countries that do not belong to the countries of the first group, but seek to catch up;
- processes of evolutionary development of the most modernized societies (Western Europe and North America), i.e., modernization as a permanent process carried out through reforms and innovations, which today means the transition to a post-industrial society.

That is why the position of many economists, in particular Bathelt H. and Henn S. [7], who believe that the determining basis of economic growth is the use of domestic technologies is of particular interest. This does not exclude the possibility and necessity of borrowing technologies, including certain technologies of wide application, to meet the needs of the domestic market. However, such borrowing can only be additional to the development of the domestic technological base.

From the point of view of Cooke P. [8], the technological way of life is a holistic and sustainable education, which includes a closed cycle, including the extraction and production of primary resources, all stages of processing and release of a set of end products that meet the appropriate type of public consumption. The life cycle of such large complexes of technically connected industries averages about a hundred years, and the period of its dominance ranges from 40 to 60 years of the last century.

Crescenzi R. and Rodríguez-Pose A. [9] resort to factor analysis in assessing the economic development of macro-regions, taking into account the potential for modernization. The study, taking into account the indicators-factors revealed the patterns of economic development depending on the modernization transformations [10]. Scientists believe that the functioning of any socio-economic or technological system is carried out in a complex interaction of a set of factors of internal and external order. All these factors are usually interrelated and interdependent.

The method of factor analysis of the innovation potential of the region was applied by Feldman MP. et al. and Howells J. [11], [12]. From among many indicators, the authors selected seven parameters that characterize the innovative potential of the region. Based on the obtained results, three main components of potential have been identified: scientific and technological resources, infrastructural resources and the level of innovation activity. These components are logically interconnected and, of course, can have a decisive influence on the formation of regional innovation potential (RIP). However, the system of evaluation indicators is questionable. In particular, the scientific and technical resource of RIP formation is represented by such indicators as the share of own funds for technological innovations, the number of used advanced technologies, the number of advanced technologies per 100 enterprises.

At the same time, Schütz A. [13], [14], [15] believes that in terms of the development of innovation potential of regions, special attention should be paid to its scientific and technical component. In particular, increasing the innovative receptivity of enterprises in small and medium-sized cities, their development of knowledge-intensive, energy- and resource-saving technologies and new products, mainly focused on the use of local fuels, non-traditional and renewable energy sources.

This view is shared by Liefner I. and Wei YD. [16], which identify such priority strategic directions for the development of innovation potential as:

- support and strengthening of basic research of domestic science in the field of innovation in order to develop scientific potential;
- ensuring the reproduction of human resources for science, technology and innovation in the region;
- development of technical and technological base, which determines the scale and pace of innovation;
- direct or indirect financial stimulation of innovative activity for the purpose of development of financial potential;
- improving the regulatory framework for innovation in order to develop institutional capacity;
- formation of regional innovation infrastructure in order to develop organizational capacity;
- formation of information infrastructure to support innovation and take into account its results in order to develop information potential.

According to Moulaert F. and Sekia F. [17], the main aspects in understanding information potential are information as a resource, information and telecommunication technologies that form the

environment for the realization of this potential. At the same time, the author identifies Internet potential as a key factor that determines the state and opportunities for the development of market relations and economic systems of different levels, based on the widespread use of information and telecommunications technologies.

3. Methods

Human development of the region's innovation potential takes place in two directions: formation and implementation. Let's try to understand their essence in relation to RIP. In most dictionaries, formation is seen as a process of action. To form means to organize, to compose, to create, to give to something stability, completeness, a certain type, and to realize means to make real, to carry out.

In addition, Saxenian A. [18] emphasizes that the implementation is perceived as the implementation of the plan and the result.

From this we can conclude about two levels in the system of development of innovation potential: the process of its creation and implementation as the results of innovation. Therefore, the system of capacity assessment should also take into account the substantive features [19], [20].

Given the structure of the innovation potential of the region and the specifics of its organization, we believe that the innovative environment of the region's economy can also be considered in conjunction with it (Figure 1.).

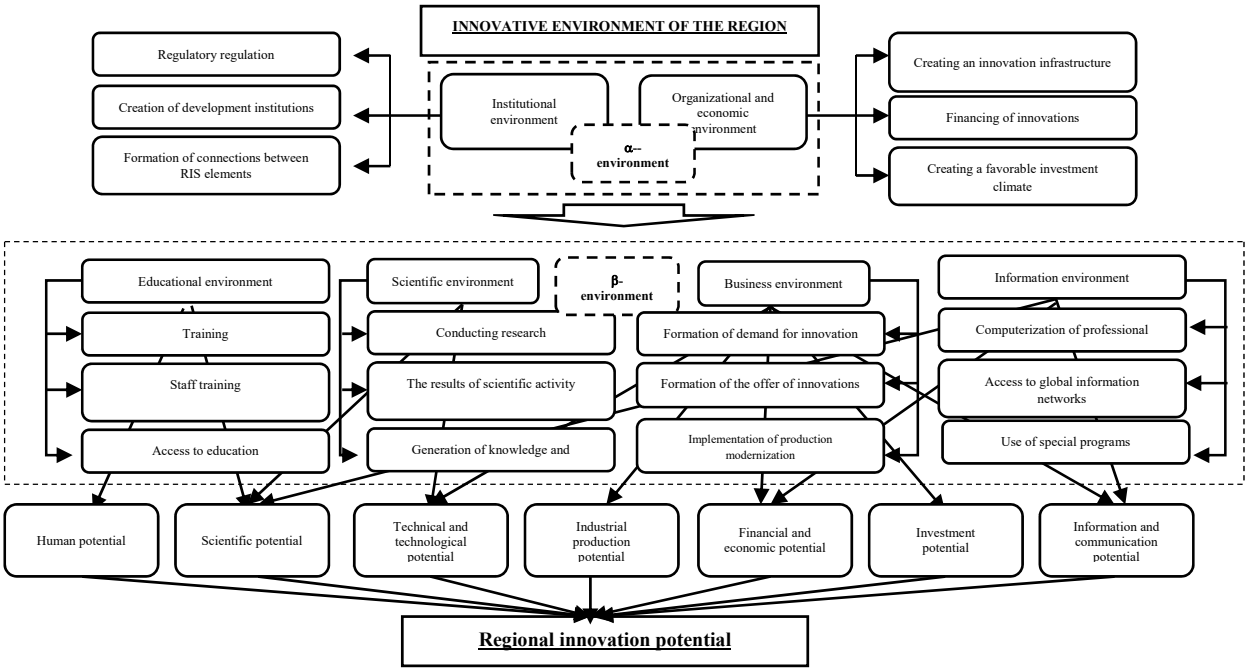

Figure 1. The system of formation of innovation potential of the region under the influence of environmental factors
Source: developed by the authors

There are two levels of influence. The innovation environment of the first order of influence ((-environment) defines some intangible connections, thus forming a network framework between the elements of the innovation system of the region. The environment of the first level forms such factors as normative-legal maintenance of innovation processes; institutional support in the form of specific documents and organizations; infrastructure connections; access to financial resources of each subject of innovation activity at each level of innovation process; motivated investment in high technology and more. In turn, the environment of influence of the second order (β-environment) forms the factors that directly affect one or another resource block of regional innovation potential.

It should be noted that the β-medium itself depends on the conditions dictated by the α-medium. It is the institutional and organizational-economic factors that contribute to the development of resource provision of innovation potential from the educational, scientific, entrepreneurial and information spheres. Such an organization allows to optimize the system of analysis and evaluation of RIP.

At the same time, resource provision can be quantified. To analyze the institutional and organizational conditions for the formation of innovation potential requires an assessment of another level. This area provides for rapid qualitative analysis within such factors as the legal framework, infrastructure, direct and indirect financial support

measures, methods of creating an investment climate in the region and others [21].

Thus, the innovative potential of the region is formed and realized under the influence of a two-tier system of environmental factors. The first level is decisive. The further organization of the processes of formation of the innovation potential of the region depends on its development.

A structured approach to the evaluation of RIP allows to take into account the degree of readiness and resource security of a particular unit and the innovation system of the region in general for the development, creation, commercialization and transfer of innovations. In addition, it is possible to determine the extent and nature of its impact on the region's economy through RIP assessment. Based on this, the trajectory of regional development can be adjusted. The algorithm for structural assessment of regional innovation potential includes five main stages (Figure 2.).

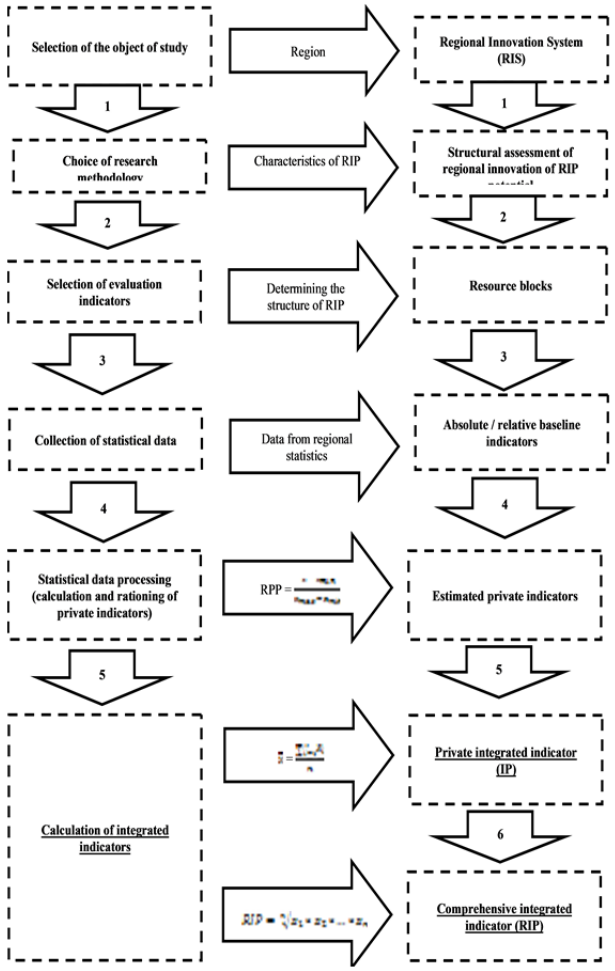

Figure 2. Algorithm for assessing regional innovation potential
Source: developed by the authors

At the first stage, the object of study is selected. As a result, we consider a holistic regional innovation system (RIS) of a particular business entity. The system itself is presented as a functional model of a black box and consists of three basic elements. "Entry" into the system is expressed by regional innovation potential, "operator" is a mechanism for regulating innovation in the region, and "exit" - the results of innovation. The next step is to determine the methodology for calculating the innovation potential, which will give a comprehensive description of the RIP and its components. The choice of structural assessment of regional innovation potential involves the next stage - the selection of indicators that determine the structure, which in turn are grouped into separate resource blocks.

In the future, statistics are collected, resulting in a set of absolute and relative baseline indicators required for the calculation. The RIP assessment is based entirely on publicly available data from the State Statistics Service, which emphasizes the universality of the developed methodology. The next step is to calculate the values of the calculated private indicators (PI), with the determination of the specific weight / share (if required).

4. Results

Returning to the assessment of the innovativeness of the region's economy, we note that of particular interest for the study is the analysis of the level of innovation activity of industrial enterprises [22]. They play an important role in the chain of innovation processes. The real sector is a segment of the economy that directly produces innovative products.

According to Figure 3., in 2020 there was a significant increase in innovation activity of industrial enterprises (1.8 times). As a result, the share of organizations that carry out innovations of any type in the total number of organizations in the region was 17.6%. At the same time, most enterprises (15.3% in 2020) develop and implement new or improved goods, works, services, technological processes or methods of production, that is, carry out technological innovations. This trend is observed throughout the analyzed period.

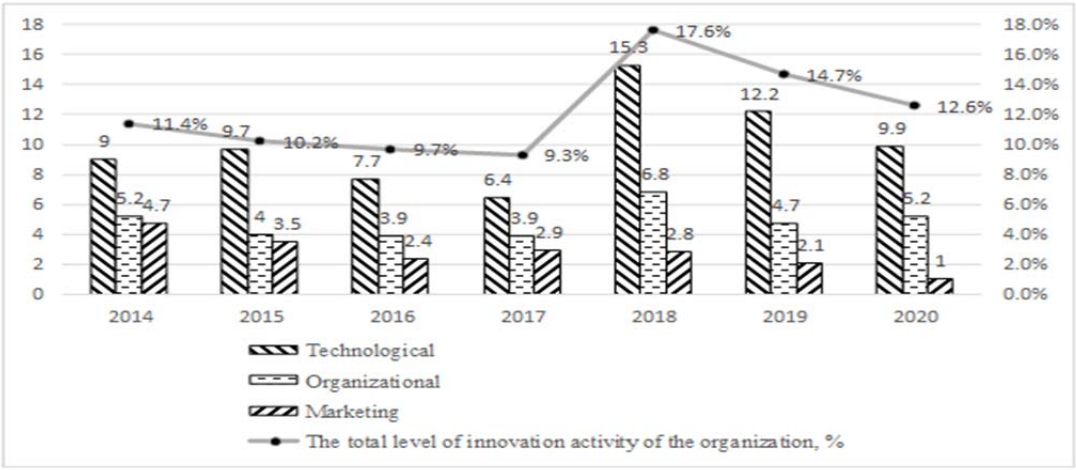

Figure 3. Total level of activity of organizations of production, manufacturing, production and distribution of electricity, gas and water, carrying out technological, organizational and marketing innovations (by region)
Source: developed by the authors

The smallest number of organizations is engaged in the implementation of new or significantly improved marketing methods aimed at better meeting the needs of consumers, the search for new markets in order to increase sales. Their share from 2014 to 2020 decreased from 4.7% to 1%. A slightly larger number of companies are implementing new methods of doing business, organizing jobs and external relations - the share of organizational innovations averages about 5%.

Among organizations that carry out technological innovations, more than 50% acquire material technologies - machinery and equipment (Figure 4.).

In some periods, the value of the indicator reached 80%, but by 2020 it stopped at 52%. This fact is primarily due to the increase in the number of organizations that purchase software from 17.4% to 48% in 2014-2020. In terms of acquisition and sale of other non-material technologies (patents, licenses, etc.) there is an unstable trend. In 2014, 13% of organizations out of the total number of technological innovations acquired new technologies, by 2017 the value increased to 17.6%, but by 2020 there is a decline in innovation activity to 8%. The rate of research and development (about 40% on average) shows consistently high values.

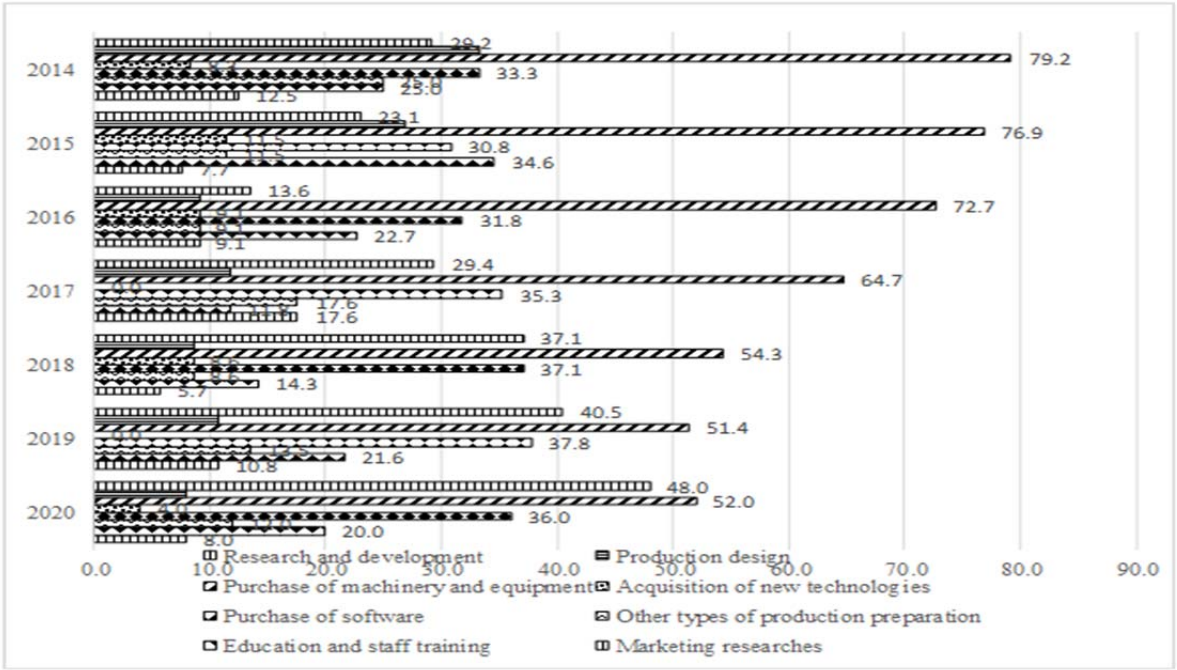

Figure 4. The share of organizations engaged in certain types of innovation, among the total number of organizations engaged in technological innovation
Source: developed by the authors

Among the sources of funding for technological innovation are traditionally the following:

- funds of organizations;
- state budget funds;
- funds of budgets of subjects and local budgets;
- extra-budgetary funds;
- foreign investments - venture funds;
- other means.

The practical implementation of these areas of innovation potential of the region requires the solution of a number of interdependent tasks. Roadmap methodology is an effective tool for setting priorities and mobilizing a large number of participants to achieve qualitatively new results in the field of innovation.

The roadmap is a common tool for developing development strategies. It allows you to visualize possible ways to achieve the goal and select the best of them. Maps can contain probable estimates of the time required to move from one stage to another. In foresight research, they are often used in the development of scenarios, reflecting the cause-and-effect relationships and clearly illustrate the step-by-step changes in a particular area, technology, product or their state over time.

Given the accumulated experience, we believe that the use of the method of road mapping to ensure the effectiveness of measures to develop regional innovation potential is quite justified. The process of creating such a road map includes several stages (Figure 5.).

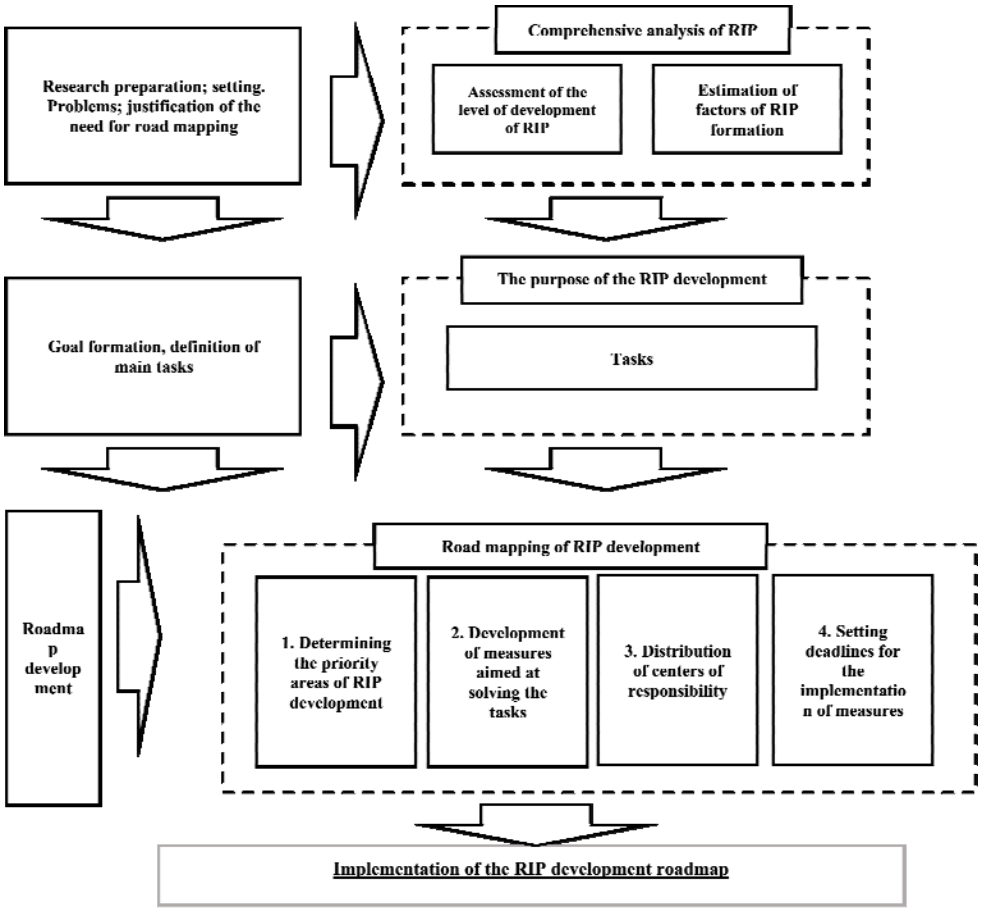

Figure 5. Scheme of formation of the road map of RIP development
Source: developed by the authors

A road map is a step-by-step scenario for the development of a certain object (technology, business, company, industry, etc.). Roadmaps can also be created to achieve political (international conflict resolution) and social goals (combating socially significant diseases, such as COVID-19). The process of forming road maps is called road mapping; and the object, the evolution of which is represented by the map, is the object of road mapping. Road mapping is based on expert information that allows you to predict the development of relevant facilities.

In preparation for the study, a comprehensive analysis of the innovation potential of the region is conducted, the results of which will be used for the purpose and objectives of the RIP management. Next, the promising areas of the RIP development are identified, which contain a set of measures, the results of which provide solutions to certain tasks and achieve the ultimate goal. Thus, road mapping

of the development of innovation potential of the region will bring together the goals, logic, implementation mechanisms and key management elements. Building a roadmap for the development of innovation potential of the region involves the above stages.

5. Discussion

As a result of the research, an analysis of the innovation potential of Kyiv region was conducted. To systematize the results and clarify the directions of management decisions, the method of SWOT-analysis was used, its application is quite common in various sectors of the economy and management. The universality of this method allows you to use it at different levels and for different objects as a tool of management analysis. SWOT-analysis of the innovation potential of the region involves identifying the strengths and weaknesses of the object of study, as well as potential opportunities and threats to its development (Table 1.).

Table 1. SWOT-analysis of the development of innovation potential of the region

Strengths (S)	**Weaknesses (W)**
☙ the presence of basic regulations; ☙ use of a range of tools to support innovation, regulated by law; ☙ regulated support for small and medium enterprises; ☙ availability of measures to support innovation; ☙ experience in conducting events that help develop integration processes (fairs, forums); ☙ availability of development of scientific and educational component of innovation infrastructure; ☙ developed research base; ☙ developed industrial potential; ☙ the presence of enterprises with sustainable development in the market; ☙ growth of innovative activity of organizations.	☙ lack of a system of strategic and program-target planning in the innovation sphere; ☙ ineffective incentives to create innovations; ☙ lack of clearly defined priorities for the development of science and innovation; ☙ weak influence of regional authorities on cluster policy; ☙ weak links between the research and development sector and business; ☙ fragmentation of innovation infrastructure; ☙ low amount of R&D funding; ☙ rather low level of efficiency of the research and development sector; ☙ moral and physical depreciation of fixed assets of industrial enterprises; ☙ low efficiency of innovation.
Opportunities (O)	**Threats (T)**
☙ innovation-oriented policy of the region; ☙ use by the authorities of available levers of influence on business for the purpose of growth of innovative activity; ☙ comprehensive state support for significant innovation projects; ☙ participation of the region in the implementation of state programs; ☙ active cooperation with development institutions; ☙ implementation of the mechanism of public-private partnership; ☙ creation of innovative territorial clusters; ☙ innovative growth on the basis of research sector and personnel reserve; ☙ differentiation of interregional and foreign economic relations of regions.	☙ increasing the gap in the level of innovation of the economy compared to other regions; ☙ weakening the competitive position of enterprises in the region; ☙ lack of effective demand for innovation; ☙ non-perception of innovations by the regional market; ☙ low level of venture capital market; ☙ lack of financial resources for innovation; ☙ reduction of research and development costs; ☙ unavailability of certain types of infrastructure support; ☙ reduction of investment activity in the region.

Source: developed by the authors

The SWOT-analysis of the innovation potential of the region allowed to identify the main problems and prospects of its development. Among the environmental factors, the strengths include:

- the presence of basic regulations, in particular the Law on Innovation (№ 40-IV of 04.07.2002);
- use of a number of basic tools to support innovation, enshrined in law (benefits, subsidies, subventions, etc.);
- regulated support for small and medium enterprises, including those who carry out innovative activities;
- availability of measures to support investment activities
- experience in conducting activities that promote the development of integration processes (fairs, forums, etc.);
- availability of a developed scientific and educational component of the innovation infrastructure.

At the same time, the environment of indirect influence creates the conditions for the formation and implementation of the RIP of a negative nature. In particular:

- lack of a system of strategic and program-target planning in the innovation sphere;
- ineffective incentives to create innovations;
- lack of clearly defined priorities for the development of science and innovation;
- weak attention of regional authorities to cluster policy;
- weak links between the research and development sector and business;
- fragmentation of innovation infrastructure;
- small amount of funding in the field of research and development work.

Based on the proposed system of formation of innovation potential of the region, it should be noted that the β-environment has a positive impact on the formation and implementation of innovation potential have a developed research base; developed industrial potential; the presence of enterprises that have a stable position in the state market; growth of innovative activity of organizations. In this development, the research base, expressed mainly by a high level of human potential, is not able to fully ensure the effectiveness of the research and development sector. This is evidenced by the low relative to other regions of the scientific potential of the RIP and its components. In addition, the weaknesses of the β-environment include the moral and physical depreciation of fixed assets of industrial enterprises, as well as low efficiency of innovation.

Thus, it can be stated that the need to assess the innovation potential of the region is due to the need to have objective information on the availability of resources to ensure regional innovation development. The RIP is a comprehensive indicator that can be used to assess not only the degree of readiness of the region for the active deployment of innovation processes, but also the structure of resource security of innovation. Such an assessment is essential for regional management decisions. With its help it is possible to reveal both key factors of growth of innovative activity for each concrete subject, and barriers of innovative development.

Therefore, we can say that the author's method has a number of advantages, namely:

- objectivity. The methodology is based on data processing of the State Statistics Service, excluding the subjectivity of the method of expert assessments.
- complexity. The authors propose a methodology that combines a system of indicators that characterize the potential of the innovation environment of the region's economy, including indicators of human, scientific, technical and technological, industrial, financial and economic, investment and information and communication resource blocks. This approach allows you to analyze the structure of the RIP, to identify strengths and weaknesses in the resource provision of innovation in the region. Based on the results, measures can be proposed to strengthen the innovation orientation of the region.
- universality. The methodology is based on the use of publicly available statistical data, therefore, can be applied to any business entity. In addition, the structure of the indicator does not exclude the possibility of using this technique to calculate the innovative potential of state-owned enterprises.
- simplicity. The method uses a fairly simple mathematical and statistical apparatus.

Thus, our proposed method allows not only to determine the magnitude of the innovation potential of the region, but also to identify opportunities and reserves for growth of this potential, to determine the benchmarks of regional innovation development in priority areas for each entity.

6. Conclusions

As part of the study, the results of the assessment of the innovation potential of the region were systematized using SWOT-analysis. Through the presented opportunities and threats to the development of innovation potential of the region, it is possible to identify ways and mechanisms of transformation of key factors of the innovation environment of the region, which are determined by a set of strategic decisions. We believe that it is advisable to consider an enlarged version of the structure of the innovation environment. There are four main elements: the institutional environment; organizational and economic environment; scientific and educational environment; business environment.

In terms of transformations of the institutional environment it is necessary:

1. Improving the regulatory and legal support of intra-regional innovation processes, in particular the formation of a system of strategic and program-target planning in the innovation sphere.
2. Strengthening state support for innovation and research, including stimulating demand for innovation.
3. Stimulating the creation and development of small and medium innovative enterprises.

In terms of transformations of the organizational and economic environment it is necessary:

1. Promoting the development of innovation infrastructure.
2. Formation of an effective system of financing innovation processes.
3. Creation of innovative territorial clusters.

These ways of development of factors of the α-environment can be a catalyst for the development of environmental factors of direct influence on the formation and implementation of RIP - scientific and educational environment and business environment. The expected effect will identify two main points of growth of the innovation potential of the region, namely the developed research sector and innovation-oriented enterprises in the region.

In order to ensure the effectiveness of the implementation of measures for the development of regional innovation potential, the method of road mapping was used. The study presents a graphical interpretation of the conceptual model of the roadmap for the development of innovation potential of the Kyiv region, which allowed:

- consider and evaluate the priority tasks of developing the innovation potential of the region;
- focus on the sequence of their solution;
- maintain the communication format between the key elements of mapping;
- logically structure the relationships between road mapping projects (directions of transformation of the innovation environment of the region).

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