

Public Management of SMART Specialization of Sustainable Development of the Region in the System of Ensuring Innovation Security



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ABSTRACT

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The main purpose of the study is to model the prospects for sustainable development of the region due to smart specialization in the system of ensuring innovative security. The methodology includes a diverse number of techniques that contributed to the achievement of the desired result. In particular, general theoretical methods of analysis, the method of comparing the key characteristics of the studied regions, the method of correlation and regression analysis were used. As a result of the study, the density of the influence of various factors (characteristics of the functioning of the educational and scientific components, indicators of the innovative activity of the business environment of the region) on the dynamics of changes over time in the performance indicators of a particular region was studied. According to the authors, this study can become a guide for regional authorities in developing an implementation plan and relevant roadmaps for the implementation of practical strategies for sustainable development of the region. The study has limitations and they relate to the inability to cover an indicative number of regions. Each region is individual and requires a separate approach. The practical value of the calculations carried out lies in the disclosure of those components and characteristics of the educational, scientific, and industrial activities of the region, the direction of efforts and resources for the activation of which will allow the region to get a guaranteed positive result through the growth of the gross regional product and the available income of the region due to an indicative increase in innovation security.

1. INTRODUCTION

The prospect of high rates of sustainable development of the country, expressed in improving the quality and comfort of life of the population and increasing the level of its competitiveness in the world market, will largely depend on the ability of its regions. In particular, this concerns their ability to correctly identify and make maximum efforts to implement those areas of activity that best reflect their specialization and thus characterize a unique regional identity.

In this process, the efficiency of the regional authorities and their awareness of the existing competitive advantages of the region and the opportunities for their expansion and development, the ability to determine, position, develop and use them in practice in order to achieve socio-economic and innovative growth of the region and indicative increase the standard of living of the population. At the same time, the implementation of this scenario is possible only on the basis of a close mutually beneficial relationship between all areas of the region's economy and all participants in the regional economy. Therefore, any scientific research in the field of

smart specialization of regions a priori has a high level of relevance.

The smart specialization approach involves incorporating local development plans into regional strategies and incorporating regional development plans into higher-level strategies such as a state regional development strategy.

Innovation plays a critical role in integrating the efforts of all sectors to make societies and territorial economic systems more competitive and sustainable in the face of globalization. High-quality regional development solutions are not always effective, as the effectiveness of a solution often depends not only on its quality, but also on its acceptance by key stakeholders. If the quality or acceptability of a decision is zero, then there will be no effects from applying that decision. Therefore, if the quality of the solution is the most important factor for policy makers, then acceptability is the predominant factor for practitioners and regional development stakeholders.

The level of innovative and sustainable development of the economies of the regions of Eastern Europe achieved today is, to put it mildly, insufficient, which leads to the low economic

efficiency of the economic processes taking place in the regions of the country and the inability of the regional authorities on this basis to provide decent conditions for integrated social development and protection and environmental protection. the security of his area of residence. At the same time, the development of all spheres of economic activity, represented in the economic structure of the region, is a desirable direction of activity, but it is impossible under the current crisis conditions of economic development. That is why the question arises of the need for a thorough choice of those areas of economic activity in the region, which, firstly, are a priority for its development in a strategic plan, and, secondly, for their implementation within a certain territory, all the necessary resources are already available today and future (material, intellectual, temporary, image, etc.). In such conditions, an important direction of successful regional policy should be the orientation of power structures towards the introduction of the principles of smart specialization.

The main purpose of the study is to model the prospects for sustainable development of the region due to smart specialization in the system of ensuring innovative security. At the same time, the structure of the article provides for a study of the literature, a description of the methodology used in the work, the presentation of the results of the study and their discussion, and the formation of appropriate conclusions.

The innovativeness of this study lies in the fact that the calculations carried out are to reveal those components and characteristics of the educational, scientific and industrial activities of the region, which in the future will allow the regional authorities to better potentiate their activities.

2. LITERATURE REVIEW

The smart specialization approach involves incorporating local development plans into regional strategies and incorporating regional development plans into higher-level strategies such as a state regional development strategy. Innovation plays a critical role in integrating the efforts of all sectors to make societies and territorial economic systems more competitive and sustainable in the face of globalization. This has become the focus of science.

There is no single vision of the problems of smart specialization in the system of sustainable development of the region. However, most scientists [1, 2] argue that the smart specialization of the region is the most effective of the tools. At the same time, it is quite important to identify those priority areas of activity and sectors of the economy that have the highest level of potential for regional innovative development and on the basis of which it is advisable to implement smart specialization projects. In addition, it is quite important, within the framework of each priority sector, to carry out a justification of those measures, the implementation of which will allow achieving the goals proclaimed in the regional development strategy in a shorter time and with the least expenditure of resources.

For example, in comparison, let's take the scientific publication of Bashynska and Dyskina [3], who also worked in the field of application of modern technologies for regional development, considered how it is possible to change the system for ensuring the sustainable development of the region through the use of modern digital technologies. However, we believe that one of these steps should be the use of smart specialization.

At the same time, as noted by another group of scientists [4, 5], the region's capabilities for the rapid innovative development of a particular type of economic activity are different, and this should also be taken into account when justifying the direction of the region's smart specialization. And here it is important to understand that it is inappropriate and economically makes an innovative breakthrough. Therefore, in order to implement smart specialization projects, countries first of all need to clearly define those areas of activity that have the highest prospects for rapid innovative growth because they are innovatively capacious and investment attractive. We agree with this and therefore we cannot cover all activities. So, we should focus only on those related to innovation security.

A significant number of studies consider smart specializations in the organization of regional policy in individual regions and countries. For example, Kaivo-oja et al. [6] considered smart specialization in the context of Finland's sustainable regional development. Comparing this study in comparison with ours, it should be noted that we also focus our attention in the study of a particular region.

As noted by Lošonczi et al. [7], there is a close relationship between the sustainable development of the region and ensuring its security, and we cannot but agree with this. As the authors note, the basis of the specifics of smart specialization of regions should be a high level of security. And this conclusion is well founded.

Most scientists also consider sustainable development and smart technologies in the context of increasing tourist attractiveness as the basis for investment security [8-10]. According to them, digitalization processes encourage the use of an innovative approach in the field of tourism, aimed at improving the service sector, improving professional skills in the industry, overcoming its seasonality, and diversifying the tourism product. To achieve this, one should resort to the use of the smart method aimed at generating the desired and planned result. However, in our opinion, not only tourism should be considered in an innovative context. Science has a great influence on the region's innovation security, too.

At the same time, based on the results of an expert review of scientific and practical literature, we came to an intermediate conclusion that the problem of modeling the prospects for sustainable development of the region through smart specialization in the innovation security system still remains.

3. METHODOLOGY

The methodological basis of the article is a set of methods of scientific knowledge, methods, and techniques used in the research process. The theoretical basis of the article is the fundamental provisions of the theory of sustainable development, system analysis, regional development, the scientific works of scientists on the issues of ensuring the innovative security of the region, the rationale for using the smart specialization tool at the regional level, systematizing the practical experience of implementing smart specialization of the region.

The method of comparing the regions of a single country was also applied to select the optimal region in accordance with our topic. However, the main method of our methodology is the correlation-regression analysis method, which was applied to carry out the simulation. The task of correlation-

regression analysis is the construction and analysis of an economic and mathematical model of the regression equation (correlation equation), which reflects the dependence of the resultant feature on several factor features and gives an estimate of the degree of connection density. Using this method, it is possible to simulate the influence of indicators of the educational and scientific basis of innovative development and innovative activity of subjects of the business environment of the region on the resulting indicators in order to determine the favorableness of the implementation of smart specialization. This method is actively used in various econometric models. It should be noted that the correct application of correlation methods makes it possible to understand the deep essence of the processes of interconnections. Correlations are not found in every particular case, but on average for many cases. Correlations imply the fact that they cannot appear for a single case. To do this, they represent the arithmetic mean of the totality of cases and demonstrate the relationship between them. In these connections between cause and effect, there is no complete correspondence, but only a certain correlation is observed. Features of correlations give rise to two problems in the theory of correlation - to determine the theoretical form of the connection and to measure the density of the connection.

The study will consist in determining the degree of density of the influence of factor indicators on the dynamics of values over time of the resulting indicator, which will be carried out using the procedures of correlation-regression analysis. Those factor indicators for which, according to the simulation results, the greatest quantitative impact on the change in each resulting indicator will be established, should be chosen as priorities in the future for the allocation of resources of all types and sources of financing, which should ensure the sustainable development of the region and bring it closer to the implementation of smart specialization. Gross regional product, gross regional product per person, region's available income, and region's available income per person were chosen as performance indicators.

4. RESULTS OF RESEARCH

Therefore, to start presenting our research results, it should be noted that the choice fell on one of the countries of Europe and its regions. Ukraine and its regions were taken into account. What is the reason for this choice, other than the difficult situation today? The answer is simple: firstly, in none of the studied regions for the period up to 2022, the sustainable development strategy was aimed at finding and implementing smart specialization, which became one of the factors that slowed down the processes of economic stabilization and overcoming the crisis; secondly, starting from 2021, the regions of Ukraine recognized the relevance and expediency of a thorough establishment of innovative security of their activities and carried out a further focus on smart specialization. These facts demonstrate that these regions should be assisted in introducing smart specialization and innovation security.

In general, today the level of scientific, intellectual, innovative development and resource provision of Ukrainian regions a priori does not meet even the basic requirements of the potential ability to achieve the boundaries of successful implementation of smart specialization in the near future. However, it is important for the study to choose the most

favorable region and, on the basis of this, to offer their ideas on how this can be improved. Therefore, from all regions of the country, one should choose those that at least now have favorable conditions for the implementation of reasonable specialization (Table 1).

Table 1. Regions with the most favorable conditions for the implementation of smart specialization

Regions		Criteria	
Lviv Region	Road transport logistics	Medical field	Tourist attraction
Odessa region	Recreation and access to the sea	Research base	Extractive industry
Kharkiv region	International aid projects	Scientific environment	Light industry
Kyiv region	Information Technology	An indicative number of scientific institutions	Innovative potential

It should be noted that the ability of the region to effectively implement smart specialization in the system for ensuring sustainable development and innovation security should, in our opinion, be associated with the fulfillment of four basic requirements or conditions regarding the presence in the region:

1. A powerful educational sphere capable of meeting the needs of the labor market of the region in highly qualified professional personnel and training competitive scientific personnel, motivated and capable of developing innovative solutions, technologies, and products.

2. Competitive branch scientific sphere, the results of which are guided by world scientific achievements and are directed to the innovative growth of economic entities in the industry.

3. An innovatively open business environment, the organizational structure of which has its own innovatively wealthy research department, which simultaneously cooperates on a partnership basis with educational or scientific organizations of the city and region in order to ensure a continuous process of innovative renewal of all areas of the enterprise.

4. Sufficient volumes of investment and financing of the educational and scientific fields of activity in the region, creation of a competitive scientific environment.

The systematization of the assessments carried out according to four conditions made it possible to build a generalized matrix of prerequisites for the implementation of smart specialization projects and select the main region that we will analyze in this article (Table 2).

It is quite important to choose the region that now has the greatest grounds for rapid innovative growth and will become an example to follow in the future with successful experience in implementing smart specialization projects. It was found that the Kyiv region occupies the leading position among the regions of Ukraine in terms of sustainable development and innovation security.

The highest level of communication density among indicators of the educational block for the Kyiv region was set for the indicator of the number of students in educational institutions. During the study period, the value of the indicator increased from 135.5 thousand people in 1996 to 150.4 thousand people in 2020, with a maximum level of 258.5 thousand people observed in 2007 [11]. At the same time, the highest level of influence is a factor indicator (very close relationship) determined by the dynamics of the volume of the

region's available income (Figure 1). According to the following figures, the x and y axes represent the change in the average value of one attribute depending on the other, according to the proposed methodology.

At the same time, the influence of the number of students of educational institutions on the dynamics of the gross regional product in terms of density is moderate. The established communication density can be explained by the rather high

activity of students in the labor market of the region (at the same time, a growth factor and constraint on the process of professional development of a young person) and its indicative potential for innovative creativity. However, the realization of this potential in practice will largely depend on the quality of the education received and the opportunities actually provided to young professionals by the business environment of the region.

Table 2. Matrix of prerequisites for the implementation of smart specialization in the regions

Regions	Availability of a powerful educational sphere	Availability of a competitive branch scientific sphere	Availability of innovative open business environment	Availability of sufficient investment and funding for the scientific sphere
Lviv Region	Favorable	Favorable	Satisfactory	Satisfactory
Odessa Region	Satisfactory	Favorable	Satisfactory	Satisfactory
Kharkiv Region	Favorable	Favorable	Favorable	Satisfactory
Kiev Region	Favorable	Favorable	Favorable	Favorable

Summarizing the conclusions obtained from the results of the assessment of the degree of influence of the indicators of the educational block on the resulting performance indicators of the region, it is possible to focus the attention of the regional authorities on the expediency, under the current conditions of the functioning of the region, to maximize efforts to increase or at least maintain the number of students in the educational institutions of the region. Thus, the region will create a basis for sustainable development, as well as prerequisites for ensuring innovation security.

An assessment of the degree of influence of the indicators of the scientific block on the resulting features selected in the study made it possible to establish that the dynamics of the number of graduate students studying in the region does not affect the change in the volume of the resulting indicators of the functioning of the region. At the same time, the number of graduate students increased from 3,734 in 1996 to 4,449 in 2022, with a peak of 5,107 in 2010. Given the fact that graduate students have always been the most active part of the scientific community (they are young ambitious and striving for a scientific degree, therefore they are constantly in scientific search), the findings made us think about the quality and effectiveness of postgraduate training programs in the region and the country as a whole.

As an example of a demonstration, let's take the indicator «Number of PhD researchers involved in research and development in the region» and, as a sample, its impact on the volume of gross regional product (Figure 2).

Of course, each factor indicator should be analyzed according to the impact on the change of each resulting indicator. To demonstrate, let's simulate the indicator "Number of PhD researchers involved in research and development in the region" of the impact on the amount of available income in the region (Figure 3).

Figure 2. Modeling the impact of the number of PhD researchers involved in research and development in the region in the amount of its gross regional product (developed by the authors)

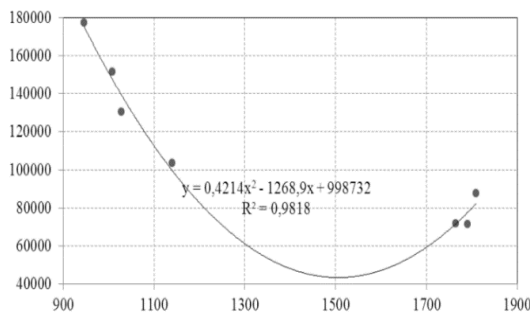
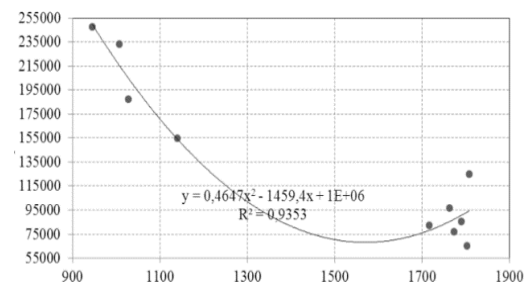
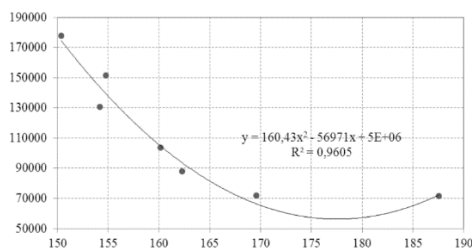


Figure 3. Modeling the impact of the number of PhD researchers involved in research and development in the region in the amount of its available income (developed by the authors)

The number of indicators selected to assess the third block, that is, the innovative activity of the region's business environment, indicates the concentration of great opportunities for the socio-economic and innovative growth of the region at this level. At the same time, it should be noted that in the course of the study it was found that the dynamics of the volume of the gross regional product of the Kyiv region is quite strongly influenced by the change in the values of factor indicators, namely, the amount of expenses of industrial enterprises for research and development in the region (Figure 4).

Similarly, for the dynamics of the volume of available income, as an example, we present the very factor indicator that, in our opinion, best characterizes the third block (Figure 5).

Figure 1. Modeling the influence of students in educational institutions of the region in the amount of its available income (developed by the authors)



Of course, there are other indicators for this block, however, in order not to accumulate articles and invest in the indicated volumes, it was necessary to immediately demonstrate the key indicators as an example. Therefore, it is precisely to increase the values of the indicator of the number of expenses of industrial enterprises for research and development in the region that the efforts and resources of regional authorities should be directed in consolidation with other stakeholders in order to increase the level of innovativeness of the regional economy and acquire opportunities for implementing smart specialization projects. Businesses should be encouraged to innovate, this will bring new investments, and they, in turn, to sustainable development. Funds should be allocated only for those developments that are indicative for the socio-economic development of the region in which the enterprises operate.

Skipping a demonstration of all key indicators, a summary of the results of the study is given in Table 3.

It should be noted that this matrix may in the future become the basis for regional authorities to make managerial decisions on the implementation of certain organizational measures, which will result in a reboot of approaches to ensuring sufficient rates of sustainable development in the region and its innovation security. Only on this basis can one come closer to understanding the feasibility of implementing those activities, the implementation of which will make it possible to realize the goals and directions of smart specialization.

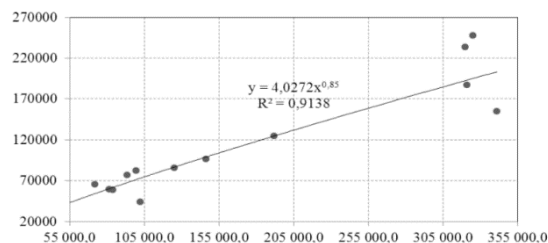


Figure 4. Modeling the influence of the indicator of innovative activity of the business environment of the region in the amount of its gross regional product (developed by the authors)

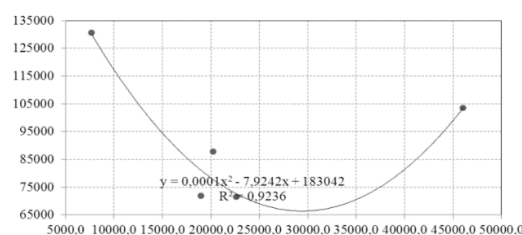


Figure 5. Modeling the influence of the indicator of innovative activity of the business environment of the region in the amount of its available income (developed by the authors)

Table 3. Matrix of results regarding the density of the influence of indicators on the dynamics of the values of the resulting indicators

Factor indicator	Gross regional product	Gross regional product per person	Available income	Available income of the region per person
Number of PhD researchers involved in research and development in the region	0.93	0.94	0.98	0.98
Number of educational institutions	0.57	0.58	0.78	0.79
Number of students in educational institutions	0.74	0.75	0.96	0.95
Implementation of innovations in industrial enterprises	0.86	0.85	0.68	0.67
Fundamental research and development expenses	0.88	0.88	0.82	0.83
Applied research and development expenses	0.96	0.96	0.65	0.64
Expenses for the implementation of scientific and technical (experimental) developments	0.94	0.94	0.63	0.56
Number of employees involved in research and development	0.91	0.92	0.95	0.95
The number of expenses of industrial enterprises for research and development	0.91	0.91	0.76	0.75

5. DISCUSSIONS

Discussing the results of the study, it should be noted that this issue is considered not only in accordance with the chosen methodology. For example, as noted by Bresciani et al. [11] and Trippel et al. [12], the regional economy has an indicative influence on the reasonable specialization of the region and its sustainable development. So, as noted by the authors [13-16], the regional economy is a rather complex multifactorial system, the effectiveness of which depends on the totality of historical, cultural, natural and climatic, demographic, socio-economic, resource, management, information and knowledge and other potentials. Each of these potentials forms the basis for the prospective development of a particular area of activity or industry in the region, provides a certain level of competitiveness at the national and international levels and creates the potential for strategic development and

opportunities to improve the level and quality of life of the population. We agree with this, however, the choice in our case of innovative security is due to the concretization of a number of indicators and its consideration at a more detailed level in this particular area.

As noted Singh et al. [17] and Kryshchanovych et al. [18], smart specialization can determine the optimal use of the region's innovative potential by maximizing the adaptation of possible directions for the development of science and education to their existing socio-economic conditions. Therefore, it is necessary to direct state and regional support to those initiatives, events, and projects that allow increasing the level of reasonable specialization of the region, and the development and introduction of new technologies and high-value-added products into production. We agree with this and it makes sense, we just wanted to add that not only potential is important here, but also security.

In general, we would like to add to the discussion that our study has a number of differences from the existing ones. It consists of the formation of a model of the influence of individual indicators on the sustainable development of the region and a matrix of results regarding the density of the influence of indicators of individual areas of activity on the sustainable development of the region. This, in turn, will form the basis for making managerial decisions on the implementation of certain organizational measures to ensure the sustainable development of the region and its innovative security. And their implementation will bring us closer to choosing the right strategy for the development of smart specialization.

It should be noted that smart specialization is not a “magic wand”, when the intention to introduce it is announced, everything will immediately change for the better. The basis for achieving the effectiveness of procedures for introducing smart specialization should be a clear understanding of the content of this management technology, the features of its use at the level of a particular region, and the specific limits of its implementation. It is also important to see and determine the prospects for the implementation of the goals of smart specialization proclaimed at the regional level.

6. CONCLUSIONS

The results of the study on the density of the influence of various factors (characteristics of the functioning of the educational and scientific components, indicators of the innovative activity of the business environment of the region) on the dynamics of changes in time of the performance indicators of a particular region should become a guideline for regional authorities when developing an implementation plan and relevant roadmaps for implementing practice strategies for the smart specialization of sustainable development of the region. The practical value of the calculations is to reveal those components and characteristics of the educational, scientific, and industrial activities of the region, the direction of efforts and resources for the activation of which will allow the region to obtain a guaranteed positive result due to the growth of the gross regional product and disposable income of the region due to a significant increase in innovation security. Consequently, having these results in hand, regional authorities will be able to coordinate their efforts and optimize the flow of material and intangible resources precisely to the components that will certainly contribute to innovative growth and sustainable development. Thanks to this, at the regional and national levels, in the strategic plan, there will be a real opportunity to save time and resources while achieving a synergistic effect through the dynamics of growth in the values of the final indicators of the functioning of the regions and an indicative increase in the level and quality of life of the country's population. However, to implement this desired scenario in practice at the regional level, effective management procedures and organizational approaches, effective smart specialization projects, adapted to the conditions of possible innovative growth and security existing in the region, must be developed.

The economies of the regions of many Eastern European countries have been in crisis for quite a long time, and specialists still cannot find effective and efficient ways to stabilize the situation. The way out of this some states should be to attract indicative amounts of investment in the real sector

of the economy, however, given the economic and legal instability in the country, investment flows from other regions of the world are practically zero, and the amount of public and private investment is not enough to stabilize the economic situation. An important, if not the main, condition for the improvement of the regional economy and the acquisition of indicators of competitiveness by it should also be considered human capital, so efforts should be made to systematically accumulate it and maximize the involvement of talents in the processes of development of the regional economy. However, low wages, lack of sufficient jobs, social insecurity, and poor living standards in the regions may encourage the most professionally mobile and gifted young people capable of creating innovations to leave the regions in search of a better life.

The study has a limitation, which is largely due to the inability to cover the approximate number of regions. Each region is individual and requires a separate approach.

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