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RESEARCH ON FACTORS OF COMPETITIVENESS OF UKRAINE

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ДОСЛІДЖЕННЯ ФАКТОРІВ КОНКУРЕНТОСПРОМОЖНОСТІ УКРАЇНИ

In the context of globalization and dynamic integration processes, the problem of the development of the competitiveness of state remains one of the conditions for its successful functioning on the international scene. At the present stage, the level of technological development and innovative potential of the country, which shape its competitiveness, is becoming increasingly significant. Despite European integration processes, an increase in exports and an increase in the IT sector's share in GDP, Ukraine loses its position in competitiveness ratings. Therefore, the purpose of this article is to investigate the factors that shape the competitiveness of Ukraine in the world economic space. Accordingly, a review of recent studies was conducted to clarify the interpretation of the category of competitiveness of state, and a profound analysis of factors that affect competitiveness of Ukraine using factor analysis of the Global Competitiveness Index was made. As a result of the analysis, the interpretation of the competitiveness of state was expanded by identifying the importance of human capital in its formation. On the basis of the conducted factor analysis of the Global Competitiveness Index of Ukraine in 2014-2018, significant human capital and innovative potential have been identified, what created the basis for the further investigation of these factors using the Global Innovation Index by a similar method and for the same period. The analysis showed that the innovative results of Ukraine are more efficient than innovative resources. In view of this, it was proposed to ensure the implementation of the results of the innovation process to the development of innovative resources, in particular for development of infrastructure and experience in business and in the market, what will increase the level of innovation of the country's economy and living standards of the population in future. In addition, it was established that the management of the implementation of innovative results for the development of Ukraine's competitiveness should take place at all its stages through a functional approach within the framework of the state program of development of the competitiveness of state on an innovative basis.

В умовах глобалізації та динамічних інтеграційних процесів проблема розвитку конкурентоспроможності держави залишається однією з умов її успішного функціонування на міжнародній арені. На сучасному етапі дедалі більшої ролі набуває рівень технологічного розвитку та інноваційний потенціал країни, які і формують її конкурентоспроможність. Незважаючи на євроінтеграційні процеси, збільшення обсягу експорту та зростання частки ІТ-галузі у ВВП, Україна втрачає позиції у рейтингах конкурентоспроможності. Тому метою даної статті є дослідження факторів, які формують конкурентоспроможність України у світовому економічному просторі. Для цього було проведено огляд останніх досліджень з метою уточнення трактування категорії конкурентоспроможності держави та здійснено безпосередній аналіз факторів, які впливають на конкурентоспроможність України за допомогою факторного аналізу Індексу глобальної конкурентоспроможності. У результаті аналізу було розширено трактування конкурентоспроможності держави за допомогою виокремлення вагомості людського капіталу у її формуванні. На основі проведеного факторного аналізу Індексу глобальної конкурентоспроможності України у 2014-2018 рр. було виявлено значний вплив людського капіталу та інноваційний потенціал, що створило підґрунтя для дослідження цих факторів за допомогою Глобального індексу аналогічним методом та за аналогічний період. Проведений аналіз засвідчив, що інноваційні результати України є значно якіснішими за інноваційні ресурси. Зважаючи на це, було запропоновано забезпечити залучення результатів інноваційного процесу до розвитку інноваційних ресурсів, зокрема інфраструктури та досвідченості у бізнесі та на ринку, що сприятиме подальшому підвищенню рівня інноваційності економіки країни та рівня життя населення. Крім цього було встановлено, що управління залучення інноваційних результатів для розвитку конкурентоспроможності України має відбуватися на усіх його етапах за допомогою функціонального підходу у рамках державної програми розвитку конкурентоспроможності держави на інноваційних засадах.

Keywords: *state's competitiveness; innovational component; human capital; factor analysis; resources; results.*

Ключові слова: *конкурентоспроможність держави; інноваційна складова; людський капітал; факторний аналіз; ресурси; результати.*

Problem statement. The increase and development of the competitiveness of Ukraine is widely investigated by domestic scientists. At the same time, there is no clear identification of the factors that affect the competitiveness of Ukraine the most. Investigation of such factors is an important aspect, since obtained results will enable to optimally direct, allocate and use resources for the development of competitiveness of Ukraine. The distinction of priority factors of influence on the competitiveness of the state can be the basis for the formation of the appropriate state strategy in the future.

Analysis of recent research and publications. The one of main fundamental works devoted to the state's competitiveness is «The Competitive Advantage of Nations» by Michael Porter, in which the nation's competitiveness is its ability to generate innovation and improvement [1]. Porter's classic model does not take into account the significance of human capital as an innovative source of national competitiveness. As a result of the Fourth Industrial Revolution, human became the cause and at the same time the creator of technological developments. Therefore, foreign scholars, in instance S. Silvanto, consider the importance of improving the image of the country to attract highly qualified specialists, which is a prerequisite for the growth of competitiveness [2]. In turn, H. Said believes that an increase in the proportion of educated people in developing countries will contribute to increased productivity and competitiveness [3]. S. Thore, on the basis of the Global Competitiveness Index, estimates the impact of the costs and tasks of the social sphere on ensuring sustainable competitiveness of the state [4]. Ukrainian scientists Okara D., Chernyshev V., and Shynkarenko L. [5], Hvorost T. [6] and Novikov V. [7] consider Ukraine's place in the international ranking of Global Competitiveness. As a result, the presented researches considered as an efficient tools state reforms, improvement of the investment climate, facilitating business sophistication and infrastructure in order to develop Ukraine's competitiveness. Okhota V. [8] examined the position of Ukraine in the Global Competitiveness Ranking and Ease of Business Ranking, and highlighted the importance of internal reforms and improvement of business environment for increasing of competitiveness. Zakharchenko V. and Zakharchenko S. [9] consider the importance of financial provision of the regions of Ukraine in the formation of international competitiveness according to the IPM methodology. The authors maintain that proper development of the financial system and investment sphere can ensure the growth of the competitiveness of business and the country as a whole. Melnyk A. and

Chikalo I, with the help of an optimization model, demonstrate that efficient management of the resource allocation in the national economy, taking into account tangible and intangible resources for the creation of a unit of GDP, will significantly increase competitiveness of Uktraine [10]. Accordingly, foreign scholars emphasize the importance of human capital in the development of the competitiveness of the state, meanwhile, domestic scientists pay more attention to the role of the state in the investigated process, which consists in carrying out state reforms, improving the investment climate, improving the distribution of financial resources, and so on. The importance of human capital in the development of competitiveness is linked, on the one hand, to increased productivity, and, on the other hand, to the development of innovations and innovative solutions in science and technology. In view of this, the competitiveness of state can be determined as the ability of its human capital with the help of available resources to ensure sustainable innovation development of the economy and growth of living standards.

Due to the brain drain and large-scale emigration of the Ukrainian population, which exacerbates the demographic situation, while at the same time high level of specialists' qualification, as well as active civic attitudes and development of leadership among young people, it is expedient to consider human capital as one of the main factors of the competitiveness of Ukraine.

Research objective. The objective of this article is to identify the factors that mostly affect the development of competitiveness of Ukraine using the factor analysis of the Global Competitiveness Index, as well as to maintain the role of human capital in the process of increasing competitiveness of Ukraine on an innovative basis.

Presentation of research. In order to increase the competitiveness of Ukraine on the basis of an innovative component, it is necessary to analyze the influence of other components on the level of competitiveness. It is therefore advisable to consider the Global Competitiveness Index, which is compiled annually by the World Economic Forum and evaluates the state's ability to ensure long-term sustainable economic growth and the well-being of its citizens. Evaluation of the twelve pillars that determine competitiveness of state is used for obtaining overall index value (tab. 1). In 2018, a new methodology for calculating the index was developed, it that takes into account the changes resulting from the Fourth Industrial Revolution, and redirects its essence to human capital and the state's ability to generate and commercialize innovation.

Table 1.
Pillars of Global Competitiveness Index (formed on the basis of 11, 12)

List of pillars till 2018	Pillars in GCI 4.0 methodology
Overall Index and its pillars values – scale from 1 (the smallest) to 7 (the biggest)	Overall Index and its pillars values – scale from 1 (the smallest) to 100 (the biggest)
Basic requirements	Enabling Environment
- institutions	- institutions
- infrastructure	- infrastructure
- macroeconomic environment	- ICT adoption
- health (life expectancy) and primary education	- macroeconomic stability
Efficiency enhancers	Human Capital
- higher education and training	- health (life expectancy)
- goods market efficiency	- skills
- labour market efficiency	Markets
- financial market development	- product market
- technological readiness	- labour market
- market size	- financial system
Innovation and sophistication factors	- market size
	Innovation Ecosystem
- business sophistication	- business dynamism
- innovation	- innovation capability

The first edition of the Global Competitiveness Index was computed over three sub-indexes, each of which was crucial to a specific type of economy. In particular, the basic requirements were decisive for the factor-driven economies, the factors that increase efficiency - for the efficient-driven economies, and innovation factors for – the innovation-driven economies [11]. The new edition of the GCI – GCI 4.0, index distinguishes four sub-indexes that more fully reveal the foundations of state competitiveness, taking into account human capital [12]. Accordingly, the overall value of the Global Competitiveness Index is calculated as a simple arithmetic mean of twelve components.

In 2014, Ukraine ranked 76th among 144 countries, in 2018 it ranks 83rd among 140 countries [12, 13]. In order to assess the competitiveness of Ukraine it is advisable to consider the value of the index and its pillars for 2014-2018 (tab. 2). Since the rating scale has been changed in 2018, it is necessary to calculate the correction to convert the values of 2018 to the value of the previous scale, since the last report demonstrates that the index value in 2018 increased by 3.1 units [12]. In addition, after analyzing the elements of each component, a certain generalization was made in the essentially identical pairs of components.

Table 2.
Overall value of Global Competitiveness Index of Ukraine in 2014-2018 (formed on the basis of 11, 12)

Value	Years			
	2014	2017	2018	2018 corrected
GCI (I)	4,1	4,1	57,1	4,3
Institutions (P_1)	3	3,2	46,3	3,5
Infrastructure (P_2)	4,2	3,9	70,1	5,3
ICT adoption (P_3)	3,5	3,8	51	3,9
Macroeconomic stability (P_4)	4,1	3,5	55,9	4,2
Health (P_5)	6,1	6	72	5,5
Skills (P_6)	4,9	5,1	68,9	5,2
Product market (P_7)	4	4	55,3	4,2
Labour market (P_8)	4,1	4	59,5	4,5
Financial system (P_9)	3,5	3,1	48,7	3,7
Market size (P_{10})	4,6	4,5	62,7	4,8
Business dynamism (P_{11})	3,7	3,7	55,3	4,2
Innovation capability (P_{12})	3,2	3,4	39	3,0

Correction of 2018 values was calculated according to correlation of values:
- GCI 2017 value = 4,1;
- GCI 2017 value in GCI 4.0 scale = 57 – 3,1 = 53,9;
- GCI 2018 value = 57;
- GCI 2018 value in previous scale = (57*4,1)/53,9 = 4,3.

Correction for any value in GCI 4.0 scale =
= GCI 2018 value * (4,1/53,9) = GCI 2018 value * 0,76.

To identify the impact of each pillar of the Global Competitiveness Index on its overall value, it is advisable to apply factor analysis using the elimination method [14, pp. 31-58]. The Index model is an arithmetic mean of twelve components:

$$I = \frac{\sum_{i=1}^{12} P_i}{12}, \text{ where} \quad (1)$$

I – GCI value;
P_i – value of each pillar [12].

Accordingly to formula 1 we conduct a factor analysis of the Global Competitiveness Index of Ukraine. Using elimination method, we gradually replace the components of the base 2014 with the values of 2018 in the formula (tab. 3).

Table 3.
Factor analysis of Global Competitiveness Index of Ukraine in 2014-2018 (formed on the basis of 11, 12)

I	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9	P_{10}	P_{11}	P_{12}
4,1	3	4,2	3,5	4,1	6,1	4,9	4	4,1	3,5	4,6	3,7	3,2
4,1	3,5	4,2	3,5	4,1	6,1	4,9	4	4,1	3,5	4,6	3,7	3,2
4,2	3,5	5,3	3,5	4,1	6,1	4,9	4	4,1	3,5	4,6	3,7	3,2
4,2	3,5	5,3	3,9	4,1	6,1	4,9	4	4,1	3,5	4,6	3,7	3,2
4,3	3,5	5,3	3,9	4,2	6,1	4,9	4	4,1	3,5	4,6	3,7	3,2
4,2	3,5	5,3	3,9	4,2	5,5	4,9	4	4,1	3,5	4,6	3,7	3,2
4,2	3,5	5,3	3,9	4,2	5,5	5,2	4	4,1	3,5	4,6	3,7	3,2
4,2	3,5	5,3	3,9	4,2	5,5	5,2	4,2	4,1	3,5	4,6	3,7	3,2
4,3	3,5	5,3	3,9	4,2	5,5	5,2	4,2	4,5	3,5	4,6	3,7	3,2
4,3	3,5	5,3	3,9	4,2	5,5	5,2	4,2	4,5	3,7	4,6	3,7	3,2
4,3	3,5	5,3	3,9	4,2	5,5	5,2	4,2	4,5	3,7	4,8	3,7	3,2
4,4	3,5	5,3	3,9	4,2	5,5	5,2	4,2	4,5	3,7	4,8	4,2	3,2
4,3	3,5	5,3	3,9	4,2	5,5	5,2	4,2	4,5	3,7	4,8	4,2	3,0

Now the effect of each component on the total index value can be traced. For this purpose, the effect of each pillar is displayed as the difference between the successively received values of the index (tab. 4).

Table 4.
Impact of each pillar on the overall value of Global Competitiveness Index of Ukraine in 2014-2018

Pillar	Value of difference
Enabling Environment	
Institutions (P_1)	0,04
Infrastructure (P_2)	0,09
ICT adoption (P_3)	0,03
Macroeconomic stability (P_4)	0,01
Sum of differences	0,18
Human capital	
Health (P_5)	-0,05
Skills (P_6)	0,03
Sum of differences	-0,02
Markets	
Product market (P_7)	0,02
Labour market (P_8)	0,04
Financial system (P_9)	0,02
Market size (P_{10})	0,01
Sum of differences	0,08
Innovation ecosystem	
Business dynamism (P_{11})	0,04
Innovation capability (P_{12})	-0,02
Sum of differences	0,02
Overall sum of differences	0,26
Difference between overall value of GCI	0,2
Summary impact of all pillars (undistributed remainder)	0,06

As a result, the greatest positive impact on the overall index value has an increase in the quality of the infrastructure by 0,09 units in a enabling environment, of skills by 0,03 units in human capital, of the labor market by 0,04 units in the markets, and of the dynamism of the business by 0,04 units in an innovative ecosystem. At the same time, the negative impact on the value of the Index had a deterioration of health by 0,05 units and of innovation potential by 0,02 units. The decrease in life expectancy in mostly is related to military actions in the East of Ukraine, the decline of innovation potential - with the emigration of highly skilled personnel and a reduction in research and development costs. In addition, there is an undistributed remainder that occurs during elimination and reflects the total impact of all the components together. Since its proportionally distributed value is too small and does not affect the values of the differences of the pillars, it should be omitted.

Because of the significant positive impact of skills of human capital, existing infrastructure, labor market and business dynamics, it is possible to reduce the negative impact of a decrease in health pillar due to improving Ukraine's innovation potential. As a result, increasing the innovation potential will contribute to the development of other components of the index.

One of the methods of assessing the level of innovation potential of the state is the Global Innovation Index. The Global Innovation Index is an index that measures the innovative potential of different economies and is calculated annually by the World Intellectual Property Organization (WIPO) [15]. This indicator is the average of two sub-indexes: Input sub-index and Output sub-index [15]. In turn, each sub-index takes into account specific parameters of the economy (fig.1).

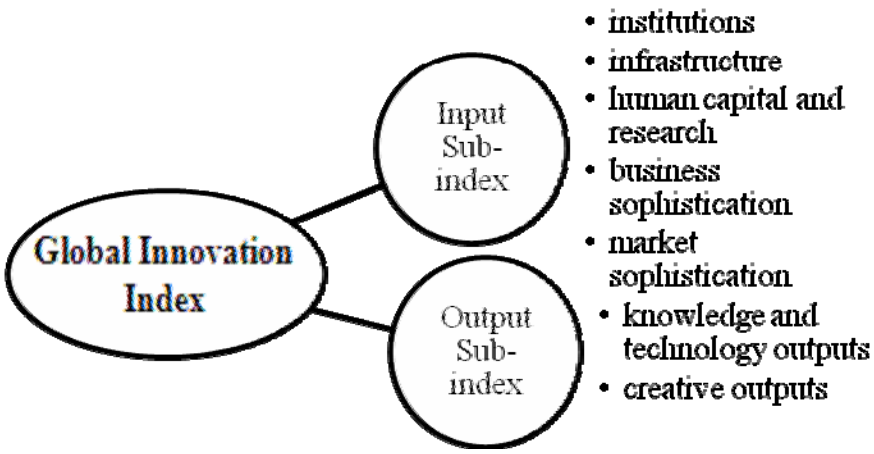

Figure 1. Structure of Global Innovation Index [15]

In 2018 Ukraine ranked 43rd position in comparison with the 63rd position in 2014 by the overall index [15, 19]. It should be noted that Ukraine ranked 35th in the Output sub-index, while the Input sub-index ranked 75th [15, 19]. Thus, the Ukrainian innovation sector produces considerably better results than input resources. Let's consider in detail the components of each sub-index (fig. 2).

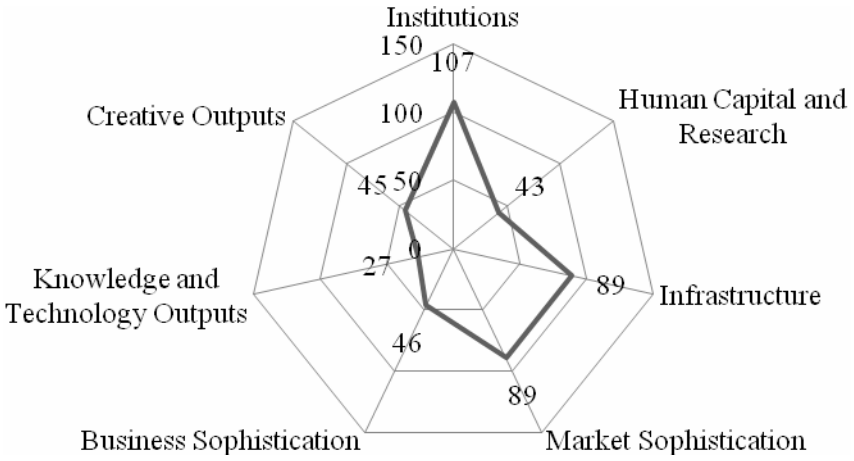

Figure 2. Rankings of the pillars of the sub-indices of the Global Innovation Index of Ukraine in 2018 [15]

Consequently, in the Output sub-index educational and technological results hold the highest rank, in the Input sub-index – human capital and research, which are determined as strong advantage in the group of countries with below the average income level.

In addition, creative results and business experience are also strong. The absolute strong advantage is the innovation efficiency ratio, which over the past 5 years exceeds the average in the overall rating – 0,9 units in Ukraine and 0,61 units in the world average [15-20] (fig.3).

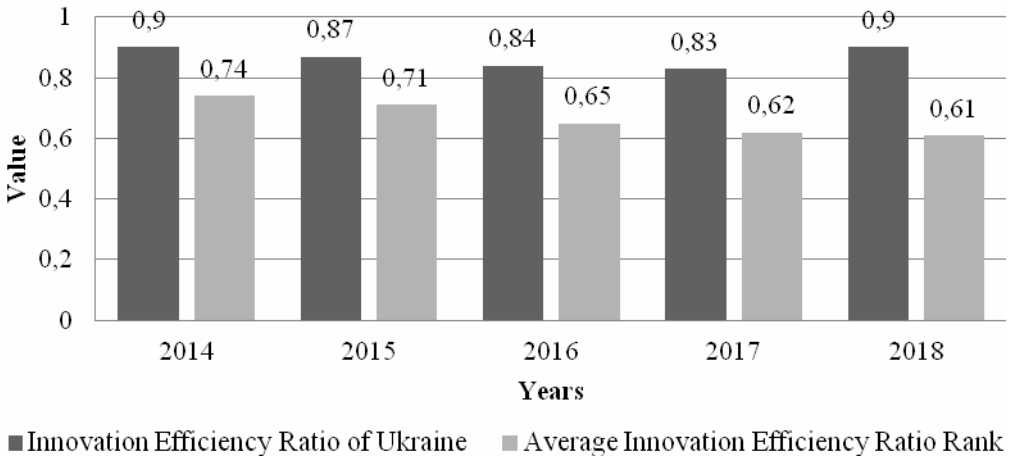

Figure 3. Innovation efficiency ratio of Ukraine and average Innovation efficiency ratio in 2014-2018 [15-20]

To determine the impact of each individual component of the index it is expedient to use factor analysis similarly like before. The value of the Global Innovation Index is calculated by the formula:

$$GII = \frac{\frac{\sum_{i=1}^{5} I_i}{5} + \frac{\sum_{j=1}^{2} O_j}{2}}{2}, \text{ where} \quad (2)$$

GII – overall value of Global Innovation Index;
I_i – i-th pillar of Input sub-index;
O_j – j-th pillar of Output sub-index [15].

Let's show absolute values of GII and its sub-indexes of Ukraine in 2014 and 2018 (tab.5).

Table 5.
Absolute values of GII and its sub-indices of Ukraine in 2014 and 2018 (formed on the basis of 15, 19)

Indicator	Years	
	2014	2018
Global Innovation Index (GII)	36,26	38,52
Institutions (I_1)	52,9	49,1
Human capital and research (I_2)	36,6	43
Infrastructure (I_3)	27,1	38,1
Market sophistication (I_4)	45,1	42,7
Business sophistication (I_5)	29,1	34,5
Knowledge and technology outputs (O_1)	38,2	36,7
Creative outputs (O_2)	30,6	36,5

Factor analysis is conducted similarly to the previous methodology for the Global Competitiveness Index. We give an appropriate calculation by the method of elimination (tab. 6).

Table 6.
Factor analysis of Global Innovation Index of Ukraine in 2014-2018 (formed on the basis of 15, 19)

GII	I_1	I_2	I_3	I_4	I_5	O_1	O_2
36,28	52,9	36,6	27,1	45,1	29,1	38,2	30,6
35,9	49,1	36,6	27,1	45,1	29,1	38,2	30,6
36,54	49,1	43	27,1	45,1	29,1	38,2	30,6
37,64	49,1	43	38,1	45,1	29,1	38,2	30,6
37,4	49,1	43	38,1	42,7	29,1	38,2	30,6
37,94	49,1	43	38,1	42,7	34,5	38,2	30,6

37,565	49,1	43	38,1	42,7	34,5	36,7	30,6
39,04	49,1	43	38,1	42,7	34,5	36,7	36,5

Similarly, it is necessary to interpret the obtained results. Let's calculate the differences characterizing the influence of each component on the total index value (tab. 7).

Table 7.
Impact of each component on the overall value of Global Innovation Index of Ukraine in 2014-2018

Component	Value of difference
Input Sub-index	
Institutions (I_1)	-0,38
Human capital and research (I_2)	0,64
Infrastructure (I_3)	1,1
Market sophistication (I_4)	-0,24
Business sophistication (I_5)	0,54
Sum of differences	1,66
Output Sub-index	
Knowledge and technology outputs (O_1)	-0,375
Creative outputs (O_2)	1,475
Sum of differences	1,1
Overall sum of differences	2,76
Difference between overall value of GII	2,26
Summary impact of all pillars (undistributed remainder)	0,5

As a result, it was found that improvement of the components of the input sub-index (by 1,66 units) led to a greater increase in the total index value than the improvement of the components of the output sub-index (by 1,1 units) over the 5 years studied. In view of this, it is necessary to provide a mechanism for implementation the results of the innovation process to develop resources, in particular infrastructure, business and market sophistication, what will further increase the level of innovation potential of the country's economy.

Conclusions. Since the analysis of the two indices showed a significant potential of human capital in Ukraine, it is appropriate to involve it in the innovation process in order to ensure the future growth of competitiveness of Ukraine in general. In particular, for the development of competitiveness, it is necessary to involve innovative developments in the form of the results of the innovation process to improve the innovative resources. In order to ensure the implementation of domestic innovations to develop the resources of the innovation process, it is necessary to create an innovative component and ensure its functioning at all stages of the management of the innovation process. According to the task, the most optimal approach is functional. The flexibility of the approach makes it possible to ensure a continuous process of management at all stages [20]. Such mechanism can be implemented through a state program in the regions with the assistance of public organizations, universities, enterprises and other stakeholders for improvement of infrastructure and decentralization of governance. Thus, innovation development will increase competitiveness of state by increasing the competitiveness and innovation potential of enterprises, and improvement the living standards of the population in regions. Such policy will contribute to the development of human capital and the creation of jobs for it, what can have a beneficial effect on the development of the labor market in Ukraine. This research is the basis for future investigations in the direction of forming the stages of the proposed mechanism for implementation of innovative results.

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