РЕГІОНАЛЬНА ЕКОНОМІКА

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COGNITIVE APPROACH TO ANALYSIS OF INVESTMENT ATTRACTIVENESS OF THE REGIONS

Urgency of the research. *The application of the cognitive approach in analyzing and formation of the investment attractiveness of the regions makes it possible to assess the basis-to-target factors characterizing the investment potential of the economic space of a particular territory.*

Target setting. *It is advisable to form cognitive maps of investment attractiveness of the regions taking into account regional factors of social and economic development in order to determine the negative and positive trends of investment activity, as well as priority sectors of development.*

Actual scientific researches and issues analysis. *The Researches of social and economic development of the regions and implementation of simulation modeling are partly covered in the works: Pashkevich M. S., Gorelova G. V., Zakharova E. N., Polyakova O. Y., Drogushova A. K., Duma L. V., Logvin V. M., Parshin Y. I.*

Uninvestigated parts of general matters defining. *In the scientific literature, not enough attention is paid to the peculiarities of cognitive approach application from the standpoint of the cognitive maps of investment attractiveness formation of the regions on the basis of evaluation of factors of different levels of the hierarchy of their social and economic development.*

The research objective. *The article is intended to substantiate the relevance of use of cognitive approach to analyzing the investment attractiveness of the regions based on factors taking into account different levels of hierarchy of their social and economic development*.

The statement of basic materials. *The effectiveness of cognitive approach implementation that analyzes the investment attractiveness of the regions, taking into account the factors of different levels of the hierarchy of their social and economic development is substantiates in the article.*

Conclusions. *The implementation of the cognitive approach in the process of analysis and formation of the investment attractiveness of the regions on the basis of taking into account the factors of different levels of the hierarchy of social and economic development allows to establish and distinguish between negative and positive trends of investment activity, as well as priority development spheres, which should be appropriately taken into account when forming integrated programs providing a favorable investment climate within the defined priorities of social and economic development of the regions*.

Keywords: *cognitive modeling; cognitive maps; investment attractiveness; region.*

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КОГНІТИВНИЙ ПІДХІД ДО АНАЛІЗУ ІНВЕСТИЦІЙНОЇ ПРИВАБЛИВОСТІ РЕГІОНІВ

Актуальність теми дослідження. *Застосування когнітивного підходу при аналізі та формуванні інвестиційної привабливості регіонів дозволяє здійснити оцінку базисних до цільових чинників, що характеризують інвестиційний потенціал економічного простору певної території.*

Постановка проблеми. *Доцільним є формування когнітивних карт інвестиційної привабливості регіонів із врахуванням регіональних чинників соціально-економічного розвитку для визначення негативних та позитивних тенденцій інвестиційної активності, а також пріоритетних галузей розвитку.*

Аналіз останніх досліджень і публікацій. *Дослідження соціально-економічного розвитку регіонів та застосування імітаційного моделювання частково висвітлено у працях: Пашкевич М. С., Горелова Г. В., Захарова Е. Н., Полякова О. Ю., Доргушаова А. К., Дума Л. В., Логвін В. М., Паршин Ю. І.*

Виділення недосліджених частин загальної проблеми. *У науковій літературі не достатньо уваги приділено особливостям застосування когнітивного підходу з позиції формування когнітивних карт інвестиційної привабливості регіонів на основі оцінки факторів різного рівня ієрархії їх соціального-економічного розвитку.*

Постановка завдання. *Стаття покликана обґрунтувати актуальність застосування когнітивного підходу до аналізу інвестиційної привабливості регіонів на основі врахування чинників різного рівня ієрархії їх соціального-економічного розвитку.*

Виклад основного матеріалу. *У статті обґрунтовується ефективність застосування когнітивного підходу, що аналізує інвестиційну привабливість регіонів з врахуванням чинників різного рівня ієрархії їх соціального-економічного розвитку.*

Висновки. *Імплементація когнітивного підходу в процесі аналізу та формування інвестиційної привабливості регіонів на основі врахування чинників різного рівня ієрархії соціального-економічного розвитку дозволяє встановити та виокремити негативні й позитивні тенденції інвестиційної активності, а також пріоритетні сфери розвитку, що відповідним чином повинно бути враховано при формуванні комплексних програм щодо забезпечення сприятливого інвестиційного клімату у межах визначених пріоритетів соціально-економічного розвитку регіонів.*

Ключові слова: *когнітивне моделювання; когнітивні карти; інвестиційна привабливість; регіон.*

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Urgency of the research. Trends in social and economic development and the investment situation of regional systems, financial and economic and political crisis processes necessitate the development of substantiated regional investment policy with a systematic and complex modeling of measures to increase the investment attractiveness of the regions. The application of the cognitive approach in analyzing and shaping the investment attractiveness of the regions allows us to take into account the basic and target factors of the cognitive model that characterize the investment potential of the economic space of a particular territory.

Target setting. Modern scientific researches in the field of regional analysis are based on the application of methods variety and mechanisms with the harmonization of a significant amount of information on the indicators of the regional economy in general and indicators of investment development in particular, as well as the synthesis of the results of different models and methods of making managerial decisions application. On this basis, it is advisable to form the cognitive maps of the investment attractiveness of the regions, taking into account regional factors of social and economic development, in order to determine the negative and positive trends of investment activity, as well as priority sectors of development.

Actual scientific researches and issues analysis. Implementation of the cognitive approach, according to Professor Pashkevich M. S., allows us to work with both qualitative and quantitative parameters and enables the filling of methods of cognitive modeling by other methods of system analysis at different stages of research and decision-making [1].

In studying the problems of sustainable development of regional social and economic systems, the formation of strategies for sustainable and safe development, scientists G. V. Gorelova, E. N. Zakharova emphasize the corresponding mathematical tools - cognitive methodology of research and decision making in complex systems, including models and methods of system analysis, cognitive theory, theory of management, stability theory, graph theory, and the theory of constants for simplicial complexes, scenario analysis, which together form the information technology of cognitive modeling of the structure and behavior of complex systems [2].

The development of a cognitive map in particular concerning the living standards of a region is highlighted in the researches of O. Y. Polyakova and Sh. A. Omarova [3].

Drogushayeva A. K. notes that the systemic and cognitive approach to the planning process allows to determine the indicators depending on the target orientation scenario of the region's development of social or economic formation of socially oriented indicators of the region's development and can be used as an instrument for assessing the effectiveness of the implementation of priority national projects at the regional level [4].

The analysis of modern scientific researches concerning cognitive modeling of social and economic development of the regional systems enable to establish the lack of practical development of cognitive modeling of investment attractiveness of the regions in the system of its social and economic development, which, accordingly, determines the unsolved problems and the relevance of this research.

The research objective. The objective of the article is to substantiate the relevance of cognitive approach use in analyzing and shaping the investment attractiveness of the regions on the basis of factors taking into account the different levels of the hierarchy of their social and economic development.

The statement of basic materials. Simulation modeling, the basis of which are sign-oriented graphs, the basis of which are charts - the causes of consequential relationships - cognitive maps are used in analyzing the nature of the dynamics and identifying possible hidden interconnections between elements of the regional system using. As part of this approach, the system is represented as a set of vertices of the graph, each containing one variable [5].

In the scientific literature, in general the cognitive maps are considered an initial statistical reflection of the links between the factors of the researched social and economic situation. The implementation of the cognitive approach is based on the formation of appropriate cognitive maps, which contains information about the system in the form of a set of concepts-factors and causally effect network that

they associate. The cognitive map reflects the subjective representations of the experts about some or other phenomena in the simulated system. A cognitive map is considered as an oriented weighted graph whose vertices are the system's factors, and arcs are the interconnections between these factors,

$$G = <V, E> \quad (1)$$

where G is an oriented digraph, in which V is the set of vertices (system's factors), E is the set of arcs representing the connections between vertices. By cognitive map it is possible to determine what factors are taken into account when studying the system, taking into account the mutual effect of these factors [6, p. 23].

While analyzing a particular situation, it is usually assumed that changes in the underlying factors are desirable. The factors of the greatest interest are the target (source) factors of the cognitive model. The task of decision-making on managing processes in such a situation is to ensure the desired changes in the target factors and this is the purpose of management. A goal is considered to be correct if the desired changes in one of the target factors do not lead to unwanted changes in other target factors. In the initial set of basic factors a set of so-called controlling (input) factors is allocated, through which the control influences on the model are given. The basic factors, trends in their changes and the degree of mutual influence between factors, obtained during the collection and processing of information are the input data for a cognitive model.

Based on the systematized statistical information [7] concerning the researched problem, an initial set of data was created for constructing a cognitive model of investment attractiveness of a region on the example of Lviv region (Tab. 1):

- factors *x* are the basic factors in the model, which are the indicators describing the social and economic situation in the region - Lviv region, which accordingly forms the basis of investment attractiveness of the region for potential investors;
- target factors *y* - factors that allocate in the aggregate of the basic factors of control influence and which will be possible levers of influence on the development of investment attractiveness of the region;
- index of capital investment in Lviv region was selected as a factor- indicator *z* of investment attractiveness development of the region.

Table 1

Input parameters of cognitive modeling of investment attractiveness of the region (for example, Lviv region)

Indicators	Units of measure-ment	Factors	Period, at the beginning of the year				
			2011	2012	2013	2014	2015
Capital investment index	%	z	120,3	86,8	81,4	88,5	106,5
Direct foreign investment from EU countries	USA million dollars	$У_1$	969,7	1015,8	1053,2	1123,7	989,7
Direct foreign investment from other countries	USA million dollars	$У_2$	217,1	284,6	262,6	255,8	208,0
Investments in tangible assets	UAH million	$У_3$	11984,3	11064,0	9669,4	9426,5	13067,4
Investments in intangible assets	UAH million	$У_4$	129,7	109,3	147,3	128,5	319,1

The evaluation of the basic to target factors (ratio x: y) of the cognitive model, which are characterizing the investment attractiveness of the Lviv region was conducted and formed in Tab. 2.

Table 2

Estimation of the basis-to-target factors (ratio x: y) of the cognitive model, which are characterizing the investment attractiveness of the region

y_1		y_2		y_3		y_4	
x_1	0,081404	x_1	-0,39241	x_1	0,376128	x_1	0,881007
x_2	0,08178	x_2	-0,39239	x_2	0,375738	x_2	0,880952
x_3	0,099701	x_3	-0,32397	x_3	0,325312	x_3	0,871695
x_4	0,079911	x_4	-0,31298	x_4	0,324862	x_6	0,908133
x_5	0,136455	x_5	-0,34482	x_5	0,292144	x_7	0,9147
x_6	0,037601	x_6	-0,41952	x_6	0,400542	x_9	0,8249
x_8	0,131256	x_8	0,001006	x_7	0,404316		
x_{10}	-0,13455	x_{10}	-0,5588	x_{10}	0,573705		
x_{11}	0,772721	x_{11}	0,149499	x_{11}	-0,36352		
x_{12}	0,685545	x_{12}	0,052688	x_{12}	-0,22596		
x_{13}	0,717658	x_{13}	0,48875	x_{13}	-0,76019		
x_{14}	-0,5696	x_{14}	-0,78916	x_{14}	0,87306		
x_{15}	0,047834	x_{15}	-0,55426	x_{15}	0,460604		
x_{16}	0,048675	x_{16}	-0,55339	x_{16}	0,459735		
x_{17}	-0,42641	x_{17}	0,413926	x_{17}	0,146595		
x_{18}	-0,42019	x_{18}	-0,03217	x_{18}	0,363277		
x_{19}	0,616122	x_{19}	0,979812	x_{26}	0,303528		
x_{20}	-0,06305	x_{20}	0,573074	x_{27}	0,303538		
x_{21}	0,118099	x_{21}	-0,50959	x_{28}	-0,08623		
x_{22}	0,751502	x_{22}	0,294135				
x_{23}	0,361034	x_{23}	0,730778				
x_{24}	0,644748	x_{24}	0,095857				
x_{25}	0,174193	x_{25}	0,820086				
x_{26}	0,158286	x_{26}	-0,39255				
x_{27}	0,158254	x_{27}	-0,39261				
x_{28}	-0,42762	x_{28}	0,363072				

The assessment of the target factors to the factor-indicator (ratio y:z) of the cognitive model that characterizes the investment attractiveness of the Lviv region is formed in Tabl. 3.

Table 3

The assessment of the target factors to the factor-indicator (ratio y:z) of the cognitive model that characterizes the investment attractiveness of the region

	z
У1	-0,71019
У2	-0,84843
У3	0,761899
У4	0,321592

As a result of this interpretation of plurality of input concepts a cognitive modeling of investment attractiveness of the region was hold on, that reflects the composition the factors of different levels of hierarchy (Fig. 1). Thus, among the numerical estimates of the constructed cognitive model, the negative values of $У_1$ and $У_2$ factors – as direct foreign investments from the EU and other countries that highlight the managing influences and which will be possible to leverage development investment attractiveness of the region among a set of basic factors, show little impact on investment processes in the region and contribute to determining the proper priorities and strategic directions in the sector to enter the targets.

The negative trends in direct foreign investment are caused by the high risk of investing in a country, where military actions are taking place; financial position of producers is worsens and lending is decreasing.

Thus, while analyzing the cognitive map of the investment attractiveness of the Lviv region of Ukraine, it is worth to pay attention to the following positive parameters:

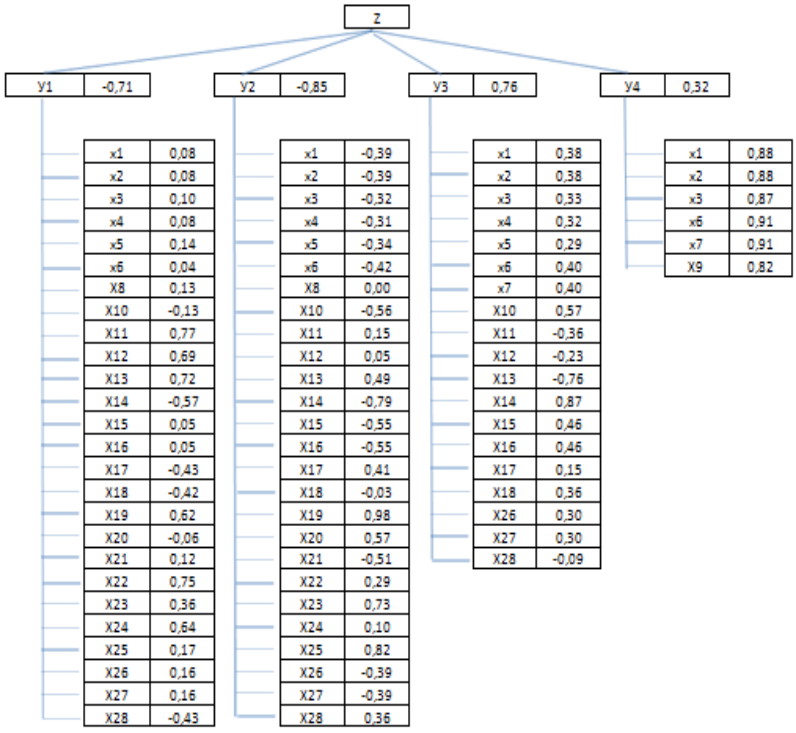

Fig. 1. Cognitive map of investment attractiveness of the region (for example, Lviv region, Ukraine)

- direct foreign investments from EU countries (**У$_1$**) - the significant influence of which contributes to the growth of agricultural production, crop production, livestock products, exports of goods and services, and, as a result, the balance of foreign trade in services;

- direct foreign investments from other countries (**У$_2$**) - the significant influence of which contributes to the growth of exports of goods and services, import of services, and in total, direct foreign investment per head;

- investments in tangible assets in Lviv region (**У$_3$**) - the significant– influence of which contributes to the growth of volumes of industrial production sold out, construction works performed;

- investment in intangible assets in the Lviv region (**У$_4$**) – the significant influence of which contributes to the growth of the gross regional product, gross regional product per head, incomes, regional incomes, region expenditures, deficit (surplus).

At the same time, the conducted modeling also allows to distinguish a certain negative tendencies of investment processes in Lviv region of Ukraine, in particular:

- lack of influence of direct foreign investment from EU countries (**У$_1$**) in the construction sector of the region;

- the absence of influence of direct foreign investment from other countries (**У$_2$**) in the formation of the gross regional product, population incomes and, respectively, the average monthly nominal wage, the volumes of industrial production sold, the volume of construction work performed;

– absence of influence of investments in tangible assets in Lviv region (**У$_3$**) in forming of volumes of agricultural production, plant production, livestock products.

Conclusions. The cognitive model of formation and development of investment attractiveness on the example of Lviv region was developed, in which the selection of factors most important for sustainable development and effective functioning of the investment environment was conducted, the analysis of influence in the system of cause-effect relationships on the complex characteristic of social and economic development of the region testifies the necessity of systematic development of direct foreign investment in the region; the significant influence of investments in tangible and intangible

assets in the formation of the gross regional product of the region; isolation of priority areas of foreign investment in the development of the agricultural sector of the region (production of crop and livestock production) and the construction sector.

Consequently, a conducted scientific research of the cognitive approach implementation in the process of forming the investment attractiveness of the region in its social and economic development allowed to establish and distinguish negative and positive tendencies of investment activity, as well as priority areas of development of the Lviv region, based on factors of different levels of the hierarchy of social and economic development of the region, which should be taken into account in the development of integrated programs to ensure a favorable investment climate within the declared priorities of the region's development.

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