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SYSTEM MODELING IN THE DEVELOPMENT OF A MODEL OF SCENARIO CONTROL OF THE REGIONAL INNOVATIVE DEVELOPMENT LEVEL

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Abstract. The article discusses the possibilities of using and approaches of system modeling in the development of the model of scenario management of the level of innovative development of the region, the interconnection of the project and the scenario management. At the same time, a set of strategic and program documents of the development of the country and its regions are considered as a system (using the example of program documents of Kazakhstan), a brief economic analysis of regional development, the role and place of scenario management in the system modeling system of innovative development of regions is given.

Keywords: region, industry, management, program, project, system approach, innovative development, scenario management.

In Russia and Kazakhstan, as well as in other CIS countries, the need for the development of innovation in the economic and social spheres is increasing. This is due, on the one hand, to the accumulated experience of modern socio-economic life in developed countries, on the other, to competition, since the leading firms of Western countries supply the CIS markets with high-tech products and quality, which makes it more difficult to promote their own.

The innovative development of the country and its regions is aimed at raising the standard of living of the population, as a result, the efficiency of social production increases. In this connection, it is important to develop a modern mechanism for enhancing innovation in the regions of the country, based on modeling the processes of the formation and implementation of innovative development programs of the regions. Implementation, the solution of such a task is associated with serious difficulties and, first of all, the need for significant changes in the leading sectors of the economy, and consequently, structural changes on a regional scale, as interconnected economic entities [1, 2]. The implementation of such changes requires a preliminary study and evaluation of the proposed measures, the expected possible consequences and risks, therefore it is necessary to create and use effective means of analyzing complex large systems and choosing development paths. To solve this problem, it is necessary to use system analysis tools and its tools: system modeling, project and scenario management. In the framework of the proposed research, these approaches are considered for analyzing the formation and implementation of regional innovation development programs in order to increase the degree of reasonableness of decisions made related to the strategy and development programs of both the national economy and its important constituent parts - regions. If we consider the regional structure of Kazakhstan, it consists of four macro-regions, which include 14 regions and three hub cities (agglomerations with centers of republican significance — Astana, Almaty, and the recently joined this list, the city of Shymkent) (Fig. 1.)

Consider briefly the analysis of the economic situation of the regions [3]. In the socio-economic development of the regions of Kazakhstan there are significant imbalances. The number of cities is 87, 39 of which are regional, 47 are district. About half of all cities are located in four regions: in Akmola, Almaty, East Kazakhstan and Karaganda regions; 10, 10, 10 and 11 respectively. Differences between macroregions are

sustainable and determine the specifics of economic interaction between regions belonging to one macroregion and between regions belonging to different macroregions. As can be seen from table 1, the southern region is the most densely populated macro-region (about 40% of the total population of the country), while the lowest GRP per capita is here. The smallest population lives in the north of the country. The share of the macroregion in the country's GDP is also the lowest. The Central-Eastern macro-region is in third place in terms of population, but here one-fifth of the country's GDP is generated. The western region is in third place in terms of population, it is the leader in contributing to the country's GDP with a high GRP per capita. Almaty and Astana are leading in terms of GRP per capita. [3].

Regional structure of the Republic of Kazakhstan

Macroregions of Kazakhstan																
Hub	Northern			Central - East			West				Southern					Hub
Regions of the Republic of Kazakhstan (16 regions - 14 regions and 2 cities of republican significance)																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Astana	Akmola region	Kostanay region	North-Kazakhstan region	East Kazakhstan region	Karaganda region	Pavlodar region	Aktobe region	Atyrau region	West-Kazakhstan region	Mangistau region	Almaty's region	Jambyl region	Kyzylorda Region	Turkestan region	Shymkent	Almaty
11	8,4			18,7			25,2				16,5					20,2
11	2,8	3,6	2	6	8,2	4,5	4,5	10,9	4,5	5,3	4,9	2,5	3	6,1		20,2
	8.992			5693.3			13470.9				8736.9					
3892,8	1330,8	1432	1229,2	1506,3	2086	2101	1878,5	6274,3	2448,3	2869,8	870,2	772,9	1349,7	744,1		4008,9

Fig. 1 Regional structure of the Republic of Kazakhstan

Table 1

Characteristics of the macro-regions of Kazakhstan on the contribution to GDP and the level of urbanization (as of: for 9 months of 2017)

Macroregions	Share in GDP,%	Population share in the total population of the Republic of Kazakhstan,%	Level of urbanization, %
Astana	11	5,68	100,0
Northern	8,4	11,97	48,6
Central - East	18,7	19,38	69,7
West	25,2	15,34	52,9
Southern	16,5	37,71	38,0
Almaty	20,2	9,92	100,0

Source: Compiled by the author according to the Committee on Statistics of the Ministry of National Economy of the Republic of Kazakhstan.

Four of the seventeen regions (Astana, Almaty, Atyrau and Karaganda regions) together account for half of the country's GDP. While the sum of the smallest GRP indicators of the other four regions (North Kazakhstan, Zhambyl, Akmola and Kostanay regions) equals only 1/10 of GDP (Fig. 2).

In the structure of GRP by the type of economic activity in nine regions, the share of industry exceeds 25 percent. (Atyrau - 58%, WKO - 55%, Karaganda region - 45.2%). Consequently, the fall in world commodity prices for these areas is very sensitive. As a result of the disproportion in the socio-economic development of the regions, imbalances in budgeting also arise, for example, 75% of the regions of Kazakhstan experience difficulties in resolving issues of socio-economic development at their own expense.

As it is known, the main strategic element – the industry in the economy of Kazakhstan is the oil and gas industry, which covers the

entire western macroregion, part of the south and the east. This explains the high share in the GDP of the western macro-region. However, not all is well with this industry. The demand for raw materials in recent years has been falling, the development of the manufacturing industry has been inhibited due to the economic situation, as evidenced by the statistics of innovation grants in this industry.

All these issues require a systematic study of regional development problems and the development of appropriate management methods.

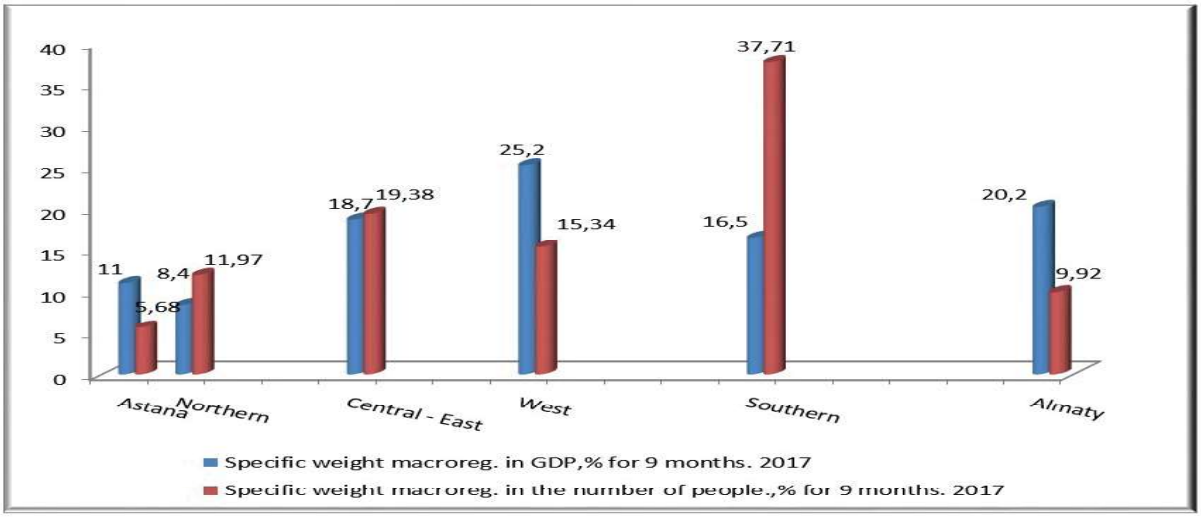

Fig.2 Comparative chart on the contribution to GDP and population shares by macro-regions of Kazakhstan (as of: for 9 months of 2017)
Source: Compiled by the author according to the Committee on Statistics of the Ministry of National Economy of the Republic of Kazakhstan

Before we consider the stages of development of system modeling, as well as the mathematical description of the formation and implementation of regional innovation development programs, let us dwell on those characteristics that allow them to be so called.

The goal-setting of system objects and their system modeling implies that an adequate formalized apparatus aimed at developing a model for managing the level of innovative development of the region will help predict the potential of economic transformation, highlight achievable goals and ways focused on innovative development [4].

Figure 3 presents the methodological interrelation of strategic and program documents, which are the development of the national economy of Kazakhstan and its regions.

In essence, strategic and program documents are the indications of ways, directions and stages of achieving the development goal (at least descriptively) – where, how and to what result you need to go – goal-setting. Thanks to the plans, conceptual uncertainty is removed and long-term socio-economic development becomes possible. At the same time, there are subsystems presented in the form of various program documents of territories, industries and departments, there is a clear hierarchy and interconnections, and the complex ones are systemically important. There is an external environment, like the economies of other territories, regions, economic external relations and the global economy. And there is also integrity, that is, emergence. Thus, the set of strategic and program documents of the country for which it is being developed, in its interconnection, is a system requiring system analysis and modeling of their implementation and a possible development option.

So, **the region, we define as a system object, the management is program-targeted, i.e. we have: goals, objectives, ways (activities) and means (resources).**

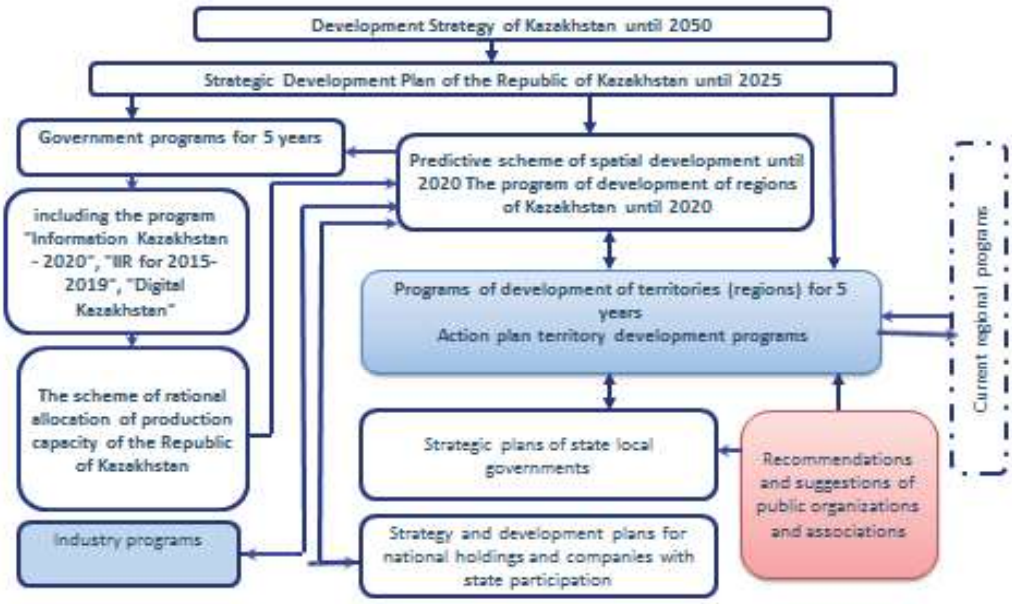

Fig. 3 Methodological interrelation of strategic and program documents

There is a need and obligation to focus the objectives of business processes of industries included in the framework of regional, national and other projects in the direction and in accordance with the objectives of the socio-economic development of territories. At the same time, the programs of socio-economic development of territories can be viewed as a set of specific real projects of specific subjects. Consequently, it is possible to define a program as a set of specific projects. Further, the program will be understood as a set of projects. Thus, the program has a set of both: the unique capabilities and limitations and the desire to create a result-oriented system [5]. Consequently, the system of project management of the region will create conditions and provide the prerequisites for a rational, coordinated socio-economic development of the region [6]. Figure 3 presents the concept of project management of the region as an open, self-developing socio-economic system.

Project management of innovative development of the region (IDR) involves the use of a multi-criteria approach that reflects the development priorities of economic entities (region, industry, enterprise) and makes it possible to take into account the whole range of interests (goals) of the industry and region, to provide the necessary amount of information to make the best decision. To this end, a management system has been developed on the basis of a comprehensive assessment of the economic and innovative potential of the industry, which makes it possible to obtain solutions with a variety of criteria and for multi-purpose projects. The technique is described in details in [6, 7, 8]. For the project management, such approaches as system, project, process and scenario approach have now become widespread. However, the scenario approach is used much less than the others, due to the additional work on the development of scenarios for the development of the project (program). In spite of the fact that the use of the scenario approach for the formation and implementation of an IDR program of a strategic nature, which are formed and implemented state development programs (see Fig. 5), plays a significant role. Using this approach makes it possible to preliminarily assess the situation and analyze the mutual influence of existing factors, as well as identify development trends, predicting them, develop and substantiate directions for managing the prevailing development conditions, and assess the consequences of making major management decisions and justify choosing the best system development strategies [10]. In this paper,

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a scenario approach is considered taking into account the methodology for the integrated assessment of the economic and innovative potential of the industry. Figure 5 shows the stages of the implementation of scenario management in conjunction with the design approach in system modeling of the formation and implementation of IDR programs.

Fig.4. The concept of project management of the region as an open, self-developing socio-economic system

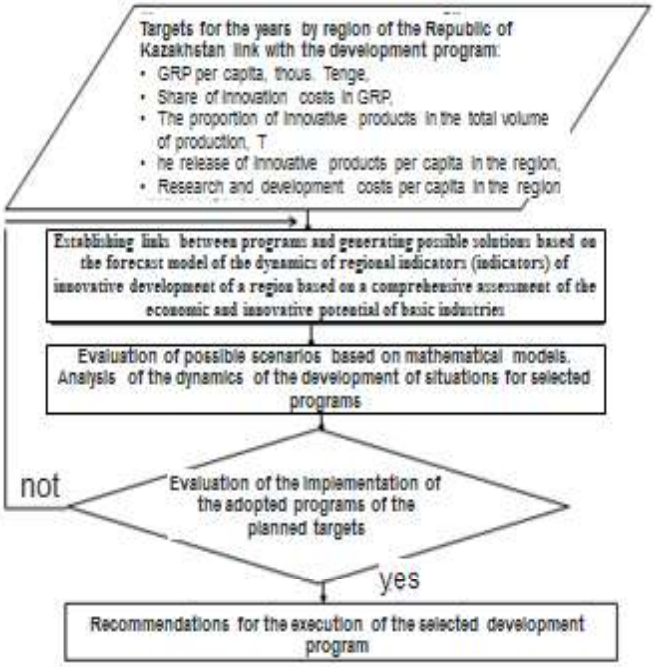

Fig. 5 Stages of the implementation of scenario management in conjunction with the design approach in system modeling of the formation and implementation of programs of IDR

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