DEVELOPMENT OF INNOVATIVE REGIONAL CLUSTER OF THE REGIONAL AIC ON THE BASIS OF NETWORK SIMULATION

Tatyana G. Gurnovich[1]
Lyubov V. Agarkova.[2]
Viktoriya A. Zhukova[3]
Anna F. Dolgopolova[4]

1. Kuban State Agrarian University. Email: gurnovich@inbox.ru
2. Stavropol State Agrarian University. Email: alv23@mail.ru
3. Stavropol State Agrarian University. Email: bekastavropol@mail.ru
4. Stavropol State Agrarian University. Email: dolgopoljva.a@mail.ru

Abstract: This paper proposes methodological approaches to the development of innovative educational cluster of the regional AIC on the basis of system approach methods and network simulation tools. The authors also simulate the management system of the regional innovative educational cluster of the AIC, substantiates the restructuring of the state administration model for the innovative educational cluster on the account of including the relations with regional economy into the model. It is proved that lack of feedback from the system, which has the cluster as an element of its infrastructure, contributes to exacerbation of imbalances and reduction of the performance of regional economic mechanism. The authors propose to use the "predator - prey" model to study the interactions in integrated economic system and to smooth over the differences. The model of innovative educational cluster management that distinguish the positive and negative types of corrective actions in integrated structures is updated. The paper proposes to enhance the capability of this model by using the tools of network simulation. Network simulation is aimed at increasing the efficiency of innovation, accelerating the adaptation of regional educational and research institutions to changing market conditions, practical implementation of the program of correcting control, and improvement of the staff training system.

Keywords: system approach, innovative educational cluster, regional AIC, cybernetic model, interaction model, network simulation, net graph.

1. INTRODUCTION

Innovative development of modern economics is related to intensification of interaction of science and education with manufacturing companies supported by governing bodies. Joining efforts of research centers, educational institutions, the state, and private sector in science and innovation allows implementing the innovation cycle from the fundamental research to introducing science-intensive output to the production. The most advanced form of integrative interaction of scientific and education entities with business and public authorities is innovative educational clusters. These clusters turn into centers of innovative development and increase the competitiveness of regional

economies. Innovative educational clusters not only solve the tasks of new products, services and technologies marketing promotion adequately, but also prepare specialists capable of using them to maximum effect. In the wake of rising self-organization and development of innovative educational clusters, its influence on the performance of regional economy grows. It inevitably results in discrepancies in the priorities of regional and cluster development, aggravation of contradictions and imbalances. All this primarily comes from the overproduction of the high-qualified personnel. Therefore, the need to improve methodology of affecting the innovative educational cluster operation in regional economy gains special relevance. The purpose of this research is development of the guidelines on modeling the cluster development, assessing the interactions on regional agroeconomic system, and methodological support of the functioning mechanism of innovative educational entities.

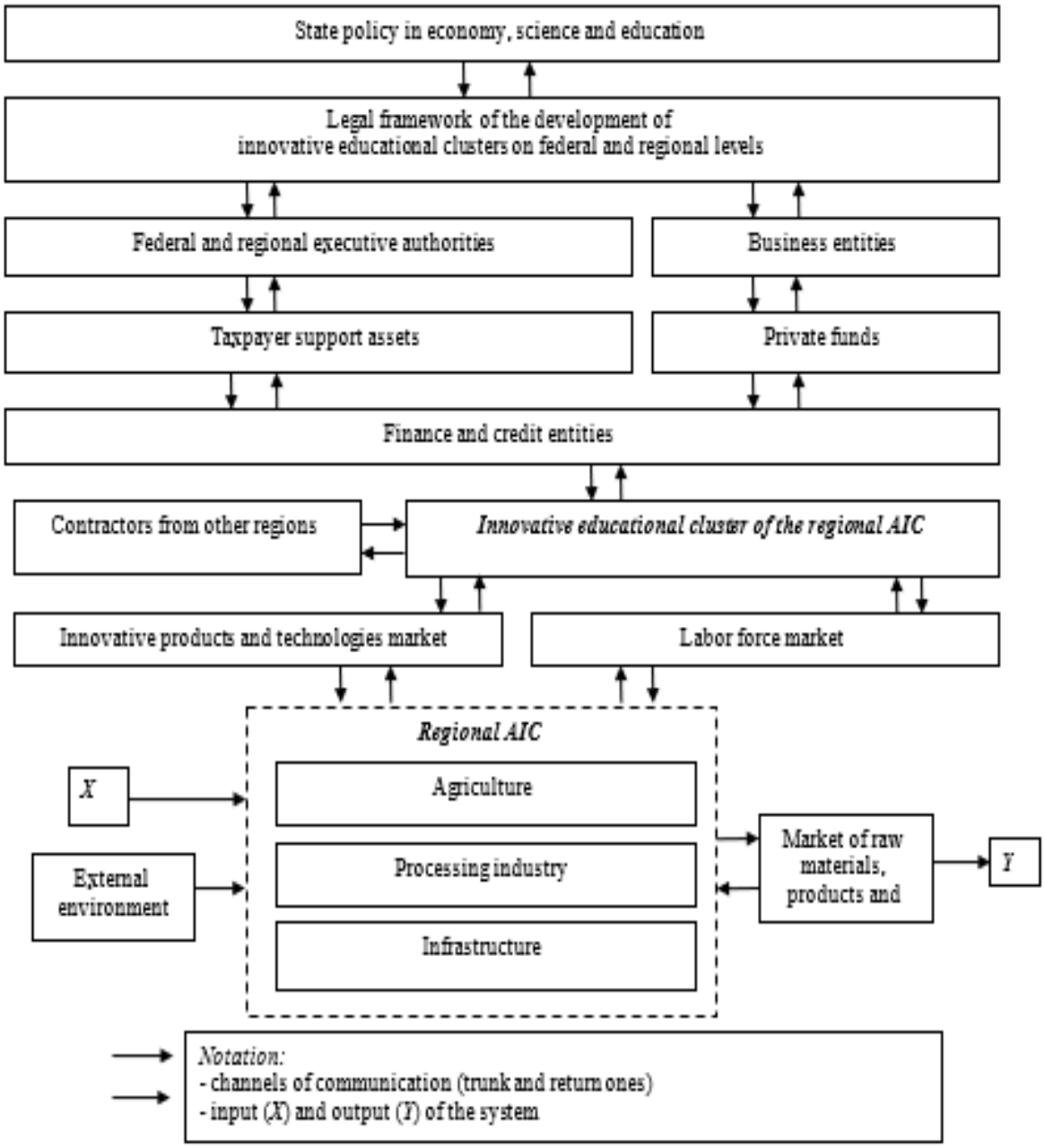
2. METHODS

Theory and methodological framework of this research is formed by the essential concepts of Russian and foreign scientists in the theories of innovative development of regional systems, clustering of the economic territory, and public-private partnership. The study is conducted on the basis of system analysis and network simulation with the development of methodological aspects of innovative and educational processes integration into the regional AIC. The authors use logic, monographic, table, decomposition, and graph plotting methods, and the "predator - prey" interaction model. Information base of the study consists of the results of monographic studies of Russian and foreign scientists in the field of economic clustering, formation of innovative educational integrated structures, and establishment of business conditions that stimulate innovative processes at the regional level.

3. RESULTS

3.1. Determination of the spheres of efficient control actions in an innovative educational cluster of the regional AIC with the use of decomposition method

System approach is an effective instrument of enhancing the structure of an innovative educational cluster of the regional AIC. This approach is able to optimize the interaction of its components, to assess the influence of these elements and their connections, and to determine the properties and mode of the object's operation. The studied cluster serves as a subsystem of a lower level in regard to the systems of innovation management of federal and sub-federal levels of government control.



Picture 1 – Cybernetic model of the innovative educational cluster of the regional AIC

Presenting the management system of regional innovative educational cluster of the AIC as a cybernetic model (picture 1) allows tracing its two interdependent components: federal and regional one. The object of management (innovative educational cluster) is presented in the scheme as an unstructured block. According to the implemented concept of private-partnership in the cluster policy, the management system consists of two elements: public executive authorities (federal and regional governments and ministries) and entrepreneurs seeking innovative development for their businesses.

The extent of some researchers' works is the system analysis of the above-mentioned structure (Biryukov, 2009; Boytsov, 2009; Smirnov, 2010). The work of A.V.

Smirnov may serve as a common example of the use of this methodology. This approach to studying regional innovative educational clusters brings the subjective problems of each participant of the cluster's financial soundness to the forefront, while the effect of the cluster's development on increasing the efficiency of its region is viewed as a possible positive effect. The subject to management is a self-organizing system that develops towards the maximization of its financial performance, establishment of the company's positive image, and acquisition of competitive advantages. Maintaining this direction is feasible at the initial stages of the cluster's life cycle. At the same time, planning the assured result of budget investments in the form of regional effect of clustering becomes reasonable. Thus, the activity of cluster's participants should be adjusted in accordance with the feedback from regional economy. Leading companies of the cluster are aware of this connection and its significance and organize their own monitoring services. However, their activities are reasoned by the subjective interests in maintaining the reputation and competitiveness against regional criteria (Kleyner, 2011).

Application of system approach methods assists the justification of priorities for the development of innovative educational cluster of the regional AIC. In this paper structural extension of the model of the government control of innovative educational cluster by means of ties with regional economy may contribute to the efficient implementation of interaction of innovation and education. The studied cluster refers to the support systems of the sphere of material production according to its socio-economic typology.

In this study the estimate of regional effect in the proposed mode is provided by setting direct and feedback links of the cluster with the agro-industrial complex of a region. Direct and back control is performed through the system of labor markets and innovation markets. The latter in turn may be regarded as a part of investment market. Both above mentioned markets and the regional innovative educational cluster itself are presented as open self-organizing systems in this model. Cluster's links with partners from other regions are distinguished and include related universities, research universities, research centers, laboratories, and other organizations in Russia and abroad.

Putting aside insignificant links of the model of this level, let us assume that the participants of innovative educational cluster supply the innovation market with scientific and technical projects and the the labor market - with professionally trained personnel able to put innovation into practice. Taking into account specific features of highly-qualified personnel, their adaptability to changing demands of the labor market due to high quality training, the example of the overproduction of agrarian personnel, who have to apply to jobs at other industries, may not be considered as a growth factor of regional performance. Studying the activity cluster as an element of infrastructure not taking into consideration the feedback from its system will inevitably lead to the market disproportionality and decrease in performance of regional economic mechanism.

Regional AIC is viewed in this model as a consolidated block, the elements of which interact via the market of raw materials, products and services. The input of this system is marked by the X variable, the output - with Y variable. System activity are modified under the influence of external environment. Alteration of external and internal economic conditions bay be traced by the feedback through the behavior of the market conditions in another open system - the market of raw materials, products and services.

The tool of program management is state policy in the sphere of economics, innovation, science and education. Innovation and cluster policies are the components of general state economic policy. Going in line with the dynamics of external and internal

conditions development, the object of control unites and realizes the interests of two management entities: the state (through the institutions of state power) and individual entrepreneurship.

Scientific literature marks the presence of two generations of cluster policy (Gorshneva, 2006). Cluster policy of the first generation is a set of measures taken by federal and regional authorities for clusters identification, determination of the field of activity responsible for the formation of firm clusters, establishment of governmental bodies for clusters support, and implementing general policy of clusters support in the country and its regions. Cluster policy of the second generation is based on the awareness about clusters existing in the country and its regions and individually deal with the developmental problems of each separate cluster.

In order to increase the efficiency of cluster policy federal executive authorities provide for methodological, research and information, advisory, and educational support for the regional executive authorities and local governmental bodies, as well as for business partnerships. Taking measures for development of international cooperation in this field is also proposed.

Currently the priority of state economic policy as increasing competitiveness and innovation potential of companies and certain industries, development of small and medium businesses and assistance in diversification of national economy by encouraging the development if regional industrial clusters. The essence of regional cluster policy is the creation of favorable economic conditions by the cluster participants development of innovative infrastructure, and increase in regional efficiency of cluster operation. Main paths of cluster development may include:

1) participation loans for analytical studies of the cluster's structure, determination of the purposes and paths of its development;

2) establishing centers for knowledge exchange in clusters, attracting affiliated organizations to cooperation under the cluster;

3) implementation of the promotion programs for the cluster enterprises entering the external markets, conducting joint research;

4) increasing the efficiency of professional training programs by means of adjustment of vocational institutions' curricula, joint organization of retraining and further training programs, traineeships;

5) aid to the commercialization of the results of research activities.

The cluster approach has taken one of the key positions in strategies of socio-economic development in some RF entities and municipalities by now. Some projects of territorial industrial clusters development is realized proactively (Concept, 2010).

The funding sources of cluster policy of federal executive power are budget funds allocated for implementation of target programs, targeted investment projects, conducting research and development works. Moreover, it is possible to use financing mechanisms for measures on cluster development on the account of federal investment fund assets, bank for development and international economic activity, venture funds, development programs for small business, and regional development fund. Funds allocated for special economic zones establishment and implementation of national projects may also be used.

At the moment a number of versatile financing mechanisms for the development of innovative educational clusters and their infrastructure are formed on the federal level. These mechanisms are purposed for:

– increasing the efficiency of the vocational education system;
– assisting the cooperation between companies and educational institutions;
– special-purpose investing into the development of engineering and transport infrastructures;
– supporting the social sphere and housing construction taking into account the tasks of cluster support;
– granting tax exemptions;
– reducing regional administrative barriers (Concept, 2007).

The authors mark the following leverages as stimulating the development of innovative educational clusters:

– creation of communication and information exchange platform;
– purposeful distribution of public contracts;
– further development of regional workforce by implementing the supplementary education and retraining programs;
– establishment and maintenance of a regional clusters brand in order to attract foreign investments (Akinin, 2012).

As it comes from the world practices and assessment of Russian specialists (Mal'chenko, 2011; Frolova, 2012), poor development of processing industry in agricultural regions results in excess demand for innovative development in the AIC. These regions need to overcome the crisis by finding new technological solutions for cost reduction or making brand new products and establishing new manufacturing companies. The rate of implementation and acquisition of innovation depends on its benefit, level of research and technology, investment attractiveness (primarily, its profitability and payback period), and the state of common investment conditions for the business development in the country and its regions. Many modern innovative projects and pilot projects may dramatically increase the work productivity in agro-industrial complex. It is especially important for the range of regions tending towards the decline of population and demographic level (Markov, 2006).

Activation and improvement of modern cluster policy in the field of implementation of innovation and workforce training system development for their economic capturing are realized in institutional and organizational cooperation between the state and business. The state and entrepreneurs work together for economic development and increase in competitiveness. In practice the process of regional clustering of economy on the basis of public-private partnership consists in:

– joint development and funding of corresponding cluster projects (for example, development project for cluster initiatives, creation of cluster infrastructure, organization of a certain cluster, etc.);
– organizational assistance from municipalities;
– holding training seminars and advisory assistance for the participants of clustering;
– grant-in-aid for scientific research for the subjects of the cluster;
– attraction of foreign investments to the clusters' development;
– lobbying of interests of the cluster's subjects (Tsikhan, 2003).

Mechanisms of public-private partnership contribute to the increase in financial stability of the cluster's participants and are meant to aid the growth of regional economic efficiency and national economy in the whole. Following on from the principle of self-

organizing innovative educational cluster, the financial strategy of its participants puts maximization of self profitability first. It is quite logical to consider the growth of regional efficiency as possible positive result of the company's well-being (Kleyner, 2011).

It is important to maintain the parity of the parties' advantages, take into account the interests of private funds by calculating its share in investments to innovative projects, and reduce administrative barriers.

The authors rely on some researchers (Afanas'ev, 2005; Voronov, 2003; Gorshneva, 2006; Dubikova, 2009; Prokhorova, 2010) who think that maintaining the competitiveness of any regional cluster is possible only on the basis of some innovative process that involves continuous reproduction of qualified staff. The regional staffing problem solution is performed according to regional strategy and tactics in the field of employment and education, small business, and labor migration.

The most significant aspect of educational policy is transition to innovative education. It consists of the following directions (Strategy, 2006; Romantsev, 2009; Frolova, 2012):

– improvement of quality and innovativeness of educational programs;
– update of retraining programs, exchange programs, and programs of further training;
– organization of students' traineeship at innovative industries;
– cooperation of sectoral and university science in the field of innovative training;
– provision of high living standard, including assistance to affordable housing programs, health services and leisure infrastructure.

It is obvious that the interests of the cluster's educational sphere participants may contradict to the regional ones at certain stages of cluster's development. The studied level of cluster management system structuring level shows that financial results and stability of financial institutions are in direct ratio with the scope of educational services. It is namely the background that provide ground for the mission, strategy and tasks of most educational institutions. However, sectorial need in professional staff at regional labor market depends on the range of other factors, thus the reproduction of highly qualified staff is not a priority indicator of regional economic efficiency.

While innovative processes are entering the economy of regional AIC, the employers' requirements to the quality of training of specialists in innovative technologies (as a crucial factor of increasing competitiveness of the clustered structures) are also growing. It should be noted that assessment of the level of staff training is performed by either the employer himself on the basis of objective criteria, or the universities according to subjective criteria. The latter prevail.

In the setting of an imbalance between demand and supply at the qualified workforce market, young specialists inevitably face the emerging problems during employment. Vocational retraining or mastering new specialty lead to unreasonable waste of efficient working time, pensionable service time and additional expenses. Labor migration to other regions may be an alternative, though it lacks favorable conditions. Excess supply of qualified workforce together with limited proper jobs for working specialists in the AIC is fraught with imbalances between professional qualification, high social status, low wages and low level of social conditions.

Adjustment of cluster's operation parameters to market environment on the basis of market monitoring may take certain positive effect in coping these contradictions.

However, only independent monitoring and proper stimulation of the cluster on the part of the state may take actual effect.

The authors take this model as a basis for the management of the innovative educational cluster. They also believe that such model makes it possible to define the range of problems and to plan the modifying controlling actions in the scope of the program of update.

3.2 "Predator - prey" model validation for the study of interactions in integrated economic systems

Interactions inevitably arise in integrated economic systems. They may be both derived from common tasks, and by the contradictions between the centers of responsibility. Economic literature marks the multilevel character of responsibility in integrated market participants. This character has economic, legal, ethic, and philanthropic sides (Carroll, 1999). Economic responsibility is determined by basic market function of the studied cluster as a supplier of innovative products and technologies as well as labor force. Market function is aimed at profit extraction, because it is based on satisfying consumer needs. Legal responsibility is stated in the regulations and includes obedience to law from all the participants of an integrated structure. Ethic responsibility implies the business practice to correspond to existing standards of morality. Philanthropic responsibility encourages the cluster's support and consolidation of the welfare of the community by participating in the implementation of various social programs.

The innovative educational cluster provides for the run of resource material, such as material and technical facilities (key and current assets, circulating assets, and intangible assets) and human resource (staff, students of universities and vocational education institutions, researchers, and research scientists). In other words, the responsibility of the subjects of innovative educational cluster is the fact that they can get profit keeping laws, ethical norms, and implementing long-term socially beneficial targets. Integrating subjects adapt to external impacts from federal and regional government agencies make certain managerial decisions and implement them in practice in accordance with the social norms.

Managerial decision making is related to simulation of possible scenarios of the development of various economic processes. The tools of economical mathematical simulation are in large variety. This work takes into account the interactions in the studied cluster and considers the "predator - prey" model in the context of the socio-economic systems. This model is studies in detail in many scientific works (Andreev, 2008; Karpova, 2008). Alfred James Lotka (1880–1949) was the first to give form to the interaction between populations bound with "predator - prey" relations. Vito Volterra (1860–1940) and V.A Kostitzin. (1883–1963) made a substantial contribution to the development of the model under study. Equations that form the basis of the interaction model were called "Lotka - Volterra equations" (Lotka, 1925; Volterra, 1931; Kostitzin, 1937; Pykh, 1977). The system of Lotka - Volterra equations is widely applied in description of biological processes, but it is also often used as a conceptual basis in socio-economic systems. For example, some works study the development behavior of the ratio between urban population and the country and the average income of the urban citizens to the average one countrywise (Kamann, Nijkamp, 1988).

Another example is the research (Modis, 1999) that deals with two types of competition peculiar for the stock market: the one between issuing companies ("prey") based on a price for traded securities, and between investors "hunting" for securities. This work simulates the processes existing in a stock market with the use of system of Lotka - Volterra equations. These models may be applied in identification of socio-economic forecasting scenarios. Moreover, they are applicable to the justification of managerial decisions meant for mitigating the fluctuations of development trends of innovative educational systems in case of risk realization. Thus, the simulation of social responsibility in clusters and other integrated structures implies selection of optimal form of social responsibility and the way out of the problem situation.

The attributes of forms of social responsibility classification for the subjects of the cluster may be the character of social needs, types of social obligations being the "burden of property", and the investment provision. For the simulation the authors take the reproductive form of social responsibility for the participants of the innovative educational cluster, and as the problem situation to study the behavior of this form. They also take the critical accumulation of integrated corporate structures' prescribed social obligations above their financial resources. In other words, the limit for the simulation process is a volume of financial resources of the cluster that provide the fulfillment of the prescribed obligations. Let us say that the innovative educational cluster operates in the economic space of a regional economic system. This cluster at this stage is the predominant, which is expressed in the maximum share of its contribution to the regional products, local labor market and the local budget on the account of its successful innovation activities. The main factors are the development characteristics of the innovative educational media, which provides the regional demand in innovative products and qualified specialists, and the load level on the part of federal and regional governing bodies.

Let us introduce the following notation:

X_1 – qualitative parameters of the functions of federal governing bodies;

X_2 – quantitative parameters of the functions of federal governing bodies;

X_3 – fill rate of local labor market;

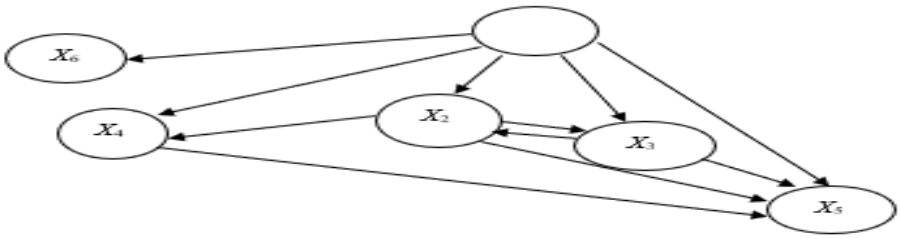
X_4 – level of the predominant cluster development;

X_5 – level of dependent economic entities development;

X_6 – level of production sphere and social infrastructure development (one may choose any system-relevant indicator, for example, electric power production rate).

The model at the picture 2 shows the relations of the load allocation in the form of socio-economic responsibility between the "predators" and the "prey":

- federal center (X_1) – regional center (X_2);
- state (X_1) – population (X_3);
- state (X_1) – sphere of agricultural production (X_4, X_5, X_6);
- innovative educational cluster (X_4) – dependent economic entity (X_5).



Picture 2 – Allocation of socio-economic load in interregional medium of an innovative educational cluster

It is known that an innovative educational cluster is targeted at the regional needs' provision with innovative products and educational services. The results of the cluster's operation are: raw materials and food for the local agrifood market saturation; financial results; expenditures of affiliated companies of this sector and the costs of regional population. The latter are determined by the socio-economic domination of this subject in the sphere of new goods, services, technologies and corresponding staff market promotion. As the regulating commissioned authorities, the authors take federal and regional governing bodies. The main "predator" is the state: it can affect the development of production and the income of the population both directly and via the regional authorities. The system-relevant indicator production the state can affect solely.

The role of intermediary "predators" is for the indicators of local labor market saturation (X_3) and the level of innovative educational cluster development (X_4). Element (X_4) can overtake the structures population (X_5) that are the "prey" in regional economic system. The proposed model describes evolution of six components, has temporal and spacial homogeneity and is expressed by the system of differential equations (1), where the coefficients $\propto_i, \beta_i, \gamma_i, \delta_i, \varepsilon_i, \theta_i$ depend on time t.

$$
\begin{aligned}
&\frac{dx_1}{dt} = -\propto_1 x_1 + \beta_1 x_1 x_2 + \gamma_1 x_1 x_3 + \delta_1 x_1 x_4 + \varepsilon_1 x_1 x_5 + \theta_1 x_1 x_6,\\
&\frac{dx_2}{dt} = -\propto_2 x_2 - \beta_2 x_1 x_2 + \gamma_2 x_2 x_3 + \delta_2 x_2 x_4 + \varepsilon_2 x_2 x_5,\\
&\frac{dx_3}{dt} = -\propto_3 x_3 - \beta_3 x_1 x_3 - \gamma_3 x_2 x_3 + \delta_3 x_3 x_4 + \\
&\varepsilon_3 x_3 x_5, \qquad (1)\\
&\frac{dx_4}{dt} = -\propto_4 x_4 - \beta_4 x_1 x_4 - \gamma_4 x_2 x_4 - \delta_4 x_3 x_4 + \varepsilon_4 x_4 x_5,\\
&\frac{dx_5}{dt} = -\propto_5 x_5 - \beta_5 x_1 x_5 - \gamma_5 x_2 x_5 - \delta_5 x_3 x_5 - \varepsilon_5 x_4 x_5,\\
&\frac{dx_6}{dt} = -\propto_6 x_6 - \theta_6 x_1 x_6.
\end{aligned}
$$

In the study of temporal factor, it should be noted that it serves as a basis for the formalization of temporal evolution by means of recurrent ratios between the parameters of the system in the boundary moments of time. The peculiar time lag of a socio-economic system is an economic cycle. The authors linearize the system of differential equations (1) and obtain a characteristic equation of the form (2):

$$
\begin{vmatrix}
\varphi_1 - \lambda & \beta_1 x_{1\infty} & \gamma_1 x_{1\infty} & \delta_1 x_{1\infty} & \varepsilon_1 x_{1\infty} & \theta_1 x_{1\infty} \\
-\beta_2 x_{2\infty} & \varphi_2 - \lambda & \gamma_2 x_{2\infty} & \delta_2 x_{2\infty} & \varepsilon_2 x_{2\infty} & 0 \\
-\beta_3 x_{3\infty} & -\gamma_3 x_{3\infty} & \varphi_3 - \lambda & \delta_3 x_{3\infty} & \varepsilon_3 x_{3\infty} & 0 \\
-\beta_4 x_{4\infty} & -\gamma_4 x_{4\infty} & -\delta_4 x_{4\infty} & \varphi_4 - \lambda & \varepsilon_4 x_{4\infty} & 0 \\
-\beta_5 x_{5\infty} & -\gamma_5 x_{5\infty} & -\delta_5 x_{5\infty} & -\varepsilon_5 x_{5\infty} & \varphi_5 - \lambda & 0 \\
0 & 0 & 0 & 0 & -\theta_6 x_{6\infty} & \varphi_6 - \lambda
\end{vmatrix} = 0. \qquad (2)
$$

The matrix (2) uses the following notation:

$$
\begin{aligned}
\varphi_1 &= -\alpha_1 + \beta_1 x_{1\infty} + \gamma_1 x_{1\infty} + \delta_1 x_{1\infty} + \varepsilon_1 x_{1\infty} + \theta_1 x_{1\infty}, \\
\varphi_2 &= -\alpha_2 - \beta_2 x_{2\infty} + \gamma_2 x_{2\infty} + \delta_2 x_{2\infty} + \varepsilon_2 x_{2\infty}, \\
\varphi_3 &= -\alpha_3 - \beta_3 x_{3\infty} - \gamma_3 x_{3\infty} + \delta_3 x_{3\infty} + \varepsilon_3 x_{3\infty}, \\
\varphi_4 &= -\alpha_4 - \beta_4 x_{4\infty} - \gamma_4 x_{4\infty} - \delta_4 x_{4\infty} + \varepsilon_4 x_{4\infty}, \\
\varphi_5 &= -\alpha_5 - \beta_5 x_{5\infty} - \gamma_5 x_{5\infty} - \delta_5 x_{5\infty} - \varepsilon_5 x_{5\infty}, \\
\varphi_6 &= -\alpha_6 - \theta_6 x_{6\infty}.
\end{aligned}
$$

The values of $x_{1\infty}, i = 1,2, \dots 6$, are the solutions to the system of equations (1) at $\frac{dx_1}{dt} = 0, i = 1,2, \dots 6$.

The proposed model of load allocation in interregional medium of an innovative educational cluster of the AIC is reasonable to use in specification of the force and direction of action on its operation efficiency. In case the control action is applied to the system-relevant areas and integrative channels of the model, the feasibility of measures on the development of regional innovative educational cluster may be accelerated on the account of generating the synergy effects.

3.3. Network simulation of the development of innovative educational cluster of the regional AIC

Controlling actions work out the system parameters to the desired state, strengthen positive impact and resist the negative dynamics of output characteristics. The consequences of controlling action on the operation of an innovative educational cluster in regional economic medium may be positive or negative. It depends on the selected point, disposition of the participants at the moment, force of investment, the stage of the cluster's development cycle, subject matter of implemented innovation, ratio of demand and supply in the markets of agricultural goods, innovative products and technologies, and labor force. The subsystems of the cluster are the regulatory, finance, and monitoring organizations. They perform certain functions that lead to the achievement of expected results in case of the coordination of actions after the function's fulfillment.

In the table 1 the authors correlate the functions and possible results of the operation of subsystems of an innovative educational cluster o the regional AIC (Prokhorova, Khachaturova, 2015; Frolova, 2012).

Table 1 – Results of fulfillment of their functions by the subsystems of an innovative educational cluster of the AIC

Subsystem	Functions	Results
Organization	Integrative Reformational Ecological	Institutional restructuring Hierarchy optimization Modernization of infrastructure Agglomeration
Regulation	Administrative Policy-making Stimulating Stabilizing	Elimination of barriers in integration of science and education Proper use of leased land Activation of scientific and technical exchange Reproduction of human resource Establishment of additional workplaces Increase in investment attractiveness of the region
Financing	Reproductive Distributional	Providing the region with innovative products and technologies Increase in competitiveness of internal and external media Realization and commercialization of the results of research work Minimization of temporary costs n the stage of innovation implementation
Monitoring	Regulatory Adjusting	Meeting the market demand Development of research and production complex Adjustment of integration processes in the system Proper use of investment sources Step-by-step implementation of innovative projects

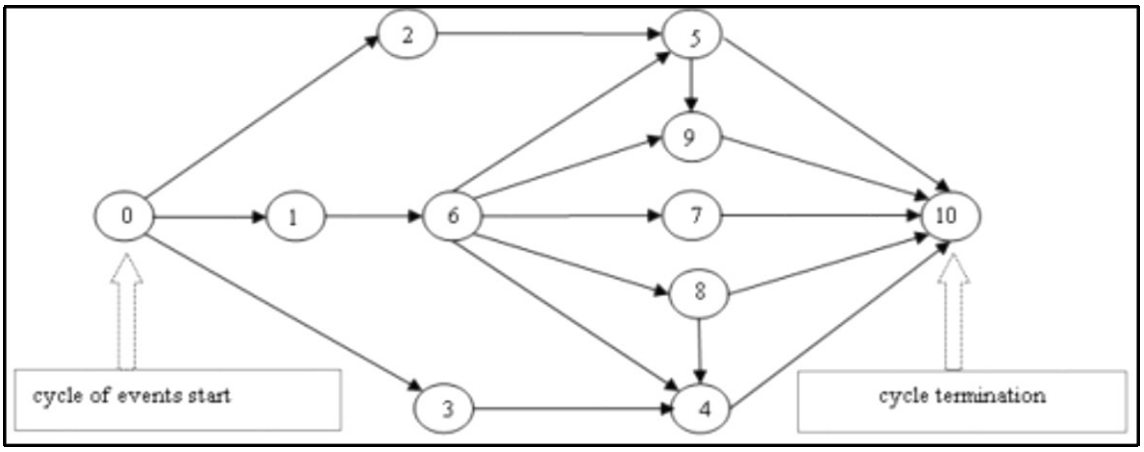
Achievement of the expected results forms the basis for further modernization of an innovative educational cluster, allows adjusting the functions programs for the system of regional administrative bodies, provides the sustainable development of the regional AIC.

From the authors' viewpoint, the multiplicative effect may accelerate the functional processes. Let us consider the mechanism of legislative, management and financial subsystems administration in the developing medium.

The net graph of development of legislative, management and financial subsystems of an innovative educational cluster of the regional AIC is shown on the picture 3 and is represented by the algorithm of carrying out the complex of the following policy measures:

1. integration of regulatory framework of the support of small and medium innovative businesses to the current state of economy and competitive environment of the region;
2. development of the business plan of innovation implementation in the small and medium agricultural business entities in the basis of marketing research;
3. development of strategy and tactics of innovative educational activity;
4. evaluation of the need in qualified specialists that are able to promote innovation projects;
5. establishment of the venture fund for the promotion of research and technological advance in production;
6. financing for innovation projects and control over the targeted use of resources;
7. employer-sponsored education for the order of innovative companies;
8. encouragement of agrarian science and innovative education development;

9. insurance of investments in research.



First level events:

0-1	development of legal framework
0-2	extension of market studies and business planning
0-3	development of strategy and tactics of innovation in regional aspect

Second level events:

1-6	elaboration of the development strategy for public-private partnership
2-5	establishment of the venture fund
3-4	forecasting the number of necessary human resources

Third level events:

6-4	qualified specialists training financing
6-5	financial support of the venture fund
6-7	financial support for employer-sponsored education
6-8	encouragement of the science and knowledge economy development
6-9	insurance of investments in research
5-9	insurance of investments in research with the participation of a venture fund

Picture 3 – Net graph of the action of programming and implementation of measures in an innovative educational cluster

According to the policy measures, the graph has three branches of the first and second levels and six branches of the events of the third level. As it comes from the position of the branches, the preferred condition of successful realization of regional innovation policy is state support of research and education activities. It defines the significance of events 5 and 6 that mark the state participation in the innovative educational cluster's transition to the new level of development. The central event that

provides for the financing for the achievement of goals is the event 6 (development of the strategy of public-private partnership).

With due regard to marketing research in the markets of labor and innovative products, it is reasonable to empower the relevant responsibility centers (analytical groups) as part of the governing bodies to perform such functional duties as evaluation of market conditions and formation of data bases of scientific advance in the AIC. Analytical reports formed on the basis of these research results are to be issued in public sources or on-line. Analysts may conclude works contracts for the development of the standard business plans for innovation implementation on the account of budget or private funds for small and medium businesses. Recommendation and propositions should be substantiated by the results of the group activity and itemized according to the thematic work agenda of research institutions and their departments.

For practical use the network model may be modified into a network plan that states the allowed time for implementation of policy measures and critical path. Optimal duration of the set of measures should be both the monitored control and the criterion of network plan execution efficiency. Practical evaluation of the duration of work for an event parameter of the network model mostly depends on the proposed objective, initial state of the system, and the degree of material, financial and intellectual resources concentration for the realization. The action of the mechanism increases the efficiency of innovation, accelerates adaptation of educational and research regional institutions to changing market conditions. Using this instrument the governing bodies can aggravate positive results in innovation and educational spheres and block negative response of the system.

4. DISCUSSION

A jump of instability on the macro level and rising menace to economic security slow the Russian agricultural economy transition to the advanced technological mode and update the tasks of strengthening provision and professional independence, particularly, on the basis of using regional competitive advantages. The key role in securing these processes is played by the formation of innovative infrastructure. This infrastructure create favorable conditions for strategic implementation of scientific and technical advance in agricultural production. The core of innovative educational clusters integrated into the growing points if regional economy are research institutions and academic science. Both the region and the cluster participants may make the efficient use of their advantages over other territories and companies. Clustering aids the preservation and efficient use of the scientific and technological potential of the core industries of the region and creates conditions for dynamic modernization of regional economy.

The strategic purpose of the innovative educational cluster is the maximization of the financial performance for each participant. The expected positive effect, being a result of cluster interaction for regional economic purposes, is viewed as possible, not compulsory. That is why dealing with problems of functional and structural enhancement of innovative educational clusters in the regional AIC is seen in improvement of economic clustering mechanism and the development of relevant tools to define the point for controlling actions, conditions optimization and assessment of possible result.

5. CONCLUSION

The basic premise for this study is the hypothesis that maintaining the competitiveness of the regional AIC is possible only by means of innovation process. The innovation process in turn is possible on the basis of continuous reproduction of qualified staff. This study substantiates the approaches to the structuring of innovative educational cluster of the regional AIC, specifies the roles of federal and regional components of the cluster. It also designates the place of market subsystems, the objects of which are labor, innovation, educational services, agricultural raw materials, and food supplies. The tool of structuring imaging is the author's method of system decomposition of the structural logic model of innovative educational cluster of the regional AIC. This method allows analyzing integration interactions.

The proposed model of the cybernetic system of science, education and production realize the interests if regional AIC and develops on the basis of existing direct and back links. The model analysis assessed the character and parameters of necessary controlling actions. All this resulted in development of priority paths of cluster development. The revealed contradictions in the interests of participants of educational spheres of the cluster and the region formulate the task of detailed study of conflicts in integrated economic systems. In this regard this paper proposes the mathematical apparatus of a known interaction model "predator - prey". The authors developed the programming mechanism of multiplicative stimulation for the innovative educational cluster. This mechanism may conciliate the imbalances in the labor market with due regard to the regional economic complex efficiency.

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