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Research paper



Decision Support System on Social Stability Governance Based on Scenario Approach

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Abstract

In modern conditions, it is necessary to organize effective information support for governance processes ensuring social stability on the basis of a comprehensive outpacing analysis of threats to regional security and sources of vulnerability of socio-economic systems, mechanisms to reduce uncertainty in the preparation and implementation of strategic and medium-term governance decisions, and improve their effectiveness in relation to the changing situations and in the external environment. The results presented in this paper are an evolution of the methodology of scenario analysis in the direction of developing formalized methods for analyzing and synthesizing alternative scenarios for the development of the situation in the social sphere and the means of supporting them.

Keywords: *Decision Support System; Social Stability Governance; Scenario Approach.*

1. Introduction

At present, improving the efficiency of social stability governance is a key, critically important strategic goal of state policy for a significant number of developed and developing countries facing a whole range of problems caused by crisis phenomena in the world economy, uncontrolled migration flows, manifestations of nationalism and religious and political extremism, threats of international terrorism, etc.

In the context of globalization, the growing interdependence of the economic and social systems of different countries, as well as the intensive development of the global information society, a social explosion can be triggered by a relatively small external or internal information impact. At the same time, the most dangerous is a purposeful negative impact on the consciousness and outlook of people (giving this consciousness desirable for the source of the impact of destructive goals, qualities and properties) in conditions created by modern information and telecommunication technologies [2].

Processes of social stability governance are basically based on the results of a comprehensive analysis and evaluation of a wide range of socio-economic, political and other indicators (indicators) that allow assessing the current situation in the state and society, as well as the risks of its destabilization. Various indicators used in the procedures of information support of the processes of preparation and implementation of managerial decisions, allow us to assess the level of social tension in society, to predict and develop adequate measures to prevent various negative effects. [2].

In these conditions, the role of the methodology of scenario analysis of the dynamics of complex systems on the basis of mathematical graph models of a special type is raised, the main idea of which was first formulated in the 1960s and is reflected in the works of F. Roberts, J.Forreester, D.Medows and a number of other scientists [4]. In order to increase the effectiveness of information support for social stability governance, it is proposed to use the methodology of analyze and synthesis alternative scenarios of development of a situation [5].

2. The main statements of the methodology of scenario analysis of the dynamics of complex systems

The methodology of scenario analysis is based on the processes of developing and researching simulation models created on the basis of the apparatus of signed digraphs. In the modeling of scenarios, both the qualitative and quantitative data are used as input data. Its main advantage is the possibility:

1. Estimation of the level of vulnerability of the social sphere under the influence of external and internal threats of destabilization.
2. Conducting a comprehensive analysis of the current situation in the social sphere at a given time horizon.
3. Formation of short-term and long-term forecasts of its development.
4. Evaluation of the effectiveness and consistency of the set of strategic and tactical decisions distributed over time and space to achieve the goals of social stability governance in conditions of uncertainty.

Within the framework of the proposed scenario analysis methodology [1,5], a basic multi-graph model of social stability including complex destructive information impact of an extremist nature

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was developed. The model includes 50 factors reflecting the socio-economic situation, the geopolitical situation and the information situation in the country.

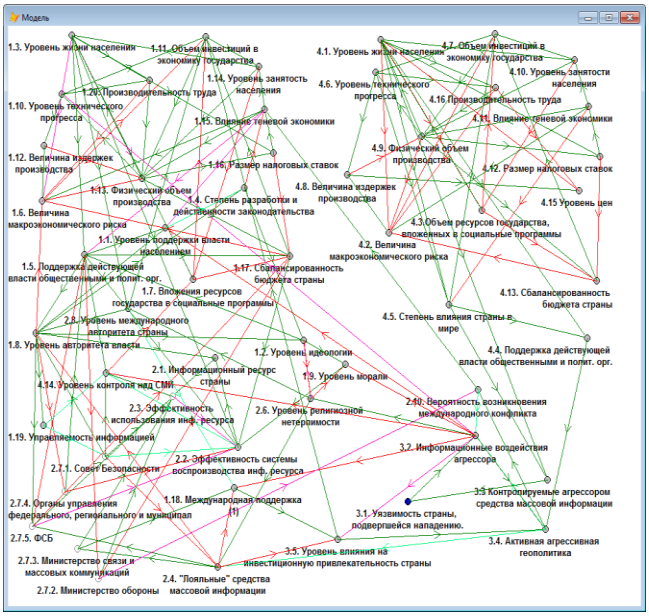


Fig.1: **The multi-graph model of social situation**

The process of modeling and synthesis of alternative scenarios of the situation development is carried out using the apparatus of functional signed graphs. The mathematical model of these graphs is an extension of the classical models of oriented digraphs. In addition, the model of digraph G (X, E), where the X – a finite set of vertices, and E – a set of arcs of the graph includes additional components. So, each vertex of the graph has the parameters and each arc of the graph has a sign, weight or functional transformation F (V, E), those in accordance with each arc is put either a sign, or a weight, or a function [5].

On expanded digraphs, the concept of a impulse and an impulse process in a discrete time space is introduced. The impulse at the vertex at time is the change of the parameter at this vertex at the time n:

$$F\left(v_i, v_j, e_{ij}\right) = f_{ij}\left(v_i, v_j\right),$$

On expanded digraphs, the concept of a impulse and an impulse process in a discrete time space is introduced. The impulse $P_i(n)$ at the vertex x_i at time $n \in N$ is the change of the parameter at this vertex at the time n:

$$P_i(n) = v_i(n) - v_i(n-1).$$

The value of the parameter at the vertex x is given by:

$$v_i(n) = v_i(n-1) + \sum_{j=1,\, j\neq i}^{N} F\left(v_i, v_j, e_{ij}\right) P_j(n-1) + P_i^0(n).$$

There is $P_i^0(n)$ — external impulse at the vertex e_i in the at time n.

Thus, equation of impulse in the considered process:

$$P_i(n) = \sum_{j=1,\, j\neq i} F(v_i, v_j, e_{ij})(P_j(n-1) + P_i^0(n)).$$

The parameters of the vertices of a graph are key indicators that describe the state and dynamics of the situation (factors), the structure of the graph reflects the cause-effect relationships between them.

3. Scenario analysis in the process of social stability governance

The main task to be solved within the framework of the scenario approach is to create the necessary initial data for the preparation and adoption of effective strategic and operational solutions, as well as a comprehensive outpacing analysis of the consequences of implementing these decisions under different conditions. The scenario of the development of a complex system development or a specific problem situation is an indispensable intermediate link between the stages of goal-setting, formation, and the implementation of specific decisions aimed at achieving the set goals. On the constructed multigraph model of social stability in the region (Fig. 1), a simulation and scenario analysis of the governance effectiveness of social stability was carried out. As a result, four scenarios are formed.

Scenario 1. «Absence of information aggression and intensive destabilizing influences»,

Scenario 2. «Information aggression without counteraction» consist of a pessimistic assessment of the consequences of the targeted implementation of a comprehensive destructive information impact (CDII) on civil society

Scenario 3. "Analysis of the effectiveness of the management of the resistance to information aggression". The formation and analysis of the effectiveness of a set of measures to counter information threats in a situation where the control system of this counteraction is not effective enough.

Scenario 4. "Evaluation of the effectiveness of centralized and coordinated countermeasures against CDII"

Scenarios 1 and 2 allow to evaluate the efficiency of the system based on the simulation of the current state of the situation.

In Scenario 3, in order to assess the effectiveness of the countermeasures ("parrying the threats" of CDII), the following transformation of the basic model was carried out. In order to express the enhanced information impact in setting the initial data, impacts (impulses) on parameters (parametric impacts) and connections (structural impacts) are used.

Parametric impacts: Impulse on factor «Using of information potential » – +1.

Structural impacts: The links between the "Using the information potential" factor and the factors "the level of counteraction to attempts to manipulate public (mass) consciousness" and "the dissemination of extremist information on the Internet" have been activated. The links reflecting the intensification of the use information resource by the governance system are activated. All paragraphs must be justified alignment. With justified alignment, both sides of the paragraph are straight.

The results of the scenario studies are obtained on the pilot version of the specialized software, which provides information support to the processes of forming and exploring alternative scenarios for the development of the situation in order to assess the effectiveness of management decisions to ensure social stability. The developed set of programs is running MS Windows. This software package provides: automation of creation and modification of graph models in the mode of dialogue with the user with the help of built-in visual design tools.

As it follows from the graphical dependences presented in Fig. 2, at the initial stage of the simulation there is a fairly long period of positive change in the main (key) factors of the country's social and economic development and its regions that directly determine the level of social stability. The society's stability towards external

destructive information influences is also growing, which reflects the positive results of the initiated control processes of the CDII counteraction. At the same time, the level of inconsistency in the use of the information resource (on the chart - fluctuations in the values of this factor with a general positive trend) starts to show up and gradually, which nevertheless does not lead to significant negative consequences during a certain time interval.

However, over a longer period of time, if long continuous destructive information campaigns are conducted, the effectiveness of counteracting them significantly decreases, which leads to an increase in threats to social stability. In addition, the information resource necessary for parrying CDII begins to dwindle, and the effectiveness of its reproduction system sharply decreases, which further exacerbates the current situation.

At the next stage of modelling, scenario 4 examines the key issues of assessing the effectiveness of managing the counteraction to information threats to social stability. In accordance with the task, a number of changes were made to the basic model. In particular, the factor reflecting the results of the centralization of the state system of information management and coordination of the actions of the constituent elements has been activated.

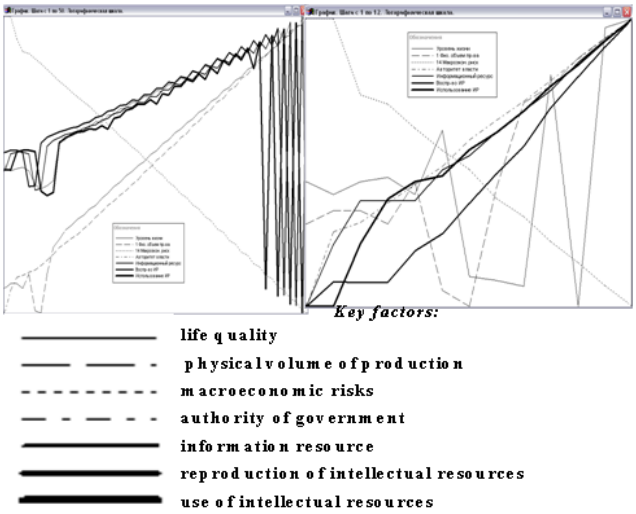


Fig.2: Dynamics of changes in the key factors (Scenario 3,4)

The results of the simulation showed that due to the increase in the efficiency of the management system over a sufficiently long time interval, it is possible to maintain the political, economic and social systems of the state under conditions of stable growth. At the same time, the effectiveness of efforts and measures to reflect CDII is also increasing.

The results of the scenario research also show that the centralization of the preparation, implementation and monitoring of strategic, tactical and operational decisions on the management of information security of the state, as well as coordination of efforts to counter information aggression in general, have a positive impact on the socio-economic and political development of the state in an active information confrontation. In addition, the information management system built in this way actually allows one to create a single information (resource and structural-technological) reserve, which along with an effective system of its reproduction significantly increases the information potential of the state.

The approach proposed for solving this problem is based on modeling and outpacing scenario analysis of the processes of development of the situation in the social sphere and in the external environment. Its main advantage is the possibility of forecasting and analyzing alternative variants of the development of the situation in the social sphere at a given time horizon, as well as evaluating the effectiveness and coherence of a multitude of strategic and tactical management decisions distributed over time and space to maintain social stability in a society in conditions of uncertainty and in the presence of external and internal destructive influences.

4. Conclusion

Today, it becomes more and more obvious that the need to effectively solve the tasks of social stability governance requires the development of fundamentally new methods of scenario analysis, the results of practical application of which should allow:

- diagnose and identify external and internal threats to social stability in the community, and also identify sources of vulnerability in a timely manner;
- provide a comprehensive assessment of the potential danger of threats to social stability and the severity of the consequences of their implementation;
- reliably evaluate the effectiveness of decisions taken to manage social security, which consists in counteracting threats to social stability and eliminating (compensating) the consequences of their impact;
- to form conclusions about the most probable and expedient directions for the development of dynamic processes in the social sphere under conditions of uncertainty, their stability and other characteristics on the basis of information on the structural features of the system under research.

Further development of applied research in this area will provide an opportunity to solve a wide range of theoretical and applied problems of planning and managing social security.

Acknowledgement

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References

[1] Kulba V., Zaikin O., Shelkov A, and Chernov I. Scenario Analysis in the Management of Regional Security and Social Stability // New Frontiers in Information and production Systems. Intelligent Systems Reference Library. 2016. Vol. 98., doi : 10.1007/978-3-319-23338-3_12

[2] Schultz V., Kulba V., Shelkov A. and Chernov I. Scenario analysis in the management of geopolitical information warfare / Ed. Member-corr. RAS V. Shultz. - M .: Nauka, 2015. (in Russian).

[3] Schultz V., Kulba V., Shelkov A. and Chernov I. Information management in the context of globalization – Moscow: Trapeznikov Institute of Control Sciences of RAS, 2017 (in Russian).

[4] Roberts, F. Discrete Mathematical Models, with Applications to Social, Biological, and Environmental Problems. Prentice-Hall, Englewood Cliffs, New Jersey. 1976.

[5] Models and methods of analysis and synthesis scenarios of socio-economic systems: in two books / Ed. V. Schulz and V. Kulba. - M .: Nauka, 2012 (in Russian).