Informatics

Modeling of Decision Making Support System in Conflicts Control

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ABSTRACT. Trends and methodological principles of conflict processes investigation enabling formalization and structuring of the subject area are analysed and a cognitive model of data structuring is proposed. © *2007 Bull. Georg. Natl. Acad. Sci.*

Key words: system, model, modeling, management, function, cognitive model.

The development of humanity and the globalization process lead to changes differing in scale and character, giving rise to various type conflicts. In their turn, conflicts play a substantial role in the life of a separate human being, as well as, in the process of functioning of any social system – family, organization, society and state. The means of conflict prevention and settling assume ever greater importance. An essential part in such a process is assigned to making skilled decisions by specialists or supervisors of any level at different stages of conflict development, that would favor their solution, weaken possible consequences and predict or control the conflicts. Economical, political, ideological, social, cultural, ethnic and other factors are intermingled in the conflict that makes difficult enough their investigation without using the scheme of knowledge transfer from one, more investigated field, to another is less studied one.

In the opinion of most scientists, up to the present day, a common theory of modeling, solution and control of conflicts has not been created. We propose a computer model of support of making managerial decisions in the process of conflict prevention and solution, which consists of the following stages.

1. Analysis of the Situation

Such analysis can be done using the PEST and SWOT methods of analysis. In the investigated field the internal and external media are marked out. In PEST analysis the attention is focused on external factors: political, economic, social and technological. In SWOT analysis the opportunities (advantages that are necessary to be used with maximum benefit) and threats (circumstances that may have serious negative effect) are considered as external factors, while the forces (on which one can count upon) and weaknesses (inner encumbrances) are considered as internal factors. In order to use the already accumulated experience of situation analysis and solution of conflictological problems it is advisable to employ a specialized data base.

2. Selection and Stimulation of Experts

In the course of the given stage the selection of methods of experiment organization and execution is realized. When choosing the experts, besides professional qualities, their emotional and psychological peculiarities are considered as well. In accordance with the organization of experts activities, the possibilities of increasing its effectiveness by stimulation is analyzed.

3. Formation of Purposes and Strategies

Practice proves that to achieve their purposes the conflicting parts analyze a considerable number of different strategic versions, seeking to select the most acceptable ones in the given concrete conditions. When controlling the realization of the strategy, the qualitative generalized comparison of strategic purposes and actual results is done.

4. Exposition of Factors Affecting the Generation and Proceeding of Conflicts, their Checking for Completeness

One of the problems of the analysis of conflictological situations that needs making a managerial decision is, in most cases, the identification of the factors or parameters causing these situations and affecting them. The Table presents the list of significant factors affecting conflict progress in former Yugoslavia, made out with experts partici-pation. The Table gives the estimation of parameters significance, their initial state, desired tendencies of changing for conflict control and estimation of factors dynamics. In order to show the significance of parameters the linguistic variables have been compared with numerical values given in the table of intervals.

5. Generation of Possible Scenarios

The generation of possible scenarios of situation development may be obtained by software support of situation model, by expert systems with the help of cognitive approach and also as a result of generation of scenarios taken out of data base on the basis of supervisor decision.

6. Estimation of Possible Decisions

In the course of the given stage the estimation of possible decisions is done in accordance with the given criteria.

7. Concordance of Decisions

The concordance of decisions is realized in the course of negotiations of supervisors, experts, mediators or representatives of the parties. In this case the subjects of the system where the conflict takes place may have different status, while the trend of their actions and aims may be of conflicting character. On the basis of the implanted laws and algorithms of estimation the model of decision making support proposes an intermediate version of concordance which afterwards can be specified with several iterations.

8. Prognosis of the Consequences of Decisions Made

Correct prognostication of possible consequences of the decisions made in conflictology greatly depends on and is determined by the experience and knowledge of the supervisor or the person making the decision. The result of the analysis carried out during the given stage can be the change of some initial approaches, return to the stage of decision concordance and in some cases even revision of goals and strategies of conflicting parties.

9. Estimation of Scenario Stability

With this purpose, the problem of system control estimate is solved. Open system is controled if control response can be delivered on it for the regulation of its behaviour.

At progressive development of the system, negentropy in it increases even more than entropy, while at destruc-tive development, disorganization, conflicts - vice versa. Thus, stability of scenarios is achieved at the expense of correct organization of system relative to entropy and negentropy correlation.

10. Analysis of Situation Development Dynamics

In the course of the given stage the comparison of the expected result with the actually received one is carried out and, in case of need, subsequent correction of the made decision is done. The given block can be used in the cases when the supervisor tracks out conflict development and makes decisions in the process of situation change.

11. Setting of Control Level (Hierarchy)

At the given stage the necessary level of control response realization for conflict regulation is determined.

Table 1

List of parameters

Parameter №	Parameter denomination	Parameter significance [1, 10]	Initial state [-1, 1]	Desired tendency [-1, 1]	Estimation of dynamics (-1, 0, 1)
1	2	3	4	5	6
1	Geostrategic situation	5	0.2	-0.1	-1
2	Historical-religious factor	6	0.3	-0.2	-1
3	Ecologic and climate factor	3	-0.1	0	0
4	Season	2	0	0	0
5	Main natural resources and their control	5	-0.2	-0.7	0
6	Struggle with international terrorism. drug trafficking distribution. illegal circulation of weapons	5	-0.1	0.5	1
7	Creation of safety system of the 21st century	3	-0.1	0.5	1
8	Formed stereotypes of interpersonal and intergroup relationships of people instrumental in starting conflicts	7	0.5	-0.8	-1
9	Effect of information factor and MMI function	8	0.3	-0.3	-1
10	Presence of military opposition and readiness to use arms and military equipment	5	0.4	-0.5	-1
11	Activity and effect of the system of international organizations and institutions (UN. OSCE. IMF. NATO. OPEC. etc.)	4	-0.2	0.7	1
12	State borders correspondence to language and territory borders of ethnoses	3	-0.4	0.4	1
13	Violation of human rights of one or another nationality	4	0.3	-0.7	-1
14	Interference in the domestic affairs of other country	5	0.2	-0.3	-1
15	Processes of changing the state border	5	0.5	-0.8	-1
16	Development of methods of conflict analysis and creation of corresponding data base	4	0	0.9	1
17	Existence of changes and innovations in the system (organization. structure. interrelation)	2	0.3	-0.5	-1
18	Quality of the managerial decisions taken	4	-0.3	0.8	1
19	Time of making managerial solutions (effectiveness)	4	0.3	-0.8	-1
20	Subject competence of all level specialists	6	-0.2	0.8	1
21	Changes in military-political situation	5	-0.5	0	0
22	Presence of mediators in conflict settling	4	0	0.5	1
23	Degree of elaboration of standard procedures of solution of contradictions arising in the process of cooperation of persons	5	-0.2	0.8	1

| 1	2	3	4	5	6
24	Factor of evolution (development of humans, labour means, social cooperation sphere, arms and military equipment)	3	0	0.9	0
25	Object and subject of conflict	8	0.7	-0.8	-1
26	Motives of parties (needs, interests and objectives of opponents)	8	0.5	-0.7	-1
27	Conflict interaction (methods and means of influencing each other)	7	0.4	-0.5	-1
28	Potential of conflicting parts	7	0.2	-0.8	-1
29	Mentality, social culture	5	-0.2	0.8	1
30	Social situation in the society	5	-0.2	0.5	1
31	Political situation in the society	5	-0.2	0.5	1
32	Well-being level of the society	5	-0.3	0.5	1
33	National self-consciousness level	4	0.4	0	0
34	Accepted system of resource distribution	5	-0.2	0.5	0
35	Condition of the economy	7	-0.5	0.5	1
36	Availability of workplaces	7	-0.5	0.5	1
37	Existence of political forces using ethno-national factor in the struggle for power	5	0.3	-0.4	-1
38	Presence and frequency of different stressful situations	7	0.2	-0.7	-1
39	Insufficiency of benefits necessary for normal vital activity of the people, dissatisfaction of positive emotions	7	0.2	-0.5	-1
40	Correspondence of the worker to the demands placed on the taken position	6	-0.1	0.8	1
41	Biological nature of human being	5	0.1	-0.3	-1
42	Social and psycological characteristics of human being	5	-0.3	0.2	0
43	Transport system development and population mobility	3	-0.4	0.5	1
44	Corruption and arbitrary rule of public servants	5	0.4	-0.5	-1
45	Criminality, uncertainty of personal safety	5	0.4	-0.8	-1
46	Breach of previously reached agreements	5	0.4	-0.8	-1
47	Dynamics of conflict	7	0.2	-0.8	-1
48	Scope and duration of conflict	7	0.3	-0.8	-1
49	Means of conflict resolution	7	0	0.5	0
50	Number of participants in conflict	7	0.3	-0.5	0
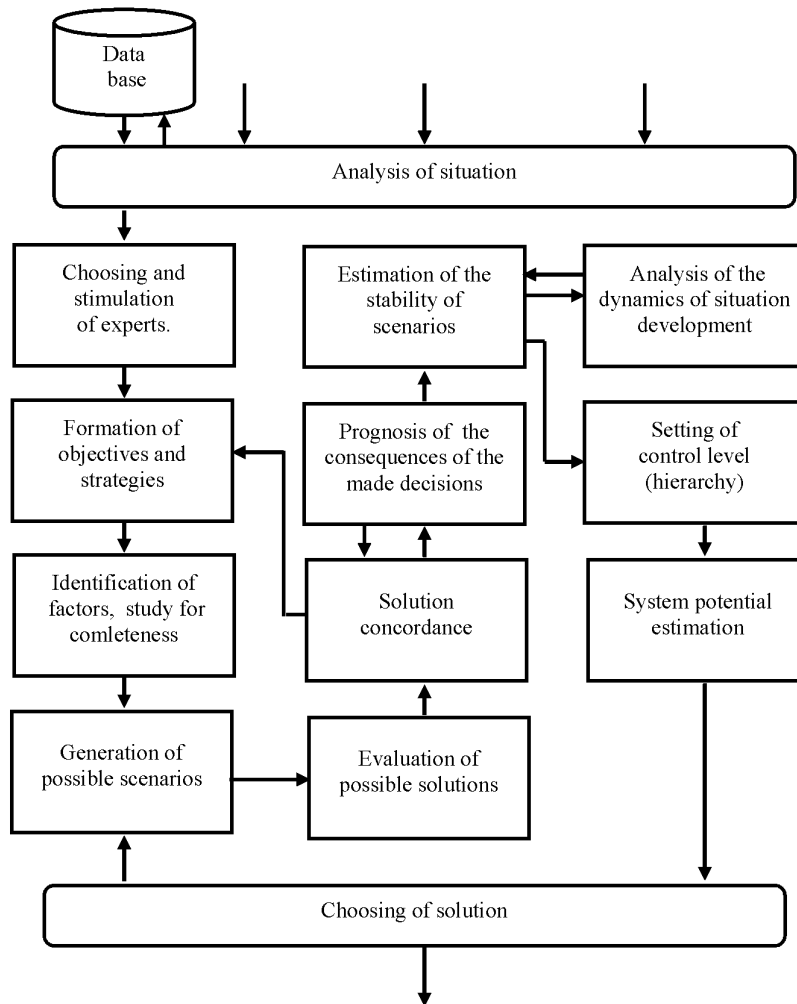
Fig. 1. Structural diagram of a decision making support model

12. Estimation of System Potential

The estimation of system potential is done with the purpose to determine the possibilities of achieving the contemplated goal.

13. Choosing the Decision

Supervisors or decision making persons are supposed to use an algorithm and the procedure of decision choosing from the set of versions obtained. As a rule, real life forces the realization of just one of the existing possibilities. The choice may have positive, as well as, negative consequences and there often is no "right for error". Considering the specifics of the conflict as the object of investigation it is necessary to take into account the possible changeability of relation of cognitive and emotional components of working out and decision making process. The given circumstance assumes the necessity of the account of opinions of all parties involved in the conflict and also depends on the qualification and skill of the decision making person.

In order to solve the most conflictologic problems it is advisable to use the available experience and knowledge on the given problem that can be united in the specialized data base (DB). The creation of such DB "Conflict" may be realized with the help of an integrated problem-oriented batch of applied programs. Model DB may be presented as

$$M = <A, B, C, D, H, F>$$

where A is meta language providing user's interaction with the complex of programs and data base control; B is the set of data files $B = \{b_i \, / \, i = \overline{1,I}\}$ including files of conflict characteristics description, files of glossary-reference book on

conflicts, etc.; C is the set of program blocks $C = \{c_j \,/\, j = \overline{1,J}\}$ intended for formalized description of conflicts and specification of information requirement of users; D is the set of program blocks $D = \{d_k \,/\, k = \overline{1,K}\}$ providing realization of operational functions; H is the set of public program blocks $H = \{h_n \,/\, n = \overline{1,N}\}$ realizing separate system functions and making the library of systems modules; F is the set of used organizational, technical means and software of data base protection from unauthorized access.

Use of data base can considerably simplify development and making necessary decisions on settling of different conflicts.

The structural diagram of the model of decision making support is given in Fig. 1.

On the whole, decision making support is considered as a multistage problem. At each of n stages the problem of maximization of the index of effectiveness W_i is solved, which depends on a_i – set of given factors, x_i – set of decisions for which a set of admissible values is determined and b_i - set of unknown (undetermined) factors of the stage. To determine the index of effectiveness W of the system the weight coefficients of k_i stages are selected with the help of experts.

$$\widetilde{W}_i = \max W_i = \underset{\forall x_i \in X_i}{W_i} \left(\alpha_i, x_i, b_i, k_i\right), \text{ where } k_i \text{ is the weight coefficient of the stage and } \sum_{i=1}^{n} k_i = 1.$$

The proposed approach enables to choose the most proper (in the sense of complexity) method of decision at each stage. If $k_i = 1/n$, it means that each stage of decision making support is equivalent, if $k_i = 0$, then the given stage falls out of the general scheme and is not considered in the given concrete case, etc.

ინფორმატიკა

გადაწყვეტილებათა მიღების მხარდამჭერი მოდელი კონფლიქტოლოგიაში

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ნაშრომში შემოთავაზებულია კონფლიქტოლოგიაში გადაწყვეტილების მიღების მხარდაჭერის მეთოდოლოგია და საინფორმაციო ტექნოლოგიები, რაც გულისხმობს ფორმალური მოდელის შექმნას და გადაწყვეტილების მიღებას შესაბამისი მათემატიკური საშუალებების გამოყენებით.

REFERENCES

1. *I. Prangishvili* (2003), Regularity of entropic and other systems. Moscow.
2. *A. Prangishvili, S. Prokopyev* (2007), Computer models of decision making support. Tbilisi, Technical University.
3. *O. Shonia* (2002), Conceptual model of conflict break up in complex systems. Trans. of the GTU, 3(9449).
4. *G. Chogovadze, G. Gogichaishvili, G. Surguladze, T. Sherozia, O. Shonia* (2001), Design and creation of automatic control systems. Tbilisi, Technical University.