FUZZY APPROACH IN IMPLEMENTATION OF E-GOVERNMENT IN THE FIELD OF REGIONAL DEVELOPMENT REGULATION

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Abstract

Sensible regional policy administration should be based on analytical implementations and software on preparation of «an electronic portrait» of the state subjects. Therefore it is necessary to create an information society which would push the municipal organizations to join the concept of «e-Government».

In order to avoid and overcome an information inequality and to create a form of regions management in the field of the regional policy, e-government can give opportunity to receive the information in the integrated electronic type. Particularly, electronic regulation of regions by e-Government assumes solution of three types of IT-problems: infrastructure creation, public portals and announcement of vertical solutions.

Obtained implementations of automation control of the regions afford to government sector the opportunity to consolidate the central and periphery informational societies and provide with the software for rendering the services accessible anytime in anyplace and by any device. To announce the vertical solutions in the field of regional policy the programs which enable to perform the transition to distributed computing operation of local government employees (considering the Internet being the environment of their interactive communication) was developed on the basis of Neuro-Fuzzy technologies.

Key Words: *e-Government, neural network, fuzzy set, differential and integral indexes of region development, utility function.*

JEL Classification: R58

1. INTRODUCTION

In the countries with the established liberal setup of economy the government are more free from the responsibility for business and fortune of managing subjects, than from liability to regional formations. Being limited by indirect regulation through taxes system, ecological, antimonopoly and other legal restrictions through laws on work and activity of trade unions and other public organizations, these states can afford completely to abandon straight interference in activity of free market subjects. But any state in the world as though did not declare and did not provide independence of the territorial and municipal formations, cannot and, the main thing, has no right to leave from the responsibility for territorial integrity of the country, for non-admission ecological, economic, ethnic and other regional

crises, for development of all state territories as environment of life support of all population. That's all is usual norm of a state policy in conditions of stably developing socio-economic relations. However, for the countries with transitive setup in economy, where occurs destruction former stereotypes and new public foundations are formed, this norm becomes priority function of the state.

The state selective support of regions frequently occurs in conditions of incompleteness, fuzziness and/or inconsistency of the available information (Knight, 1921). It takes a key place in the national policy on region development which because of absence science-based and information-analytical (data ware) support of regional goal-oriented program is frequently carried out in uncertainty conditions. There is the most complicated problem of objective selection of the neediest regions for which one can perceptibly and justifiably to spend the state resources.

Now an opportunity of overcoming of uncertainty in economy often consider in application of new information technologies include smart tools of information processing. In modern information technologies one of such tools is the Neural Network based Fuzzy Inferences System (Yager, 1994). Such approach enables to create essentially new hardware and software allowing considerably expanding classes of solved management problems in uncertainty conditions, in particular problems of parameters identification and forecasting of behavior complex dynamic semi structured systems. Development of methods and algorithms of fuzzy mathematics in the neural network logic basis allows raising essentially accuracy carried out operations, a degree of its objectivity and, that, efficiency of decision-making in uncertainty conditions.

2. ESSENCE AND PROBLEMS OF STATE REGULATION OF REGIONAL DEVELOPMENT

Organizational-legal mechanisms are realized through political, legal, social, financial and economic bodies of the government by various forms of the state selective support of regions (Lvov, 1999). Thus there is the most complicated problem of objective selection of the most requiring regions for which it is possible perceptibly and justifiability to spend the state resources. Therefore, the scientifically grounded choice of the optimum decision in the field of the state regional policy has paramount importance as inside of the state each action changing structure and proportions of political, social, economic and other relations in favor of one territorial units, automatically changes theirs for others.

The state selective support of regions can be carried out in the form of transfers; financial support of depressive regions; the goal-oriented program; budgetary investments, etc. Such variety of support forms of regions entails charges of huge cash resources, first of all, at the expense of state budget. However, their full account and estimation are complicated by that the state support of territories is carried out as directly, and indirectly.

There are five basic approaches to a choice of a subject of corresponding regulative actions of the state. The first to the most widespread is the criterion of political expediency according to which preferences from the central authorities receive the regional formations most actively realizing a deal of the state.

The second on the importance and frequency of using is the method of individual selection of regional problems within the limits of which the reasons of occurrence of a problem,

socio-economic efficiency of its decision, etc. should be considered. It is easy to notice, that at absence of the same quantitatively expressed parameters of comparison of the importance, acuteness, urgency of the decision of similar problems, and also without representation about efficiency of alternative decisions final selection will be carried out besides at domination of political reasons.

The third method of selection of regional problems is their ranging by the criteria which have been specially picked up in conformity with specificity of an occasion for given ranging. Such occasions can be development of the state forecast and the intermediate program of socio-economic development of the state, an estimation of regional situations from positions of compliance to the deal of reforms, etc.

The fourth method is the integrated grouping of territorial formations on the limited number of parameters for realization of concrete kinds of selective state support. For example, with a view of inter budgetary alignment by those there can be a method of reference of the separate state regions to categories «requiring» or «especially requiring», «donors» or «recipients».

At last, the fifth, most simple and most rare method of regional problems selection is direct calculation of need for the state support under the certain formulas and with using of few unequivocally treated parameters. For example, on such basis calculation of volume of the transfers directed to separate regions on channels of interbudgetary relations is conducted.

3. PROBLEM DEFINITION OF REGIONAL GOVERNING

Modernization of existing system of state regulation of regional development by principles of priority, validity, productivity and control should be carried out on the basis of the program-goal mechanism of this governing. The analysis of results of regional goal-oriented program realization in some countries has revealed a lot of typical lacks and problems:

- default of goal-oriented program on date of performance, volumes and results;
- permanent underfunding of the accepted programs;
- permanent updating of goal-oriented programs during their realization;
- absence of substantiation of priorities of resources distribution between programs;
- indistinct, unspecific formulation of the purposes of the majority of programs;
- absence of real coordination between separate programs (programs are fairly often happen interrelated, duplicate each other, etc.);
- inefficiency of mechanisms of the responsibility of the state customers and executors for realization of program tasks;
- absence of control mechanisms over using of the budgetary funds allocated for realization of goal-oriented programs and conformity obtained results to the program purposes;

- absence of legislative fastening of mechanisms of development and realization of goal-oriented programs;
- obviously belittled role in development and realizations of the state authorities programs specially created for the decision of regional policy problems.

One of principal causes of these shortcomings is absence of scientifically proved program package adequate to real structure of the nagging regional problems and corresponding to real financial facilities of the state and regions. Overcoming of the designated problems and elimination of basic shortcomings it is possible only at system updating methodical approaches to the organization of this extremely important activity for the state. Thus the maximal concentration of means on the minimal number of the programs solving the nagging regional problems and guaranteeing their decision in setup date at the established limit of resources should become dominating. Extremely precisely and specifically to formulate a regional problem designates to create primary preconditions for concentration of forces and means on the decision essentially solved (instead of politically declared) problems in specifically certain time-frame. That is why it is so important at the characteristic of the problem pretended to «the program status» to answer following questions:

- Whether this problem is unique or there are its any analogues?
- Why it can be qualified as «extreme» or «special»?
- What character of the given problem (it is branch, inter-branch, regional and inter-regional)?
- Whether it is solvable generally and, if yes, in what degree?

As easily note, that with each answer to these questions the field of the problems demanding the program-goal decision is essentially converged. Hence, the confidence in that it is impossible dispense with program and that there is possibility of extremely high concentration of means on concrete program object.

Crucial issue in substantiation of necessity of resources concentration to the goal-oriented program decision of the regional problem it is necessary to consider the forecast of consequences of program non-acceptance and to check the program for utility. Thus it is necessary to take into consideration losses which took place towards the program design, and probability of damage increase in the future. Moreover, with a glance of economy originality and a socially-psychological climate in each state subject the maximal differentiation of government approaches to the estimation of regional needs is inevitable. Therefore carrying out of the sensible regional policy should lean on analytical designs and powerful program-information resources for preparation of adequate «portrait» of each state subject.

4. TOOLS OF MODELING AND FORECASTING IN UNCERTAINTY CONDITIONS

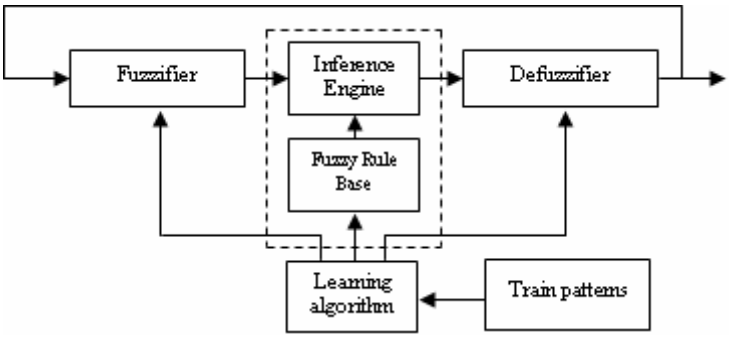
Feature of problems of management in uncertainty conditions consists that measurements (supervision) of input and output values are carried out at a level of soft computing which adequate representation is possible at the expense of their representation in the fuzzy sets

(Zadeh, 1974). In particular, those are the problems described by semi structured and/or unstructured data, i.e. data about which it is known only its membership of a certain type. However only in combination to neural networks mathematical apparatus of Fuzzy Logic became completely adequate for modeling and forecasting semi structured (fuzzy) systems which concerned before to the category of «practically hopeless» problems. It has allowed essentially enhancing the responsibility for made decisions.

During last decades it was observed essential expansion of the mathematical apparatus underlying the description of problem areas, described by an openness, dynamism and semistructureness. The important step in enhancement of approaches to modeling such areas is works of D.A. Pospelov on semiotics systems. In the further this theory has developed by A.N. Averkin (1995), which has generalized concept of semiotics system to fuzzy case.

In particular, fuzzy semiotics system of modeling he has set in the form of $\mu SS = \{\{\mu FS_i\},\{E_j\}\}$ ($i = \overline{1,n}$; $j = \overline{1,m}$), where $\aleph = \{E_j\}(j = \overline{1,m})$ is the set of transitions from one fuzzy model μFS_j to another; n is the number of fuzzy models; m is the number of transitions between them. By this approach it is possible to design the verbal model most full reflecting of semi structured system in uncertainty conditions. In particular, for adequate fuzzy modeling of economic system and the subsequent forecasting of its possible conditions it is necessary to adjust corresponding fuzzy models μFS_i $(i = \overline{1,n})$ for the term-norms are set by users of modeling system. The model μFS_i $(i = \overline{1,n})$ using a set of fuzzy rules is realized by scheme expressed in Figure 1.

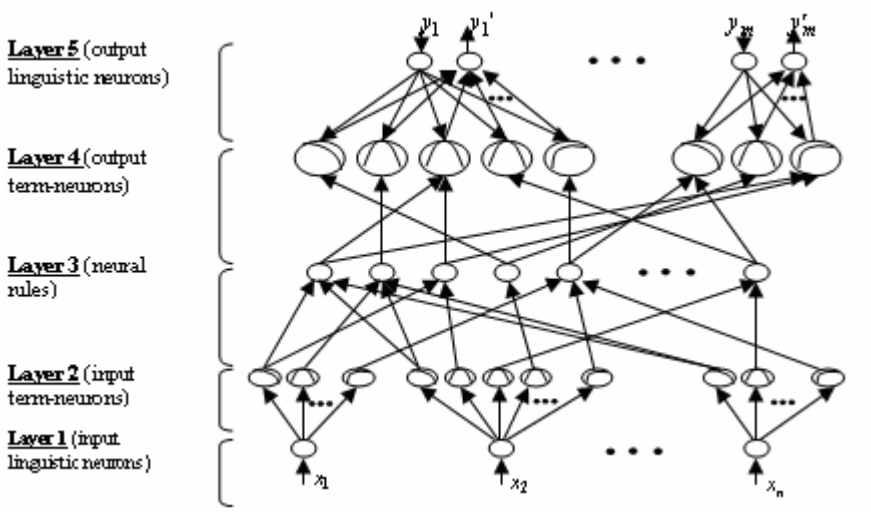
Figure-1: The structure of fuzzy model



For complex realization of this approach it is possible to take advantage of a connection five-layer neural network which differential nature provides its ability to self-organizing own structure and adjustment of parameters on the basis of training patterns and training algorithm. As a result it is possible to achieve more perfect logic rules and optimum parameters for input and output membership functions. Following connection neural

network $\mu FS_i \ (i = \overline{1,n})$ (Figure 2) integrates procedures of fuzzy modeling (Yager, 1994).

Figure-2: Neural network based fuzzy logic model



5. INFORMATION SUPPORT OF SELECTIVE DECISION-MAKING FOR REGIONS DEVELOPMENT

Each region by virtue of historically developed foundations differs by originality of economy and socially-psychological climate. Therefore at estimation of regional needs and levels of socio-economic development it is necessary to carry out differentiation of approaches as much as possible. In this sense carrying out of effective regional policy can and should lean on scientifically proved designs and modern information tools. Such approach allows, first, to obtain adequate «portraits» of the state subjects reflecting all aspects of its socio-economic development, and, secondly, to generate balanced offers for their forward development on the basis of short-term, intermediate term and long-term qualitative and quantitative forecasting.

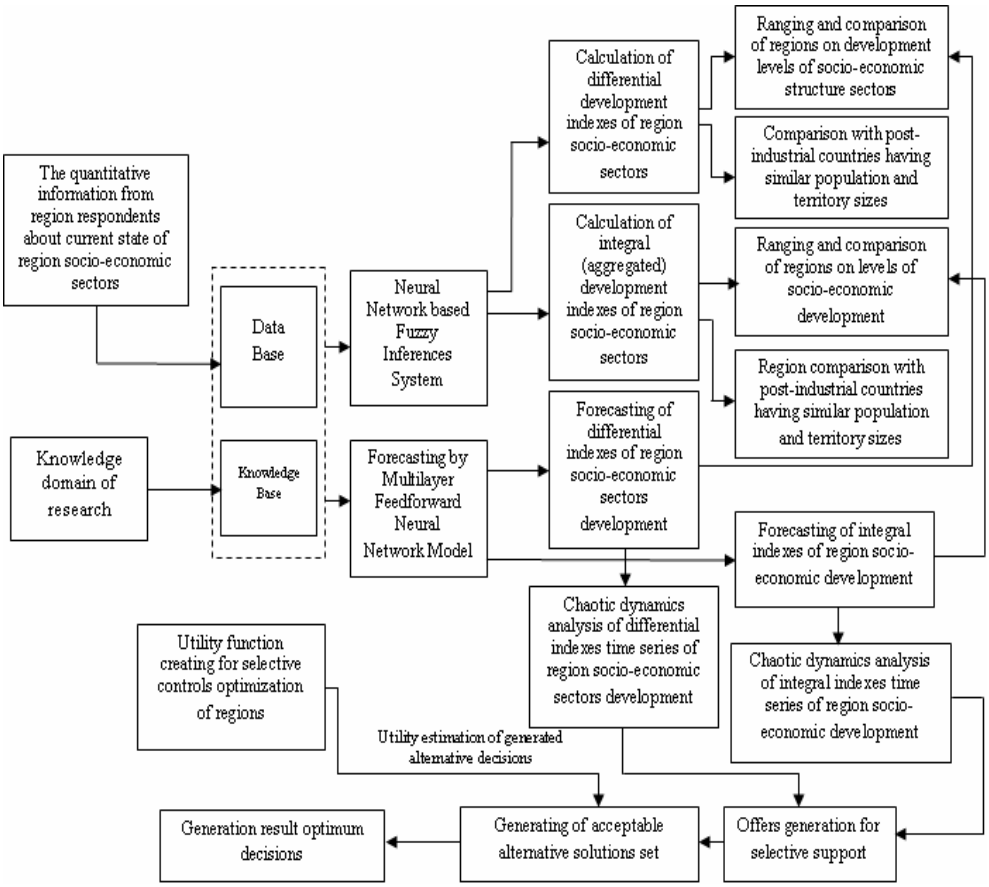
In Figure 3 it is offered the fundamental scheme of support information system of decision-making on the basis of the information database monthly updated by total questionnaire design of region respondents which in on-line transmit quantitative characteristics of current conditions of region socio-economic sectors to the generated database. Ultimate goal of offered system is generation of optimum decisions in the field of selective support of regions in whole and in separate segments of their socio-economic structure.

Within the limits of the given approach and the scheme (Figure 3) it is offered to carry out the row of the actions grouped in two blocks (Table 1): the block of analytical development and the block of decision-making.

Table 1: Proposed action in the field of selective support and region governance

Block name	Offered actions
Designing of adequate models for estimation of region socio-economic development levels and the state subjects as a whole and on various sectors by method of «immersing» of the fuzzy conclusions mechanism into neural network logic basis (Neural Network based Fuzzy Inferences System).	On the basis of numerical estimation of the basic sectors of socio-economic development of the state subjects calculation of corresponding differential and integrated indexes.
	By calculated indexes comparison of socio-economic development levels of the state regions, both as a whole, and on sectors of socio-economic structure.
	By calculated indexes ranking and classification of the state subjects on corresponding sectors of socio-economic structure.
	Comparison obtained results with corresponding estimations of UN Development Program.
	Comparison of socio-economic development levels of the state regions with corresponding socio-economic development levels of post-industrial countries with similar population and territory sizes.
	Interpretation and visualization of obtained results.
For the purpose of analysis of future tendencies of the state region socio-economic development creating the corresponding prediction modeling.	Analysis of chaotic dynamics of time series reflecting of development tendencies of basic sectors of the state region socio-economic structure.
	By the multilayer hierarchical neural network forecasting of semistructured time series reflecting of development tendencies of basic sectors of the state region socio-economic structure.
	By the multilayer hierarchical neural network forecasting of aggregated semistructured time series reflecting of development tendencies of basic sectors of the state region socio-economic structure.
	Interpretation and visualization of obtained results.
Creating of decision making information system in the field of selective support and governance of region socio-economic structure sectors.	Generation of offers and recommendations to conduct of necessary actions for alignment of backlog of regions social and economic development up to a nation-wide level.
	Construction of utility function for ensuring of optimum socio-economic policy in regions.
	Estimation of managerial and selective decisions to development of regions by utility function.
	Choice of the optimum decision in the field of increase of region socio-economic development levels on the basis of estimation of alternative offers utilities.
	Stability test of the decisions directed to increasing of regions socio-economic development levels.
	Interpretation and visualization of obtained results.

Figure-3: The structure of decision making support information system for region governance



6. CALCULATION OF SECTORAL REGIONAL DEVELOPMENT INDEXES (on an example of education service support in regions)

The state selective support of regions frequently occurs in conditions of incompleteness, fuzziness and/or inconsistency of the available information. It takes a key place in the national policy on region development which because of absence science-based and information-analytical (data ware) support of regional goal-oriented program is frequently carried out in uncertainty conditions. There is the most complicated problem of objective selection of the neediest regions for which one can perceptibly and justifiably to spend the state resources.

Feature of management problems in uncertainty conditions consists that inputs and outputs measurements (supervision) are carried out at a level of «soft computing» which adequate representation is possible due to their representation in the type of fuzzy sets. In particular,

the incoming data from the respondents characterizing different spheres of the region socio-economic structure (for example, such as a demography, nonmaterial, manpower resources and employment, social maintenance, industry, agriculture, education, public services, construction activity, medical care, etc.), is described by weakly structured and/or unstructured data that is data about whom their accessory to the certain type is known only. Therefore for the estimation of regions socio-economic development levels on different sectors it is offered to use fuzzy (verbal) models based on implicative form «If-then». The given approach allows to process weakly structured data and to involve in computational process various qualitative categories. In particular, the education sphere in the regions characterized by respondents' weakly structured data is considered. On the basis of these data sectoral indexes of development are calculated and regions are ranked. For estimation of development levels of the region education systems we shall take advantage of a method of fuzzy conclusion. For this purpose let us take an advantage of sufficient in our opinion of number of implicative rules constructed on the basis of linguistic variables from Table 2:

- If $x_1 = \widetilde{X}_1$ and $x_2 = \widetilde{X}_2$ and $x_5 = \widetilde{X}_5$ and $x_6 = \widetilde{X}_6$ and $x_9 = \widetilde{X}_9$ and $x_{10} = \widetilde{X}_{10}$, then $Y = \widetilde{S}$.
- If $x_1 = \neg\widetilde{X}_1$ and $x_2 = \widetilde{X}_2$ and $x_5 = \widetilde{X}_5$ and $x_6 = \widetilde{X}_6$ and $x_9 = \widetilde{X}_9$ and $x_{10} = \widetilde{X}_{10}$ and $x_7 = \widetilde{X}_7$ and $x_{11} = \widetilde{X}_{11}$, then $Y = \widetilde{S}$.
- If $x_1 = \widetilde{X}_1$ and $x_2 = \widetilde{X}_2$ and $x_3 = \widetilde{X}_3$ and $x_4 = \widetilde{X}_4$ and $x_5 = \widetilde{X}_5$ and $x_6 = \widetilde{X}_6$ and $x_9 = \widetilde{X}_9$ and $x_{10} = \widetilde{X}_{10}$, then $Y = M\widetilde{S}$.
- If $x_1 = \widetilde{X}_1$ and $x_2 = \widetilde{X}_2$ and $x_3 = \widetilde{X}_3$ and $x_4 = \widetilde{X}_4$ and $x_5 = \widetilde{X}_5$ and $x_6 = \widetilde{X}_6$ and $x_7 = \widetilde{X}_7$ and $x_9 = \widetilde{X}_9$ and $x_{10} = \widetilde{X}_{10}$, then $Y = V\widetilde{S}$.
- If $x_1 = \widetilde{X}_1$ and $x_2 = \widetilde{X}_2$ and $x_3 = \widetilde{X}_3$ and $x_4 = \widetilde{X}_4$ and $x_5 = \widetilde{X}_5$ and $x_6 = \widetilde{X}_6$ and $x_7 = \widetilde{X}_7$ and $x_8 = \widetilde{X}_8$ and $x_9 = \widetilde{X}_9$ and $x_{10} = \widetilde{X}_{10}$ and $x_{11} = \widetilde{X}_{11}$ and $x_{12} = \widetilde{X}_{12}$, then $Y = \widetilde{P}$.
- If $x_1 = \neg\widetilde{X}_1$ and $x_2 = \neg\widetilde{X}_2$ and $x_5 = \neg\widetilde{X}_5$ and $x_6 = \neg\widetilde{X}_6$ and $x_9 = \widetilde{X}_9$ and $x_{10} = \neg\widetilde{X}_{10}$, then $Y = U\widetilde{S}$.

Table 2: Linguistic parameters of the education system in fuzzy infomedia

Symbol	The linguistic variables accepted as parameters	Qualitative criterion of an estimation (fuzzy terms)	Symbol
x_1	Education spendings	Full	$\widetilde{X}_1$
x_2	Seating accommodation at preschool institutions	Enough	$\widetilde{X}_2$
x_3	Seating accommodation at boarding school	Enough	$\widetilde{X}_3$
x_4	Seating accommodation at schools for handicapped children	Enough	$\widetilde{X}_4$
x_5	Seating accommodation at secondary school	Enough	$\widetilde{X}_5$
x_6	Number of teachers	Enough	$\widetilde{X}_6$
x_7	Modern training equipment supply	Enough	$\widetilde{X}_7$
x_8	Computer supply	Enough	$\widetilde{X}_8$
x_9	Number of the educational institutions, demanding thorough repair	One ore several schools	$\widetilde{X}_9$
x_{10}	The population aggregate which are not having the educational institutions	Be absent	$\widetilde{X}_{10}$
x_{11}	Specialized secondary schools	Enough number	$\widetilde{X}_{11}$
x_{12}	Seating accommodation at the new schools up built at the expense of government	Enough	$\widetilde{X}_{12}$

For values (terms) of linguistic variable Y used in the rules on the basis of discrete set $I = \{0,1; 0,2; ...; 1\}$ let us construct corresponding fuzzy sets by the instrumentality of following membership functions: $\widetilde{S}$ =satisfactory – $\mu_{\widetilde{S}}(x) = x,\ x \in I$; $M\widetilde{S}$ = "more than satisfactory" – $\mu_{M\widetilde{S}}(x) = \sqrt{x},\ x \in I$; $\widetilde{P}$ = "high" – $\mu_{\widetilde{P}}(x) = \begin{cases} 1, x = 1, \\ 0, x < 1; \end{cases}$ $V\widetilde{S}$ = "very satisfactory" – $\mu_{V\widetilde{S}}(x) = x^2,\ x \in I$; $U\widetilde{S}$ = "unsatisfactory" – $\mu_{U\widetilde{S}}(x) = 1 - x,\ x \in I$. Terms of input variables used in rules are designated by fuzzy sets $\widetilde{X}_k$ ($k = \overline{1,12}$) with gauss membership functions $\mu_{\widetilde{X}_k}(u) = e^{-\frac{(u-u_0)^2}{\sigma^2}}$, where u_0 is the center; σ^2 is the density of distribution of regional data in define statistical interval. Then on the basis of 5 arbitrary regions described by the statistical data (Table 2) let us generate the estimation criteria of the education system:

$$\widetilde{X}_1 = \frac{0.3}{u_1} + \frac{0.2}{u_2} + \frac{0.6}{u_3} + \frac{1}{u_4} + \frac{0.8}{u_5};\ \widetilde{X}_2 = \frac{0.7}{u_1} + \frac{0.4}{u_2} + \frac{0.55}{u_3} + \frac{1}{u_4} + \frac{0.9}{u_5};$$

$$\widetilde{X}_3 = \frac{0.4}{u_1} + \frac{0.3}{u_2} + \frac{0.7}{u_3} + \frac{0.5}{u_4} + \frac{0.95}{u_5};\ \widetilde{X}_4 = \frac{0.95}{u_1} + \frac{0.25}{u_2} + \frac{0.8}{u_3} + \frac{0.4}{u_4} + \frac{0.7}{u_5};$$

$$\widetilde{X}_5 = \frac{0.7}{u_1} + \frac{0.35}{u_2} + \frac{1}{u_3} + \frac{0.9}{u_4} + \frac{0.25}{u_5};\ \widetilde{X}_6 = \frac{0.1}{u_1} + \frac{0.2}{u_2} + \frac{0.9}{u_3} + \frac{0.4}{u_4} + \frac{0.7}{u_5};$$

$$\widetilde{X}_7 = \frac{0.25}{u_1} + \frac{0.3}{u_2} + \frac{0.2}{u_3} + \frac{0.1}{u_4} + \frac{0.5}{u_5};\ \widetilde{X}_8 = \frac{0.5}{u_1} + \frac{0.75}{u_2} + \frac{0.9}{u_3} + \frac{0.4}{u_4} + \frac{1}{u_5};$$

$$\widetilde{X}_9 = \frac{0.8}{u_1} + \frac{0.65}{u_2} + \frac{0.15}{u_3} + \frac{0.95}{u_4} + \frac{0.4}{u_5};\ \widetilde{X}_{10} = \frac{0.95}{u_1} + \frac{0.15}{u_2} + \frac{0.8}{u_3} + \frac{0.3}{u_4} + \frac{0.6}{u_5};$$

$$\widetilde{X}_{11} = \frac{0.15}{u_1} + \frac{0.9}{u_2} + \frac{1}{u_3} + \frac{0.45}{u_4} + \frac{0.8}{u_5};\ \widetilde{X}_{12} = \frac{0.5}{u_1} + \frac{0.2}{u_2} + \frac{0.8}{u_3} + \frac{0.3}{u_4} + \frac{0.95}{u_5}.$$

Further, by a minimum principle for the left parts of fuzzy rules we shall define corresponding fuzzy sets $\widetilde{M}_i$ ($i = \overline{1,6}$). Then rules can be presented in following more compact appearance:

- if $\boldsymbol{x} = \widetilde{M}_1$, then $Y = \widetilde{S}$, where $\widetilde{M}_1 = \left\{\frac{0.1}{u_1}; \frac{0.15}{u_2}; \frac{0.15}{u_3}; \frac{0.3}{u_4}; \frac{0.25}{u_5}\right\}$;
- if $\boldsymbol{x} = \widetilde{M}_2$, then $Y = \widetilde{S}$; where $\widetilde{M}_2 = \left\{\frac{0.1}{u_1}; \frac{0.15}{u_2}; \frac{0.15}{u_3}; \frac{0.1}{u_4}; \frac{0.25}{u_5}\right\}$;
- if $\boldsymbol{x} = \widetilde{M}_3$, then $Y = M\widetilde{S}$, where $\widetilde{M}_3 = \left\{\frac{0.1}{u_1}; \frac{0.15}{u_2}; \frac{0.15}{u_3}; \frac{0.3}{u_4}; \frac{0.25}{u_5}\right\}$;
- if $\boldsymbol{x} = \widetilde{M}_4$, then $Y = V\widetilde{S}$, where $\widetilde{M}_4 = \left\{\frac{0.1}{u_1}; \frac{0.15}{u_2}; \frac{0.15}{u_3}; \frac{0.1}{u_4}; \frac{0.25}{u_5}\right\}$;
- if $\boldsymbol{x} = \widetilde{M}_5$, then $Y = \widetilde{P}$, where $\widetilde{M}_5 = \left\{\frac{0.1}{u_1}; \frac{0.15}{u_2}; \frac{0.15}{u_3}; \frac{0.1}{u_4}; \frac{0.25}{u_5}\right\}$;
- if $\boldsymbol{x} = \widetilde{M}_6$, then $Y = U\widetilde{S}$, where $\widetilde{M}_6 = \left\{\frac{0.05}{u_1}; \frac{0.6}{u_2}; \frac{0}{u_3}; \frac{0}{u_4}; \frac{0.1}{u_5}\right\}$.

For transformation of these rules we shall take advantage of Lukasevich's implication operation: $\mu_{\widetilde{D}}(u,j) = \min(1,1-\mu_{\widetilde{M}}(u)+\mu_{\widetilde{Y}}(j))$. As a result for each pair $(u,j) \in U \times J$ on product $U \times J$ one can obtaine fuzzy relations $\widetilde{D}_i$ ($i = \overline{1,6}$) in following matrix types:

$\widetilde{D}_1 =$

	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
u_1	0.9	1	1	1	1	1	1	1	1	1	1
u_2	0.85	0.95	1	1	1	1	1	1	1	1	1
u_3	0.85	0.95	1	1	1	1	1	1	1	1	1
u_4	0.7	0.8	0.9	1	1	1	1	1	1	1	1
u_5	0.75	0.85	0.95	1	1	1	1	1	1	1	1

$\widetilde{D}_2 =$

	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
u_1	0.9	1	1	1	1	1	1	1	1	1	1
u_2	0.85	0.95	1	1	1	1	1	1	1	1	1
u_3	0.85	0.95	1	1	1	1	1	1	1	1	1
u_4	0.9	1	1	1	1	1	1	1	1	1	1
u_5	0.75	0.85	0.95	1	1	1	1	1	1	1	1

$\widetilde{D}_3 =$

	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
u_1	0.9	1	1	1	1	1	1	1	1	1	1
u_2	0.85	1	1	1	1	1	1	1	1	1	1
u_3	0.85	1	1	1	1	1	1	1	1	1	1
u_4	0.7	1	1	1	1	1	1	1	1	1	1
u_5	0.75	1	1	1	1	1	1	1	1	1	1

$\widetilde{D}_4 =$

	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
u_1	0.9	0.91	0.94	0.99	1	1	1	1	1	1	1
u_2	0.85	0.86	0.89	0.94	1	1	1	1	1	1	1
u_3	0.85	0.86	0.89	0.94	1	1	1	1	1	1	1
u_4	0.9	0.91	0.94	0.99	1	1	1	1	1	1	1
u_5	0.75	0.76	0.79	0.84	0.91	1	1	1	1	1	1

$\tilde{D}_5 =$

	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
u_1	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1
u_2	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	1
u_3	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	1
u_4	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1
u_5	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	1

$\tilde{D}_6 =$

	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
u_1	1	1	1	1	1	1	1	1	1	1	0.95
u_2	1	1	1	1	1	0.9	0.8	0.7	0.6	0.5	0.4
u_3	1	1	1	1	1	1	1	1	1	1	1
u_4	1	1	1	1	1	1	1	1	1	1	1
u_5	1	1	1	1	1	1	1	1	1	1	0.9

Further, on the basis of intersection these relations one can obtain the general required decision:

$\tilde{D} =$

	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
u_1	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.95
u_2	0.85	0.85	0.85	0.85	0.85	0.85	0.8	0.7	0.6	0.5	0.4
u_3	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	1
u_4	0.7	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1
u_5	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.9

At last, fuzzy sets obtained for regions are compared on the interval I. For first region (u_1) from last matrix it is had:

$$E_1 = \left\{ \frac{0.9}{0} + \frac{0.9}{0.1} + \frac{0.9}{0.2} + \frac{0.9}{0.3} + \frac{0.9}{0.4} + \frac{0.9}{0.5} + \frac{0.9}{0.6} + \frac{0.9}{0.7} + \frac{0.9}{0.8} + \frac{0.9}{0.9} + \frac{0.95}{1.0} \right\}.$$

On the basis of it let us construct level sets $E_{j\alpha}$ and calculate corresponding cardinal number by formula $M(E_{j\alpha}) = \sum_{j=1}^{n} \frac{x_j}{n}$.

$0 < \alpha < 0.9$: $\Delta\alpha = 0.9$; $E_{1\alpha} = \{0; 0.1; 0.2; 0.3; 0.4; 0.5; 0.6; 0.7; 0.8; 0.9; 1\}$;
$M(E_{1\alpha}) = 0{,}5$;

$0.9 < \alpha < 0.95$: $\Delta\alpha = 0.05$; $E_{1\alpha} = \{1\}$; $M(E_{1\alpha}) = 1$.

Then it is possible to find a numerical estimation for E_1 as:

$$F(E_1) = \frac{1}{\alpha_{\max}} \int_0^{\alpha_{\max}} M(E_{1\alpha}) d\alpha = \frac{1}{0.95} \int_0^{0.95} M(E_{1\alpha}) d\alpha = \frac{1}{0.95} (0.9 \cdot 0.5 + 0.05 \cdot 1) = 0.526$$

Similarly it is possible to obtain numerical estimations for other regions: $F(E_2) = 0.426$; $F(E_3) = 0.575$; $F(E_4) = 0.565$; $F(E_5) = 0.583$. Region having the highest sectoral index of education organization is considered as the best. In our case it will be fifth region, and further descending ordering: the third, the fourth, the first and the second.

7. CONCLUSION

Within the limits of the further development of the state institutes and consolidating of vertical connections the analysis of prospects of the state selective policy development to regions support is carried out On the basis of modern information technologies (in particular, Neuro-Fuzzy mechanism of modeling) the basic scheme of regional decision making information support and the provisional list of the actions necessary for its realization are offered.

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