Formation of Innovative Strategy of Development of the Region on the Basis of Indistinct Modeling

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Abstract: Problems of management arc considered by development of regional economy and problems of indistinct representation of the initial data about state of the economy in view of them not full definiteness and updatings are noted. The approach to construction of models of region on the basis of the device of indistinct logic is proved. The method of construction indistinct econometrics models of region on the basis of definition of levels of values of functions of an accessory is offered. Problems of definition of potential results of accepted decisions are formulated at changes of values of operating variables. Are developed indistinct regressives models, allowing to choose rational strategy of its development with application of the innovative projects which results of introduction also have interval and indistinct estimations. The developed toolkit allows to raise adequacy of accepted decisions to available knowledge of processes in region.

Key words: Strategy of development of region . identification model . indistinct econometrics models . imitation of accepted decisions

INTRODUCTION

The careful qualitative and quantitative analysis of occurring processes is necessary for development of innovative strategy of development of economy of the region, allocation is more whole developments and definition of key factors of success. However the statistical data characterizing economy of the region, have not completely certain character and are repeatedly corrected. Therefore decision-making on development, introduction of innovations has indistinct character, not completely definite purposes of development, restrictions also have interval character. In these conditions the tools considering not full definiteness of a situation and allowing to form the decision in the conditions of an illegibility are necessary. The problem consists in definition of an illegibility of basic data about the region and development of the device of indistinct modeling of decision-making.

Analysis of the last researches and publications. Experience of foreign countries with the developed market economy showed that for the solution of problems of management of development of the region application of methods of the strategic analysis and an econometric [1] is necessary. In recent years in regions of Russia development programs began to be developed, the state program of information of management is accepted. But implementation of such programs needs organizational and methodical ensuring management processes [2, 3], preparation of decisions on strategy of development of economy on the basis of tools and techniques of the indistinct analysis [4]. Therefore development of new approaches to management of economic processes in the region, to a choice of strategy on the basis of the accounting of incomplete definiteness of data is an actual scientific task [5, 6]. In economy of regions a number of works of various schools of sciences is devoted to research of processes. F. Kene constructed tables for the description of processes of internal and external exchanges of resources between regions. T. Parsons created the theory of the regional social systems which are carrying out objective, adaptive, interval and directing functions. A number of theories of the region considering the different parties of its functioning of [7, 8], for example, the neoclassical theory is created considers economic differentiation of regions; the theory of the cumulative reasons G. Murdal considers action of market forces in regional economy; the theory of local growth concentrates attention on region development at the expense of mobilization of its potential [9]. However these theories do not consider a problem of management of the region on the basis of integration of knowledge of economy of the region [10]. Despite considerable volume of researches on questions of development of regions organizational and methodical aspects of a goals management in the

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conditions of incomplete or unreliable information are developed by the region far not fully. It is not considered that estimates of economic indicators have interval character [11, 12] and in fact, are indistinct. In available works reliability of data is not analysed, clearness is not considered «is more whole also than restrictions at the solution of problems of management, structural features of management are insufficiently considered by the region. Therefore for the determined models insufficient efficiency is characteristic. In the conditions of uncertainty models with the indistinct parameters which construction is based on the theory of indistinct sets are more acceptable.

Research objective-to develop the main approaches to creation of statistical models of the region with indistinct factors a method of the indistinct regression analysis and to formulate and solve problems of optimization of management of the region in the indistinct environment.

Results of research. From system positions the region has entrances and exits and realizes transformations of resources to results, i.e. process of functioning of the region (R) can be described in the following sizes:

$$P = <X, Y, A, R, t>$$ (1)

where the X, Y-entrances and exits; A-transformations X in At; R-region resources; t-time.

As the system, the region is characterized by the parameters (attributes) which are rather independent of time and the variables describing interrelations of internal objects. Objects-it is parts or region components. Attributes-properties of objects (made production, branches, number, population structure etc.). The relations of objects can be causal (investments-a production gain), logic (the project-increase in production), casual. All external objects leading to changes of attributes will be a region environment (outside world).

The system campaign in studying of regional economy gives the general window of vision and problems. For the solution of problems of management it is realized by region development in the form of the scheme (Fig. 1).

The region as system is composition of various structures (physical, geographical, technological, economic, demographic):

1) Resources, climatic, physical conditions-formulate a coherent set;
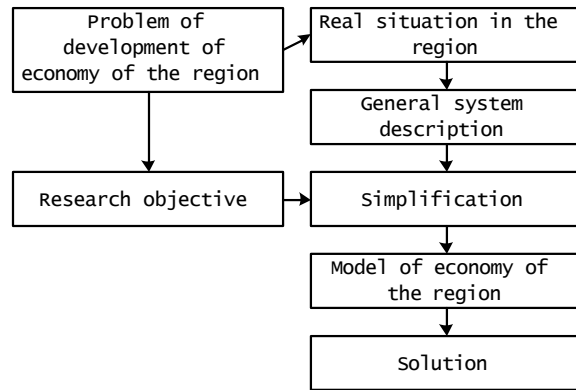2) The technology, education, production, distribution, an exchange-form a region basis;

Fig. 1: The scheme of a system approach to management of the region

3) The demography, population distribution on territories, employment, the income-form the social block,
4) Political and legal structures, psychology, mentality, organizational culture-define standards of behavior and lives.

These structures have different plasticity and convertibility in time. Changes of structures have the certain limits characterizing development or a depression in the region. The hierarchy of variability of regional structures can be estimated indexes or rates and to present as follows:
nature;

2) Position of the region;
3) Demographic structure;
4) Social structure and psychology;
5) Political and legal structure, technology, production, consumption, accumulation;
6) Economic events: price, cost, income, expenses.

The regional economy evolves under the influence of certain factors and motive forces, such as, on the one hand, the technology, the population and movement is more whole and on the other hand, changes in policy; education; investments and credits; changes in distribution of the income; changes of ratios between the industry and agriculture.

In development in social and economic system of the region there can be structural tension. They are defined by different extent of development of structures under the influence of above-mentioned factors and motive forces, absence of synchronization of changes. Structural tension is resolved or self-organizing, or by consecutive changes and the adaptation of different structures.

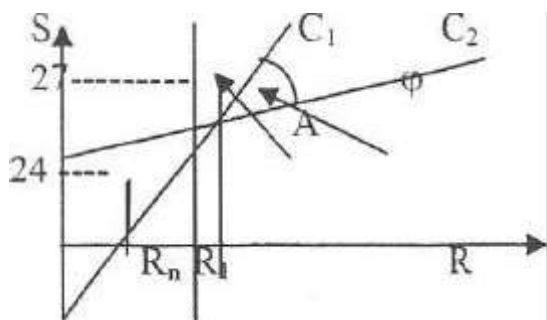Condition of balance of regional economy is equality (Fig. 2):
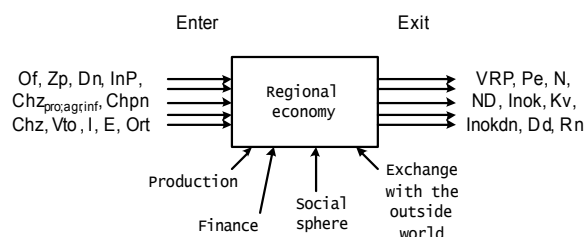
Fig. 2: Balance of economy of the region

Fig. 3: Formal representation of economy of the region

Fig. 4: Influence of factors on VRP

volume of market sales (S) = regional income (R)   (2)

On graphics the line (C) shows the attitude of expenses (S) and the regional income (R). At change of market prices there is a correction of expenses and economy is stimulated. The tilt angle of the line (C) is defined by a ratio:

m = (change of expenses)/(production change) (3)

Let's calculate (m) for 2013 (in relation to 2012) for the Rostov region:

$$m = (26,923-24,664)/47,6 = 0,047 = tg\ \varphi,$$

i.e. the line of states of the economy of the region shows its development. Management of economy of the region is guided by increase in changes of production depending on its condition. If R1 equilibrium state, conditions to the left of R1 conduct to increase in

production and on the right-to its folding. Let Rn corresponds to a full employment, then the level of production of R1 is higher than purchasing power of the population. It will lead to decline in demand and balance loss. On the basis of questionnaire of experts in economy of the Rostov region of R> S therefore there are incentives to considerable expansion of production.

The regional economy realizes a complex of the business processes providing on an exit results: gross regional a product (VRP), the national income (NI), development per capita on the basis of use of different resources and other variables (Fig. 3):

Between the variables characterizing regional economy, there are communications and the relations which need to be revealed for creation of model and the subsequent aprioristic modeling of possible strategy of development. For experimental identification of similar communications we will carry out the cognitive analysis directed on definition of the semantic (semantic) relations of variables and their assessment. The constructed cognitive hag-is the sign focused count (orgraf) $G = <V, E, In>$, in which: V-a set of tops (the variables characterizing economy of the region), Vi top ? V, i = 1,2, ..., k are elements of studied system; E-a set of arches, eij arches ? E, i, j = 1, 2, ..., n reflect interrelations between Vi and Vj tops; In-indicators of force of influence of Vi on Vj; in a studied situation of bij can be positive (a sign «+» over an arch) when the increase (reduction) of one indicator leads to increase (reduction) of another; negative (a sign «-» over an arch) when the increase (reduction) of one indicator leads to reduction (increase) in another (when return interaction takes place); or there is no (bij =0).

For example, VRP are influenced by capital investments (Kv), number of the busy population (Chz), the amount of export (E), volume of the fixed business assets (Of) and the income of the population (Dn). These influences are reflected by Fig. 4.

Orgraf of influences will be the cognitive map showing distribution of influences of elements of the region at qualitative level. Experts on the basis of available knowledge bring in lines of the questionnaire the corresponding values ±bij (0,1-weak influence; 3-the moderate; 5-the appreciable; 7-the considerable; 9,10-strong influence).

For example, at creation of multiple-factor model of dependence of the income of the population (Dn) from 13 influencing factors the look equation is received:

$$D_n = -16.4 - 0.006Chz + 0.016Chz_{pro;agr;inf} + 0.6Inok - 0.27Inokdg - 10.8Kv + 4.8Kv_{pro;agr;inf} + 17.8ND - 14.3ND_{pro;agr;inf} + 0.8Of + 0.033Pe - 0.56Vof + 2.0Vto;\ (R^2 = 0.99, \bar{R}^2 = 0.95, dw = 2.27, F = 25.74)$$
(4)

For the accounting of an illegibility we will enter levels of accessory of values of factors, for everyone α-level we will define parameters of the equation of multiple regression, using an E-views package. The indistinct

equations, allowing to receive the indistinct characteristic of an exit of Y were calculated at indistinct values of ekzogenny variables. The calculated model for dependence of VRP on 6 factors has a form:

$$\hat{Y} = 0.304 - 4.843 * X_1 + 5.451 * X_2 - 9.457 * X_3 + 0.745 * X_4 - 0.749 * X_5 + 0.165 * X_6; (R^2 = 0.97, \bar{R}^2 = 0.93, DW = 2.21, F = 25.74) \tag{5}$$

Let's consider the mathematical model presented in the form of the indistinct equation of multiple regression:

$$\tilde{Y} = \tilde{a}_0 + \tilde{a}_1 x_1 + \tilde{a}_2 x_2 + \ldots\ldots\ldots + \tilde{a}_n x_n \tag{6}$$

Let's assume that indistinct factors $\tilde{a}_i$ i (i = 0,...,n) are normal indistinct sets on R:

$$a_i = (U_{a_i \in R} \mu_{a_i}(a_i)) \div a_i \tag{7}$$

Let's define α-level sets of indistinct factors $\tilde{a}_i^\alpha$:

$$a_i^\beta = \{a_i \mid a_i \in R, \mu \tilde{a}_i(a_i) \geq \alpha\}, i = 0, n, где \alpha \in [0,1] \tag{8}$$

Then for each level it is possible to write the equation of multiple regression:

$$\begin{cases} Y^{\alpha 0} = a_0^{\alpha 0} + a_1^{\alpha 0} x_1 + \ldots\ldots + a_n^{\alpha 0} x_n \\ Y^{\alpha 1} = a_0^{\alpha 1} + a_1^{\alpha 1} x_1 + \ldots\ldots + a_n^{\alpha 1} x_n \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ Y^{\alpha p} = a_0^{\alpha p} + a_1^{\alpha 1} x_1 + \ldots\ldots + a_n^{\alpha p} x_n \end{cases} \tag{9}$$

These equations are the equations of multiple regression representing correlation communication between many sizes at levels α_j. For estimation of indistinct factors $\tilde{a}_0$, $\tilde{a}_1$, $\tilde{a}_2$,..., $\tilde{a}_n$ 0,..., 1, it is enough to define such factors $\tilde{a}_0^{\alpha j}$, $\tilde{a}_1^{\alpha j}$, ..., $\tilde{a}_n^{\alpha j}$, at each level a, which satisfy to a condition:

$$I_i = \sum_{i=0}^{p} (y_i^{\alpha j} - \hat{y}_i^{\alpha j}) \rightarrow min, j = 1 \ldots p \tag{10}$$

$$где \hat{y}_i^{\alpha j} = a_0^{\alpha j} + a_1^{\alpha j} x_1 + \ldots, a_n^{\alpha j} x_n$$

Having model of object of management in the form of the equations of communication of resultants and operating variables, it is possible to solve problems of achievement of wished results at the expense of variations of managing directors of variables. Let's consider the solution of problems of management of regional economy on the basis of use constructed above indistinct econometric models. Problem of indistinct optimization ỹ it is formulated as follows: to find such vector

$$X = (x_1,\ldots,x_n), \text{ for which}$$

$$y = f(x) \rightarrow max \tag{11}$$

under the conditions:

$$\varphi_i(x) \leq B_i, i = 1 \ldots m, x \in X \tag{12}$$

Here f and φ-indistinct functions, max-indistinct maximum f(x), Bi-indistinct numbers.

If f and φ-indistinct functions also represent indistinct expansion of accurate function, i.e. are usual functions, but with indistinct factors or variables, then the task (11)-(12) represents a problem of indistinct mathematical programming. Optimization with the indistinct purpose. The problem of optimization with the indistinct purpose is formulated as follows:

$$Y = f(x) \rightarrow max \tag{13}$$

under the constraints $\varphi(x) = 0, x ? X$

For the solution of this task are used α-level sets of indistinct criterion function. Then any indistinct purpose represents the indistinct relation of preference between elements of admissible strategy of development of the Rostov region and therefore, the solution of a problem of indistinct mathematical programming with the indistinct purpose is consolidated to the solution of a problem of multicriterial decision-making (number of criteria equally to quantity of levels). It means that for the solution of a task (13) it is enough to solve a problem:

$$\begin{cases} f^{(\alpha)}(x) \rightarrow max \\ \text{under the constraints} \\ \varphi(x) = 0, x \in X \end{cases} \tag{14-15}$$

In a linear case it is enough to solve a problem:

$$\begin{cases} f^{\alpha 0}(x) = c^{\alpha 0} x \rightarrow max \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ f^{\alpha n}(x) = c^{\alpha n} x \rightarrow max \end{cases} \tag{16}$$

under the constraints $A * x \leq B, x \geq 0$

Example. As criterion function we choose the equation of multiple regression for the Dn variables; Inok; Of; Pe; Kv; ND; at level α = 1. Corresponding to example conditions: 1→4) It is necessary to define, at

what values x_1(Chz), x_2(Chz$_{pro;agr;inf}$), x_3(Kv$_{pro;a?t \cdot inf}$) ? x_5(ND$_{pro;a?t \cdot inf}$) criterion function reaches a maximum, if value x_4(ND) ? x_6(Vto) are fixed (for example, for 2012), for Chz, Chz$_{pro;a?t \cdot inf}$, Kv$_{pro;a?t \cdot inf}$, ND$_{|pro;a?t \cdot inf}$, Vto there are strict restrictions, (Inok, Dn, Pe, Of)-indistinct purpose. 5) It is necessary to define, at what values x_1(Chz), x_2(Chz$_{pro;agr;inf}$), x_4(ND$_{pro;agr;inf}$) and x_6(Vto) criterion function reaches a maximum, if value x_3(ND) and x_5(Of) are fixed, for Chz, Chz$_{pro;agr;inf}$, ND$_{pro;agr;inf}$, Vto there are strict restrictions, (ND)-indistinct purpose. 6) It is necessary to define, at what values x_1(DN), x_2(InokDn), x_5(Vof) and X_6(Vto) criterion function reaches a maximum, if value x_3(Kv) and x_4(Pe) are fixed, for Dn, InokDn, Pe and Vto there are strict restrictions and (Kv)-indistinct purpose.

For Dn (at Inok-indistinct purpose) the problem of management looks like:

$$
\begin{cases}
\alpha = 1 & - 120.59x_4 - 2.40x_6 - 502.24 \rightarrow \max \\
\alpha^1 = 0,8 & - 115.77x_4 - 2.30x_6 - 479.17 \rightarrow \max \\
\alpha^2 = 0,8 & - 125.41x_4 - 2.50x_6 - 525.32 \rightarrow \max \\
\alpha^1 = 0,5 & - 114.56x_4 - 2.28x_6 - 473.39 \rightarrow \max \\
\alpha^2 - 0,5 & - 126.62x_4 - 2.52x_6 - 531.09 \rightarrow \max \\
\alpha^1 = 0,3 & - 113.35x_4 - 2.26x_6 - 467.64 \rightarrow \max \\
\alpha^2 = 0,3 & - 127.83x_4 - 2.54x_6 - 540.88 \rightarrow \max
\end{cases}
$$
$$
-12.66x_4 - 0.58x_6 \leq 57.84
$$
$$
\alpha(\min) \leq ND \leq \alpha(\max) \quad (17)
$$
$$
\alpha(\min) \leq Vto \leq \alpha(\max)
$$

Conclusions and offers. A basis of the stated approach are calculated indistinct models for four blocks of economy of the Rostov region, the purposes of management and resultants indicators are formulated and combinations of managing directors of the variables, allowing to reach goals are calculated. Thus innovative projects and their potential possibilities were included in developed strategy in economy development. Thus, the offered technique of a choice of operating influences for achievement of a goal of development of regional economy is efficient and giving the necessary decisions for managers.

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