GEOMETRIC METHODS OF MODELING THE GEOMETRIC PROBLEMS OF ECONOMETRICS

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Summary. The article, based on the methods of a point BN-calculation, the new areas of research are given in order to expand the application of geometry tools to improve the efficiency of administrative decisions' making on the basis of multifactor processes research within geometric econometrics.

Keywords: **Baluba-Naydish calculation, multifactor economic processes, geometric Econometrics.**

Formulation of the problem. With the aim of enhancing the energy security of the country, reducing greenhouse gas emissions and energy intensity of GDP, at the State level a strategy for sustainable development "Ukraine-2020" was adopted. At the core of this strategy the methodology of sustainable development is based, which provides simultaneous balanced solutions to economic, environmental and social problems of the territories, the appropriate system of indicators (factors) of sustainable development are developed.

At the municipal level, to address such problems, so-called "action plans" for sustainable energy development (APSED) are developed. The implementation of these plans, such as the reduction of CO2 emissions, increasing energy efficiency and quality of public services requires significant investment. When determining portfolio of priority investment projects one must simultaneously take into account a large number of different factors. To optimize this work information systems support management solutions are necessary, developed on the basis of appropriate mathematical models.

Analysis of recent researches. At the moment, there is a significant work of mathematical modelling of energy efficiency, virtually in every area of the municipal economy. In particular, the direction of geometric modeling in energy, including construction, ventilation, lighting and heat supply disruption is initiated by the scientists of the scientific school KNUBA O.L. Pidgorniy, V.O. Ploskiy, O.V. Sergeychuk [1, 2]. The scholars of the NTUU "KPI", in particular, A.V. Prakhovnik, A.M. Kovalchuk, etc. have created a wide range of effective technologies and models in construction, creation of energy and power [3]. Modeling of energy efficient buildings in detail is developed in the works of V. Martynov [4].

However, the problem of modeling the sustainable energy development of the city, the combination of all branches of municipal management in one system, are not solved efficiently. In particular, the TRACE model [5], developed by the World Bank, does not take into account local characteristics, the results are very approximate and not always optimal.

The main problem of modelling of sustainable energy development is the great variability of a set of source factors, depending on the features of a specific locality (City). Change in quantity and quality factors of the model always leads to her adjustment, so the model developed for one city, can not be used for another one without sophisticated processing. Thus, the development of a universal method of multifactor mod that will change the original sets of factors without substantially changing the structure of the model is relevant.

In our view, branch science "Geometric Econometrics", that is systematically developed in doctoral dissertation O. A. Bondar [6], in the largest extent refers to the ways of solving the problem of multifactor simulation. In making effective management decisions, modeling is practically the only research tool of complex economic systems. Analytical methods for the study of real-world complex systems are ineffective because of the increased complexity of the system caused a sharp increase in computer operations, moreover, do not always provide an adequate solution. In this case, changing source conditions always leads to the replacement model.

In the branch of science "Geometric Econometrics" is indicated that complex economic systems are generally composed of disparate elements that when modeling it is desirable to describe a homogeneous mathematical formalisms in parametric form of multidimensional space, which would provide the ability to create new classes of functional models for solving the relationship for different combinations of integrated factors both internal and external environments.

The study, which are offered by the authors of this article is devoted to the development of a universal method of modeling in parametric form of multidimensional space for multifactorial economic processes from disparate components. The base for these studies is the point BN-calculation [7].

The wording of the purposes of the article. Expansion of the instruments applied geometry through the development of a method of modeling in parametric form of multidimensional space for multifactorial economic processes of disparate elements that provide an opportunity to increase the effectiveness of the solution of the problems of sustainable development to increase productivity and minimize risk control with account of changing internal and external environments, the quantity and quality of output parameters and dimension of the space of economic process with optimization of decision making on a interpretation basis.

Main part. Given the above, the feasibility study is caused by the need to:

1) gaps and improve the effectiveness of existing methods and models for the management of the processes of decision-making on sustainable development of the city;

2) the solution to the problem of improving the accuracy and reliability of the predicted and obtained results of a computer experiment using the model in comparison with the actual performance of the process

3) resolving duplicate approaches, their fragmentation and the difficulties of determining the partial integrated characteristics of the course of the economic process of sustainable development of the city.

In our view, point BN-calculation in the largest extent can solve the above defined three areas of research. With using point BN-calculation it is possible to create new methods of interpretation modelling of multidimensional multifactorial processes in applied geometry in particular and geometrical econometrics in General.

The thing is that point BN-calculation based on two methods:

1) method of design (projection) on the axis projection (coordinate system);

2) method comparison of two homogeneous geometric shapes or their respective properties that represent the parameters that correspond to the simple relation of three points straight.

What are the advantages of the point BN-calculation before the traditional methods of applied geometry appear as a result of the use of these two methods? Consider the projection of the simplest geometrical figures – point (fig. 1-2).

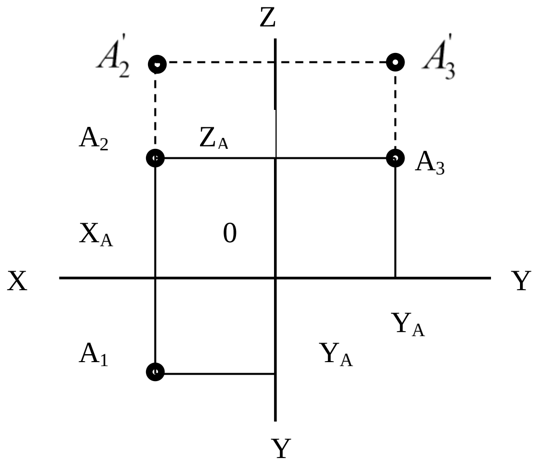

Fig.1. The projection of the point A on the plane of projection P1, P2, P3

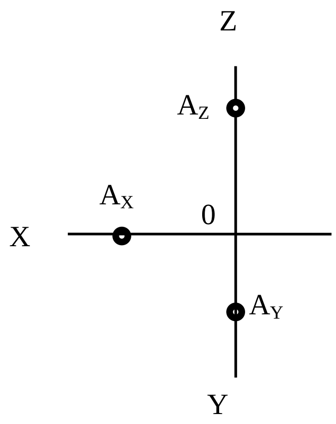

Fig.2. The projection of the point A on the axis of the coordinate system

In the case of traditional projection (fig. 1) to the plane of projection, the replacement of the position of one of any of the projection point A entails a change in the position of the second projection. For example, let's change the A2, then you must be sure to change the position of the projection of the A3, changing position A1 will change the position of the A2, etc. Conversely, in the case of projection point A on axis, change the position of any of the projection of the Ax, Ay, Az nor in any case does not entail a change of the position of the other projections. And in the first and second cases, change the position of the projection, we have another point, but in the first case it is necessary to perform a more geometric operations. In terms of millions of points will get significant spending by resources. Consider the projections section on the plane of the projection (fig. 3) and the axis of the coordinate system (fig. 4).

In case if for the Fig. 3 and Fig. 4 ttake a segment AB to the same, then the simple relationships of three points straight will be kept equal

MAB=M1A1B1= M2A2B2= M3A3B3= MxAxBx= MyAyBy= MzAzBz.

In this case, image projections in Figure 3, in addition to a simple ratio of the three points of the line are still lines of projection of communication, at the same time, in Figure 4 the projection axis coming together just because of a simple ratio of the three points, as a result, projection of MxAxBx, MyAyBy, MzAzBz, we can put on the plane or in three-dimensional space any where.

The use of two methods of the point BN-calculation creates an opportunity to develop a new direction in modeling processes in general. For example, on the axis of the projection of the two points that reflect the projection of two states of the process on this axis. Their mutual arrangement (fig. 5), which is determined by the value of ΔX, determines the course of the process.

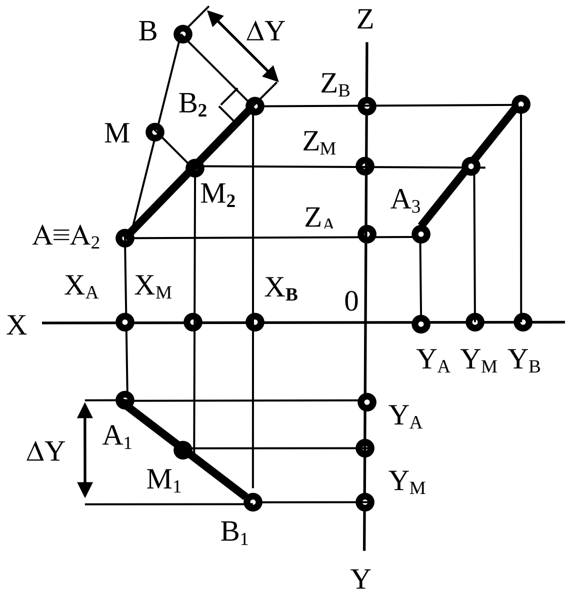

Fig.3. The projection of the segment AB on the plane of projection

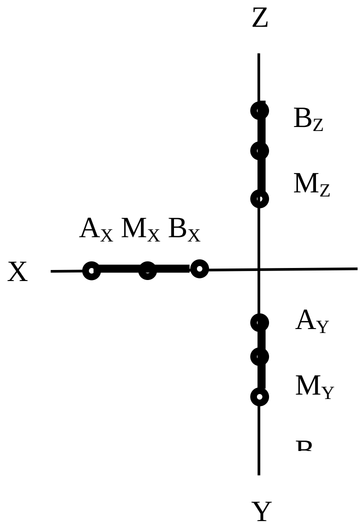

Fig.4. The projection of the segment AB on the axis of the coordinate system

The problem arises of how to change the process in case of change of mutual position of points Ax and Bx, that is, how to change the course of the process of with regard to geometric transformations that you want to change the geometrical figure (fig. 5) to optimize the course of the process, etc

The second example. Let the projection Ax (fig. 6) displays the projection state segment BxCx, where is the variable point Mx, displays the projection flow process. What changes will in the course of the process according to the results of any geometric shape transformations? Such issues of geometric nature of the analysis process and its optimization, you can put many, resulting in a solution of which might be new theory of geometric transformations in modeling processes

If you take two axis and consider various connections (Figure 7), then there are still more options of geometric changes between the projection on the axes, which will entail the changes in the process, that require research.

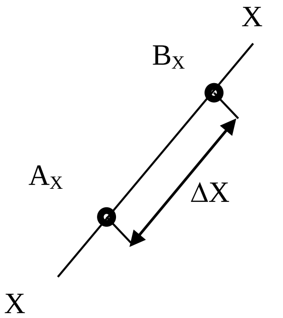

Fig.5. The projections of the two process states

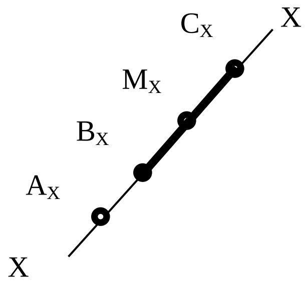

Fig.6. The geometric figure of the projection process

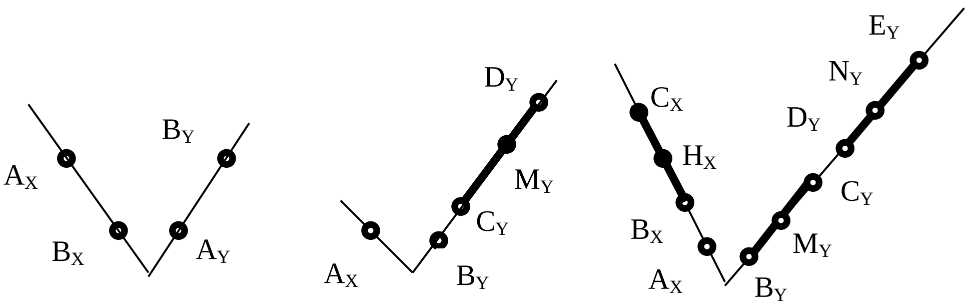

Fig. 7. Examples of combinations of geometric images, which are the projections of the factors of the process

If each factor that is taken into account in the study process, put in line with the axis and, thus, these factors will be n, then we obtain the system n axes that will be designed in the comparison of similar properties in the relevant factors. In this case, if not to take into account the relationship between projections, which is possible in the point BN-calculation , the system n axes may be filed as part of n straights with links direct, i.e. angles between the axes should not be direct, but may be such.

It should be noted that the projection on the axis has and other benefits before projection on the plane of projection. If you want to display the progress of the process on planes that are not necessarily mutually-perpendicular, then it must be pairwise considered appropriate axis, for example:

X1X2, X3X4, …, Xn-1Xn, or other communication

X1X3, X1X4, X2X3, X2X4, …, X1Xn-1, X2Xn-1, X3Xn, X4Xn, etc.

Considering the combination of three axes in a variety of forms, we will get a three-dimensional projection of the ongoing process

X1Xn-1X4, X2XnX4, X3Xn-1Xn, …, X4X3Xn-1, X4X5Xn, etc.

Four-dimension projections of n-dimensional process we can get by a combination of projection on the corresponding axes:

X1X5Xn-1Xn, X2Xn-1XnX3, …, X1X4Xn-1Xn, etc.

Thus, received a one-, two-, three-, and (n-1)-dimensional projections of the process model, which can be regarded as sub-models, separate them to explore, study, analyze, replace factors that are not directly affect or influence the adequacy of sub-model overrun sub-process and, eventually, to optimize sub-processes based on computer simulations.

All examined above and other combinations and geometric transformations require the complete systematization and research of the change of geometrical figures changes the course of the process that you want to change the geometric figures on the projections to optimize for a specific factor in the progress of the process etc. In our opinion, research in this direction, in a certain way, expand the instruments applied geometry in particular and geometrical econometrics in general.

If you consider interpretation constructivism of industry theory of "Geometric econometrics" and interpretation constructs, as a result of the application of the geometric and formal schemes on the abstract level, the interpretation constructs of industry theory of "Geometric econometrics "can be submitted in the form of the scheme (by O.A. Bondar) (fig. 8).

According to this scheme, our studies are on the first level and, basically, the third and fourth levels. What is the problem of choosing source data to create their model and the election simulation options?

As you know, for the study of any process, it is disaggregated, dividing into separate elements. Among the obtained items-factors, according to the researcher, certain factors are more significant, other less significant. But ahead of this no one can know. From the quality of the model depends on the actual course of the adequacy of the disaggregation process, which can be verified by performing computer experiments and carrying out remedial actions (V level constructs by O. A. Bondar).

The thing is that the application of point LE-calculus allows to model not on projections, but in space measurement of which can identify the researcher, who creates a model of the process. For this purpose the factors, obtained in the result of the disaggregation process, should be divided into two groups. The first group should include factors that determine the fixed point of the status process (coordinates). The second group of factors forms a response surface representing the progress of the process. As it turned out, the distribution factors into groups is a very complex task.

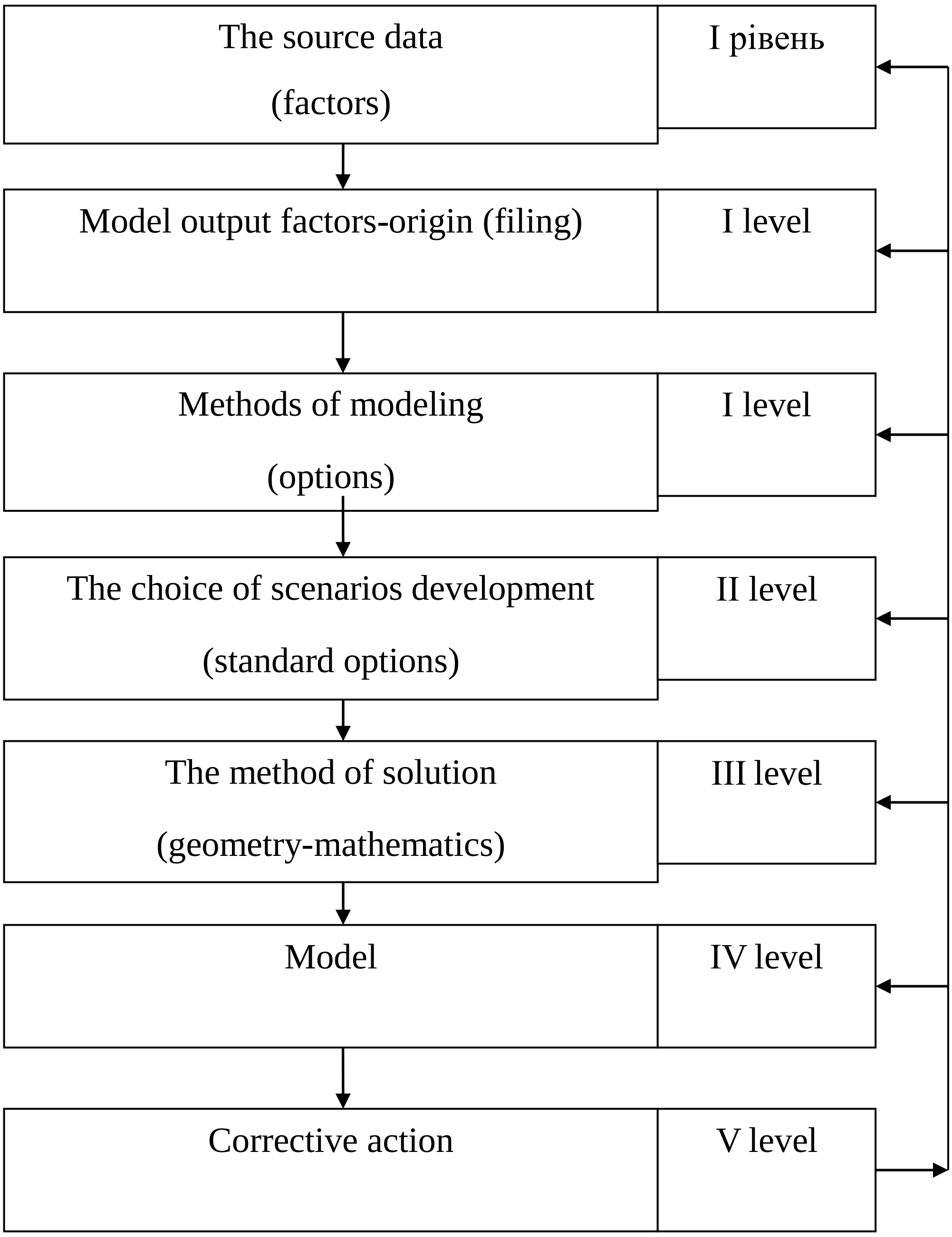

Fig. 8. Interpretive constructs branch of the theory of "Geometric econometrics" (O. A. Bondar)

The adequacy of the model depends on correct separation factors. For the division into groups is necessary to establish the relationships between the factors to determine its reference points (fixed states), etc. The result of the detection of the factors of the process and their division into two groups is to create a model of the input factors (the second interpretation construct of the 1st level by O. A. Bondar). Search for the most effective allocation of the factors of the process into two groups by their transfer from one group to another leads to the election of a method of modelling (third interpretation construct of the 1st level by O. A. Bondar).

It is clear that each process requires an individual approach to each of the three examined solving construct. But before us a problem to find the generalization in the construction of output data process stands

Conclusions. This article outlined the tasks of research to develop new instruments of applied geometry through the development of a method of modeling in parametric form of multidimensional space for multifactorial economic processes of disparate elements that provide an opportunity to increase the efficiency of solving the problems of sustainable development of the city. These studies and created by their results geometric algorithms for making decision will expand opportunities and improve the quality of solving geometric econometrics.

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