Advances in Economics, Business and Management Research, volume 156
2nd International Scientific and Practical Conference on Digital Economy (ISCDE 2020)

Multilayer Multi-Component Models of Anthropotechnics of Management

Chulkov V.O.

National Research Moscow State University of Civil Engineering, Moscow 129337, Russia
Corresponding author. Email: aljurgaitis@gmail.com

ABSTRACT

Philosophical concepts of the structure of the world and human life include the study and intellectual monitoring of the components of the functional system of MTE (man, technology and environment). The necessity and intensity of the mutual influences of man, technology and environment were understood differently at different periods. The desire to take from nature all that is necessary for man led, against the backdrop of a certain scientific and technological progress, to irreversible anthropogenic impacts on the environment and, as a consequence, to its pathogenic effects on humans. Ecological activity for identifying and eliminating pathogenic influences covers and determines all other types of human activity. Outside this sphere of influence, other types of activity can lose their meaning.

Keywords: *anthropotechnics of management, multilayer multi-component models, development of the "man-technology-environment" system*

1. INTRODUCTION

During the life cycle of the MTE system, natural conditions, materials and structures in use, the resulting energy flows and other influences lead to significant emissions of various mineral and organic substances that respond differently to biological and chemical cycles of the environment. The presence and vital activity of people in such objects and their surroundings also favor the occurrence of spontaneous and specially organized processes of deformation of the initial state of the MTE system, leading to unexpected results and effects. Initially, a comfortable MTE system can get out of this state as a result of completely different influences, including both monotonous and threshold (dramatically affecting) ones.

2. MATERIALS AND METHODS

All known models of human life are multi-component (multi-point) and multi-parameter (Fig. 1).
The dimension of multi-point logics can be reasonably increased without limitation. As necessary, special models are developed for assessing the revealed properties of the formed multi-point logics (the so-called “model models” according to Kotov I.I.).
The objectives of the study in such models are to identify:

– ranges and patterns of change in the values of each parameter separately, which is the basic concept or “one-point logic”;

– paired relationships of parameters (dyads) with the determination of the intensity and direction of the impact (such relationships are called “two-point logics”, they are a two-level system for managing the situation in the environment);

– system interaction of three parameters (triads), ensuring the achievement of a given result (formation of "three-point logics").

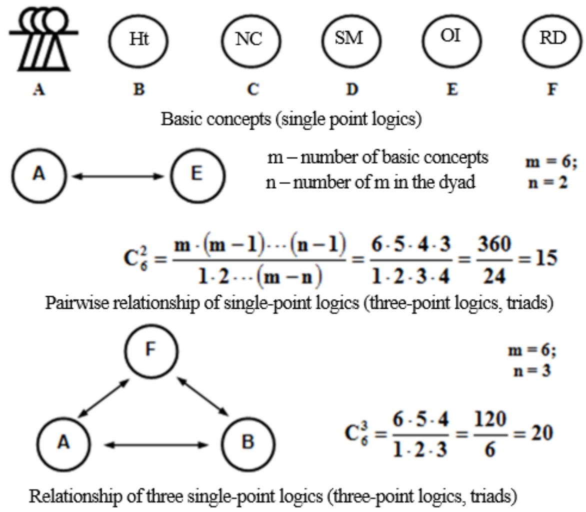
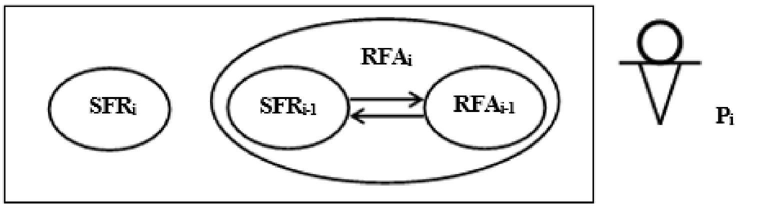


Figure 1 The phase formation of infographic models of multi-point logics (2003, [1])

A - labor resources and technology;
B – habita (H)t;
C - natural and climatic conditions (NC);
D - structures and materials (SM);
E - organization and investment (OI);
F - reorganization design (RD).
The choice of a set of single-point logics is carried out, as a rule, by a team of experts for each MTE system individually.
The study and analysis of two-level logic for managing the situation in different settings was performed by Golovnyak

V.V., Kotelnikov S.I., Nikolsky A.E., Shchedrovitsky G.P. and other Russian scientists. As a result, there was a national approach to management in functional systems for different subject areas of activity (technical, environmental, social, economic and other systems).

Modern ideas establish several interconnected hierarchical levels of perception and understanding of activity. The feasibility of using a hierarchical infographic multilayer model of a logical "assembly-disassembly" of objects (objects or processes), known in the methodological movement of Schedrovitsky G.P. as a "whatnot" (Fig. 2), for study and design of various functional systems of activity in construction is shown by Chulkov V.O. in 1973 [2].



SFRi - a system-forming resource of the i-th layer of the "whatnot" (object or process that provides the ability to convert a two-component set of the i-th layer of the "whatnot" into a workable purposeful system of activity and transfer this system, as a result of activity in the i-th layer, to i + 1 layer.
RFAi - the result of activity in the i-1 layer (interconnected two-component set).
SFRi-1 - a system-forming resource of the I -1 layer of the "whatnot".
RFAi-1 - the result of activity in the i-2 layer.
Pi - the person responsible for the i-th layer of the "whatnot"

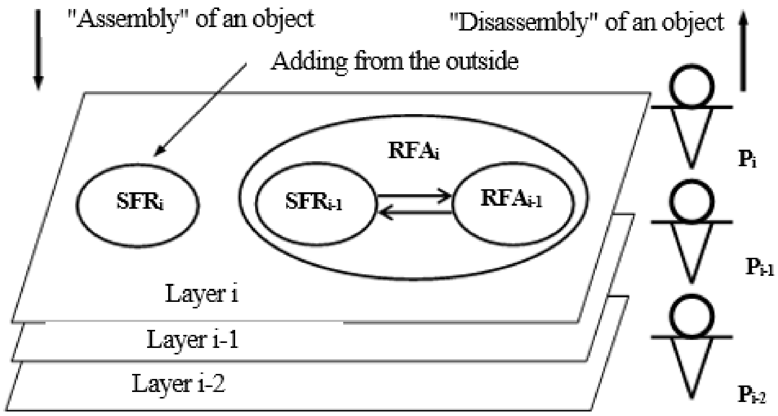


Figure 2 Multilayer infographic model of activity formation (2003, [1])

Note: 1. A fragment of the model can be continued in the direction of "assembly" from parts to the whole and in the direction of "disassembly" from the whole to parts.

2. The transfer of SFR is carried out only between adjacent layers.

3. The positions of persons Pi should be strictly formalized to ensure quality control of the activity and its results.

The procedures for using the "whatnot" to model the "assembly-disassemby" of construction objects (objects and processes) based on their mathematical description and quantitative assessment of technologies for transition from one layer of the model to another were studied by Syrov S.V. and Tuzova M.A., 1986 [3], Kotelnikov S.I., 1989 [4], Rafikov S.A., 2000 [5], Buryanov P.D., 2003 [6].

Mathematical description as an integral part of the geometric model according to Doctor of Technical Sciences Professor V. A. Osipov [7, 8, etc.], makes it possible to formalize and quantify the dynamics:

– changes in the parameters of the two-component sets TSij, the type and intensity of the relationship of the individual components of TSij at different levels of the multilevel infographic model ("whatnot");

– formation of new objects (objects or processes) and their properties during the transition from one to another layer of the "whatnot" (Figure 2).

When moving according to the "whatnot" model from bottom to top, there is a sequential "assembly", blocking, increasing the scale and significance of the studied activity, and when moving according to the model from top to bottom, sequential "disassembly", disaggregation and detailing of the studied activity is carried out.

The basic model of the "whatnot" layer (Figure 2) is the two-component set TS_i (subject and object of the functional system of activity). The left component of TSi is activity-oriented; it answers the question: what and how to do with the right component of the two-component set TS_i?

We denote the left component by SFR_i (system-forming resource of the i-th layer of the "whatnot"). This is the object or process that ensures the conversion of the two-component set of the i-th layer of the "whatnot" into a functional system of activity and the transfer of this system to the i +1 layer.

The right component of TS_i is an exact copy of the two-component set of TS_{i-1} of the plane of the i-1 level with the identification of all the relationships between the components of TS_{i-1} (i.e. it is an interconnected two-component set). In Fig. 2, the right component is designated RFA_i (result of functional activity in the i -1 layer).

The function F_i of transferring RFA from the n-1 plane to the n plane:

$$F_i = F \{ SFR_i \leftrightarrow RFA_{i-1} \} = \{ SFR_i \leftrightarrow (SFR_{i-1} \leftrightarrow RFA_{i-2})\}.$$

3. RESULTS AND DISCUSSION

Such a transfer is performed by the person responsible for layer i of the whatnot, performing the functional activity displayed by this layer and being the main manager of the activity implemented in this layer of functional system.

The transfer of RFA is carried out only between adjacent layers (planes) of the model, and the positions of the figures responsible for each layer should be strictly formalized to ensure control of the activity and its results. SFR of each layer is an independent original component and is added to the "whatnot" model from the side (as a conscious need for the development of the MTE system).

Each layer of the "whatnot" corresponds to a certain level of perception of activity by its participant, reflects the structure and differences of this level, the characteristics of possible results. A higher level of perception requires for its development the indispensable implementation of the previous level, the development of a certain amount of knowledge, the development of conditioned and unconditioned reflexes of perception and understanding of activity.

If the researcher misses consideration of at least one layer of this infographic model, then the analysis of activity can lose not only quality but also meaning.

The upper levels of the model reflect the most complex representations, require significant cognitive activity, analysis and synthesis of situations and problems, the development of new technologies, a high level of knowledge and professional culture, the development of skills in the formation and use of both primary infographic information models of activities and secondary "model models" according to Kotov I.I. [9] from each participant in the activity.

In forming the "whatnot" model, the principles of semiotics (Pospelov D.A., Piotrovsky R.G. et al.) and frame theory (Minsky M.), visualization tools and methods for heuristic and predictive representation, modern computer technologies for compilation and replication of visual models are used.

The study of Efimova S.M. is of considerable interest [10]. It is devoted to the development of a formal model of knowledge representation, the algebra of which is different from Codd's relational algebra, and a comparative analysis of such a representation with network and relational models.

Among the many interconnected points ("elements") of the information network, there are collections combined by a common relationship with one of the known points of the information field (which is called the "spider-graph body"), and the lines connecting this body with all interconnected elements of the set are called "spider-graph legs"(S-graph). The top of the S-graph (the body of the spider-graph) corresponds to the name of the elementary information unit. S-graphs can be "linked" to each other by legs having the same marks.

Such an idea of the formation of S-graphs fully corresponds to the set of multi-point logics united around one basic concept (single-point logic).

The information field of the set of elements of different logics is defined by a network of "linked" S-graphs and denoted by a following triad

$(S,L,N,) = \{ S_t \}_t = \{ <s_t , \{ < l_{tk} , N_{tk} >_{tk} \}k> \}_t$,

Where: $S= \{s_t \}_t$ - set names of "linked" S-graphs; $L = \{\{ l_{tk} \}_k\}_t$ - set of all legs of "linked" S-graphs; $N = \{ \{ N_{tk} \}_k \}_t$ – sets of mark collections that mark these legs. Figure 1 describes the basic concepts (single-point logic):

A - labor resources and technology;

B - habitat;

C - natural and climatic conditions;

D - structures and materials;

E - organization and investment;

F - reorganization design.

At the first stage, all the components of multi-point logics were considered as equally probable, without prioritizing points, and to study this set of logics, flat models of regular geometric figures were used.

Masturov I.Ya. claims [11] that to describe the interaction of the object and the environment, logics with a base from 2 to 9 are used, among which the most famous are Indian (base 3) and Chinese (base 5) logic.

For an adequate description of the interaction of the object with the environment, the logics with bases 3 and 9 are enough. The latter is reducible to the first and is its extension.

In the studied set, the number N_{ij} of logics of lower dimension included in the replacing logic is determined, which allows one to judge the variety of logic elements covered by a network of S-graphs.

The number of constituent logics for each of the dimensions of the studied logics is determined by the expression $\Sigma N_{i+1} = (2 \Sigma N_i) + K_1 - K_2$.

The considered range of dimensions of replacing logics (from 1 to 9) meets the conditions $K_1 = 1$; $K_2 = 0$, and the above expression takes the form $\Sigma N_{i+1} = (2 \Sigma N_i) + 1$.

4. CONCLUSION

Management situations where one or more priority logic points are of greatest interest.

It is necessary to rank and bring into correspondence such priorities, to establish the content and strength of communication of priority and non-priority points.

As an example, Fig. 3 shows a three-dimensional spatial model for determining the relationship of triads with the dominant role of one of the basic concepts.

The number of priority points varies from 1 to m (where m is the dimension of multi-point logic). The number of models of the whole gamut of possible variants of priority points in the logic is m+1.

This series of models has the property of symmetry (the use of “inverse”, “turned over” models).

The boundary of occurrence of symmetric (inverse) models of multi-point logics is determined by the expressions:

- for logics having even values of m : m / 2 + 1 ;
- for logics having odd values of m : m / 2 .

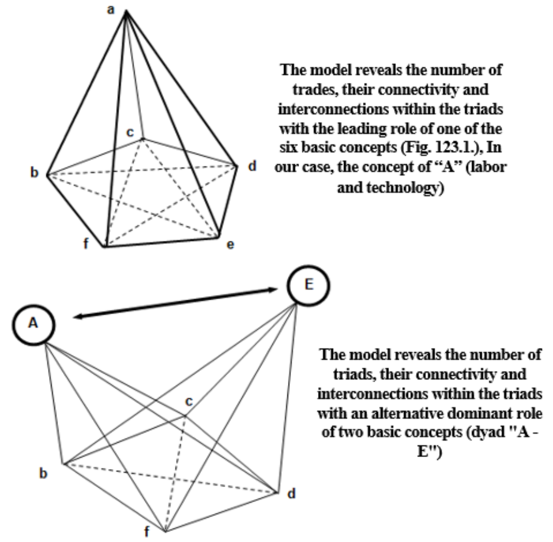


Figure 3 Spatial models of the relationship of triads with the dominant role of one of the basic concepts (upper model) or with the dominant role of one of the dyads (lower model), (2003, [1])

REFERENCES

[1] Life safety. Organizational and anthropotechnical reliability of functional systems of the mobile environment of construction production. Series "Infographic Fundamentals of Functional Systems" (IFFS), Ed. V.O. Chulkov, Moscow: ASV Publishing House, 2003, 176 p.

[2] V.O. Chulkov, Introduction to the course of drawing elements of computer-aided design, Conf. of the faculty of general technical training “Technical means in the educational process”. - M.: Moscow Aviation Institute named after Sergo Ordzhonikidze, 1973, pp. 5-7.

[3] S.V. Syrov, M.A. Tuzova, Improving the set of technical means for processing documentation based on the use of computer graphics, Informatics and interactive computer graphics, Dilijan, Yerevan: Goskomtsen Arm.SSR, pp. 129-133, 1986.

[4] S.I. Kotelnikov, Formation of mock-up document processing systems in the context of design automation. - PhD diss. - 05.13.12.- Defended on 12.25.1989, 16 p.

[5] S.A. Rafikov, Automation of the design of the reconstruction of unique objects of historical development of urban areas. - PhD diss. - 05.13.12.- Defended on 27.12.2000, 18 p.

[6] P.D. Buryanov, Infographic modeling of the characteristics of closed mobile workplaces in CAD construction. - PhD diss. - 05.13.12.- Defended on 4.12.2003.- 18 p.

[7] V.A. Osipov, Theoretical foundations of the formation of a system of machine geometry and graphics. Textbook.- M.: MAI, 1983, 83p.

[8] V.A. Osipov, The principles of the formation and study of the system of machine geometry and graphics, Geometric modeling and graphics in computer-aided design systems: Thematic collection of scientific papers.- M.: MAI, 1983, pp. 3-10.

[9] I.I. Kotov, Modeling and urgent tasks of applied geometry: Abstracts of the Volga Interzonal scientific and methodological conference on applied geometry, engineering graphics and standardization, Kuibyshev: Publishing House of Electrotechnical Institute, 1974, pp. 161-163.

[10] S.M. Efimova, On the algebraic approach to the problem of knowledge representation, Situational management and semiotic modeling: Collection of papers of scientific council on complex problem of “Cybernetics” of the Academy of Sciences of the USSR, M.: Scientific council on complex problem of “Cybernetics” of the Academy of Sciences of the USSR, 1983, pp. 54-73.

[11] I.Ya. Masturov, Computer-aided design monitoring of construction objects as a habitat. PhD diss. - 05.13.12.- Defenced on 6.7.1999, 16 p.