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E.V. Skakalina

Candidate of Sciences(Engineering),

Associate Professor of the Department of Computer and Information Technologies and Systems, Poltava National Technical Yuri Kondratyuk University, Poltava, Ukraine

ORCID:0000-0002-6441-3467

e-mail : wboss@i.ua

**OPTIMIZATION OF MANAGEMENT BY COMPLEX DISTRIBUTED SYSTEMS**

ОПТИМІЗАЦІЯ УПРАВЛІННЯ СКЛАДНИМИ РОЗПОДІЛЕНИМИ СИСТЕМАМИ

**Abstract.** A new approach to managing complex distributed systems based on a variety of information technologies is presented. The existing problems related to the multilevel management, the contradictory achievement of the efficiency criterion at different levels of management are analyzed. A cluster of complex territorially-distributed systems as economic entities with a vertically integrated organizational structure and corresponding levels of management is singled out. As a criterion for the effectiveness of managing the systems of a selected cluster, the criterion for a minimum of the cost expression of the expenditure part of the budget was chosen. Effective intellectual information technologies are proposed to achieve the given efficiency criterion. Results of application of these technologies in production and logistic processes are given.

**Key words:** intelligent control systems, information technologies, genetic algorithms, fuzzy sets, neuro-network group method of data handling.

Increasing the efficiency of functioning of a large class of complex territorially distributed systems (CTDS) and its cluster of complex organizational and technical systems (industrial, energy, transport) is inextricably linked with the increase in the level of computerization and the level of use of intelligent information technologies. Information and its effective application become a strategic resource for the transition to intellectual management. Further optimization of the management of the CTDS to improve the efficiency and quality of decisions is hindered by the insufficient use of new hybrid models, methods, and information technologies. The increasing complexity of modern industrial and organizational and technical objects makes it necessary to use the methods of system analysis, the general theory of systems [1, p.24], the theory of complex systems as a generalization of systems theory [2, p.4]. In modern conditions, the management system of the CTDS and decision support system should use the principles of multi-algorithmic, hybrid, modularity.

 An analysis of the existing models of management of the CTDS as an integrated structure and the degree of compliance of the ERP, BPM and other corporate governance systems implemented in the CTDS ERP, BPM and other corporate governance systems with the current needs of the CTDS in optimizing all existing types of production and accompanying activities of economic entities allows us to reach a substantiated conclusion regarding the material mismatch applied in these systems methods of optimizing production and logistics processes. The objective challenges of modern activity in the conditions of the CTDS require the use of intelligent information technology at all levels of management of complex objects, while minimizing such key parameters as the full cost of implementing ERP, BPM and other corporate governance systems, the timing of their implementation, the availability of staff with the appropriate level vocational training. The analysis of classical optimization techniques implemented in the well-known ERP systems shows that quite often they do not provide adequate managerial decisions due to significant time expenditures for finding the optimal solution. The use of innovative logistics as an independent competitive power will enable the national CTDS in a rapidly changing world market to maintain leadership in the process of achieving goals and strategies.

 In the set-theoretical form, the CAS model can be represented in the following form [3, p.11] :

*∑ == {U,Y,X,A,S},* (1)

where *U={u1,u2,…,un }* – is the set of control actions (control) by the system;

*Y={y1,y2,…,ym}* – set of output variables (output) of the system; *X= {x1,x2,…,xk}* – is the set of input parameters of the system; *A= {a1,a2,…,aj}* – is the set of intra-system parameters of the CTDS; *Y=S(U,X,A)* – is a function that determines the dependence of output parameters on input parameters, control actions and intra-system parameters. Then, on the basis of this model, we get the set-theoretic model of a CTDS with control:

*∑ =={U,Y,YG,X,A,F,S},* (2)

where *F* is the transition rule that forms the control action u to achieve the specified values ​​of the intra-system parameters. But in the real conditions of the operation of the CTDS , uncontrollable disturbing influences are necessarily present, which introduce an uncertainty factor. To reduce this uncertainty factor, it is suggested to use the set of information technologies Ω = {Ω1, Ω2, Ω3, Ω4} as control actions U [4, p.269].

 The set Ω represents the integration of the corresponding IT and consists of the following elements:

Ω1 - information technology for optimizing the production activity of a complex territorially distributed system (CTDS) by means of project management (ITOPA);

  Ω2 - information technology of optimization of logistic activity of CTDS on the basis of application of hybrid genetic algorithms and fuzzy sets (ITOLA);

Ω3 - Information technology for the optimization of financial risks of CTDS on the basis of fuzzy sets application (ITOFR);

Ω4 - information technology of short-term forecasting of any financial indicator of the CTDS on the basis of neuro-network modification of the method of group consideration of arguments (ITSF).

As the criterion for the effectiveness of the management of the CTDS , the total cost of the expenditure part of the budget is applied when the selected process is optimized for the processing cycle: *Z = Re + He*, which is invariant to the type of the domain; where *Z* is the total cost of the expenditure part of the CTDS budget;

*Re ≤* $\sum\_{i=1}^{e}ri$ - the total sum of the value equivalent of all material resources for the realization of the production activity of the CTDS in the processing cycle;

ri - value equivalent of the material resource for the i-th stage of the PC of the CTDS ;

Hв ≤ $\sum\_{i=1}^{e}h$i - the total sum of the cost equivalent of all human resources for the realization of the production activity of the CTDS in the processing cycle;

 hi is the cost equivalent of the human resource for the i-th stage of the PC CTDS ;

Tв≤$\sum\_{i=1}^{e}t$I - the total time of the cycle of the PC CTDS ;

ti - the time of the i-th stage of the PC CTDS .

 Verification of the developed information technologies in the subject areas "fuel and energy complex", "agricultural production", "logistics", "renewable energy" showed the following range of reduction of the cost part of the STDS budget: from 5% to 23% depending on the subject area.

**Conclusions.** Intelligent information technologies created on a single platform can be built in both the existing management systems of the CTDS and decision support systems. These technologies are integrated in the concept of PL-Logistics, Smart city, Green Computing.

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