УДК 004.9:519.23

QUALITATIVE COMPARISON OF MODERN INFORMATION TECHNOLOGIES USED FOR SYSTEM-INFORMATION-ANALYTICAL RESEARCH

V. Osypenko

National university of life and environmental sciences of Ukraine
15, str. Geroiv Oborony, Kyiv, Ukraine

У статті подано якісне порівняння сучасних методів та інформаційних технологій, які використовуються або потенційно можуть бути використані в системних інформаційно-аналітичних дослідженнях (СІАД) складних систем. З точки зору прийнятої класифікації представлена система субкритеріїв для оцінки якості основних характеристик таких технологій. Для порівняльного аналізу в якості інтелектуальної інформаційної технології системного аналізу складних систем включена індуктивна технологія СІАД.

Ключові слова: інформаційні технології, системний предметний аналіз, якісне порівняння, інновація

This paper presents a qualitative comparison of modern methods and information technologies that are used or can potentially be used in innovative system-information-analytical research (SIAR). The sub-criteria system for assessment the quality of major characteristics of such technologies presented from the standpoint of the accepted classification. For comparative analysis a new inductive technology SIAR as intelligent information technology of system analysis of complex systems have been included.

Keywords: information technologies, system-subjective analysis, comparative method, innovation

В статье представлены результаты качественного сравнения современных методов и информационных технологий, которые используются или могут быть использованы в системных информационно-аналитических исследованиях (СИАД) сложных систем. С точки зрения принятой классификации представлена система субкритериев для оценки качества основных характеристик таких технологий. Для сравнительного анализа в качестве интеллектуальной информационной технологии системного анализа сложных систем включена индуктивная технология СИАД.

Ключевые слова: информационные технологии, системный предметный анализ, качественное сравнение, инновация

1 Introduction

One of the leading areas of application of Intelligent Information Technologies (IIT) is the system analysis of complex objects, problems or processes and synthesis of information products for direct decision-making and / or to create a knowledge-oriented decision support systems, including uncertainty conditions. On the conceptual uncertainty of system-analytical research in general sense said in the many works. In particular about it said in [1].

This wide class of IIT includes technologies of system-information-analytical research (SIAR). For today the term "system-information-analytical research" is already widely accepted for use in the scientific literature [2], [3] and others, and is

applied specifically to SIAR of innovation-searching direction. Such technologies are actually intended to create the information-recommendatory (still sometimes said advisory or consulting) primary documents [4] containing new knowledge about the complex object or aimed at directly solving the problem. Since at the beginning of such complex researches the final information base is principally unknown, mentioned above conceptual uncertainty inherent and for such innovative research.

At present in searching SIAR actively used a significant amount of technologies and procedures depending on the nature and complexity of the problem, phenomenon or process are researched, industry and so on. But among these technologies there is some part of them, which contains the most developed, tested methods and therefore are the most used in solving practical problems. Needless, probably, to reject here and the role of advertising factor.

In [5] the result of SIAR $R^*(I_b^*)$ is interpreted as a specific document $D\{R^*(I_b^*)\}$, which reflected the results of system-subjective analysis of a complex object (process, phenomenon or problem at all), based on constructed during study optimal information basis I_b^*, conform with the requirements, has the information-recommendatory nature, endowed with a certain official status, and access level. $D\{R^*(I_b^*)\}$ means ready and prepared according to the requirements primary document, built on a set of optimal results $\{R^*(I_b^*)\}$ that may still be some sketchy character. This alone results $R^*(I_b^*)$ differ from the final document $D\{R^*(I_b^*)\}$.

That is, the result of SIAR is a primary document $D\{R^*(I_b^*)\}$ that contains a specific new knowledge to solve problems and developed for making appropriate decision. Therefore, the comparative analysis will involve information technologies that are either already used in SIAR, or potentially could be such with necessary adjustments or modifications, of course.

2 The purpose of work

The purpose of this paper is to perform a qualitative comparison of modern techniques and information technologies that are used or such that could potentially be used in SIAR.

3 Core material

The comparative method in science is one of the most used in cases where the numerical experiment cannot be applied for objective reasons (whopping costs of money or time, etc.). In addition, when comparing the methods and techniques used or can potentially be used in SIAR, we must remember that the vast majority of them developed under solving specific application of system tasks (corresponding sources shortly listed at the end of the paper).

Let define the basic criteria (more accuracy – sub-criteria) concerning the characteristics selected for testing of modern methods and technologies that can used in SIAR of innovative direction. The elementary sub-criteria set for qualitative comparative analysis was as follows:

cr_1 – degree of subjective impact the head of research;

cr_2 – degree of performers conformity ;

cr_3 – the complexity;

cr_4 – possibility of accurate assessment of the cycles number SIAR;

cr_5 – possibility of budgeting accuracy;

cr_6 – level of theoretical justification of the method;

cr_7 – rate of "convergence" to a satisfying result.

Table.

Qualitative comparison of modern methods and information technologies that are used or can potentially be used in SIAR

Method, technology	cr_1	cr_2	cr_3	cr_4	cr_5	cr_6	cr_7	Boundaries and scope of applications	Perspective of application in SIAR
Methods such as Delphi-type [6]	4	4	4	2	2	5	4	wide; in various areas	4
Methods such as tree-of- aims [7]	3	2	3	4	4	4	4	middle; in various areas	3
Method of predictive graph [8]	3	3	3	4	3	5	4	narrow; in various areas	4
Morphological methods of SA [9]	3	3	4	4	4	4	5	middle; in various areas	3
Methods for SA by S. Optner [10]	3	3	4	3	3	5	4	narrow; economy	4
Methods for SA by S. Young [11]	3	3	4	3	3	5	4	narrow; economy, technology	4

							Continuation of table	
Methods for SA by Y. Chernyak [12]	3	3	4	3	3	5	4	middle; economy, sociology	4
Generalized SA-technology [13]	3	3	4	3	3	5	4	wide; in various areas	5
InductiveSIAR-technology [14]	2	2	4	4	5	5	5	wide; in various areas	5

Sub-criteria $cr_1 - cr_7$ was selected as being the most often found in analytical and critical materials of the wide literature that is relevant to the subject of this work. While it is clear and it should be emphasized that the choice of sub-criteria and their evaluation is somewhat subjective.

In addition, in order for better understanding possibilities of new information inductive technology (IT) SIAR, in the list of investigated techniques were included a generalized method of CA [13] and, of course, IT SIAR [14].

Classification in the penultimate column of Table 1 applies to boundaries and priority area of applications. This classification, as also almost any other ones, performs the target role. In the present study it was important to know how broad and how many the subject areas are covered by certain method, where it would be applicable. It was to draw attention to the original sphere, in which was firstly developed and applied such technique or technology. Because of this, the characteristics of application breadth in research were useful to define the following:

1) narrow: technology can be applied simultaneously only for a narrow direction, i.e. in the same applied field, such as "football", for example ;

2) middle: may be used simultaneously in a relatively "narrow" direction with the tangent to it too "relatively narrow" areas of research, such as "playing sports";

3) wide: it can be used both in the broad direction with the adjacent to it by many as broad and medium and narrow areas of research, such as "sports", for example.

Conclusions

The paper considers the qualitative comparative analysis of modern methods and information technologies that are used or can potentially be used in the searching SIAR. Qualitative analysis is almost always has some hue of subjectivity because comparison involves the selection criteria and their evaluation from the standpoint of a target factor. In this case, the such factor was a qualitative assessment of an expert

method or system analysis technology as well as inductive technology in terms of their applications in SIAR. Coming here, sub-criteria was selected as being most common in analytical and critical materials of the vast literature that is relevant to the topic of this work.

After analyzing the results from the Table 1, we can draw still some conclusions:

1) the choice of research method depends largely on the critical impact of the sub-criteria $cr_1 - cr_7$ to implement innovative project (scope, subject matter, complexity, etc.) and / or its outcome;

2) in complex searching projects, as important and positive trend, is a combination of several information technologies included in the exploration of problem and / or their elements;

3) reducing the influence of the research project moderator and, as a result – reducing of performers conformity, can improve "rating" method in its application in SIAR.

References

[1] Zgurovsky M.Z. Fundamentals of systems analysis // M.Z. Zgurovsky, N.D. Pankratova. — K.: Publishing Group BHV, — 2007. — 544 p. [In Ukraine].

[2] The theoretical and methodological foundations of system-information-analytical research. Monograph / Ed. by Dr. Sci., Prof. A.I. Selivanov., M.: IPKGS. — 2004. — 184 p. [In Russian].

[3] System analysis and analytical research: A guide for professional analysts // A.I. Rakitov, D.A. Bondyaev, I.B. Romanov [etc.] / Ed. by A.I. Rakitov. — M. — 2009. — 448 p. [In Russian].

[4] Law of Ukraine «On Information». — [Electronic resource]. — Mode of access: http://www.rada.gov.ua.

[5] Osypenko V.V. The Main Trends in Modern Inductive Information Technologies of System-Analytical Researches / V.V. Osypenko // Proceedings of 4-th International Workshop on Inductive Modeling (IWIM-2011), July 4 – 10, Kyiv, 2011. — Pp. 63-71.

[6] Delphi Method: Techniques and Applications // Harold A. Linstone (Editor), Murray Turoff (Editor), Publisher: Addison-Wesley Educational Publishers Inc, — 1975. — 621 p.

[7] Surmin U.P. Systems theory and systems analysis: study guide / K.: MAUP, — 2003. — 368 p. [In Russian].

[8] Saaty T. Decision-making. The method of analysis of hierarchies // Trans. from English. R. Vachnadze /M.: Radio and communication, — 1993. — 279 p. [In Russian].

[9] Odrin V.M. Morphological analysis of the technical systems // M.: VNIIPO, — 1989. — 312 p. [In Russian].

[10] Optner S.L. System analysis solutions for business and industry issues. — M.: Soviet Radio, — 1969. — 216 p. [In Russian].

[11] Young S. System Management Organization / Trans. from English. ed. S.P. Nikanorova, S.A. Batasova / M.: Soviet radio. — 1972. — 456 p. [In Russian].

[12] Chernyak Y.I. System analysis in economic management / M.: Economy. - 1975. - 191 p. [In Russian].

[13] Osypenko V. Info-logical structure of inductive technologies of the searching system-information-analytical researches // V. Osypenko / Bulletin of National University "Lvivska politehnika", Ser. "The Computer Science and Information Technologies". — 2013. № 751. — Pp. 315-319.

[14] Osypenko V.V. The Results Estimation in the Integrated System-Analytical investigations Technologies / V.V. Osypenko // USiM. — 2012. — № 1. — Pp. 26-31. [In Russian].