УДК 004.8 5.2.2. Математические, статистические и инструментальные методы в экономике	UDC 004.8 5.2.2. Mathematical, statistical and instrumental methods in economics
ИНФОРМАЦИОННЫЕ, КОГНИТИВНЫЕ И ИНТЕЛЛЕКТУАЛЬНЫЕ ТЕХНОЛОГИИ В ЭКОНОМИКЕ	**INFORMATION, COGNITIVE AND INTELLECTUAL TECHNOLOGIES IN THE ECONOMY**
Луценко Евгений Вениаминович	Lutsenko Evgeniy Veniaminovich
д.э.н., к.т.н., профессор	Doctor of Economics, Ph.D., Professor
Web of Science ResearcherID S-8667-2018	Web of Science ResearcherID S-8667-2018
Scopus Author ID: 57188763047	Scopus Author ID: 57188763047
РИНЦ SPIN-код: 9523-7101	RSCI SPIN code: 9523-7101
prof.lutsenko@gmail.com http://lc.kubagro.ru	prof.lutsenko@gmail.com http://lc.kubagro.ru
https://www.researchgate.net/profile/Eugene_Lutsenko	https://www.researchgate.net/profile/Eugene_Lutsenko
В 2003 году автором защищена докторская диссертация по теме: «Системно-когнитивный анализ в управлении АПК». В 2011 году в Перечне критических технологий Российской Федерации появился п.8. Нано-, био-, информационные, когнитивные технологии, а в 2021 году в номенклатуру научных специальностей была включена специальность: 5.12.4. Когнитивное моделирование. В ходе революции в области искусственного интеллекта начала XXI века стало ясно, что системы искусственного интеллекта могут применяться в качестве инструмента автоматизации процесса научного познания, многократно увеличивающего возможности естественного интеллекта, во всех областях науки, группах научных специальностей и научных специальностях, отраженных в номенклатуре научных специальностей. В этой номенклатуре и сейчас есть научные специальности, наименования которых образованы путем объединения названия методов исследования и наименования науки, например: «2.9.8. Интеллектуальные транспортные системы», «5.2.2. Математические, статистические и инструментальные методы в экономике». Совершенно аналогично предлагается образовать наименование новой экономической специальности: «5.2.8. Информационные, когнитивные и интеллектуальные технологии в экономике». В статье дается краткий обзор работ автора за период около 25 лет, которые соответствуют этой новой перспективной научной специальности.	In 2003, the author defended his doctoral dissertation on the topic: “System-cognitive analysis in the management of the agro-industrial complex.” In 2011, item 8 appeared in the List of Critical Technologies of the Russian Federation. Nano-, bio-, information, cognitive technologies, and in 2021 the specialty was included in the range of scientific specialties: 5.12.4. Cognitive modeling. During the revolution in the field of artificial intelligence at the beginning of the 21st century, it became clear that artificial intelligence systems can be used as a tool for automating the process of scientific knowledge, which greatly increases the capabilities of natural intelligence, in all areas of science, groups of scientific specialties and scientific specialties reflected in the nomenclature of scientific specialties . In this nomenclature there are still scientific specialties, the names of which are formed by combining the name of research methods and the name of science, for example: “2.9.8. Intelligent transport systems", "5.2.2. Mathematical, statistical and instrumental methods in economics.” In a completely similar way, it is proposed to create the name of the new economic specialty: “5.2.8. Information, cognitive and intellectual technologies in economics.” The article provides a brief overview of the author's work over a period of about 25 years, which corresponds to this new promising scientific specialty.
Ключевые слова: системы искусственного интеллекта, автоматизация процессов познания, номенклатура научных специальностей, критические технологии Российской Федерации	Key words: artificial intelligence systems, automation of cognition processes, nomenclature of scientific specialties, critical technologies of the Russian Federation
http://dx.doi.org/10.21515/1990-4665-196-007	

CONTENT

I. Introduction

In 2003, the author defended his doctoral dissertation on the topic: “System-cognitive analysis in the management of the agro-industrial complex” [1, 2][1].

In 2011, item 8 appeared in the List of Critical Technologies of the Russian Federation. Nano-, bio-, information, cognitive technologies [3].

In 2021, the following specialty was included in the list of scientific specialties: 5.12.4. Cognitive modeling [4].

During the revolution in the field of artificial intelligence at the beginning of the 21st century, it became clear that artificial intelligence systems can be used as a tool for automating the process of scientific knowledge, which greatly increases the capabilities of natural intelligence, in all areas of science, groups of scientific specialties and scientific specialties reflected in the nomenclature of scientific specialties [5-12].

In this nomenclature there are still scientific specialties, the names of which are formed by combining the name of research methods and the name of science, for example: “2.9.8. Intelligent transport systems", "5.2.2. Mathematical, statistical and instrumental methods in economics” [4].

[1] All references to sources are given in accordance with the work [1] according to the list of references

In a completely similar way, it is proposed to create the name of the new economic specialty: “5.2.8. Information, cognitive and intellectual technologies in economics” [11, 12].

The article provides a brief overview of the author's works over a period of more than 20 years since the defense of his doctoral dissertation, which correspond to this proposed new promising scientific specialty.

II. Methodology

The research method used was Automated Systemic Cognitive Analysis (ASC-analysis), proposed by the author in 2002 in [13]. ASC analysis is described in a large number of works published in full open free access in the RSCI [14], on the author’s website [15] and the author’s page in ResearchGate [16], as well as on a number of other sites. Therefore, it is not advisable to do this again in this short work.

III. Results

On the author’s website [15] at the link: http://lc.kubagro.ru/aidos/index.htma large number of monographs and textbooks by the author on the use of information, cognitive and intellectual technologies in economics, as well as in other fields of science, have been published. All these monographs and textbooks are fully open and freely available. Below is a brief overview of them in chronological order.

The monograph [17] develops a promising concept of cognitive analytical systems that provide automation of the main functions performed by a person in the process of meaningful cognition and analysis of Reality. Using the example of the universal automated pattern recognition system “EIDOS” (version 5.1) developed by the author, the issues of using such systems for carrying out adaptive semantic analysis when making decisions in various subject areas are considered: law enforcement, sociological and political science research, and

many others. The experience of application is described and prospects are outlined, issues of organizational and legal support for the use of the EIDOS system and other systems of this class are highlighted. The promising man-machine remote telekinetic control systems proposed by L.A. Bakuradze and the author in 1979-1981, which include systems in many ways similar to the “EIDOS” system, are briefly described. The theoretical foundations of the information theory of value developed by the author are outlined, on the basis of which approaches to determining the cost of meaningful analytical information generated by applications of the EIDOS system are analyzed. This work provides the most complete description of the EIDOS system itself and the technology of its application at the time of writing.

The monograph [18] discusses the theory and practice of synthesizing a promising class of automated control systems: adaptive automated control systems for complex systems. An original approach to the synthesis of automated control systems is proposed, based on methods of pattern recognition and decision making. On the basis of information theory, an integral method of pattern recognition and decision-making has been developed, focused on application in automated control systems, as well as a methodology, technique and infrastructure for the synthesis of adaptive automated control systems by complex systems, and the experience and prospects for using the proposed technology are highlighted. These mathematical models and technologies are supported by specific numerical examples of calculating automatic control systems for a complex technical system. An instrumental software shell (cognitive analytical system "Eidos") is described that implements the proposed models and technologies. The work is intended for specialists involved in the development of intelligent methods for managing complex systems. It may be useful for engineers and automated control systems specialists interested in new areas of application of automated control technologies, as well as for undergraduate and graduate students of relevant specialties. This work is

included in the collections of the US Library of Congress: https://catalog.loc.gov/vwebv/search?searchArg=Lutsenko+EV.

The monograph [19] discusses the fundamentals of system analysis, primarily in terms of its application to create adaptive control systems for complex systems. A university was chosen as a specific complex system, the main goal of managing which is to ensure international quality in the training of specialists. One of the main problems of system analysis is the development of an adequate adaptive mathematical model of a complex system, on the one hand, taking into account all the significant factors influencing the behavior of the system, and on the other, having minimal redundancy. Based on information theory, a mathematical model and a decision-making method have been developed, focused on application in automated control systems, as well as a methodology, technique and infrastructure for the synthesis of adaptive automated control systems by complex systems, and the experience and prospects for using this technology are highlighted. Examples are given from the field of quality management of specialist training, conflictology, etc. The proposed mathematical models and technologies are embodied in a specific software system that provides model synthesis, its optimization and application for the intended purposes (“Adaptive system for analysis and forecasting of states of complex systems DELTA”, RF patent No. 2000610164 dated 04/03/2000). The work is intended for specialists involved in the development of intelligent methods for managing complex systems. It can be useful for undergraduate and graduate students as an additional teaching aid for the courses: "System Analysis", "Mathematical Modeling", "Decision Theory", "Information Theory".

Monograph [20] is the main (at the moment) work that sets out the theoretical foundations and technology of application of a new interdisciplinary scientific direction, called “Automated system-cognitive analysis” (ASC-analysis), in which information theories are studied from a unified perspective

processes of cognition and labor (in the form of managing the subject of labor). The issues of using ASC analysis for reflexive control of active systems are considered, which include socio-economic systems, people with their “mental reality”, biological and ecological systems, as well as a new class of technical systems: technical systems with parameters that qualitatively change in the process normal operation. In this case, the process of cognition itself in the form of ASC analysis is included directly in the management cycle as a periodically performed stage. A mathematical model of ASK analysis is proposed, based on a systemic generalization of the semantic theory of information of A. Kharkevich, as well as a corresponding numerical method and special software tools that implement it - the Universal Cognitive Analytical System "Eidos" (with the environmental systems "Eidos-Fund" and "Eidos- Ψ"). 4 numerical examples of the application of ASC analysis in various subject areas are given, incl. in economics, the experience and prospects for its application are discussed in detail. For students, graduate students and scientists working in the field of system analysis, cognitive analysis, reflexive control of active systems, cognitive modeling, for everyone interested in artificial intelligence, intelligent data processing and intelligent control.

The textbook [21] consists of three parts: a course of lectures; workshops and independent work programs for students. The course of lectures includes 16 lectures, grouped into 4 sections: introduction to intelligent information systems; theoretical foundations and operation of the universal cognitive analytical system "Eidos"; principles of building intelligent information systems; application and prospects of artificial intelligence systems. The workshop is based on the universal cognitive analytical system "Eidos", developed by the author of the manual, and includes 10 laboratory works. The program of independent work for students in the discipline includes theoretical questions and practical tasks submitted for examination in the discipline and the state exam, as well as a list of basic and additional literature, including Internet sites

on artificial intelligence. For full-time and part-time students, graduate students, teachers and researchers interested in the problems of artificial intelligence systems.

The monograph [22] is devoted to solving the problems of managing the agro-industrial complex at various levels of its organization: investment management of the quality of life of the population of the region; managing the sustainability of the region's processing complex; management of crop productivity and product quality. These problems are solved in the monograph on a single standardized methodological and instrumental-technological basis of systemic-cognitive analysis, which provides both the synthesis and verification of semantic information models, and their use for forecasting and management in the agro-industrial complex. Recommended for graduate students, teachers and researchers involved in and interested in the problems of managing complex systems using artificial intelligence technologies.

The textbook [23] is the 1st volume of a two-volume set of educational literature and includes a “Lecture Course”, consisting of 16 lectures grouped into 4 sections: introduction to intelligent information systems; theoretical foundations and operation of the universal cognitive analytical system "Eidos"; principles of building intelligent information systems; application and prospects of artificial intelligence systems. For full-time and part-time students, graduate students, teachers and researchers interested in the problems of artificial intelligence systems.

The textbook [24] is the 2nd volume of a two-volume set of educational literature and includes a “Laboratory workshop” and a “Program for independent work of students.” The laboratory workshop is based on the universal cognitive analytical system "Eidos", developed by the author of this textbook, and includes 10 laboratory works. The program of independent work for students in the discipline includes theoretical questions and practical tasks submitted for examination in the discipline and the state exam, as well as a list

of basic and additional literature, including Internet sites on artificial intelligence. Note that at the time of writing this work, the Eidos system contains a large number of intelligent local (i.e., supplied with the installation) and cloud educational and scientific Eidos applications (currently there are 31 and more than 392, respectively: http://lc.kubagro.ru/Source_data_applications/WebAppls.htm, http://lc.kubagro.ru/aidos/Presentation_Aidos-online.pdf, http://lc.kubagro.ru/Presentation_LutsenkoEV.pdf.

The monograph [25] is devoted to solving the problems of synthesizing multi-level semantic information models: the influence of extreme environmental factors on the affective and cognitive components of the self-image of police officers; the influence of the self-image structure on the conative component of police officers, i.e. style and structure of their activities in these situations. All these problems are solved in the monograph on a single standardized methodological and instrumental-technological basis of system-cognitive analysis, which provides both the synthesis and verification of semantic information models, and their use for identification, forecasting and management decision-making support. The well-known statistical package SPSS is also used. Recommended for employees of psychological services, graduate students, teachers and researchers involved in and interested in psychological and mathematical problems of identifying and predicting the structural and content characteristics of personality.

In the monograph [26], the problems of managing the yield and quality of crop and fruit growing products are solved on a single standardized methodological and instrumental-technological basis of system-cognitive analysis, which provides both synthesis, adaptation and verification of semantic information models, and their use for forecasting and decision support (management) in the agro-industrial complex, as well as for scientific research of the subject area. Designed for students of centers of additional agronomic

education, full-time and part-time students, graduate students, teachers and researchers interested in the use of modern intelligent information technologies in general and system-cognitive analysis in particular to solve problems of forecasting and decision support in crop production.

The monograph [27] presents a version of the theory of similarity in sociology, called “Astrosociotypology”. The theory is based on the hypothesis of spatio-temporal similarity of phenomena and processes of the same nature. This principle is methodologically related to the principles of relativity of Galileo and Einstein, but is more general. Methods for typing and identifying the social status of respondents based on their astronomical indicators at the time of birth have been developed and algorithms that implement the method are presented. Due to the large dimension of the problem, to solve it, an artificial intelligence system "Eidos-astra" was created, the training of which was carried out on the AstroDatabank database, containing more than 26 thousand records of biographies of famous and private people belonging to certain social categories. The patterns of recognition of social categories have been established. For anyone who is interested in the opportunity to take another step in understanding personality traits, social qualities and the system of determining human behavior.

The monograph [28] consists of five chapters. The 1st chapter provides an introduction to intelligent information systems, the 2nd chapter: the theoretical foundations and technology for using automated system-cognitive analysis (ASC analysis), the 3rd chapter: ASC analysis is considered as a methodology for the synthesis and operation of reflexive automated control systems by active objects (using the example of automated control systems for the quality of training of specialists), in the 4th: the technology of practical application of automated control analysis in university automated control systems is considered, in the 5th: prospects for the development of automated information processing and control systems (AIS). In addition, the monograph includes an

explanatory dictionary of terms on system-cognitive analysis and artificial intelligence systems and a large list of literature on this topic. For full-time and part-time students, graduate students, teachers and researchers interested in modern intelligent information technologies and their application in automated information processing and control systems (APIS), as well as in automated control systems and in the educational process when teaching the disciplines: "Informatics" and "Intelligent information systems".

The monograph [29] discusses a knowledge-based economy. To perform its functions, management uses special technologies, techniques and software systems. Traditionally, these tools were developed by large research centers, usually foreign, and then distributed to Russian corporations, usually without adaptation or localization. The high cost of these technologies makes them virtually inaccessible to medium and small firms. The monograph reveals the role of controlling as an intra-company institution designed to provide the company's management with all the necessary tools, teach them how to use them and control the quality of this use. The possibilities of using Automated Systemic Cognitive Analysis (ASC Analysis) as a basic technology for controlling a medium and small company are described in detail. Detailed numerical examples of the use of ASC analysis are given to solve a wide variety of controlling problems at various hierarchical levels of information and knowledge processing in a company. For students, graduate students, teachers and researchers interested in modern intellectual technologies and the prospects for their application in management and controlling, as well as in the educational process.

The monograph [30] presents information models of socio-economic and natural processes in their relationship with the space environment. The theory is based on the hypothesis of spatio-temporal similarity of phenomena and processes of the same nature. Methods have been developed and algorithms for

recognizing various events in geophysics, economics and sociology have been presented, including seismic events, geomagnetic field variations, the movement of the Earth's pole, exchange rates, economic indices and social categories. Due to the large dimension of the problems under consideration, artificial intelligence systems “Eidos-Astra” and “Eidos-Geo” have been created to solve them, and methods and algorithms for data visualization have been developed. For anyone who is interested in the opportunity to take another step in understanding the general properties of the system of determination of socio-economic and natural processes. Links to this information are available in leading foreign libraries, incl. at the US Library of Congress[2].

Monograph [31] is devoted to solving the problems of managing the agro-industrial complex of the region at various levels of its organization: investment management of the quality of life of the population of the region; managing the sustainability of the region's processing subcomplex; management of the efficiency of agricultural production systems. Addressed to researchers and graduate students, it will be useful to heads of the agro-industrial complex and regional administrations, heads and managers of agro-industrial complex enterprises.

In the monograph [32], an intellectual model was created and studied that characterizes the influence of all types of factors on economic, energy and financial-economic results in grain production: natural, agrotechnological, energy and financial-economic. The problem of scientifically based, effective forecasting of results and making management decisions on the choice of agricultural technologies that provide the desired result has been solved. A presentation on this work is available on the author’s website [15] at the link:http://lc.kubagro.ru/Presentation_LutsenkoEV.pdf. The monograph is intended for students of additional agronomic education, teachers and

[2] http://lc.kubagro.ru/aidos/index.htm

researchers interested in intelligent information technologies, specialists and managers of agronomic services, as well as for full-time and (correspondence) students of relevant specialties.

The monograph [33], consisting of two interrelated parts, examines the prospects and some “growth points” of modern theoretical and computational mathematics. Part 1 covers the following issues: numbers and sets - the basis of modern mathematics; mathematical, pragmatic and computer numbers; from ordinary sets - to fuzzy ones; theory of fuzzy sets and “fuzzy doubling” of mathematics; on reducing the theory of fuzzy sets to the theory of random sets; interval numbers as a special case of fuzzy sets; development of interval mathematics (interval doubling of mathematics). The 2nd part is devoted to issues of system generalization of mathematics: a system as a generalization of a set; systematic generalization of mathematics and problems arising from this; systematic generalization of operations on sets (using the example of the operation of combining Boolean); systemic generalization of the concept of function and functional dependence; cognitive functions; knowledge matrices as a fuzzy mapping of a system of arguments onto a system of function values with a calculated degree of truth; modification of the least squares method for approximating cognitive functions; development of the idea of a systematic generalization of mathematics in the field of information theory - systemic (emergent) information theory; information measures of the level of systematicity - emergence coefficients; direct and inverse, direct and indirect plausible logical reasoning with a calculated degree of truth; intellectual system Eidos-X++ as a toolkit that implements the ideas of systemic fuzzy interval generalization of mathematics. Some thoughts presented in the monograph are controversial and debatable in nature and are expressed in the form of scientific discussion.

The monograph [34] is devoted to a detailed consideration of one of the possible solutions to a problem that is relevant for the country’s agro-industrial

complex, namely, that the process of harvesting and harvesting is traditionally extremely irrational, with huge unjustified costs of various types of resources, and this in the conditions of the modern economy , is completely unacceptable. For students, graduate students, scientists and developers, administrators and practitioners involved in and interested in the theory, technology and practice of automation of operational management of harvesting and procurement of cereal grains and sugar beets in the agro-industrial complex at the district and inter-district (regional) levels. Work [35] considers a mathematical model of operational (daily) management of harvesting and procurement processes in the agro-industrial complex at the regional and district levels. The model is implemented in the form of a software system, the implementation of which in 8 districts of the Krasnodar Territory, the Republic of Adygea and the Kursk Region for the harvesting and procurement of cereal grains, sugar beets and rice made it possible to obtain a direct economic effect of more than 500 million rubles in 1983-1992 prices.

The 2012 monograph [36] is devoted to the universal cognitive analytical system “Eidos” and its application in scientific research in various fields of science and in the educational process. Chapter 1 describes the history of the basic Eidos system and the Eidos Foundation, Eidos-Ψ and Eidos Astra environment systems. Chapter 2 briefly examines Systemic Cognitive Analysis and Systemic Information Theory, which are the theoretical foundations of the Eidos system. Chapter 3 discusses the applications of the Eidos system in scientific research in various fields of science: economics, technical sciences, psychology, medicine, astrogeophysics and astrosociology, and agriculture. Chapter 4 discusses the use of the “Eidos” system in the educational process when teaching the disciplines: “Intelligent Information Systems”, “Representation of Knowledge in Intelligent Information Systems”, “Knowledge Management”, “Functional and Cost Analysis of Personnel Management Systems and Technologies”, "Fundamentals of management theory." Chapter 5

discusses the prospects for the development of the “Eidos” system: theoretical foundations, software tools, visualization apparatus for cognitive functions and eidos, intelligent portals for intelligent on-line services via the Internet. The appendices provide a glossary, implementation acts and a description of the infrastructure for using the Eidos system. For students, graduate students, teachers and researchers interested in modern intellectual technologies and the prospects for their application in scientific research and the educational process.

The monograph [37], consisting of two interconnected parts of approximately equal volume, discusses promising mathematical and instrumental methods of controlling. Part 1, which includes 4 chapters, is devoted to high statistical technologies in controlling. It covers the following questions: what is controlling, controlling methods, a general view of mathematical and instrumental methods of controlling, specific areas of mathematical and instrumental methods of controlling, economic and mathematical support for controlling. Part 2 includes 8 chapters and contains a brief description of a new promising controlling tool: automated system-cognitive analysis (ASC-analysis) and reveals the possibilities of its application in a number of subject areas: in controlling scientific and educational activities, knowledge management and information security of a self-learning organization , benchmarking of a trading company, management of technological knowledge in a manufacturing company, management of the company’s personnel by solving a generalized assignment problem, forecasting auto insurance risks (underwriting), quantitative automated SWOT and PEST analysis using ASK analysis and the Eidos-X++ intelligent system " Some thoughts presented in the monograph are controversial and debatable in nature and are expressed in the form of scientific discussion.

The monograph [38] consists of 7 chapters. Introductory chapter 1 is devoted to the main issues of using organizational and economic modeling in solving problems of controlling. Chapter 2 provides the first historical analysis

of the development of statistical methods in our country. Some results of applied statistics are discussed in Chapter 3. Organizational and economic support for controlling, innovation and management using the example of the rocket and space industry is discussed in Chapter 4. The use of automated system-cognitive analysis (ASC-analysis) in economics is presented in Chapter 5. ASC-analysis in assessing the results of scientific and teaching activities - the subject of Chapter 6. In the final Chapter 7, ASC analysis and information theory are used to solve some statistical problems. The monograph continues the books previously published by the same publishing house “System Fuzzy Interval Mathematics” (Orlov A. I., Lutsenko E. V., 2014) and “Advanced Mathematical and Instrumental Methods of Controlling” (Orlov A. I., Lutsenko E. V. , Loiko V.I., 2015). Some thoughts presented in the monograph are controversial and debatable in nature and are expressed in the form of scientific discussion.

The monograph [39] is devoted to the use of automated systemic cognitive analysis (ASC analysis) and its software tools - the Eidos intelligent system in the law enforcement field. The application of ASC analysis in managing the quality of training of law enforcement officers, studying the typology of educational activity and individual characteristics, self-image and stylistic characteristics of individual activity in extreme conditions for their use in the educational process is shown. Intended for students, graduate students, teachers and researchers interested in modern innovative technologies and the prospects for their application in scientific and applied research, as well as in quality training of law enforcement specialists. This monograph is available in the US Library of Congress.

The monograph [40] is devoted to the problems of scientometrics and modern approaches to their solution. The problems of the current stage of development of scientometrics are closely related to the problems of science and education, which are the object of research and measurement in scientometrics. Therefore, these issues are also touched upon, but only to the extent necessary to

consider the main topic. The monograph consists of 4 parts devoted to the basic concepts and problems of scientometrics, modern theoretical and instrumental approaches to their solution and recommendations. Many of the arguments put forward by the authors are controversial and are proposed as a matter of scientific discussion. Intended for everyone interested in this issue.

The monograph [41] is devoted to the problems of scientometrics and modern approaches to their solution. The problems of the current stage of development of scientometrics are closely related to the problems of science and education, which are the object of research and measurement in scientometrics. Therefore, these issues are also touched upon, but only to the extent necessary to consider the main topic. The monograph consists of 8 chapters devoted to various problems of measuring the results of scientific activity and modern theoretical and instrumental approaches to their solution and recommendations. Many of the arguments put forward by the authors are controversial and are proposed as a matter of scientific discussion. Intended for everyone interested in this issue.

The training manual [42] presents educational and methodological materials for studying artificial intelligence systems (AI). These systems ensure the acquisition of knowledge by identifying it from empirical data, the accumulation of knowledge and its representation in knowledge bases based on various models of knowledge representation, the use of knowledge to solve various problems, primarily problems of identification, forecasting, decision-making and research of the simulated subject area by research of its model. A glossary of terms used in this area is provided. Intended for master's students in the field of training 09.04.02 Information systems and technologies, training profile “Information systems and technologies in science and management.”

The monograph [43] presents the results of developing a new direction in the development of the digital economy – the solidarity economy. A brief description of automated system-cognitive analysis with its software tools, the

intelligent system “Eidos”, is given and three numerical examples of their application for solving problems for banks, insurance and retail are given. The information variation principle and its manifestation in the technology and economics of the digital society are considered. Intended for teachers, students and anyone interested in this issue.

The training manual [44] presents educational and methodological materials for studying system-cognitive modeling in the agro-industrial complex. Detailed numerical examples of the use of Automated Systemic Cognitive Analysis (ASC-analysis) and its software tools - the intelligent system "Eidos" for solving problems in mechanization, agronomy and veterinary medicine are given. Systemic-cognitive modeling involves identifying knowledge from empirical data, accumulating knowledge and using knowledge to solve problems of identification, forecasting, decision-making and exploration of the modeled domain by examining its model. A glossary of terms used in this area is provided. Intended for undergraduates, graduate students and anyone interested in this issue.

The monograph [45] discusses high statistical technologies, problems of environmental safety management, and provides an automated system-cognitive analysis of the influence of environmental factors on the quality of life of the population of the region. Intended for students, teachers and anyone interested in this topic.

The monograph [46] presents the theory of resonant seismogenesis and the author’s methodology for automated system-cognitive earthquake forecasting. Physical models of mantle convection and information models of the influence of planetary gravitational complexes on the formation of seismic events are considered. A description of an open scalable interactive intelligent on-line environment for teaching and scientific research based on ASC analysis and the Eidos system is given. Intended for seismologists, artificial intelligence specialists and anyone interested in this topic.

The monograph [47] presents the theory of resonant seismogenesis and the author's methodology and technique for automated system-cognitive earthquake forecasting. Physical models of mantle convection and information models of the influence of planetary gravitational complexes on the formation of seismic events are considered. Detailed numerical examples of ASC analysis of seismicity, an annotated atlas of earthquake forecasts, and a description of an open scalable interactive intelligent on-line environment for training and scientific research based on ASC analysis and the Eidos system are given. Intended for seismologists, artificial intelligence specialists and anyone interested in this topic.

The monograph [48] includes five chapters that describe the theoretical and mathematical foundations of scenario and spectral automated system-cognitive analysis (ASC-analysis) and provide detailed numerical examples of its application for forecasting in financial markets and image analysis. Intended for undergraduate, graduate and postgraduate students, as well as teachers and developers in the field of artificial intelligence, anyone interested in this topic.

The monograph [49] discusses the theoretical foundations of systemic fuzzy interval mathematics, the relationship between the semantic content of the concepts "data", "information" and "knowledge", the theoretical and mathematical foundations of basic, scenario, spectral and text automated system-cognitive analysis (ASC analysis) . Numerical examples of the application of scenario and spectral ASC analysis for forecasting in financial markets and image analysis are given. Intended for undergraduate, graduate and postgraduate students, as well as teachers, researchers and developers in the field of high statistical technologies and artificial intelligence, for everyone interested in this issue.

The monograph [50] discusses the algorithm for using Automated Systemic Cognitive Analysis and its software tools of the intelligent system "Eidos" for solving various problems in the field of veterinary medicine:

identification, diagnosis, forecasting, decision-making and research of a modeling object by studying its model. The publication is intended for those interested in the application of cognitive technologies and other artificial intelligence methods. Full text of the monograph (513 pages) on the Researchgate website: Lutsenko EV Cognitive veterinary medicine // February 2023, DOI:10.13140/RG.2.2.28032.92163, License CC BY 4.0, https://www.researchgate.net/publication/368476220/.

The monograph [51] studied the dependence of the educational achievements of university students on their studies in the educational unit “Small Faculty of Mathematics” during their studies in high school and on the results of the Unified State Exam. A sample of 230 students of the Faculty of Mathematics and Computer Science of the Kuban State University of the direction of training 02.03.01 Mathematics and Computer Science for 2019–2022 was studied. The study was carried out using automated system-cognitive analysis (ASC-analysis) and its software tools - the intelligent system " Eidos." Addressed to all those studying the effectiveness of preparing schoolchildren for study at a higher educational institution. The monograph was prepared within the framework of a grant from the Kuban Science Foundation (scientific project No. PPN-21.1/10 “Digital didactics for subject teaching, educational work of students and professional training of teachers”).

Monograph [52] is a brief preliminary report by the author on scientific work over a period of approximately 25 years from 1999 to the present (2024). The basics of Automated Systemic Cognitive Analysis (ASC-analysis) and its software tools - the intelligent system "Eidos" for solving problems: identification, diagnostics, forecasting, decision-making and research of a modeling object by studying its model in a variety of subject areas are considered. The publication is intended for those interested in the application of cognitive technologies and other artificial intelligence methods in various fields of science and education.

IV. Discussion

The development of information, cognitive and intellectual technologies (ICIT) in the economy represents significant progress in the field of scientific knowledge and practical application. With the growing needs and challenges of the modern world, the potential of these technologies in solving complex problems and optimizing processes in the economic sphere is becoming more and more apparent.

Information technology plays a key role in providing access to and analysis of data, allowing informed decisions to be made based on factual information. The use of cognitive technologies makes it possible to model and analyze human cognitive processes, which opens up new opportunities for optimizing learning, decision-making and increasing work efficiency in the economic sphere. Intelligent technologies such as machine learning and artificial intelligence help automate routine tasks, identify hidden patterns, and predict the behavior of markets and economic processes.

It is important to note that the development of ICT in economics requires an integrated approach and interaction of various fields of knowledge, such as computer science, economics, psychology and others. Both technical and human aspects need to be considered in order to create effective and sustainable information systems and technologies.

The promotion of the new scientific specialty “Information, cognitive and intellectual technologies in economics” opens up new prospects for further research and innovation in this area. The works presented in this article are aimed at developing this area and, as the author hopes, can serve as an incentive for further research and practical application of ICT in economics.

V. Conclusion

The article examined the significant contribution of information, cognitive and intellectual technologies to the economy. The development of these technologies opens up new horizons for the modern world, providing the opportunity for more accurate data analysis, optimization of decision-making processes and increased efficiency of economic activity.

Information technologies provide access to the necessary data and their analysis, cognitive technologies help to understand human cognitive processes, and intelligent technologies help automate routines and predict economic events.

The promotion of the new scientific specialty “Information, cognitive and intellectual technologies in economics” is an important step in ensuring the further development of this area of research. The presented works of the author emphasize the importance of integrating various scientific disciplines and focus on the potential of using ICT for solving modern economic problems.

In general, the development of information, cognitive and intellectual technologies in the economy opens up new opportunities for improving production processes, optimizing management decisions and creating innovative products and services, which ultimately contributes to the sustainable development of society and the economy as a whole.

Желающие могут ознакомиться с данной работой на русском языке по ссылке: https://www.researchgate.net/publication/378129244.

Literature

1. Lutsenko E.V. Information, cognitive and intellectual technologies in the economy // February 2024, DOI: 10.13140/RG.2.2.17790.56641, License CC BY 4.0, https://www.researchgate.net/publication/378129244