Management of an organization in a difficult economic environment based on an information system

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Abstract. The article provides a definition and describes the stages of implementation of integrated management, which is a further development of classical management, focused on ensuring the stable development of economic systems in the face of anomalous economic situations (pre-crisis, crisis, post-crisis). It is shown that anomalous economic situations lead to complication and expansion of the management subsystem functionality towards solving difficult formalized and poorly structured management tasks. Their solution presupposes the availability of appropriate information support integrated into the intellectual information system of decision support of integrated management, including methodological, program, technical, organizational support and personnel involved in the framework of integrated management. A description is given of the composition and structure of the management system implementing the integrated management, as well as the corresponding intellectual information system.

1. Introduction
The functioning of a modern economic organization (EO) is almost constantly exposed to stressful influences, which are caused by the influence of various external and internal factors [1, 2]. External (political, economic, social, etc.) and internal (financial, personnel, etc.) factors quite often affect randomly, quickly and in a complex [2]. The latter means that several EO subsystems (financial, marketing, raw materials, etc.) can be negatively affected simultaneously [3]. The successful conduct of modern business presupposes an almost constant solution of managerial tasks aimed at combating threats arising from such negative influences [4]. Such tasks are implemented by the management subsystem and makes higher demands on its functionality. It is required to solve weakly formalized and not formalized management tasks [5-7]. Information support that is necessary for their solution is implemented by intelligent information systems for special purposes (for example, decision support systems, expert systems, and others) [8-10]. As
a result, classical management (CM) acquires new content and is characterized as integrated management (IM) with its own conceptual provisions [11]. However, descriptions of information systems implemented within the framework of IM are not given in modern scientific literature. Therefore, the formation of the composition and structure of the information system of IM EO, to which this article is devoted, is an urgent scientific and practical task.

2. Materials and methods
IM implementation includes three stages: monitoring of the external environment; EO state analysis; synthesis and implementation of actions.

The importance of the first stage of IM is difficult to overestimate. Having information about world-class events allows you to check the progress of the current EO activities and draw up plans for its further development. Information about emerging crises is of particular value. It can be used in the interests of forecasting, caused by them (emerging crises), possible threats or reducing their negative consequences for the activities of the EO [12].

The second stage in the implementation of IM is to analyze the conditions of EO, which, according to the time criterion, can be retrospective, current and expected. This stage is no less important than the first, since it allows diagnostics, including at early stages, and in a timely manner to move from negative trends in various types of activities (financial, personnel, etc.) with EO to the adoption of appropriate measures that make up the content of the implementation of the third stage of IM.

The essence of the third stage of IM is to generalize and implement actions aimed at the sustainable development of EO both in a fairly calm situation and in stressful situations. It is shown in [1] that it is also advisable to use innovation and investment management, the implementation of the 5S management form (self-determination, self-sufficiency, self-financing, self-government, independence) as tools for ensuring sustainable development of EO.

The implementation of all stages of IM presupposes the availability of appropriate information support (IS). IS is understood as a set of models, methods, techniques, algorithms, programs and technical means used for the purpose of automated and automatic search, identification, analysis, transformation, storage and provision of reliable and useful (pragmatic) information to decision-makers in this subject area on the basis of computer tools. Simultaneously with the integration and implementation of this input-output in the EO, the integrated management information system (ISIM) includes methodological, software, technical, organizational support and personnel involved in the activities of the IM.

A preliminary analysis of the specifics of situations in which it is advisable to use ISIM showed that along with formalized tasks, the developed system has to solve complex formalized and poorly structured tasks [13]. Intelligent information decision support systems are designed to solve similar problems [14].

Intelligent information system for decision support of integrated management (IISDS IM), hereinafter for the purpose of reduction - a system, in this work we will understand an interactive computer program designed for collecting, storing and synthesizing information, as well as conducting analytical calculations in the field of financial and economic activities EO in abnormal (pre-crisis, crisis, post-crisis) economic situations using a set of models and the experience of experts (experts).

The organizational diagram of the implementation of IM in EO is shown in figure 1.

3. Discussion
In the left part of the figure 1, in a dash-dotted rectangle, the elements of the IM control system are shown: the subject of the IM (the person who makes decisions in the field of IM) and the IISDS IM. In the right part of the figure 1, in a dash-dotted rectangle, elements of the CM control system are shown: objects and subjects of classical management. In the role of subjects of CM are persons who make decisions in the field of CM (for example, top managers of EO). The objects of CM are EO subsystems (financial, sales, raw
In addition, feedback (feedback) is shown in this figure 1. They are marked with numbers 1, 2 and 3.

**Figure 1.** Organizational diagram of the implementation of IM in EO.

The IM control system can operate in three operating modes: "Direct control", "Indirect control", "Mixed control".

The "Direct control" mode is used when the control system is fully operational and directly controls all the EO subsystems. In fact, we are talking about the automatic mode of the system. Information about the effectiveness of control actions is received via feedbacks 2 and 3.

The "Indirect control" mode is used at the stage of debugging the IM control system and its elements. In this mode of operation, CM subjects seek advice from the IM management system. If IISDS IM is able to answer them, then it does it. Otherwise, a person who makes decisions in the field of IM answers the questions. Information about the effectiveness of the control actions proposed by the IM control system comes from feedback 1.

The Mixed Control mode combines the two previous modes. This mode of operation will prevail in the system. Since the adjustment of the IISSPR IM requires a long time (from several months to several years) and for psychological reasons, the head of the EO will always strive to control the correct functioning of the control system of the MI, and especially the IISDS IM.

Structurally-function chart IISDS IM is provided in figure 2.

**Figure 2.** Structurally-functional scheme IISDS IM.
The decision-maker using a system constantly carries out monitoring of the external environment for the purpose of identification of abnormal economic situations and regularities of their emergence. At the same time the main sources of information are the Internet, social networks, scientific publications, mass media, etc. For the revealed situation of the decision-maker chooses the corresponding model, carries out calculations on its basis and uses the received results for adoption of further decisions.

4. Results

The following subsystems are a part IISDS IM: management; processing and data storage and knowledge; explanation; interpretation of rules; user interface; intellectual information search; formation of output results.

The subsystem of management realizes computation process, synchronizes work and provides interaction of all subsystems.

The subsystem of processing and data storage and knowledge provides formalization, interpretation and information storage for databases, models and knowledge.

The subsystem of an explanation is an element of expert systems and is used for justification of the decisions received by this system for the decision-maker.

The interpreter of rules is also an element of expert systems and is used as the mechanism of correct knowledge deployment for obtaining required result.

The user interface provides a possibility of interaction of the decision-maker with a system. Interaction happens through the system of the menu and hints.

The intelligent information search subsystem evaluates the completeness of existing information in the system and provides search for new information from various sources (Internet, social networks, etc.).

The subsystem of formation of output results generates for the decision-maker reporting materials in various forms (schedules, tables, the text, etc.).

The given appearance IISDS IM shows its similarity with the complex intellectual system integrating decision making support system and expert system in the structure. Implementation of this system involves its public program interface and modularity of creation. Full-function IISDS IM version will provide intellectual support of decision-making in EO that will allow to manage more effectively it in abnormal economic situations.

References

[1] Mistrov L E and Morozov V P 2016 Information system for supporting investment decisions in conditions of uncertainty in the external environment (Voronezh: Voronezh GASU) p 245
[2] Poryadina V, Burkov V, Barkalov S, Ilin I and Kalinina O 2018 Competitive mechanisms of the functioning of social and economic systems MATEC Web of Conf. 70 01122
[3] Memeti A, Azizi A and Luma Osman S 2019 Human Resources Management System: SoA Reference Model International Journal on Information Technologies and Security 4(11) 29-38
[4] Liu Z, Yang D-S, Wen D, Zhang W-M and Mao W 2011 Cyber-physical-social systems for command and control IEEE Intelligent Systems 26 92–6
[5] Burkov V, Shchepkin A and Irirkov V 2019 Methodology and technology of control system development Studies in Systems Decision and Control 1(18) 29-38
[6] Piegat A 2001 Fuzzy modeling and control (Berlin–Heidelberg: Springer) p 371
[7] Pearl J 2000 Causality: Models, Reasoning and Inference (Cambridge: Cambridge University Press) p 400
[8] Mihaylov D 2019 A Way to Accelerate the Process of Gathering Information for Decision-making International Journal on Information Technologies and Security 4(11) 39-50
[9] Ivanova D and Elenkov A 2019 Big Data Analytics for Air Quality Monitoring Assessment Based on
IoT Platform International Journal on Information Technologies and Security 2(11) 43-50
[10] Romansky R 2019 A Survey of Informatization and Privacy in the Digital Age and Basic Principles of the New Regulation International Journal on Information Technologies and Security 1(11) 95-106
[11] Morozov V P 2012 Methodology and Technology of Integrated Management of Construction Organization (Voronezh: Voronezh GASU) p 150
[12] Barkalov S, Mistrov L and Morozov V 2019 Information Management of Financial Investment Portfolio Organizations J. FES: Finance. Economy. Strategy B 16(3) 17-22
[13] Averina T, Belousov V and Kurochka P 2019 Algorithms of a logical conclusion of knowledge in difficult technical systems on the basis of indistinct rules IEEE 11th International Conference on Application of Information and Communication Technologies AICT-2017 (Moscow) 8687040
[14] Yannibelli V and Amandi A 2011 A knowledge-based evolutionary assistant to software development project scheduling J Expert Syst. Appl. 38(7) 8403-13