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TECHNOLOGICAL AND TACTICAL SUBSYSTEMS OF THE INTELLIGENT MANAGEMENT INFORMATION SYSTEM (ON THE EXAMPLE OF AN OIL AND GAS CORPORATION)

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Summary. Providing Ukraine with its own oil and natural gas is one of the main tasks of the national economy. The possibility of development of the oil and gas industry is primarily determined by the volume of explored and mined resources. Since the existing explored reserves will not ensure the growth of oil and gas production, it is necessary to increase the amount of investments in the exploration and development of new deposits and hydrocarbon deposits with the aim of increasing their reserves and further growth of production, which requires the adoption of management decisions, which are characterized by increased technological and economic risk, uncertainty.

Taking into account the main reasons for the decline in oil and gas production in Ukraine, the specifics of the industry and the requirements for information systems in the oil and gas industry, it can be argued that the use of intelligent technologies not only at the strategic, but also at the tactical and technological levels of management - is one of the keys to success in creating/reengineering, implementation and effective use of management decision support systems.

The scientific and practical results presented in the article regarding the innovative configurations of architecture and design, proposed intellectual methodology for tactical and technological subsystems of the corporation management information systems. The above-proposed solutions - should be taken into account when reengineering corporate information systems not only in the oil and gas industry in Ukraine [1-3].

Moreover, the obtained results are relevant and applicable not only for local companies, but also for international corporations on emerging markets in the context of global and regional macroeconomic and military crisis phenomena.

Keywords: management, information system, oil & gas company, knowledge-oriented technology

INTRODUCTION

The oil and gas sector is a powerful sector of Ukraine's economy, the influence of which on the functioning and development of the entire national economy is decisive, but until now Ukraine was one of the energy-deficit countries [4]. Despite the current radical crisis phenomena [5, 6], the oil and gas industry of Ukraine with significant volumes of unexplored oil and gas resources, with the cost of oil and gas several times lower than world prices, the presence of a significant number of oil and gas industries, drilling and geophysical enterprises, oil refineries, tinned network of oil and gas pipelines, highly qualified production teams allows, with their effective use, to stabilize and, in the future, to increase oil and gas production.

Substantial and confirmed factors for the oil and gas production industry of Ukraine which actualize the need for intellectual support for making effective management decisions (primarily at the technological and tactical levels of management): complex logical organization, large volume and expert nature of management information (on the territory of Ukraine there are three oil and gas-bearing regions within which to date, more than 300 oil and gas deposits have been discovered; the oil and gas complex of Ukraine unites more than 200 enterprises and organizations); decisions are made annually regarding investment in hydrocarbon exploration in the amount of about UAH 1 billion; high industry risk of management decisions (the results of the conducted seismic exploration showed the absence of deposits, the drilled well turned out to be unproductive, the well was watered, etc.); the need to reduce the period from the moment of investment of funds to the start of operation [7-10].

An important reason for the decline in the volume of oil and gas production is insufficient management efficiency of the cycle of parallel business processes of the domestic oil and gas company: exploration, development and development of deposits, production and sale of oil and gas [11-12]. Therefore, one of the necessary factors to increase the Ukrainian production of hydrocarbons is to increase the efficiency of the oil and gas company's business process management through the use of effective economic and mathematical modeling at the strategic level of management and the use of knowledge-oriented decision support tools as an integral component of the complex information system of the oil and gas company [13].

The most important conclusion of the economic analysis of the oil and gas industry is that, taking into account the trend of growth of reserves of explored fields, in order to maintain production in countries with well-explored subsoils, it is necessary to significantly improve the technology of exploration and production of hydrocarbons and use all possible innovations in the field of exploration and production management [14]. The introduction of innovative achievements in the field of intelligent information systems and information technologies in the oil and gas industry is one of the main factors for ensuring the growth of oil and gas reserves in Ukraine, which has significant uncertainty.

In addition, it is worth noting that foreign oil and gas companies in order to maintain their maximum efficiency in the conditions of: market liberalization, globalization, increased competition, decreasing consumer loyalty, constant variations in oil and gas prices, the development of the Internet and mobile technologies [15], growing costs for drilling and completeness - must have an open environment of intelligent information technologies, which allows unhindered and effective sharing of knowledge throughout the company and throughout the value chain.

PROBLEM STATEMENT AND RELEVANCE OF THE RESEARCH

Since the information system is an important component of the management system of an oil and gas company, there is a need to study its specifics and use the obtained results in further developments. In particular, the specifics of the main production processes have a significant influence on the management organization of a modern domestic oil and gas production company; traditional economic specifics of the oil and gas industry; the transition of the domestic oil and gas complex from a centralized economy to a competitive market caused a number of additional restrictions in management; main trends in the management of the global oil and gas industry. It is possible to distinguish 3 levels of management of an oil and gas production company: technological; tactical; strategic.

Currently, it is at the technological and tactical levels of managing an oil and gas company (in the current crisis conditions) that a stable objective effect can be obtained today from the reengineering of these two levels of information systems, taking into account the above innovative technologies and solutions.

THE MAIN PART

If we take into account the factor of the time horizon of management, the IS of an oil and gas production company can be divided into 3 levels [16]:

- technological process control subsystems (SCADA);

- operational and tactical management subsystems (OLTP);
- analytical subsystem of strategic management (OLAP and BI).

All the listed three management levels of an oil and gas production company should form a single system and be components of the corporate IS [17]. There are direct and inverse relationships between these levels.

The object of management of technological process control subsystems is almost all main and auxiliary technological processes and their corresponding technological equipment.

This subsystem works in real time and performs the following standard functions: collection and pre-processing of analog and discrete sensor information, control of analog parameters in relation to permissible modes and limits, keeping an event log, keeping an archive of variables of all kinds with the maximum historical depth, calculating side and integral indicators technological process flow, discrete and analog control of technological processes and individual objects, etc [18, 19].

The automation of the management of technological processes of an oil and gas production company is especially effective when the tasks of accounting and management are solved in a complex, and in particular, it allows solving the following tasks: operational control and control of violation of the technical process, which involves periodic or on-demand registration of controlled parameters; search for optimal mode parameters; operational accounting of equipment operation; drawing up a material balance sheet [20, 21].

The conditions that promote and encourage the introduction of automation and telemechanization of technological processes in the oil and gas industry are: full mechanization and electrification of technical processes; continuity of technical processes; round-the-clock nature of work; dispersion of technical objects on large areas; homogeneity of technical objects and technical processes taking place on them; connection of all technical objects through the main product – hydrocarbons [22, 23].

The oil and gas company's process control subsystem consists of: SCADA servers, archive servers, operator workstations, engineer workstations, technical support workstations, and dispatcher workstations. The IS architecture of the technological level depends on the version of the shop architecture: centralized or decentralized. This IS level of an oil and gas company is the most theoretically researched and practically developed.

The structure of the oil and gas company's OLTP subsystem is multi-level in accordance with the company's organizational structure, and each hierarchical level of management is a certain information processing and decision-making node. Each problem is solved at the level where the upstream data for its solution arise and the result is used; generalized information is transmitted to other levels.

The main features of this subsystem: a single information space, which is united by a general system of management of distributed data banks under the control of the SQL server; maximum coverage of all sources and consumers of information; information focus on providing management with information for its use in DS processes.

Based on experience, the following functional areas of the OLTP subsystem of an oil and gas production company can be distinguished:

- contracts and sales (accounting of contracts, accounting of orders for oil and gas, planning and accounting of product sales);

- warehouse (warehouse accounting, accounting of purchases of raw materials and components);

- accounting (accounting of all indicators of the company's activity through the processing of the main volume of primary documents, namely: keeping the general ledger, accounting of debtors, accounting of creditors, accounting of fixed assets, material accounting, calculation of salaries, distribution of costs, consolidation of debt obligations, management reporting);

- planning and economic unit (automation of technical and economic calculations of indicators of the production activity plan and analysis of its economic activity: calculation of needs for resources and materials (personnel, salary fund, depreciation deductions, energy costs, etc.), marketing, pricing, budgeting, production capacity planning);

- finance (keeping a current account, tracking cash flows, keeping payment calendars, drawing up a financial plan) [24];

- personnel (maintenance of the staff schedule, management of personnel files, planning of staff training, accounting of working hours, determination of personnel costs, determination of staffing, preparation of reports);

- Capt. construction and repair (maintenance of equipment register, commissioning/decommissioning of equipment, planning of equipment maintenance, management of repair orders, maintenance of equipment cards, maintenance of statistics);

- production (recording of extracted hydrocarbons, operational dispatching management of production). The transition of oil and gas companies to Western business standards will direct them to reengineering, and therefore to restructuring the structure of their ERP subsystems. Namely, the transition to the following functional units: "finances" (strategic management; medium-term management; operational management); "material and technical support" - logistics (collection of logistics orders; logistics accounting; logistics planning; logistics control; logistics analysis); "operational management" (management of gas and oil production and supplies; settlements with suppliers and consumers; dispatch management of oil and gas transportation); "financial and accounting" (financial management; accounting); "intelligence"; "boring"; "oil and gas production"; "transport of hydrocarbons"; "capital construction"; "science"; "energy"; "labor and personnel"; "engineering and equipment".

In addition to the blocks listed above, the experience of Western oil and gas companies shows the need for additional inclusion of the following blocks: controlling, quality management, project management, information flow management.

Basically, at different levels of the company, the functional composition of the subsystem is preserved, but the "weight" of some of them changes (for example, the weight of the "science" block).

The main tasks of the IS OLTP subsystem of the oil and gas production company are: cost reduction; implementation of modern methods of financial, production, management accounting. The OLTP-IS subsystem of an oil and gas

company has the following requirements: universality, "transparency", efficiency, reliability, manageability, scalability.

The time horizon of the operation of the subsystem of the second level of the oil and gas company is from 1 month to 1 year.

CONCLUSIONS

In summary, from the functional point of view, the IS of a vertically integrated oil and gas company is divided into the following main subsystems: exploration and production management subsystem; transport management subsystem; implementation management subsystem; subsystem of the control apparatus.

All IS levels of an oil and gas company are subject to increased requirements for ensuring reliability and confidentiality through: increased reliability of software and hardware, encryption of information, regulation of access rights.

The technological cycle of an oil and gas production company must be provided with the collection, processing, storage and possibility of repeated use of geological-geophysical, industrial and technological information. That is why the tool for the implementation of this provision is the formation of a corporate bank of digital geological and geophysical information of an oil and gas company - in order to create a single information space for increasing the efficiency of work in the search, exploration and development of oil and gas deposits, reducing costs for their implementation. The data of the corporate bank of geological and geophysical information can be divided into the following types: cultural, seismic, well, development and archival. Also, the considered data can be divided into: physical objects, digital objects, digital data values. That is why the specifics of the IS of oil and gas production companies is the mandatory availability and joint use at the OLTP and OLAP levels (by departments: geology, development of deposits and reserves; drilling; production) of a bank of geological and geophysical information.

The successful solution of the above tasks largely depends on the rational organization of information support, which allows solving the following problems: centralized data management, information compatibility, flexibility and effective operation of the information base. Software for IS of an oil and gas company is divided into: system-wide (to ensure the functioning of all system links and is a platform for their construction), information (to organize distributed processing of information based on the "client-server" architecture), specialized (to perform special functions in the system: interaction interfaces, e-mail, etc.), application or custom software (for the performance of system functions that ensure the performance of the assigned functional tasks, in particular DSS).

Based on the analysis of the experience of the leading Western integrator companies, the following set of tools for creating a custom-made complex IS of an oil and gas company at the appropriate stages is proposed: planning and control of works (MS Project, MS Outlook); development management (MS Visual SourceSafe, PVCS (Version Manager, Tracker, Configuration Builder)); design (Power Designer, BPWin, ARis Tools, Visio); development (Power Builder, MS Visual C++, Visual Cafe, IBS Tools).

The experience of American and Western European oil and gas companies shows that one of the important services provided by a territorially distributed

information system, and serves as an additional means of making more consistent and effective decisions, are e-mail services. It is important for each oil and gas branch to create a mail server that will provide access to personal mailboxes via SMTP/POP3 protocols, and this server should be compatible with the domain addressing system of the Internet.

It should be noted that one of the features of the applied IS of an oil and gas company is the mandatory presence in its composition of GIS support, which consists of databases of spatial and semantic information and software designed for its processing.

It can be concluded that the main goal of creating an integrated IS of an oil and gas production company is to increase the company's market value based on increasing the efficiency of management, improving the quality and efficiency of management decisions.

PROSPECTS OF USE OF RESEARCH RESULTS.

Taking into account the complex of solutions developed and proposed in this article regarding the subsystems of the information system of the domestic oil and gas company, the system of economic and mathematical decision-making support at the macro level of the oil and gas production company, the use of knowledge-oriented technologies (as a component of the means of implementing the developed knowledge management policy of the oil and gas production company) require significant changes in the organizational structure of the oil and gas company, changes in the business processes of management decision-making, significant investments in the software and hardware of the corporate information system subject to reengineering [25-28].

However, according to the testimony of both Western and domestic experts and top managers, if even according to the most pessimistic forecast, the result of implementation will be an increase in the effectiveness of management decisions by 5-10%, taking into account the huge calculation base, the application of knowledge-oriented technology is economically justified.

It is necessary to take into account the fact that knowledge-oriented information technologies cannot completely replace an experienced and objective manager and a team of expert professionals in solving the tasks of an oil and gas company, but is only a tool that provides management support to solve problems faster and more efficiently [29-30].

The theoretical provisions put forward in the dissertation and the developed DSS project are universal for implementation by both state and private oil and gas companies of various sizes, resident and non-resident companies, however, in order for a specific company to obtain its own additional competitive advantages over others, additional research and development is required. In addition, it should be noted that the full-scale practical implementation of similar content, scope and complexity of projects in the oil and gas industry, according to Western experts, takes up to 5 years for a highly experienced research team.

Therefore, it can be concluded that, subject to further additional research and improvements, the practical use of the theoretical provisions put forward in the thesis is a necessary factor for ensuring the successful future existence of any oil and gas production company.

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