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DESIGN OF INNOVATIVE MANAGEMENT INFORMATION SYSTEM (ON THE EXAMPLE OF AN OIL & GAS EXPLORATION COMPANY)

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Summary. *The changes that have taken place in the Ukrainian economy in recent years due to the consistent impact of global macroeconomic, epidemiological and regional military factors of the crisis - actualized for enterprises and corporations a complex reorganization of their management systems, an integral component of which are adaptive innovative information systems [1].*

On the basis of the above information, it is possible to draw a preliminary conclusion regarding the importance of such reengineering of the information system of an oil and gas company, the result of which will be an increase in the efficiency of managing the integral complex of business processes of an oil and gas company, which will lead to an increase in the production of own hydrocarbons in Ukraine, a decrease in their cost price, an improvement raw material base of the gas and oil industry [2, 3].

The scientific and practical results presented in the article regarding the design of management information systems should be taken into account when reengineering corporate information

systems not only in the oil and gas industry in Ukraine. Moreover, the obtained results are relevant and applicable not only for local companies, but also for international applications in the context of global, regional macroeconomic and current national crisis phenomena.
***Keywords**: information system, management, finance, oil & gas company*

Introduction

The oil and gas industry of Ukraine continuing to be in a suboptimal state, which is caused by a number of historical factors: the change in economic relations in Ukraine, the growing role of market mechanisms and the influence of the world economy; changing the structure and functions of leading oil and gas companies; excessive number of personnel due to an increase in the management vertical; the complexity of managing financial flows; increasing the risk of making management decisions; new requirements for compliance with international reporting standards; insufficient investment attractiveness [4-6].

All these factors are related in one way or another to: insufficient or lack of information regarding the main production and financial processes and its low efficiency, lack of perfect tools for comprehensive analysis and forecasting, insufficient functionality of existing information systems [7, 8].

Thus, the existing situation in the field of information systems of oil and gas companies was created as a result of: lack of general approaches to the integration of management information systems; heterogeneous composition of software and technical means; absence of an IS (information system) development strategy; incompleteness of informatization projects and their insufficient funding [9]. The listed factors of unbalanced automation have the greatest negative impact at the strategic level of management of an oil and gas company, where the cost of a manager's error is the greatest [10].

Moreover, the changes that have taken place in Ukrainian economy in recent years due to the consistent influence of global macroeconomic, epidemiological and regional military factors have actualized for oil and gas companies a comprehensive reorganization of their management systems, an integral component of which are effective innovative information systems.

Problem statement and relevance of the research

On the basis of the above information, it is possible to draw a preliminary conclusion regarding the importance of creating an information system of an oil and gas company, the result of which will be an increase in the efficiency of management of the entire complex of business processes of an oil and gas production enterprise, which is one of the set of factors, the implementation of which will lead to an increase in the production of own hydrocarbons in Ukraine, reducing their cost price, improving the raw material base of the gas and oil industry.

The main part and results

Such a system must meet the following requirements: multi-level and scalability; compliance with the requirements of open systems and standardization; maximum compatibility with other existing systems; reliability and protection; adequacy of production and financial processes; unification of equipment and software; management tools for corporate information systems should provide centralized and decentralized management, logical reconfiguration.

IS is a management tool of an oil and gas production company, therefore:

- the tasks of the IS coincide with the tasks of the oil and gas production company;

- the solutions offered by IS will eventually become the decisions of the company's management.

The management of an oil and gas production company is connected with the processes of collection, transmission and primary processing of a certain information, which is necessary to determine the nature and intensity of management actions. In addition, in the oil and gas production industry, all processes are interconnected in space and time. Therefore, the information network of a company must be organized rationally: with minimum costs and maximum effect [11]. For this, it is necessary to determine the following parameters of the complex of processes of collection, transmission and primary processing of information of an oil and gas production company: rational methods of transmission of information, classify transmission channels according to the type and frequency of information, choose the appropriate type of channel, unify the forms of transmission of information, determine the economic feasibility of manual operations, determine the optimal structure of the information system and the most convenient location of information processing points, choose fonts and codes, determine the possibility of using existing means of communication, management and payment of information, determine and develop those means that are lacking, etc [12]. But this is not the direct goal of this study.

The processes of collection, transmission and initial processing of information of an oil and gas production company impose the following requirements on it: completeness and compactness; intelligibility; clearness; timeliness; reliability; constancy; complexity.

According to the depth of use, information in the IS of an oil and gas production company can be classified as: descriptive information; information that is the basis for decision-making; information with conclusions of little complexity.

By types, information in the IS of an oil and gas production company can be classified as: technical and economic; technological; geological and industrial.

The construction of IS of an oil and gas company should be based on the following principles: automation is not an end in itself, but a step on the way to rationalization and optimization of the organizational and staff structure and business processes at an enterprise, their information support (problem-oriented approach); automation in the oil and gas complex gives a much greater effect with an integrated approach; phasing of automation and pilot phase, cascading approach to replication; open interaction specifications; quality assurance; ensuring information security; centralization of financing and project management; use of modern types of IS.

The application of the listed elements of the IS strategy of an oil and gas company will have the effect of: optimization of IS creation costs, protection of investments in IS creation, shortening of development terms, creation of a unified information space.

The oil and gas company's IS should have the following main qualitative characteristics: provision of a unified accounting, planning and analysis

methodology; solving problems of accounting, financial planning and analysis [13], warehouse accounting, material and technical support; solutions to specific problems of oil companies; uniformity of normative reference information; information provision of the management structure of the oil company and the use of modern DBMS and DS tools; multi-platform technology; extensibility and scalability; taking into account the specifics of the hardware platform at different levels.

Problems of information support at enterprises of the oil and gas complex:

1). General problems: lack of unity of normative and reference information;

- problems of territorially distributed structures;

2). Specific industry problems:

2.1.) Divisions of oil product supply

The main type of activity of such enterprises is the retail and wholesale sale of petroleum products through petrol gas stations (PS) and oil depots. Therefore, the main problem they face is accounting for the specifics of the product itself - fuel. In addition, the main customers are large customers, such as agriculture, regional administration, etc. Such customers can pick up fuel from oil depots and PS located throughout a possibly very large area.

Managing several dozen PS and oil depots, it is necessary to plan the receipt and movement of fuel very precisely, as well as control the availability of the necessary amount of working capital. Obviously, it is impossible to track fuel residues at such a large number of objects "by phone". A specialized solution for oil product supply enterprises was developed to solve such problems.

In more detail, the range of problems of the oil product supply enterprise looks as follows: high labor intensity of collection and generalization (consolidation) of data of territorially distributed areas of accounting; lack of operational data of the company's production and financial activities/results; a large number of errors in the processing of variable PS reports; low efficiency in the formation and processing of notices; lack of operational data on the movement of fuel and lubricants in transit, through oil depots and PS in all branches; high labor intensity of processes of purchase and redistribution of fuel and lubricant materials; lack of operational and reliable information about mutual settlements (mutual offsets) with suppliers and consumers; low efficiency of obtaining data for accounting of PS activities (surplus-shortage, volume of sales, sales, taxes, arrival of fuel); lack of a single accounting methodology for all branches.

2.2.) Subdivisions for oil refining

As for all industrial enterprises, one of the problems of oil refining enterprises is planning the cost price (in this case, the cost price of processing) and obtaining data on the actual costs incurred. In addition, in connection with the general situation of the industry in Ukraine, when the share of "quasi-money" in the oil and gas industry (bills of exchange, barter, complex offsets) reached 50% of the total volume of financial flows, there is an urgent need to solve financial resource management issues.

In addition, problems arise in the following cases: formation and control over the implementation of production plans; obtaining operational and reliable information on technical and economic indicators of production activities; formation

of production plans taking into account operational technical and economic indicators, strategic goals and production features; management of business plans of the enterprise; budgeting, maintaining a strategic plan of income and expenses; management of financial resources and assets of the enterprise; tax planning, planning the occurrence and repayment of liabilities; management of receivables and payables, including with complex offsetting schemes; drawing up operational consolidated reporting on the company's activities - here the problem of the lack of a truly unified accounting and planning methodology - in Ukrainian and Western standards - becomes acute; ensuring the interaction of different levels of automated enterprise management systems and automated technological process management systems.

2.3.) Mining units

The main problems of oil and gas production companies are the effective management of the production process from the point of view of profitability of wells and cost reduction. In more detail, the problems of oil and gas production enterprises look as follows: how to increase the efficiency of decision-making regarding exploration in new areas and the beginning of experimental and industrial exploitation; how to improve the efficiency of field development management (fuel and lubricants, production and pumping regimes in the reservoir pressure system); how to increase the volumes and increase the efficiency of extraction, to match the pumping modes with the modes of product inflow to the extraction wells, to reduce water inflow; how to reconcile water pumping regimes with geological regimes; how to reduce production, technological, energy, and operating costs throughout the entire technological chain of the oil production process by coordinating modes, eliminating flow throttling, etc.; how to increase the efficiency of oil and gas sales; how to obtain operational and reliable information on technical and economic indicators of production activity; how to establish an end-to-end information space from wells and fields to the top management of the company [14-17].

Additional problems in the creation of IS of an oil and gas company arise when: managing the enterprise's business plans; budgeting, maintaining a strategic plan of income and expenses; planning the flow of funds and managing the company's assets; tax planning; management of receivables and payables, including with complex offsetting schemes; preparation of operational consolidated reporting on the activities of subsidiaries (oil and gas production departments) in Ukrainian and Western standards; formation of production plans taking into account operational technical and economic indicators, strategic goals and production features.

It can be concluded that it is the complex system approach to the management of an oil and gas company that should solve the problems of accurately reflecting the real state of the above-mentioned objects, as well as meet the ever-growing needs of management personnel for operational and convenient information for making management decisions.

The information system of an oil and gas company should be such a system that allows managers to get operational access to information at any level, therefore, the services of the head office, extractive enterprises, drilling operations management and many auxiliary services (transport management, communication, research, etc.).

We note that the greatest effect will be the implementation of the principles of the developed information system (in particular, the implementation of intelligent DS by knowledge-oriented DSS) throughout the management vertical and, as a result, a corresponding increase in management efficiency at all levels [18-20].

As practice has shown, the following requirements are put forward to the system integrator company when implementing the IS of an oil and gas company: readiness to provide management automation at a modern level; the ability to adapt existing algorithms and information technologies to the specifics of the oil and gas complex; the need to pay great attention to support, prospects for the further development of the project.

When implementing IS of an oil and gas company, OLTP technologies are set up at the first stage, but the second stage is more important for achieving the goal set in this paper: the use of powerful management and analytical capabilities of IS and special industry solutions (that is, the use of intelligent OLAP, and later DSS) [21, 22].

Based on the analysis of existing developments, the study of the Western experience of creating IS of oil and gas production companies, the analysis of organizational structures, information flows - developed in fig. 1. the concept of the information system architecture of an oil and gas company.

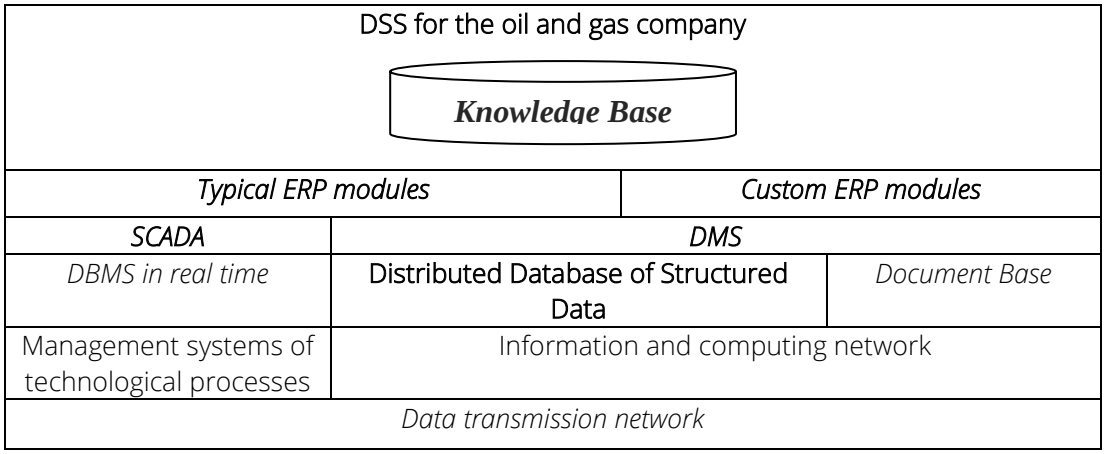

Fig. 1. the concept of the information system architecture of an oil and gas company

Conclusions

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: subsystems of technological process management (technological information) (SCADA (supervisory control and data acquisition) - a similar subsystem, or supervisory control and data collection); ERP (enterprise resource planning) type subsystem (OLTP - a similar subsystem, or enterprise resource planning and management system) (planning, economic and production information); analytical subsystem of top management (administrative and managerial analytical information and knowledge) (OLAP-like subsystem).

All the listed three levels of management of an oil and gas production company should form a single system and be components of the corporate IS. Between these

levels, there are direct (implementation of plans) and reverse (correction of plans due to a critical accumulated level of disturbances that are poorly amenable to operational management; formation of technical and economic indicators) connections.

Taking into account the obtained results of the economic analysis of the oil and gas production complex, the specifics of the oil and gas industry, the main factor in increasing production is the improvement of the efficiency of knowledge management in general thanks to the application of economic and mathematical modeling in the implementation of the knowledge-oriented decision support system of an oil and gas production company. This HYBRID DSS will be based on the following technologies: economic and mathematical modeling of the main investment and production business processes in the conditions of crisis phenomena, Data Science technology for filling and updating the corporate knowledge base, rule-oriented fuzzy Inference [23-25].

It should be noted that the implementation of the above mentioned in this article design decisions can potentially increase efficiency of an oil and gas production company by 10-15% at any rate.

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