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Research paper

Automating the Process of an Oil and Gas Company Property Management: Regulatory and Economic Aspects

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Abstract

In this article, the authors consider the modern principles and features of maintaining the oil and gas company equipment database in the ERP system for the growth of the efficient use of property assets in oil and gas companies with a view to establishing common methodological principles and approaches thereto, and the formation of management reporting in these companies and their subsidiaries. The proposed methodology establishes the unified requirements to the management accounting and the formation of a system of effective use of assets of an oil and gas company in modern conditions, allowing to modernize and repair each technological process of the oil and gas companies both in a staged manner and, in general, and to timely receive management information for each technological process or for each business unit regarding the use of property assets of an oil and gas company. The article describes the prototype model for the classification and grouping of the company property, which can be implemented in modules on SAP or Oracle platforms in order to visualize methodology of the future system implemented on directories of a unified budget classifier. It was argued that the primary goal of the ERP system implementation was the creation of an understandable and functional system of the company asset management that would allow a much more efficient budget planning to optimize stock balances, costs for repairs, investment costs, in other words, would improve the efficiency and transparency of the entire workflow.

Keywords: *Management accounting, ERP system, international financial reporting standards, reporting automation, oil and gas business, classifier, enterprise asset management system, vertically integrated company, property modernization, facilities directory.*

1. Introduction

Preparation of various statutory and management reporting for different persons and scopes within a vertically integrated oil and gas company with affiliated legal persons and branches not always provides an opportunity to obtain accurate information and results in untimely decision-making and the "business blindness" that causes huge losses, while errors in statutory reporting may lead to the problems with shareholders and regulatory authorities. The corporate reporting system takes up the laborious process of financial documents' preparation and winds down the errors due to the human factor impact. SAP platform automation systems are most often used for solving the problems of reporting consolidation with the support of transformation under IFRS (international financial reporting standards) [1] or Oracle [2]. These solutions allow taking into account the complex dependencies among group companies, ownership of shares, and participation in affiliated companies. Summary data prepared in a uniform format, regardless of how complex the holding structure is, allow creating consolidated accounts, conducting comparative analysis, and assessing the performance of all divisions of the Group.

Thus, the oil and gas companies need such a project accounting, which will allow controlling all the processes in the company from assessing the financial condition in general to assessing the need for capital construction, from creating the investment program before planning and accounting of actual costs for alterations in the context of budget items. Such automated solution will ensure the formation of cost of capital work in progress, the fixed assets item, taking into account all direct and indirect costs, marketing and transportation, processes of formation of document flow and accounting for the shipment of own and customer-owned products, i.e., the automation of processing and operating companies in the group.

The works of Russian and foreign scientists in the field of technical and economic and financial analysis, financial management and budgeting in the fuel and energy sector of the economy, such as A.E. Cherepovitsyn [3], A. Shuen, P. Feiler, D. Teece [4], M. Pan, J. Sikorski, J. Akroyd, S. Mosbach, R. Lau, M. Kraft [5], Ya.V. Kryukov [6], K.B. Dobrova, N.G. Danilochkina, N.V. Cherner, V.P. Dobrov, P.P. Dobrov, E.N. [7] have served as the theoretical and methodological basis for the research.

2. Methods

The theoretical and methodological basis of the research. When writing the article, the authors relied on research and applications of Russian and foreign scientists and practitioners on research problems in the field of process organization and management accounting automation in enterprises in general and more specifically in oil and gas companies. The work performed is based on general and specific methods of economic analysis and scientific generalization. The dialectical method of cognition and the systematic approach to the study of the problem were used in the work; the general scientific and special research methods were

applied, namely the analysis, in particular, comparative analysis, synthesis, as well as historical and logical methods, and graphical techniques.

Information base. During the research, materials from the Ministry of Industry and Energy of the Russian Federation, the Ministry of Economic Development and Trade of the Russian Federation, the oil industry publications [8], as well as the materials of conferences and seminars, monographs and the results of scientific research of domestic and foreign scientists and economists were used.

3. Results

3.1. The need to implement the ERP system in an oil and gas company

In the face of changes in legislation, with a high degree of depreciation of funds, increasing costs and lack of investment resources, the tasks of efficient management of the property of the oil and gas company are becoming ever more urgent. The ERP system is an organizational strategy for the integration of production and operations, human resources, financial and asset management, focused on the continuous balancing and optimizing resources through the specialized integrated software package that provides a common data model and processes for all spheres of activity.

The introduction of the ERP system in the oil and gas company makes it possible to achieve accuracy in the planning of economic activities and to maintain an adequate actual accounting of all the major resources: material, financial, personnel, etc. According to T. Khudyakova, A. Shmidt, the use of the system makes it possible to easily standardize common businesses processes, using the best industry practices [9]. ERP creates a single information space, covering all the group companies for the extraction, processing and marketing of oil and gas products, unifies business processes, accounting policies and directories. There does not exist the model solution for oil and gas companies to accelerate implementation and take into account the specificity of the processes. Oil and gas companies need a solution allowing:

- to automate activities: the processes of collecting the needs of repair and production services, to automatically calculate the inventory items purchase plans, to form contracts and agreements that are optimal under the delivery terms;
- to automate the activity processes: production planning, ten-day plan adjustments, material balance calculations, operator sheets, preparation of a daily operational summary, and much more.

The implementation of the ERP system in the oil and gas company involves the integrated data processing in the modules implemented by companies of this segment on SAP or Oracle platforms with the subsequent construction of an asset register, the formation of a legal register, the reflection of production and financial activities related to property items:

- Purchase and sale operations accounting: keeping track of contracts, accounting of payments;
- Calculation of taxes, accounting of tax payments;
- Accounting for rent and leasing operations: the reflection of internal and external rent processes, leasing of property items, accounting of obligations under contracts, calculation of rental payments, modelling and definition of operating costs by rental units;
- Insurance operations accounting: keeping track of contracts, accounting of insurance payments;
- Capital construction accounting: the formation of capital construction plan items, accounting for actual costs, capital construction works, accounting of payments;
- Monitoring and assessment of physical and moral production of the equipment;
- Planning, accounting and control of measures for the reconstruction, repair and renovation of property items;
- Accounting and management of property objects within the investment budget; and
- Accounting of expenses on property items (Fig.1).

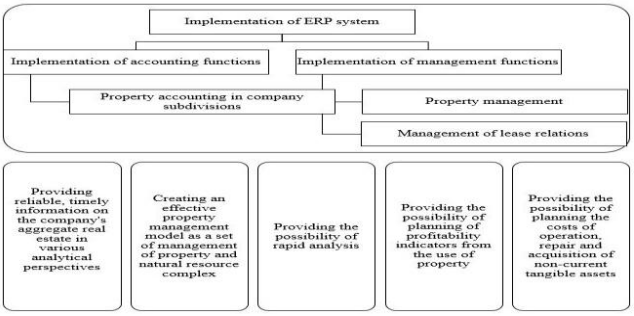

Fig.1: Planned results of ERP system implementation

As can be seen from the data in Fig.1, the implementation of this project will allow to create a single register, ensure structuring and integrity of data on property, increase the utilization of property, and achieve the efficiency of information for making effective decisions.

It is also necessary to accentuate the legal basis for reporting in the current context, namely, the fact that foreign software developers are starting to comply with the terms of the sectorial sanctions imposed by the United States against a number of Russian companies. For example, since January 29, 2018, Oracle has ceased to cooperate with Russian enterprises on the sanctions list (283 companies from Directive No. 4 of the sectorial sanctions dated September 12, 2014). They include the enterprises of Gazprom, Rosneft, LUKOIL and Surgutneftegaz. Sanctions are applied to those entities in which the share of the listed company is 33% or which has the majority of the voting rights, i.e. the issue of the formation of the Oracle-based ERP system may become a problem for the listed companies in the oil and gas sector due to the fact that at the moment Oracle is the largest software developer that joined the sanctions against listed Russian companies, but it must also be emphasized that this directive is applied only to the provision of financial services, for example, in accounting.

3.2. Multifunctionality and goal-setting in the use of ERP system in an oil and gas company

The oil and gas industry is one of the leaders of the Russian economy in the field of information technology. Traditionally, the implementation of specialized accounting systems that support not only international but also industry accounting standards (ERP system) is the first step in automating. Let us analyze the solution for implementing the ERP system to automate the business processes in the property, taking the standard SAP module functionality as a basis. Such a system of business process automation in the property will be designed to effectively manage the property portfolio through the creation of a unified information environment for the management of property items, land and related documents and contracts, the formation and application of a unified property accounting methodology in the company's subdivisions and assets. This will allow using it as a resource management system of the enterprise with its coordination with adjacent systems [10] and thereby providing the property professionals with the access to the most complete and reliable information on a number of important areas (Fig.2).

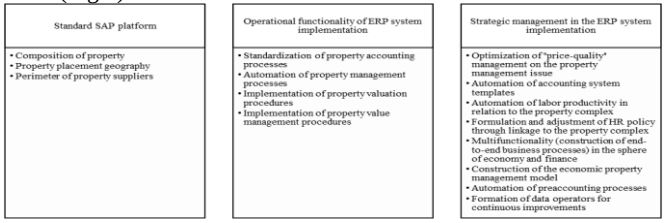

Fig.2: Formation of a single information environment

First of all, it is necessary to adjust such coordination with financial management and capital construction systems. From a legal point of view to determine the amount of capital investments (for each investment project), which is the main instrument, there are methodologies and regulatory framework to monitor the valuation of different types of assets. For example, for oil and gas construction, these are such groups of facilities as field facilities, overground infrastructure facilities, the linear part of main pipelines, and ground facilities for pipelines. As for maintenance of management information in accordance with Fig.1 and Fig.2, the functionality must appear on the selected SAP platform allowing to establish links between property items and plots with contracts, which in turn will allow to automatically track the contract expiration dates and to signal this in advance. Moreover, such a module may include characteristics of a flexible instrument for property audit both for the company as a whole and its subsidiaries and affiliates (see Fig.3).

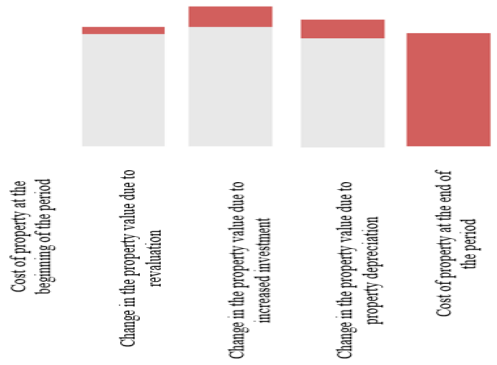

Fig.3: Results of property audits in the ERP system

Thus, the formation of a unified information asset management environment has several directions for improving the efficiency of activity of the company and its subsidiaries, related to the planning of repairs, reliability of equipment and reduction of risks arising when the equipment is operated. Continuous formation of different reference solutions (the extreme right square of Fig.2) provides an opportunity for the development of the asset management system as an integrated management system for reliability and risks of operation facilities that correlates with foreign RCM and RBI (Reliability Centered Maintenance, Risk-Based Inspections) methodologies.

In this case, the main purpose of the ERP system is the creation of an understandable and functional system of accounting for major costs of maintenance and repair of technological equipment of the enterprise using SAP. In its turn, this provides the opportunity to accurately calculate the routine maintenance and repair of main and auxiliary equipment of the company, make an order for the specific type of works, necessary materials, to evaluate the needs in human resources and much more. This will enable much more efficient budget planning, optimize stock balances, and enhance the efficiency and transparency of the entire workflow, allow the company to significantly reduce costs for maintenance and repair of equipment, and also prepare the ground for approval of the increase in the overhaul interval of technological facilities by the regulatory authorities.

In addition, the SAP platform allows the introduction of 3D modelling technologies for the design, construction and maintenance of industrial facilities. Such technologies allow providing buildings and units in the most user-friendly format "as built/installed", to correctly and quickly place the technological components, excluding various contradictions and conflicts. This results in the reduction of the terms for the creation and reconstruction of oil refineries, the increase in the efficiency and safety of their operation, and the reduction of the downtime of the plant's technological equipment.

Certainly, the introduction of ERP systems will not only change the company's infrastructure, but would require it to develop a set of regulatory documents for planning and development of the system functionality: creating the prototype of the company, implementing technical document management, implementing laser scanning of process facilities at all stages of the life cycle of business processes (entry, operation, disposal of property and reporting). The methodological scope of the transition to this system will necessarily include the labor-intensive work to conduct a survey of the functional management of land and property assets, the company's IT systems in all locations, the formation of functional and technical requirements for the development of a template solution and the development of options for the target architecture of the future IT solution.

The ERP system supports budgeting functions, which simplifies the process of drawing up and coordinating a budget that takes into account the needs of the company's business units and at the same time its strategic goals, performs budgetary control of performance and deviations across the whole vertically integrated structure. The advantages of this subsolution include the use of levels of sliding forecasting, operational planning, investment planning, standardization and reduction of the labor intensity of the reporting process, unification of the list of reports and budgeting forms. Due to planning solutions, budget cycles are reduced to 2-3 weeks, and the accuracy of financial forecasts and analysis increases to 80%.

A feature of the activities of oil and gas companies is the need to invest in development. Since long-term investment of capital cannot be reoriented to other purposes in the short term without substantial losses, development of deposits requires careful study and further control at each project implementation stage. Specifically to meet the needs of a vertically integrated oil and gas company, ERP system will enable the functionality on managing the efficiency of investments in the field development:

- Increasing the volume of profitable production and the level of extraction of residual reserves within the field;
- Development of projects and programs aimed at direct reduction of operational and capital expenditures by major expense items;
- Evaluation of the effectiveness of investments in mining companies, planning of investments in oil and gas producing assets for 1, 5, 20 years;
- Support and preservation of the shareholder value of the company;
- Justification of investment measures; and
- Mining assets portfolio management.
- The Enterprise Asset Management system (EAM) is a specialized integrated solution based on the principles of the ERP system, which allows minimizing costs, reducing the total cost of ownership of the main production assets, increasing their payback, and the efficiency of repair planning. The system allows converting large amounts of data into readable information about assets in real time, enabling informed decision-making at all levels of management.

EAM allows reducing:

- Maintenance costs - by 25-30%,
- Cost of emergency works - by 31%, and
- Time of equipment downtime - by 20%.

The asset management solution can also be built on the information platforms such as SAP, Oracle, etc., and also integrate with 3D models of property items and geoinformation technologies.

This allows significantly expanding the EAM functionality and consolidating all data on building elements and its territory in a single information space with reference to spatial information, keeping records of the state of items using 3D models, and publishing data on the web. In addition, this solution allows optimizing the logistics functions and organization of work of the company mobile teams based on GPS/GLONASS technologies.

Thus, the use of the EAM solution in a vertical integrated oil and gas company in the ERP system allows:

- To prepare generalized information on the property complex for the company's management;
- To support the tasks of the capital construction departments: the processes of inventory, monitoring, development planning, en-

gineering surveys, planning of construction and repair works of buildings, engineering networks and communications;
- To implement the principles and models of the corporate spatial information management system to solve the problems of geological exploration, environmental protection, capital construction, etc.; and
- To improve the efficiency of the use, planning, management of the life cycle of territorially distributed property assets.

3.3. The methodology for constructing a property management system of an oil and gas company in the ERP system to increase the efficiency of the use of property assets

In order to increase the effectiveness of the use of the property assets of oil and gas company in modern conditions in the technologically lagging countries, it is necessary to carry out a constant and step-by-step modernization. In addition, it should be noted that investment in the modernization of equipment and assets in the oil and gas companies increases the company value, affects its reputation and market risks. Thus, investment in the property modernization must be regarded as investment and operating components of the company business process. Renovation and modernization of property and/or equipment for oil and gas companies are directly related to their level of profitability since worn-out machines and mechanisms are less efficient. The schedule of replacement, repair and reequipment of property and/or equipment should be compiled for some years to come. Special attention in modern conditions should be given to electric pump units pumping oil since this technology is of top priority for specialists implementing the energy efficiency program which is the flagship one today.

The property or equipment in oil and gas companies can be replaced both at individual stages of the production process, and cover all the stages thereof. Before deciding whether to perform a full or step-by-step upgrade, you need to carefully analyze the performance of each site to identify reserve capacities and bottlenecks. If some production work areas are of incompatible performance, then it makes sense to carry out stage-by-stage modernization to bring low-productive areas to a higher level.

This approach can be called a high-risk one from a reputational point of view, since the company will be in a state of constant modernization, and a low-risk one with the operational component, relative to the entire project, the low cost of one-time investments will allow to gradually obtain positive results through the use of budgeting principles.

To make a successful decision on the equipment upgrade, the company management must take into account the following restrictions:

• The difference in the production capacities of different areas in calculating the payback of the modernization process;
• The company's infrastructure and the resources availability;
• Compliance of planned capacities with environmental standards and the requirements of regulatory bodies; and
• The possibility of involving production personnel of appropriate qualifications.

Let us consider the proposed methodology for maintaining a database of equipment and property management system of the oil and gas company, taking into account the EAM approach in the ERP system for increasing the effectiveness of the use of property assets of the oil and gas company.

The aggregated and processed information is displayed at the personal working computer of the manager in the format necessary for making managerial decisions by the top management and middle managers of the company. All actualized data are presented in the format of diagrams, graphs, histograms, which allow analyzing the current indicators in a convenient form and compare them with the indicators of the previous time periods, by conducting factor analysis and taking into account the factors controlled by the company's management. To visualize the key performance indicators in the form of graphical panels in this example, the target SAP system was selected (Fig.4).

Fig.4: The process of generating property information for making management decisions by the company top management and middle managers

Let us consider the property management structure of the oil and gas company, taking into account the EAM approach in the ERP system for increasing the effectiveness of the use of property assets (Fig.5):

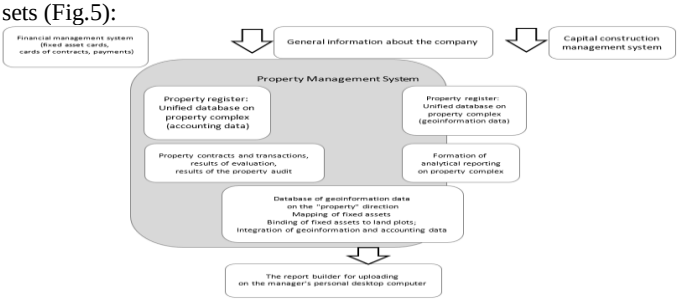

Fig.5: Architecture of property management system

1. General information about the company;
2. The architecture of the property management system for the company as a whole (with the definition of a unified reference book for property accounting by structural units of the company);
3. The structure of the property register, types and attributes of property (as part of unified directories);
4. Automatic creation of property items and land plots (from the moment of entry in the books until write-off);
5. Linking the property items and land plots in the design mode on accounting and geoinformation data);
6. Maintenance of contractual documents and linking of property items and land plots with them (in the modes "document has been entered", "document is waiting for processing", "document has been drawn");
7. Electronic documents on the company's property portfolio (in real time mode);
8. Accounting of the results of business processes of valuation and audit of property (with the possibility of entering the operational correction data, clause 7);
9. Functionality for mass changes in the attributes of the property register (with the possibility of entering operational correction data, clauses 1 to 8);
10. Reporting in ERP system (property register on complex criteria);
11. Flexible reporting in the property (designer mode for financial, accounting, tax and information reflection of information);
12. Automated place (personal working computer) of the head on the "property" direction;
13. Integration of the automated system on geoinformation and accounting data in the "property" direction;
14. Information volume of the geoinformation data subsystem on the "property" direction; and
15. Functions and user interface of support and downloading in the operational and current mode of the systems for geoinformation and accounting data on the "property" direction with the possibility of their transformation for data analysis, factor analysis and management decision-making.

The result of automation of property management business processes in the oil and gas companies and the organization of a common information space in the process of the complete construction of an asset management system is presented in Fig.6.

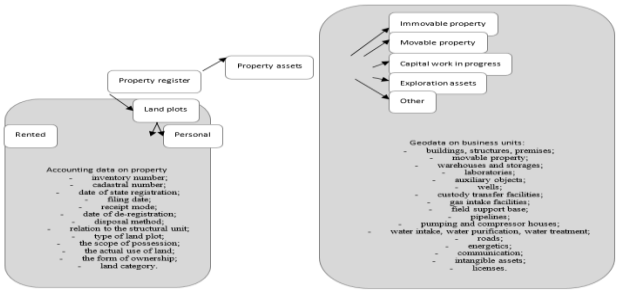

Fig.6: Architecture of property management business processes in oil and gas companies

Thus, the benefits of implementing a property management system in oil and gas companies are the following:

– ensuring the prompt and continuous entry of structured information on the company's assets and improving the transparency of processes of accounting thereof;
– obtaining of up-to-date and reliable information on the company's property complex through the creation of a unified property register;
– maintenance of the basic business processes on property management in a real-time mode;
– increasing the effectiveness of joint work of specialists from various subdivisions of the company;
– reduction of costs for economic analysis in the context of technological facilities;
– obtaining consolidated reporting for making managerial decisions and reducing the time for its preparation; reduction of tax, financial and legal risks;
– ensuring the prompt formation of key indicators of the effectiveness of the property management process and displaying thereof through the manager's personal working computer; and
– development of an integrated information environment by bridging the gap between geoinformation and accounting data.

4. Discussion

The practical significance of the research results to solve the task of evaluating the asset management effectiveness, which now is important and relevant both at the methodological level and in terms of applied use, requiring in-depth analysis and improvement and their applicability, is as follows:

✓ Target model of the property management accounting has been unified and systematized with the possibility of its uploading and updating at all levels of management of the group of companies, holding or an oil and gas sector enterprise;
✓ Prerequisites have been created for the possible application of the company's property management accounting methodology, based on the EAM approach in the ERP system, for subsequent implementation of reporting in financial consolidation processes for all companies as a whole; and
✓ The introduction of the methodology for maintaining the equipment database of an oil and gas company, which takes into account the EAM approach in the ERP system for improving the efficiency of the use of the property assets of the oil and gas company, allows the company managers to provide the latest information for making managerial decisions.

5. Conclusion

Based on the results of the study on the methodology of financial and economic planning in the oil and gas sector enterprises, the following conclusions can be drawn:

- The initial data for determining the frequency of replacement or repair, diagnostic control and routine stops are the indicators of the functionality of each type of equipment, information on operating modes and conditions, failure, etc., which the management of an oil and gas company can receive online in the ERP system;
- Such methodology based on the EAM approach in the ERP system currently allows oil and gas producing and processing companies to transfer the most energy-intensive fleet of equipment (drives of sucker rod pumps, pump units, main pumps and oil treatment pumps, etc.) for maintenance and repair according to the actual technical condition;
- The implementation of the methodology for maintaining a database of oil and gas company equipment that takes into account the EAM approach in the ERP system provides an opportunity to obtain up-to-date and reliable information on the property complex of both the company as a whole and its structural elements in order to provide the main business processes for property management in the real-time mode, and further enhance the effectiveness of joint work of specialists from different divisions.

References

[1] SAP Advanced Planning and Optimization System - Supply Chain Management. SAP CIS. https://www.sap.com/cis/products/advanced-planning-optimization.html
[2] ERP solutions from Oracle. Oracle. https://www.oracle.com/ru/applications/enterprise-resource-planning/solutions/related-solutions.html
[3] Cherepovitsyn AE (2008), *Kontseptual'nyye podkhody k razrabotke innovatsionnooriyentirovannoy strategii razvitiya neftegazovogo kompleksa*: Monografiya [Conceptual approaches to the development of an innovation-oriented strategy for the development of the oil and gas sector: Monograph]. St. Petersburg, SPGGI.
[4] Shuen A, Feiler P, Teece D (2014), Dynamic capabilities in the upstream oil and gas sector: Managing next generation competition. *Energy Strategy Reviews*, 3, 5-13.
[5] Pan M, Sikorski J, Akroyd J, Mosbach S, Lau R, Kraft M (2016), Design technologies for eco-industrial parks: From unit operations to processes, plants and industrial networks. *Applied Energy*, 175, 305-323.
[6] Kryukov YaV (2005), *Informatsionnaya podderzhka protsessa upravleniya aktivami neftyanoy kompanii, predstavlennymi zapasami uglevodorodnogo syr'ya* [Information support for the process of managing the assets of the oil company, represented by hydrocarbon reserves]. Novosibirsk, Institute of Economics and OPP SO RAS.
[7] Dobrova KB, Danilochkina NG, Cherner NV, Dobrov VP, Dobrov PP, Sepiashvili EN (2018), Innovational management of industrial enterprises in the energy sector. *European Research Studies Journal*, 21(1), 447-458.
[8] Energeticheskaya strategiya Rossii na period do 2035 g. [Energy strategy of Russia for the period up to 2035.]. The Ministry of Energy of the Russian Federation. https://minenergo.gov.ru/node/1913
[9] Khudyakova T, Shmidt A (2018), Methodical approaches to managing the sustainability of enterprises in a variable economy. *Espacios*, 39, 28.
[10] Tkacheva OA, Tsurak LA, Getmanova IA, Chistyakov AV, Zakharov SV (2017), New possibilities and tools for corporate strategic management for supporting its high competitiveness and economic effectiveness. *European Research Studies Journal*, 22(3B), 578-587.