Project Management System of Exploration Program in the Light of Prioritizing of Reservoir Engineering Stages According to the Criterion of Prospects

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Abstract. A model of the project portfolio management system of a geological exploration enterprise has been developed, taking into account the stages of work. The model includes a control object, a decision-making subsystem, which includes a control device represented by the decision support software system "Balance of Groundwater Availability" (BGA) and an executive device represented by a decision-maker, making decisions at a geological exploration enterprise. The stimulus to the target asset arises on the one hand in connection with the implementation of sectorial and federal programs within the area for the development of the geological industry and the reproduction of mineral resources, on the other hand, it is the need to maintain a certain balance of the availability of raw materials in the region, in particular, underground water. Hence, it is necessary for the underground water exploration company to take into account the specifics of the programs in view of the interconnection of the sites within one large field of regional scale. In this case, the project portfolio needs to be managed, taking into account the network nature of their interaction, i.e. mutual influence on the remaining sections of the field. On the other hand, when forming a portfolio of projects of a geological exploration enterprise, it is necessary to take into account staging and phasing of geological exploration, their seasonal nature allows viewing the model of the management system in the context of discrete time. The work was carried out with the financial support of the grant of the President of the Russian Federation No. MD-2409.2020.5.

1. Introduction
Geological exploration companies currently perform work on the geological study of the subsurface and the reproduction of mineral resources from a regulatory and legal point of view. Their activities are determined by the federal Law of the Russian Federation "On Subsurface Resources" and controlled by the executive authorities in the subjects of the Russian Federation in terms of compliance with technical, environmental, sanitary and epidemiological requirements during geological exploration [1]. Geological exploration works are characterized by specific functions related to their staging and phasing, specified by the use of a system of successive approximations during the work, as well as their seasonal nature. The obtained geological information about the subsurface is consolidated in geological reports, which are examined by the National Reserves Committee of the Federal Subsoil Management Agency (Russian GKZ) and the Territorial Mineral
Reserves Commissions (TMRC), as well as by the council for science and engineering (NTS) of the federal and regional executive authorities in the sub-sovereign entities of Russia [2,3]. The specifics of the work of geological exploration enterprises determine the need for side-by-side execution of several projects of geological exploration of the subsurface. Under the project of geological study of subsurface resources (PGIN), we will understand a set of exploration tasks, containing resource allocation, corresponding to the project arguments, and aimed at obtaining real and interpreted geological information about the object of study for determining technical and economic compliance of the geological object in accordance with the technical task for carrying out the work [2-7]. The portfolio of geological exploration projects (PGP) is defined as a set of projects of a geological exploration enterprise that are integrated into a network of interconnected projects, aimed at increasing state of geological exploration of the region where the work is being carried out [8-9]. The purpose of this article is to perform a simulation of the project portfolio management system of a geological exploration enterprise, taking into account the stages of work. For greater certainty, it should be noted that the management object includes geological exploration enterprises, doing the job in the part of fresh groundwater and underground mineral water.

2. Theoretical part
As part of the model, it is possible to define such elements as the management object (MO), represented by the portfolio of projects of the exploration enterprise; the decision engine, consisting of the executive unit (EU), represented by the decision-maker at the exploration enterprise, and the control device, represented by the decision support system "Balance of ground water supply" [10-14]. The main components of the project portfolio management system of a geological exploration enterprise are: a management object( MO), a controlling unit (CU), an executive unit (EU), detecting devices (DD), a measuring unit (MU), outside environment, and feedback [17-19]. According to the control theory, this model is based on the application of the principles of compensation and feedback. From the point of view of the control theory, within the framework of the studied object of research, synthesis task is set, which is expressed in the control algorithm determination and based on this algorithm implementation of the functional structure of the control system that meets the requirements of quality and accuracy [1]. The management system under consideration is active due to the fact that an integral element of the project, according to the above definition, is its resourcing, the structure of which also includes staffing for each project. Accordingly, an execution condition, when the system is recognized as active if at least one subject in its composition has the property of activity, the freedom to choose its state [4, 15-16], holds true. The essence of managing the project portfolio of a geological exploration enterprise is to develop and implement such an impact on the management object (the project portfolio of a geological exploration enterprise), where it passes into a new qualitative state or functions in steady state acceptable mode of operation [20]. In this case, a management entity is understood as a device that performs management, i.e., an executive unit represented by a decision-maker at a geological exploration enterprise. Also, in our opinion, it is advisable to include a control means represented by a decision support system in the structure of the management entity.

3. Practical part
When ranking projects, the following criteria should be taken into account:

1. The initial state of the mineral resource base in the area with its type of raw material. For example, in case of underground water project, it is necessary to take into account the state of all industrial and raw materials facilities that use particular areas of the field as part of the mining zone represented by a field of regional scale. An example is the Byakovsky section of the Bryansk field of fresh underground water. Let’s denote via matrix $M_{s_i}$ the initial state of the object $i$.

2. The need of the region, mining zone, industrial and raw material object in this type of mineral. Let’s denote via matrix $P_{o_i}$ the initial state of the object $i$.

3. The annual productivity of the enterprise for the extraction of this type of raw material. Let’s denote via matrix $P_{r_i}$ the initial state of the object $i$. 
4. Estimated loss factor of the useful component $k_p$ in $i$-th year.

If we take into account that the program is evaluated according to $n$ criteria, where $x_i$ is the value of each $j$-th criterion, $w_i$ is the weight of each $j$-th criterion, then the ranking of deposits is performed after the evaluation according to the formula (1).

$$Pr_i = \sum_{j=1}^{n} w_i x_i$$  \hspace{1cm} (1)

In conditions of limited funding for geological exploration, it is advisable to rank projects by the value of the parameter $Pr_i$, then include in the program of work on the geological study of the subsurface and the reproduction of the mineral resource base the projects having the value $Pr_i$, when ranked, will be within the scope of funding for the program activities.

4. Conclusions

Thus, the authors analyze the main terms of project management in geological exploration production. In particular, the definition of the project is given as a set of geological exploration tasks having the appropriate resource allocation in accordance with the project parameters and aimed at obtaining real and interpreted geological information about the object of study to determine the compliance of the technical and economic parameters of the geological object with the technical task for carrying out of works. The project portfolio is understood as a set of projects of a geological exploration enterprise, united in a network of interconnected projects aimed at increasing geological knowledge of the regional area of works. The authors have developed a model of the project portfolio management system for a geological exploration enterprise, taking into account the stages of work. This model allows ranking of deposits in the region, taking into account the prospects of their inclusion in the project portfolio of the exploration enterprise.

5. References

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