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Selection of HR-Strategy in the Location of the Transport-Technological System of Oil Fields in the Russian Arctic *

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Abstract. The development of Arctic hydrocarbon resources is in the sphere of interests of many large companies. At the same time, the vast northern territories and polar seas do not have a developed infrastructure that would allow implementing various transport and technological solutions for the development of oil fields. The opportunities for attracting the resources of the Russian Arctic into economic circulation are currently being used to a small extent, which is caused by various factors, both objective and subjective, that were formed at the previous stages of the country's development. This work is devoted to the problem of choosing an HR strategy when placing objects of the transport and technological system of oil fields in the Russian Arctic, taking into account the ecological, economic and socio-economic features of this macroregion. Using the example of oil and gas fields in the coastal-shelf zone of the south-eastern part of the Barents and Kara Seas, the authors consider multivariate forecasts for the formation of a rational scheme for the transportation of hydrocarbons as an integral part of the regional oil and gas complex. The authors assign a special role to the important economic and socio-psychological components associated with the processes of organizing the work of oil workers. At the same time, they come to the conclusion that the shift method of labor organization, adopted by many large mining companies, should not displace, but only complement the traditional methods of attracting personnel to the Arctic oil infrastructure facilities. The use of the combined method of labor organization in the Arctic is the most optimal, allowing to integrate the advantages and localize the disadvantages of other methods of labor organization.
Keywords: *Arctic, oil field, HR strategy, transport and technological system, ecological and economic objects, expert assessment, socio-economic feature.*

Introduction

The stability of Russia's oil industry determines its geopolitical significance in the global community, since it holds the leading positions among oil and gas exporting countries. However, oil and gas reserves increase is significantly lower than production over the past decade. All large fields, which provide the bulk of oil, are in the stage of declining production. The development of new oil and gas producing regions has been practically curtailed. At the same time, the quality of the resource base is deteriorating, since the share of hard-to-recover reserves has exceeded 55%. The third part of oil reserves has a high degree of depletion (70–80%) [1, Gubaydullin M.G. et al.]. In this regard, the effective use and development of the resource base of the Arctic zone of the Russian Federation, aimed at the stable provision of Russia's demand for hydrocarbon resources, appears to be an urgent national economic task. The Russian Federation possesses vast northern

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territories and polar seas, therefore, the development of the resources in the Arctic zone of the Russian Federation (AZRF) is in the sphere of constant interests of Russian oil companies. At the same time, the country's Arctic zone remains very poorly developed. The involvement of Russian Arctic resources, especially the Arctic shelf, into economic circulation is currently taking place to a small extent, which is caused by various objective and subjective factors that were formed in the previous stages of the country's development.

As part of the implementation of the Arctic Zone Development Strategy [1] further development of the northern territories of the Timan-Pechora oil and gas province and hydrocarbon deposits on the continental shelf of the Barents and Kara Seas will be continued. The implementation of large infrastructure projects provides for the integration of the Arctic zone of the Russian Federation with the developed regions of Russia. This document also indicates the need to improve the transport infrastructure in the regions of Arctic continental shelf development in order to diversify the main routes of Russian hydrocarbons supply to the world markets.

The seas of the Arctic shelf of Russia contain huge reserves of hydrocarbons, which should ensure the economic development of the country in the 21st century. According to the latest estimates, up to 80% of Russia's potential hydrocarbon reserves are concentrated on the Arctic shelf. The total initial recoverable hydrocarbon resources (TIR) of the Russian maritime periphery are about 100 billion tons of oil equivalent (TOE) or, according to some authors, tons of fuel oil equivalent (TFOE) in the naphta equivalent (of which 13.5 billion tons of oil and more than 73 trillion m^3 of gas). Recoverable oil reserves amount to more than 400 million tons, and gas reserves are more than 10 trillion m^3. This is despite the fact that the exploration of the TIR of hydrocarbons on the Russian shelf does not exceed 9–12% [2, Gubaydullin M.G.].

The Timan-Pechora province, adjacent to the western part of the Russian Arctic shelf from the south, also has a significant reserve for studying prospective oil and gas territories: only 34 % of the total area of the province has been licensed so far. The total initial recoverable oil resources here amount to 5.6 billion tons, of which more than half (52.1%) are undiscovered resources of the C3+D categories, and the residual reserves of the ABC1+C2 categories amount to 34.6%. Geological TIR of free gas — 3.2 trillion m^3, undiscovered resources of categories C3+D amount to 62.6% [3, Kuranov A.V.].

The rate of exploration, construction and development of oil and gas fields in the northeastern part of the Timan-Pechora oil and gas province, as well as in the western AZRF sector, is largely determined by the availability of transport infrastructure, the development of which, as follows from the analysis of the prospects of poorly explored territories, is an independent task [4, Tutygin A.G. et al.]. In order to select the optimal transportation route for the produced petroleum

[1] Strategiya razvitiya Arkticheskoy zony Rossiyskoy Federatsii i obespecheniya natsional'noy bezopasnosti na period do 2035 goda (utverzhdena Ukazom Prezidenta Rossiyskoy Federatsii ot 26 oktyabrya 2020 g. № 645) [Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035 (approved by the Decree of the President of the Russian Federation dated October 26, 2020 No. 645)]. URL: https://www.garant.ru/products/ipo/prime/doc/74710556/ (accessed 20 January 2021).

hydrocarbons from a particular field, it is necessary to consider several options to choose the most economically feasible and environmentally safe one [1, Gubaydullin M.G. et al.; 5, Korobov V.B.]. It is also necessary to take into account socio-economic peculiarities of the fields' development, which significantly increases the effectiveness of the decisions made. First of all, this refers to the validity of the choice by oil and transport companies of an appropriate strategy for providing these processes with qualified labor resources (HR strategies). The latter is not possible without a targeted state policy in terms of social support measures for the population in the territory of the Russian Arctic [6, Lipina S.A., Smirnov O.O., Kudryashova E.V.].

Peculiarities of the ecological and economic assessment of the Arctic zone facilities

The investigated problem of choosing the optimal alternative for location of oil transport infrastructure facilities can be solved by a variety of methods [7, Tutygin A.G., Antipov E.O., Korobov V.B.; 8, Ambrosio L.]. Existence of a large number of methods indicates the complexity of the problem. The difficulty lies in the fact that a large number of various influencing factors, which have varying and even contradictory impact on the final result, have to be taken into account. Therefore, in recent years, expert methods have been widely used in economics to solve this kind of problems, when at the initial stages of project implementation the information available is obviously insufficient or limited for decision making [9, Korobov V.B., Tutygin A.G.; 10, Orlov A.I.]. Their advantage lies in the fact that the technologies based on expert evaluations allow specialists in a given field to evaluate the state of an object, the relationship between its components, compare them with each other and predict the possible consequences based on their knowledge of the subject, extensive research experience and practice. Practice has shown that they are quite applicable for assessing transport alternatives for exporting oil from the western part of the Russian Arctic by sea [5, Korobov V.B.].

Expert assessments are formalized in the form of conclusions and prioritization, which can be expressed explicitly by ranking, and implicitly, when special scales are used to compare factors (situations) with subsequent processing of expert judgments by mathematical methods.

An increasing number of factors influence the analysis of events and decision-making. Often one has to deal with situations where the factors are partially or completely unrelated to each other, which does not allow using the concept of "system" for research. For such cases, the concept of object is proposed, which does not impose any rigid requirements on interrelations between its components, which makes it possible to solve a wider class of problems in various areas of fundamental and applied sciences [11, Korobov V.B., Tutygin A.G., Rusinov O.V.].

Ecological and economic objects, which are the elements of the transport and technological system (TTS) for hydrocarbon raw material export from the Arctic regions, consist of a large number of natural, technogenic and social components. Consideration of such objects as a set of not necessarily dependent components makes it possible to take into account the factors influencing their functioning to a much more complete extent. When solving such problems, the classical

conceptual scheme, which includes a number of stages from goal-setting through modelling and expert assessment to interpretation of the final results, appears to be the most appropriate from a practical point of view (Fig. 1).

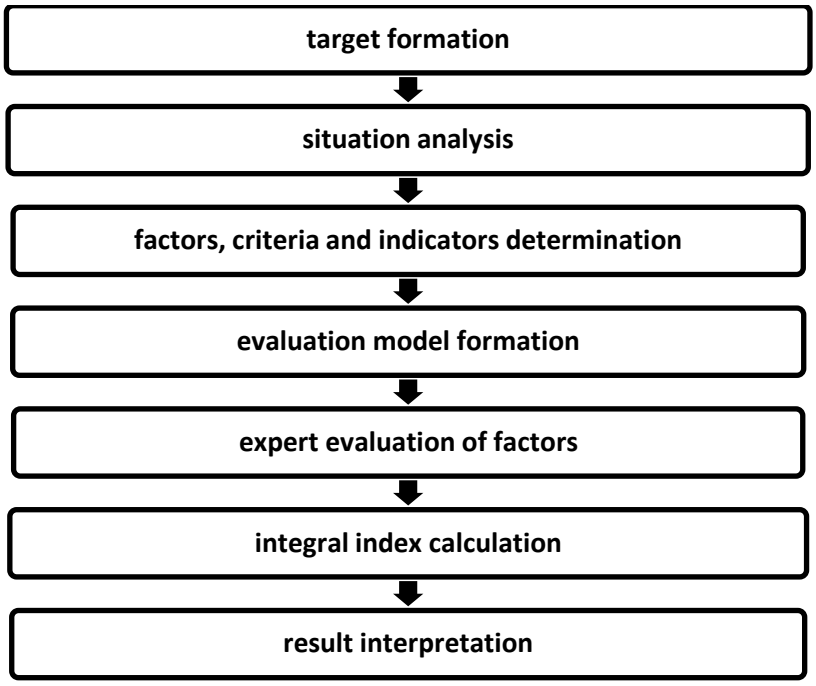

Fig. 1. Conceptual scheme for assessment of ecological and economic objects in the TTS.

When choosing factors for the expert evaluation procedure, one should take into account not only their influence on the transport infrastructure, but also infrastructure facilities influence on the natural environment in case of possible emergency oil spills [12, Nordam T. et al.; 13, Wein R., Bliss L.], since the costs of mitigation, especially in offshore areas, are time-consuming and require considerable expenses. In addition, the delivery of the necessary equipment to the sites of accidents is associated with certain difficulties in unloading it from ships to the shore [14, Eseev M.K. et al.]. Application of scoring classifications with weight coefficients of influencing factors makes it possible to solve successfully the logistics and related ecological and economic problems [9, Korobov V.B., Tutygin A.G.; 15, Gubaydullin M.G. et al.; 16, Tutygin A.G. et al.]. For calculation of weight coefficients of influencing factors, it is more expedient to use the method of ranking factors and, if necessary, analytical networks for their subsequent refinement. In this case, the indicators of factors can be found by any method with their subsequent reduction to a dimensionless form (for example, scores) by constructing appropriate scales. This kind of research is of an interdisciplinary nature, when specialists from different sciences, in close interaction, comprehensively study and evaluate projects for the development of Arctic resources based on the relationship of key indicators and factors.

The expert methods used in such cases, based on systemic knowledge of the subject, extensive experience of previous research and practice, allow specialists in this field to adequately assess the state of an object, the relationship between its components and subsystems, compare them with each other and predict the possible consequences of its further functioning. Based on

information obtained both from theoretical sources and by analyzing empirical material and judgments of experts, evaluation matrices are developed to rank factors that affect the location of oil transport infrastructure facilities. The analysis of such matrices shows the probability of external strategic factors occurrence and the degree of their potential influence both on the facilities themselves and on the external environment during field development. Quantitative estimates of factors are obtained by finding their weight coefficients, which are calculated by the ranking method used in multicriteria estimation tasks.

Analysis methodology of alternatives for oil and gas transport system construction

The main stage of the research sets a task to calculate an integral index for assessing the significance of factors affecting the construction of oil transport infrastructure in the development of fields and the production of Arctic oil, which is necessary for the formation of an integrated ecological and economic model. This model allows conducting a system analysis of factor groups assessment with development and analysis of corresponding matrices. As noted in [7, Tutygin A.G., Antipov E.O., Korobov V.B., p. 208], expert and analytical technologies can be successfully used for modeling when solving problems of placing pipelines, terminals and other objects of oil transport infrastructure.

As an example of the above procedure implementation, let us consider an issue related to choosing an alternative for construction of oil and gas transport infrastructure to deliver hydrocarbons from the Korotaikha Depression to the shipping terminal. In the north-east of the Timan-Pechora oil and gas province within the Korotaikha Depression, there is a significant reserve for increasing the explored raw hydrocarbon base [3, Kuranov A.V.]. It is associated with the involvement in the development of unclaimed promising oil and gas facilities of the zonal and local levels.

A scheme of possible alternative options for the export of hydrocarbon resources from the Korotaikha Depression is shown in Fig. 2. The southern direction (option 1) towards Usinsk and the northern direction to the Varandey terminal (option 2) involve pipeline transportation of oil. Option 3 to Indiga should be considered mainly for the export of natural gas.

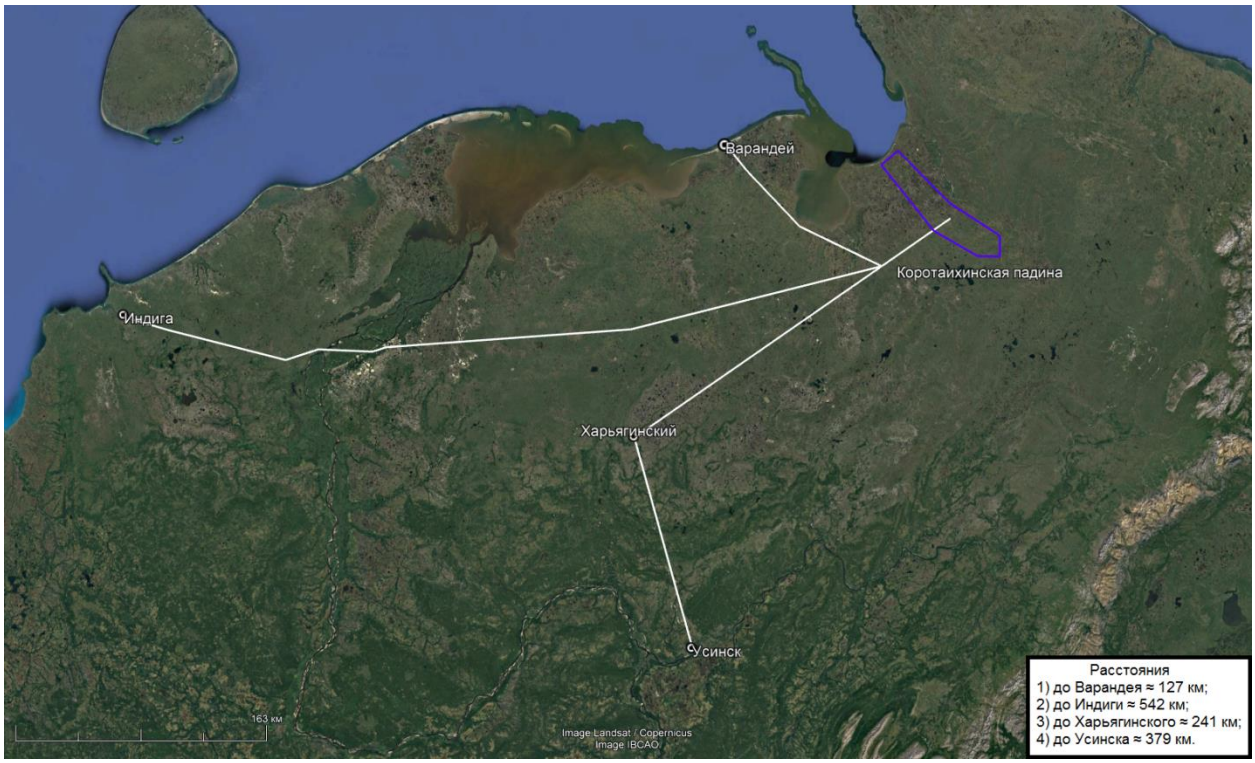

Fig. 2. Scheme of alternatives for transportation of oil hydrocarbons from the Korotaikha depression.

In a first approximation, the problem of choosing the most promising alternative can be solved by ranking the factors, taking into account their weight coefficients [5, Korobov V.B.; 9, Korobov V.B., Tutygin A.G.].

The integral indicator of the alternative is the ranking scores of the factors, taking into account their significance. Calculations are carried out according to the formula $R = \sum_{i,j=1}^{N} k_i r_{ij}$, where R — the total estimate of the alternative rank, and r_{ij} — the rank of i-factor of the j-alternative, k_i — the weight coefficients of the factors.

Labor organization process as an important socio-economic component of the oil transport and technological system

In research [16, Tutygin A.G. et al.], devoted to the assessment of the cost ratio in the construction of oil transport infrastructure in the Arctic, the authors have already conducted a detailed analysis of the influencing economic factors. To make the picture complete, social factors should be added, first of all, the availability of labor resources from both local residents and those recruited from other regions, including for shift work. In fact, the essence of HR-strategy of an oil or transport and technological company operating in the Russian Arctic is in a conscious choice of one or another option for providing facilities with labor resources. Let us consider the example of labor organization at oil pumping stations (OPS).

The main object for labor organization in pipeline system operation is intermediate pumping stations. It should be noted that the number of intermediate pumping stations is determined

by the length of a pipeline at the average rate of one station per 100 km of the route. Table 1 shows qualification characteristics and average number of service personnel.

Table 1

The number of industrial and production staff of OPS

Occupation	Number, people
Head of oil pumping station	1
Mechanic	2
Master on duty	4
Driver	8
Locksmith-repairman	8
Instrumentation locksmith	4
Electrician	4
Driver mechanic	4
Lineman	4
Tank farm operator (if any)	4
Total	43

It should be noted that while it may not be difficult to find a driver of a tracked vehicle in nearby villages, there are often neither a qualified mechanic nor other specialists with the appropriate skills and admission to technological equipment service among the local population. In general, the choice of staffing the oil pumping station — at the expense of the local population, either by shift workers, or in a combined way — is one of the key issues in the personnel policy of oil companies.

On the one hand, the availability of local labor resources is an important social factor, which must be taken into account when ranking oil export options. On the other hand, qualified personnel are often concentrated not in settlements located in the developed territories, but in cities and large industrial centers located far beyond the Arctic zone of the Russian Federation. In connection with the above, HR services of oil and gas companies do not have to rely solely on labor potential, which is formed only at the expense of the local population of the northern territories. Therefore, one of the features of the personnel policy of corporations working in the Arctic for the development of hydrocarbon deposits, including the creation and operation of pipeline transportation system, is the use of a rotational method.

Undoubtedly, the use of the rotational method of labor organization is cost-effective for enterprises, but at the same time, it has a number of significant disadvantages, manifested in negative socio-psychological effects on workers and their families, as well as generating conflict situations in relations with the local population, and considerable costs associated with the delivery of workers. In addition, the long-term presence of “shift workers” in the confined space of the working collective, cut off from the usual habitat, can lead to various kinds of psychological problems, which are described in detail, for example, in works [17, Janis I.L.; 18, Stoner J.; 19, Simonova N.N., Korneeva Ya.A.].

As noted in the work of one of the authors [20, Gubaydullin M.G. et al.], the development of oil and gas resources is still carried out mainly on a rotational basis. Rotational settlements are created both at the stage of construction of transport infrastructure facilities, and during the development and operation of oil and gas fields.

Let us consider some of the advantages and disadvantages of labour organisation by various methods.

Table 2

Comparative analysis of work organisation methods in the North and the Arctic

	Labour organisation methods		
	Rotational	Local population	Combined
Advantages	Factual absence of company costs for creation of new settlements with social infrastructure [2]; Ability to attract highly qualified personnel; Mobility of shift workers; Reduction of costs on transportation of the personnel to the place of work.	Decrease of social tension and unemployment rate in the region; Ensuring an increase of incomes of the local population; Stimulating local development; Promotion of small and medium-sized business development by stimulating solvent demand of the local population for goods and services [23].	Possibility of training service specialists at the level of the Arctic macro-region [24]; Eliminates the conflict of interests in the development of the territory and large business [23]; Has a long history of use in the practice of international companies (Total, EXXON, etc.)
Disadvantages	Lack of developed social infrastructure; Lack of recreational facilities; High social and psychological risks; The high risk of developing various diseases among the staff [21, p. 42]; High costs for medical and professional monitoring of personnel selection; Violation of the principle of balanced development of the territory where hydrocarbon production is carried out; Conflict of interests with the local population, including the indigenous peoples of the North [22].	Lack of the necessary potential at the level of municipalities and settlements of the Russian Arctic to provide corporate business with highly professional labor resources.	The need to make systematic adjustments to the HR policy of corporations in order to achieve a consensus of various social groups and a balance of territorial and public interests [23].

The comparisons of advantages and disadvantages of different labour organization methods given in Table 2 suggest that the choice of one or another variant of personnel policy when recruiting personnel to work at oil infrastructure facilities in the Arctic is far from unambiguous and is associated with a significant number of factors of a different nature. In confirmation of the

[2] Davydova N.S. Sotsial'no-ekonomicheskie problemy primeneniya vakhtovogo metoda organizatsii truda v sovremennykh usloviyakh Rossii [Social and economic problems of application of the rotational method of the organization of work in modern conditions of Russia]. Regional'nye problemy preobrazovaniya ekonomiki [Regional problems of economic transformation]. URL: https://cyberleninka.ru/article/n/sotsialno-ekonomicheskie-problemy-primeneniya-vahtovogo-metoda-organizatsii-truda-v-sovremennyh-usloviyah-rossii (accessed 20 Septenber 2020).

abovementioned it should be mentioned that, for example, according to the results of studies conducted by Russian psychologists [25, Korneeva Ya.A., Simonova N.N., p. 25] found that most of the surveyed employees of oil and gas companies (73.7%) have a high level of situational meteorological response, which indicates an increased sensitivity of workers to weather conditions.

The results of the study on the psychological safety of the personnel during shift work organization in the Arctic conditions are also of interest. In research [26, Tyulyubaeva T.O., Korneeva Ya.A., Simonova N.N., p. 84], on the basis of empirical data, it is shown that a number of professional groups of workers in the rotational work organization are characterized by different levels of psychological safety. The group of the greatest psychological danger includes representatives of the profession of a driver, an operator of a treatment plant, an operator of a boiler room. Engineering and technical workers, oil and gas production operators, maintenance specialists are more resistant to psychological risk factors [26, Tyulyubaeva T.O., Korneeva Ya.A., Simonova N.N., p. 85].

One of the acute problems of resource development in the Arctic is the preservation and development of the activities of the indigenous peoples of the North. It is no secret that intensive production of hydrocarbons causes irreparable damage to the territory of indigenous peoples' habitats and, as a consequence, to their health and demography. So "... in the conditions of a sharp increase in the technogenic and anthropogenic load on the natural complexes of the macroregion, associated with the intensive development of fuel and energy resources, deposits of rare and precious metals, the development of coastal transport infrastructure and a multiple increase in the population created in the Russian Arctic "support zones", the threat of disappearance of indigenous people is formed (there are about 200 Entsy people and less than 100 Vodi people) ..." [22, Pavlenko V.I. et al., p. 26].

It should be noted that for the regions of the Russian Arctic there is another serious problem that aggravates social disproportions — the imbalance of the economic situation, in particular, the dynamics of economic growth and the standard of living of the population, requiring the development and implementation of systemic strategic decisions [27, Tutygin A.G., Chizhova L.A., p. 131]. Thus, the low degree of economic diversification of cities, the monofunctionality of the settlements of the Russian Arctic becomes the cause of unemployment of the local population [28, Kryukov V.A., Skufyina T.P., Korchak E.A., p. 144]. In addition, for the entire territory of the Russian Arctic, the situation of natural population decline and migration outflow of the working age population has become typical [29, Tortsev A.M., p. 116; 30, Voronina L.V., p. 135]. Nevertheless, a very powerful industrial layer has been created in the Arctic zone of Russia, and the scale of economic activity significantly exceeds the indicators of such subarctic countries as Denmark, Norway, Sweden, Finland, Iceland [31, Pavlenko V.I. et al., p. 8].

Unfortunately, today, in the Russian Arctic, "... big business is aimed at a full-scale exploitation of resources in order to obtain the maximum economic result for itself, leaving behind social problems secondary to it. Indeed, local labor resources, and hence the population itself, are often

simply not of interest to corporate structures, which are increasingly using the rotational method of attracting personnel ...” [23, Tutygin A.G. et al., p. 39].

Conclusion

Thus, to summarise the above, the following conclusions can be drawn.

The situation in the oil and gas industry is characterized by a number of problems, including a deterioration in the quality of the raw material base, an increase in the share of hard-to-recover reserves, a poorly developed transport infrastructure, and a number of other environmental, economic and socio-economic characteristics.

Absence of the developed general theory of choice of influencing factors for the formalization of environmental and economic objects aggravates the situations that arise in the process of making strategic decisions related to the formation of a transport and technological infrastructure of oil fields in the Arctic.

The development of theoretical foundations for the choice of logistics flows for the export of hydrocarbons in the development of oil and gas fields in the coastal shelf zone of the south-eastern part of the Barents and Kara Seas using expert methods will allow to make an alternative forecast of a rational scheme formation for the transportation of oil and gas as an integral part of the regional oil and gas complex, taking into account social economic factors, primarily in terms of the provision of qualified labor resources.

The rotational work organisation as a key component of the HR strategies of oil companies should not displace, but can only complement the traditional methods of attracting personnel to the Arctic oil infrastructure facilities. In our opinion, the use of a combined method of labor organisation in the North and the Arctic is the most optimal, allowing to integrate the advantages and localize the disadvantages of other methods of labor organization.

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