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Transport Infrastructure of Oil and Gas Complex

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***Abstract**: Transportation infrastructure is a rather sufficient part of economic development for any country urban, suburban or even rural area. Thus, one of the main aims of the government and local authorities is to intensify all types of logistic connection and transport for the economic growth of the country on the base of globalization processes. So, a lot of new theoretical and practical activities related to the development of transport infrastructure are increasingly becoming objects of research. Transport is one of the key issues of every country economic growth and, on the other hand, transport reflects economic activity. There are therefore problems related to assessing the efficiency of transport infrastructure and the relationship between transport infrastructure and economic growth in the region's oil and gas industry. The main window of opportunities in the area of transport infrastructure enhancement can be opened only after working out the special measures for successful solution of the so-called public life problems. Practical realization of the presented measures for the optimization of transport infrastructure of oil and gas complex of Siberian Federal district will form an opportunity for the improvement of regulation of relations, activation of transport flows and services, in addition, the integration conditions are provided for oil and gas complex at the spatial level.*

***Keywords:** transport infrastructure; interregional differentiation; spatial integration of regions; interregional innovation; economic growth; polarized development; entrepreneurial structures*

I. INTRODUCTION

THE RELEVANCE of the research topic is determined by the fact that transport infrastructure can be considered as a unique part of the whole global economy. The matter is that the growth of transport activity is tightly linked to the globalized world economy development and national welfare, thus growing worldwide as the economy grows.

The issues which impede the implementation of an effective transport infrastructure of oil and gas complex, both at the country and regional levels, are highlighted. Modern transport infrastructure development does not provide the possibility to minimize the specific transport and transaction costs of the enterprises in oil and gas sector and improve the

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efficiency of economy development at the regional level. Thus, the priority task is the creation of a mechanism to optimize the transport infrastructure.

The author's definition of transport infrastructure at the regional level: formed strategic goals and objectives of the conceptual development of the oil and gas complex in the field of transportation is given.

In the presented article the author's definition of transport infrastructure at the regional level is given: strategic goals and problems of conceptual development of oil and gas complex in the sphere of transportation are formed. Besides, the examples of optimization of transport infrastructure in the foreign practice are studied, the author's position is presented on its basis for the formation of the sufficient level of requirements to the organization of the transport and information segments of oil and gas complex infrastructure.

Transportation reflects economic activity, because products must be moved to markets. An efficient transport network is essential for sustaining the economic success. In developing countries, the refinement of infrastructure, and especially the transport modernization is a key factor of the economic stability or even strong growth.

Lower trade costs tend to increase the demand for the region's product; this effect manifests itself in the first channel. The mechanism in the second channel is less simple with the use of the appropriate effects. As the friction, associated with the commutation, decreases, the spatial length of oil and gas complex increases.

The goal of the research is to study the theoretical base of the research and form a model for the transport infrastructure optimization of the oil and gas complex in the Siberian Federal district.

To achieve this goal, the following tasks must be accomplished:

- to describe the theoretical aspects of studying the transport infrastructure of oil and gas complex;
- to form a methodological issue of the research;
- to form a model for the assessment and improvement of transport infrastructure of oil and gas complex.

The object of the research is transport infrastructure of oil and gas complex.

The subject of the research is a methodology for the optimization of transport infrastructure of oil and gas complex.

The structure of the work is determined by the issue, the goal and tasks of the research.

II. LITERATURE REVIEW

The definition "infrastructure", coming from two ancient Latin words, means a base for dissemination of some object from one certain place. Such determination is widespread in scientific literature.

Infrastructure is an integral part of the territorial structure of the national economy, which is made up of the transport, communications, trade, energy and water management system, as well as accommodation and school facilities: medical, cultural, sports, and others for residents and their residents. location in any territory [2].

Russian researchers Rudnev and Kudryavtsev believe that transport infrastructure is a regional capital of transport infrastructure, that is to say: "A certain type of capital which demonstrates a specific social character, manifested by the capacity of infrastructure for transport to bring benefits to the region not only economically, but also considering socio-cultural characteristics and the formation of a synergistic effect as soon as it is implemented" [1].

Infrastructure is a compound area that consists of a large number of various elements. But generally speaking, all of them can be divided into two main types of infrastructure. They are complex and flexible infrastructures. "Physical infrastructure" signifies a large number of buildings, railroads, highways, pipelines, bridges and other objects that give an opportunity for the proper functioning of an industrialized country.

Intangible infrastructure, on the other hand, constitutes the necessary structure to support various organizations.

It can also consist of material and non-material holdings. Physical holdings can be considered as structures where the infrastructure system is located and the equipment used to maintain the facilities. Non-material holdings consist of different numeric algorithms, directives and guidelines, the financial institutions and foundational structure. Transport infrastructure is today one of the most important elements of infrastructure [4].

Transport infrastructure contributes to the development of links between regions of a country and between countries and, therefore, supports the formation of mutual economic, social and cultural ties. To assess the results of the development of transport infrastructure, it is first necessary to determine the role of transport infrastructure in the general transport and logistics system [3].

This approach allows us to identify the factors and conditions that affect the development of transport infrastructure; in the future, this may help to determine the range of measurement indicators and the characteristics of the development of transport infrastructure. As a general rule, it is assumed that the logistics infrastructure that ensures the efficient functioning of logistics processes includes "technical means, methods for their treatment and systems for their use".

Thus, logistics infrastructure is a combination of various objects, equipment, tools and technical devices that facilitate the completion of logistics processes in micro and macro logistics systems.

The logistics infrastructure in this sense of the concept includes:

warehouse infrastructure, including: buildings and premises, storage areas, storage equipment,

so-called processing infrastructures, in particular: internal transport, auxiliary equipment for handling goods, transport infrastructure,

transport packaging infrastructure: marked with a code, not marked with a code,

IT infrastructure, including: hardware, software, hardware and equipment for telecommunication purposes [12].

A typical pipeline transport chain involves transporting enriched gas (a compound of methane and other different hydride fractures) from a marine gas field area to an onshore gas distribution unit and transporting the so-called desiccated gas (methane without any impurities) to the consumers and finally to the end-users. The process of gas transporting includes several stages: condensation, sea transportation and final gas recovery. We suppose refining, i.e. the operation of the well flow segregation into various gaseous and liquid elements, in the context of natural gas production, thus we do not take it into consideration as a part of the analysis of the transport infrastructure project.

Oil investments are among the earliest applications of the valuation of real options. A license obtained by an oil company for exploration and exploitation of oil reserves may be considered as an opportunity to invest into the development of oil fields, if there are favorable market conditions [7].

In the study of Konovalenko, they consider the possibility of applying the approach of real variants to oil and gas investment assessment and discuss the advantages of the analysis of real options compared to the traditional methods of solution analysis [8]. Kostenko considers the value of flexibility in the development of offshore fields in the Siberian Federal district using the stochastic dynamic programming to simulate the market risk and manifold uncertainty [9].

Merkulov, Tkachenko assume a stochastic interest rate and convenient profitability when assessing the real investments into the oil deposits [10]. Mozgovaya unites Bellman's equation with the algorithm of the evaluation of real options for the presentation of the successive investment decisions in the development of oil fields [11]. Ostroukhova examines the application of system dynamics to the analysis of real options in oil and gas industry [12].

Sadykova uses the stochastic dynamic programming to analyze the interaction between two types of real options that arise in natural gas production: the ability to scale the level of production and the possibility of increasing the extraction factor by means of suspending the production. However, the focus on investment into transport infrastructure is limited [12].

A common approach to investment into the infrastructure of underwater gas transportation sector, both in research and practice, is the application of optimization techniques in which the existing models and potential projects are included in the model and the optimal design is defined with an emphasis on the properties of the network [14].

When the optimal design of transport infrastructure is determined, the investment analysis focuses on the activity at its "nodes": production, gas consumption and the processing of costs for the development of transport infrastructure within the overall costs of the project. The lower part of the chain of gas value formation began to attract interest to the research of real variants relatively not long ago [13].

To name a few examples, give an estimate of the investment variants for the electric power stations with the combined cycle of natural gas and the object, using the method of the smallest Monte Carlo squares to simulate gas price fluctuations. Following the same power registration scheme according to the fluctuations in electricity and natural gas prices, estimate the additional cost, created by using a linear package of short-term storage pipelines.

The authors study how, considering the pipeline throughput, it is possible to adjust the inlet and outlet pressure in the pipeline so that the gas can be pumped at one speed and removed at a different speed. Their paper assesses one of the flexible capabilities of the gas transportation system from the point of view of a large consumer of industrial gas, which may also be relevant to gas producers.

A complex approach to the problem solution gives us an opportunity to affirm the hypothesis that the accepted grading system absorbs most of the positive influence of infrastructure development on the economy. Furthermore, the valuation of such positive influence impacts is distributed among the subprojects, and is usually assessed by implication.

The proposed approach is focused on a transport solution that separates the transport infrastructure project from on-site development. The analysis includes all the components of the gas value chain associated with the transportation of gas. In particular, we consider the export compression, which in practice is considered to be part of the field infrastructure within the pipeline transport network. The impact on shippers and owners of new infrastructure is fixed in the existing practice at the assessment of deposits that are initially related to the infrastructure project [16].

However, the service life of the source fields is usually shorter than the service life of the transport infrastructure. The approach also takes into account the impact on shippers and owners that arise after the cessation of the production of the source fields. In addition to considering the effects over a longer analytical period, we reduce the cash flow with discount rate.

This shows the effects that are void in the commercial discounting. The impact on consignors, stevedores and consumers in the other parts of the infrastructure system is implicitly complicated in the decision-making process due to the involvement of the system operator in the investment planning. However, these impacts are not clearly assessed [17].

The proposed structure also assimilates the flexibility value of infrastructure investments. This is the solution purpose flexibility, that allows gas to be transported to markets with the highest cost, and the strategic flexibility, provided by the excess pipeline throughput, enabling future connections. An important contribution of the proposed method is the analysis of external effects. Environmental costs associated with gas transportation are indirectly absorbed by the up to date counting methodology in which the ecological taxes are taken into consideration in the process of operating costs calculation [15].

These impacts are assessed according to their social significance. In addition, we evaluate the external effects of the environment for the entire period of analysis, during the life of the source gas fields. The evaluations, presented in the case study, show, that the emissions to the atmosphere, associated with pipeline transport, are significant, when the entire transport chain is considered; and the cost of this environmental impact is an important aspect of the comprehensive economic analysis of the project.

III. METHODOLOGY

A research project of this type can be criticized for some methodological noncoherence: how can a project use an *economic methodology*, which is mainly used to solve economic problems. A reasonable answer to this question requires a clear definition of logistics as a field of research. Some of them tried to give such a definition and define the boundaries of the discipline.

However, logistics is still a relatively young and unsettled area, and because of its interdisciplinary nature and the wide variety of research prospects and relevant methodologies, there is currently no widely acknowledged understanding of logistics as an academic subject.

The disciplines that provide logistics with theories and methods include accounting, business/management, computer science, economics, marketing, mathematics, philosophy, political science, psychology and sociology. Each of the root disciplines emphasizes the field of logistics, which leads to difficulties in reaching a consensus on the boundaries of logistics as an academic discipline [19].

It models and analyzes economic systems as networks and flows of objects in time and space (in particular, goods, information, money and people) that create value for people. The scientific challenges of the discipline are mainly associated with the establishment and organization of these networks, the mobilization and control of flows.

3.1 Cornerstones for understanding logistics

The authors identify five cornerstones for understanding logistics as a university discipline:

1) *Network perspective.* A distinctive approach to logistics is its interpretation of economic systems like networks and economic processes like flows of objects such as goods, information, people and money [20].

2) Logistics requests for sequential aggregation levels. Any logistical problem can be interpreted as a network of flows, which in the future can be considered as part of a network of a much higher level [24].

3) *Interdisciplinary logistics.* Logistics uses methods from other disciplines, such as mathematics, technology, economics and the social sciences, but also develops them further. Interdisciplinarity is at the heart of logistics and is a central element of the logistics paradigm [25].

4) Unity within the framework of various terminological, conceptual and methodological foundations of logistics, borrowed from various root disciplines, through a network model [26].

5) *Orientation towards logistics.* "Logistics as an applied science is primarily aimed at solving the research problems and the problems that real economic activity faces." [27]. It aims to actively promote a better understanding of these problems and to find appropriate solutions.

These five cornerstones help to determine the position of this research project in the logistics discipline. This is an applied research; therefore, there is no claim to the development of new theories, but rather to the adaptation of the existing practical problems to the solution in the planning and risk assessment in the Norwegian gas transportation network infrastructure investments.

Thus, the methodological basis of the economy was chosen, which is one of the most conducive disciplines to logistics.

The analysis unit in this research project is the transport infrastructure network of oil and gas complex. Network perspective is a unifying feature of the provisions that make up the thesis.

The study focuses on the problems of investment planning and assessment that arise at the expansion of the transport system, which can be described as a regional macro logistics. The network of oil and gas complex can be considered at a higher level of aggregation as the top part of the European gas transportation system.

The scientific literature review on evaluation methodologies shows a relatively small number of examples concerning the upstream gas sector. Since the development of oil infrastructure is usually a matter of private capital investment, in the existing literature the approaches to evaluation are discussed, common to commercial decision-making.

3.2. Oil transport sector valuation double system method

The studies address the problems of *valuation methodology* in the oil transport sector on the base of analytical staged method. A large amount of information about the influence of the offshore gas production on the ecology is also given in the works [29, 30].

The article provides an overview of research in this area and discusses the practical steps for the complex analysis and gradation of the offshore production on the environment. The state of the literature gives us one of the most widespread *method that is known as a "double" system:*

1) the producers assess projects from a mercantile position,

2) and government agencies monitor the possible effect of the production by the means of natural resources management and ecological expertise.

So, we propose a more complex access that measures general changes in social welfare since the project has been realized.

The development of a new transport infrastructure is associated with the need to evacuate oil and gas from proven reserves. However, it is expected that the medium-sized field will reach nearly ten – fifteen years, and the durability of the pipes can reach fifty years. The economic analysis of the transport solution should consider the economic consequences that arise after the cessation of production of source fields.

3.3 Changes in social surplus dependences

We need also pay a special attention to the absence of reliable methodology for the analysis period, because the source data changes according to the project type [28, 29]. A change in social security can be considered as a modification in overall social surplus. In accordance with market rivalry assumptions, a change in social surplus is described by the next dependence:

- $\Delta SS = \Delta CS + \Delta PS + \Delta GS$,
- ΔSS - change of social surplus;
- ΔCS - change of consumer's surplus;
- ΔPS - change of producer's surplus;
- ΔGS - change of governmental surplus.

Such change is possible to describe as an impact of the project in the next groups of stakeholders:

1) consignors in the new infrastructure;
2) depositors in the new infrastructure;
3) consignors in the existing infrastructure;
4) owners of the existing infrastructure.

An average company can be a member in any of these groups. Shippers and investors include the same companies; in the pipeline project most of the potential shippers are involved in the investments, at least at the initial stages (the share of participation in the pipeline infrastructure may be sold at a later stage, or institutional investors can participate in the project from the very beginning). So, for the purpose of analysis structuring the preliminary ranging of agents should be considered as a ranging of various companies impacts in the project [31, 32].

3.4 Advantage of considering transport infrastructure separately from gas field development

In the up-to-date assessment methodologies, the transport infrastructure project is mainly considered as one of the aspects of the appropriate development of the gas field. The proposed method examines the infrastructure project separately from the field development, paying particular attention to the transport chain. In the study the term "transport infrastructure" implies an infrastructure for the delivery of oil and gas extracted from the field and delivered to the market [20].

In the market of perfect competitiveness, the transport infrastructure would consider the change of general welfare as a result of the impact of oil and gas complex development.

It should be taken into consideration that oil and gas transport infrastructure projects have external effects – the direct impact on the surroundings: for example, the impact on the environment, the impact on fishery and marine traffic, and other implications for developing economy. The surroundings can be considered as a group of consignors in the developed methodology.

Infrastructure projects in oil and gas complex can also affect the secondary markets: methanol production, electricity market, labour market and regional economic activity [21-24].

Within the framework of this segments a welfare function is used, which scale is limited by oil and gas production and transportation sector and leaves the consequences for the secondary markets beyond the scope based on an effective market assumption.

Taking into account the developing sector of transport infrastructure of oil and gas complex, it can even be considered as a part of world transport infrastructure of oil and gas complex. Thus, the studies at a higher level of aggregation may be another direction for the further research.

IV. RESULTS AND DISCUSSION

Preliminary we will describe the situation in the development of oil and gas complex of Siberian Federal district. Russia was the world's largest producer of crude oil (including the rental of condensate) and the world's second largest producer of dry natural gas in 2017.

In 2017, oil production and condensate rental increased by 1.3% and dry natural gas production by 2.1%. Most of the oil and natural gas production in Russia is located in Western Siberia, part of central Russia, which stretches from the northern border of Kazakhstan to the Arctic Ocean. However, new technologies, the growth of Asian markets and Western sanctions could in the long term alter the regional balance of Russian oil and natural gas production [17, 18].

In 2017, oil and natural gas production in Western Siberia amounted to 6.2 million barrels per day of crude oil and 21.1 trillion cubic feet (Tcf) of natural gas, respectively, compared to levels peak production in the 1980s. Russian energy companies Rosneft and Gazprom Neft’ increased the efficiency of the old fields in Western Siberia by introducing technologies such as horizontal drilling with horizontal and multi-stage hydraulic fractionation; However, further production growth in Western Siberia will require significant investment. Consequently, Russia is considering the

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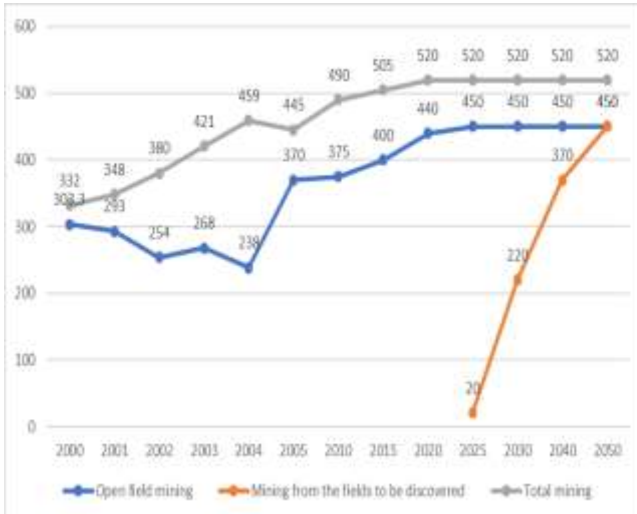
possibility of developing its large but less accessible reserves in hitherto undeveloped regions. Fig. 1 shows the dynamics and forecast of oil production in the Siberian Federal District.

Fig. 1. *Forecast of oil production in Russia till 2050 [17]*



In parallel with the increase in production, Russia seeks to diversify its export market, responding to the growing demand for energy in China. Russian energy exports have historically been absorbed by developed markets in Europe, but strong economic growth has led to increased demand from emerging markets in Asia, especially China. Gazprom reached an agreement earlier this year to deliver up to 1.3 trillion feet of gas per year to China since 2018. Natural gas will be mainly produced at fields in Eastern Siberia [18].

The Russian government has offered tax breaks and reduced export tariffs for Russian companies that have expanded their business in Eastern Siberia, the northwest and the Arctic region. The discovery of the East Siberian oil and gas field in Vankorsk in 2009 - the largest discovery of oil in Russia in almost three decades - has contributed to an increase in oil production in Russia since 2010. Offshore reserves in the Far East can also play an important role. role in offsetting by reducing production in older areas.

US and European Union (EU) sanctions (introduced until September after Russia's participation in the separation of Crimea from Ukraine and its subsequent participation in supporting separatists in some parts of eastern Ukraine) restrict Russia's access to foreign technology and capital and prevent Russian energy companies from participating in joint projects with foreign energy companies.

These sanctions can have a significant impact on Russia's long-term development of significant shale and Arctic resources, as well as on existing projects requiring significant investments, such as the Vankor field. More recently, additional US and EU sanctions have been applied, increasing the likelihood of larger and older impacts on development and production in the Russian energy sector [18].

On the receiving terminal the possible liquid residues and solids are removed, the gas passes through the final quality check and the pressure and temperature are adjusted before feeding into the distributors down the flow. In some cases, transportation upwards (rich gas pipelines) can be more than the export (dry gas pipelines). Some fields, located close to the shore, have no stages of processing on the shelf. The unprocessed well flow is routed directly through the multi-phase pipelines to the onshore processing facility. There are also fields not related to the onshore processing enterprise [33].

The need for transport services (D) is determined by two arguments: the need for gas and the rate of production, that are strongly influenced by the exploration success. Taking into account that all produced Norwegian gas would be realized, so transport need would consist of proven gas reserves and possible discoveries. The project has been initiated by investors to accumulate resources for the purpose of gas transportation (fixed volume). Over the planning horizon of investors, their need for transport infrastructure has been recorded [11].

The described approach to the assessment expansion option can be adapted to the pipeline investment as follows. The investment value of the excess pipeline throughput is the price, that the investors pay to be able to expand the system by tying the new vehicles and connecting the new fields until a later date.

The value of this parameter depends on the uncertainty over the project value. The project evaluation includes all the parts of the value-added chain, from the subsoil to the market, including the cost estimates for the development of the deposits, offshore, onshore processing plants and gas transportation to the relevant market. To approximate the stochastic process, followed by the project value, three parameters are required: the estimate of the current cost of the project; the volatility of profitability; and the risk-free rate. The risk-free rate during the validity period of the option is constant; there can be used the one that is determined by the government bonds [27].

The initial value of the $V0$ project can be estimated as a traditional NPV, calculated on the basis of the risk-free discount rate. The volatility of the σ project value is approaching by Monte Carlo method, which includes various price and resource scenarios. The k scaling potential is limited by the available excess capacity.

Option execution price – the additional investments needed to modernize the pipeline with the new compressors, as well as to develop the new fields that are moving, if the market conditions are favorable. The expansion possibility can be realized at any time in the future, but it is limited by the life expectancy of the considered pipeline [28].

The theory of real options is a means of structuring and evaluating the flexible strategies for the resolution of uncertainty.

Real options are a particularly attractive concept, when capital-intensive irreversible investments must be made under the great uncertainty. In case of gas transportation infrastructure projects, the multi-billion-dollar investment decisions are made in conditions of the uncertainty of gas prices and the extremely inaccurate knowledge about the long-term resource base.

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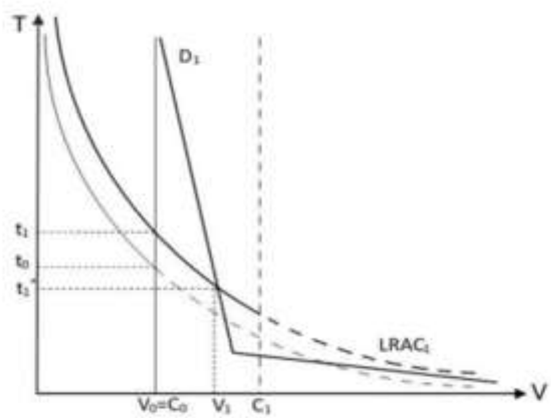
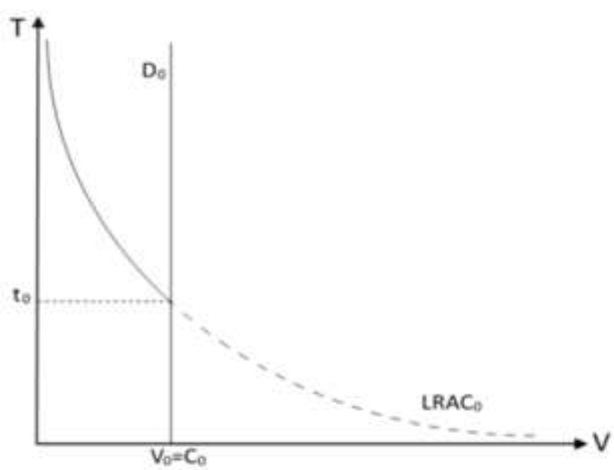
In Figure 2 the line D0 parallel to ordinate axis represents a need for gas transportation. Investors offer a decision for the pipelines ("0-alternative") with content C0, taking into consideration the fixed volume V0. This dependence is represented by a curve LRAC0. The tariff (T) will be achieved at t0 level.

Fig. 2. *Short-term demand for transport services*



The pipeline operator tests the new infrastructure reliability and durability considering the possible new volumes of gas exceeding the established one. In Figure 3 the situation is created when the pipeline operator introduces an alternative ("alternative 1") with a content C1 based on its scenario of average resources.

Fig. 3. *Long-term demand scenario, an average resource*



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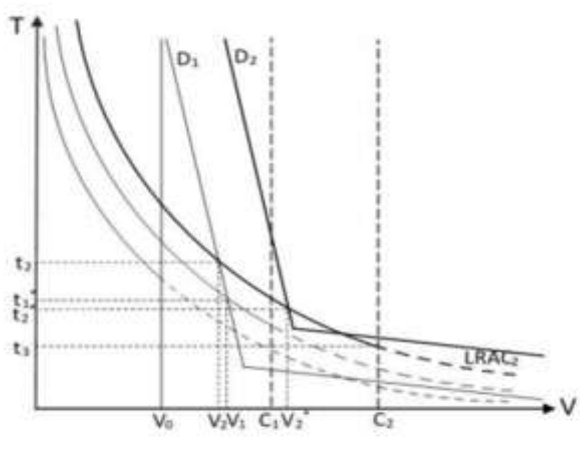
A higher throughput solution requires higher investment costs and implies a long-term average cost curve LRAC1. The long-term need line D1 is tilted down: the transport tariff will be one of the causes for a decision of new wells or even fields developing in the nearby area [17].

It should be strengthened that, long-term demand is inelastic until the reduction of tariff to some fixed level; so, for large and medium-sized events, the price level is not a crucial factor. Margin field development is rather susceptive to transportation expenses [34].

Under some fixed value of tariffs, the limit for the margin deposits development is overcame, making demand more elastic. In short perspective, the LRAC1 function shows an increase of T1 because of a higher first investment. On the other hand, in a medium perspective, the tariff does not exceed the level, t1 *, increasing the transported volume to V1.

The pipeline operator is also exploring the possibilities of two presented ways of situation development. For the first possible situation, the Alternative-1 bandwidth is insufficient in the perspective, and a refined logistic scheme should be needed. Otherwise the production stage of the project may be delayed until the installed solution contains available bandwidth. Thus, any of these scenarios means some loss of well-being. So, the “Alternative-2”, presented by the LRAC2 curve is more suitable (Fig. 4)

Fig. 4. *Long-term demand, a scenario with a high level of resources*



If the potential resources in the studied area are significant, the demand function is falling and its elastic component is much higher (which means that not only high resources, but also a lot of smaller resources have been found in this area, downshifting the cost threshold).

For the case of Alternative 2, the new tariff t2 * has been established for the first junction of the demand and cost functions; thus, the volume transported will be V2 *.

The next junction of the demand function and the LTAC2 price curve is after the inflection. By this dependence the fixation of tariff t3 at the junction of the two functions will stimulate the development of margin fields up to the bandwidth limit C2.

The main disadvantage of "alternative-2" is related with the average resource scenario. When it takes place, the tariff increases to the t2 value. It shows that transported gas volume V2, is less than the corresponding volume V1, for the "alternative-1" scenario. In the case of the lack of resources in the area the need for transportation infrastructure projects decreases, so the tariff will increase for the purpose of the initial investments' restoration.

By the most widespread CBA methodology, such risks must be taken into consideration by means of the expected values or a scenario analysis usage. But for a solution with excess capacity the solution should be found as a solution of a problem with extra uncertainty and flexibility. Such solution cannot be obtained by finding the standard NPV. The preparatory works and investments for reserving extra capacity gives an access to production increase in the future and interconnection with new gas according to the favorable situation.

Flexibility is not only an economic, but also a social category, which should be considered when raising tariffs because of the higher preliminary investments. Using such methodology, we have to take into consideration the real CBA options: flexibility must be added to the advantages of a solution with excessive bandwidth. The study proposes a methodology to assess the real flexibility options offered by the potential for excess investment in gas transport infrastructure, and it is shown that it strongly influences the decision-making process in favor of another pipeline with preliminary investments.

Investments in upstream oil and gas infrastructure are made by private oil and gas producers which that assume the investment risks according to their investments. A new project can have long-term influence on the existing infrastructure and the creation of total value in this sector. In addition, infrastructure modernization can have external consequences.

Regulatory framework in the oil and gas complex is organized in such a way, that the commercial interests are balanced with the socio-economic considerations. In the area of gas transportation infrastructure development this is achieved through the participation of the system operator in the project planning and the concept selection, as well as the corresponding evaluation of the project before the official approval. The decisions on infrastructure development, adopted so far, reflect the fact, that the impact on the price formation in the gas market and the impact on the third parties are, to some extent, implicitly considered in the decision-making [35].

However, some important socio-economic consequences may or may not be explicitly assessed in the widespread assessment methodology. The proposed method offers a basis for the comprehensive economic analysis of the infrastructure projects in the gas production area. The introduction does not need any serious changes to the widespread planning and evaluation methodologies. Thus it should be taken into consideration and could play a coordinating role in planning and evaluation practices.

V. CONCLUSION

Based on the results of the study, the following conclusions should be made:

Transport is a priority area of economic development. Adequate infrastructure is the main prerequisite for the country's transport system.

Transport has a significant direct and indirect impact on economic efficiency and economic growth. Transport infrastructure is essential for sustainable economic growth in the country. There is a relationship between the quality of transport infrastructure and macroeconomic indicators of the country. A well-developed transport infrastructure provides certain advantages due to certain macroeconomic factors of productivity. Thus, an analysis of the interaction between transport infrastructure and the economy, as well as an assessment of the impact of this interaction, is a vital issue in the context of the government's strategic development plan.

Approaches based on the calculations of the Global Competitiveness Index (GKI) and the Logistics Performance Index (LPI) applied at the international level characterize the global situation in a particular country and in a specific aspect; it is evaluated in the context of globalization and allows you to track changes over time. However, GKI and LPI indices in a country cannot be used to measure the impact of transport infrastructure performance on productivity and to measure the return on investment in transport infrastructure.

An analysis of GDP growth trends and development indicators of the transport sector confirmed the correlation between economic growth and the development of the transport industry.

The performance of transport infrastructure depends on the type of performance measurement. The development of a methodology for measuring efficiency remains important for the development of the national economy. There is a need to develop a system for measuring and evaluating global indicators of transport infrastructure and economic growth, which should be systematically evaluated and which in general will be useful for all decision-makers involved in transport.

Infrastructure developments in NSQ are financed by the oil companies that need transport solutions for their gas fields. The development of the transport network is coordinated by an independent system operator to account for the impact of the new infrastructure development on the existing transport system and the impact of the overall value formation on SNA.

Among other aspects, the system operator examines each infrastructure object from a long-term perspective and evaluates the possibilities for the future linkages. Due to the high economy of scale, the investments into the excess throughput of the pipeline are an opportunity for the cost-effective combinations in the future. When CNG and pipeline solution are considered, there is a tradeoff between the flexibility of CNG assignment and the strategic flexibility, provided by the excess pipeline throughput. The flexibility of LNG assignment can be easily included in the project estimate as a price premium per unit of sold gas.

The task of estimating the monetary value of flexibility, provided by the excess throughput, is not simple. This document shows how the analysis of real parameters can be applied to assess the value of flexibility in the pipeline investments and how this value can be used by the public supervisor in evaluating the project.

The simulated example demonstrated the importance of evaluating the real options in the investments into oil and gas projects. The inclusion of the flexibility value, provided by the excess pipeline throughput, can change the results of the investment assessment.

Among other things, there may be an option to postpone a decision or option to incrementally expand the system step-by-step by means of the new connections of different sizes, which are a composite option. Given that the investing into the excess potential of the pipelines through the lens of the analysis of real options have some limitations, because they may not include such effects as increasing the value formation onshore due to the oil activity expansion. However, the actual value of an option can be a good indicator of the cost of the excess pipeline throughput and play an important role in the project evaluation.

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