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SUBSTANTIATION OF THE METHODOLOGY FOR DETERMINING THE MARKET VALUE OF PATENTED DEVELOPMENTS RELATED TO THE OIL AND GAS PRODUCTION INDUSTRY

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ABSTRACT

The given article is devoted to the problem of substantiation of the methodology to determine the market value of patented developments related to the oil and gas industry. The presented results of analytical studies allow concluding that the lag in the development of the Russian market of intangible assets is significant in comparison with not only the developed countries, but also with the developing ones. The article analyzes the existing approaches and methods for assessing the market value of intangible assets. The patented technical and technological solutions associated with the implementation of work on the development and hydrodynamic studies of wells in conditions of weakly cemented reservoirs saturated with high-viscosity oils are substantiated in this article. The market value of the patented development is substantiated: patent №2131023 «A method for developing, studying wells and intensifying oil and gas inflows and an instrument for its implementation». As a result of this work, a conclusion is made about the possibility to use in calculations the primary indicators which affect the cost of patented developments, contributing to the increase in profits by a licensee during the development of oil and gas wells. In this context, the practical value of the proposed methodology for performing calculations with the purpose to establish the value equivalent for which a patent can be sold is that it can be extended to patents related to jet technology used in oil and gas production for generating foam or aerated liquids.

Keywords: patent; cost of exclusive rights; fluid inflow enhancement; jet equipment.

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1. Introduction

The oil and gas production industry is given a decisive role in the economic development of the Russian Federation in the context of increasing sanctions pressure. Hydrocarbon production is a competitive sector of the Russian economy; oil and gas are among the primary exported resources. For many decades, the activities of business entities in the oil and gas production complex have stimulated the progressive socio-economic development of the state, as well as technologically related sectors of the national economy. Intangible assets (IA) are given a key role in the production and financial activities of enterprises in the oil and gas production industry as one of the components of the resource potential of business entities. Certain aspects of the IA influence on the level of mobilization of the innovative potential of enterprises in the oil and gas industry are covered in sufficient detail in scientific research by Russian and foreign scientists; however, it should be noted that in the overwhelming majority of works, central attention is given to issues related to intellectual property management, without considering the practical application of approaches to justifying the market value of patented developments for the purpose of their subsequent commercialization.

2. Main part

In her study [1], a patent attorney of the Russian Federation and the Eurasian Patent Office N. Z. Mazur described the situation on the domestic intangible assets market as a large-scale undervaluation in the context of lagging behind foreign countries [2-6].

The theme of managing intangible assets in the oil and gas industry is the subject of the works of many Russian and foreign researchers [2-6].

Let us present the results of analytical studies of market indicators HMA that were obtained by the World Intellectual Property Organization [7] on the basis of information posted in the public domain by foreign and Russian consulting companies.

When conducting analytical studies, the following indicators were compared:

– costs associated with the acquisition of software, as a percentage to gross domestic product (SE);

– price for a trade mark for economic entities leading

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Table 1
Maturity level of the Russian intangible assets market (as of 2022) [8]

State	Level economic development	SE	BV	IAIN
RF	developing	0.30	47,00	56.70
Compared to developing countries		-5.26%	-37.78%	-20.18%
Compared to developed countries		-53.85%	-75.03%	-35.20%

by market capitalization, as a percentage to gross domestic product (BV);

– share of intangible assets in common property for economic entities leading by market capitalization (IAIN).

Let us consider the level of maturity of the Russian intangible assets market (table 1).

The results of analytical studies presented in table 1 allow us to conclude that the lag in the development of the Russian intangible assets market is significant not only in comparison with the developed countries, but also with the developing ones. Also, the insufficient level of the innovative component of intangible assets of domestic business entities is clearly visible in comparison with the international level.

The analytical studies of investment activity in Russian companies (in terms of intangible assets) unveil the consequences of the command-administrative management. Thus, according to the information provided on the Rosstat website [9], this specificity is reflected in the excess of the amount of investments in the renewal of the material base of business entities over investments in intangible assets, in the context of increasing growth potential.

Based on the definition given in the Tax Code of the Russian Federation [10], intangible assets should include material assets that do not have a material embodiment, but which can be identified. Examples include licenses for certain types of activities, trademarks, results of intellectual activity (Internet sites, software, etc.), patented developments that have a cost estimate.

As noted in the paper [11], domestic business entities representing the oil and gas industry, as innovative enterprises, have a significant share of intangible assets in the capital structure.

The current Russian legislation (Civil Code of the Russian Federation) examines the objects of patent rights [12].

Let us consider the aspects of civil law relations with patented developments in the intellectual property market (IP).

The owner of the copyright to the result of intellectual activity is the licensor.

The recipient of a set of rights (for a fee) for the practical use of an intangible asset is the licensee.

Trade operations with intellectual property rights are carried out in compliance with license agreements. License agreements differ from other types of trade transactions.

Let us consider the basic provisions of the agreement between the licensor and the licensee [13]:

– transfer of technical ideas that are the subject of the contract;

– retention of the patent holder's right of ownership to the result of intellectual activity;

– the contract is concluded for a pre-agreed period;

– the territorial aspects of the rights transferred to the licensee;

– the license agreement describes the key provisions to establish the license price and the procedure for making payments between the parties;

– bilateral exchange of innovative solutions to improve the subjects of the concluded agreement.

The problematic nature of selecting potential licensees is that, their assessment must be completed before the initiation of the negotiation process on the proposed agreement. An incorrect choice of licensee can lead to both direct (reduction of expected financial receipts – remuneration) and indirect (loss of positions in the local market, the rights to which belong to the licensee) risks for the licensor.

Setting the price for obtaining a set of rights in connection with the use of intangible assets is a key problem in trade operations with intangible assets. There is no unified methodology to set the price in international practice, whereas, they rely on cost when determining prices for tangible assets. Prices for intellectual property rights, fixed by a license agreement, can differ considerably (downward) from the costs of research and development.

The expected amount of additional profit to be received by the licensee is usually relied upon in the established practice of license agreements trading. Then, a percentage of the cost of the sold products is fixed in favor of the licensor.

As noted in the paper [14], the procedure for determining the market value of intangible assets is associated with a number of difficulties for each of the parties to the transaction, which is due to the complexity of taking into account the interests of the counterparties.

The federal assessment standard «Approaches and methods of assessment (FSO V)» [15] provides three approaches to assessment. Let us analyze the approaches to assessment, as well as the methods that form them.

The income approach is based on the fact that the value of an asset corresponds to the value of financial receipts generated by the assessed object or the value of total costs that were avoided when implementing this asset in the production process. Thus, the value established with the help of this approach directly depends on the potential of intangible assets to generate alternative financial receipts.

The comparative approach is based on establishing the value of intangible assets using information on transactions with similar objects on market terms.

The cost approach involves determining the replacement cost of intangible assets. Its fundamental principle is that an economic entity that invests capital for the purpose of subsequently extracting profit will not pay more for an intangible asset than is necessary for its creation or acquisition from an alternative owner.

Since intangible assets are a non-standard type of asset for valuation the approaches studied have their own characteristics in terms of the methods used [16] (fig. 1).

Let us make a detailed analysis of the approaches under study to the valuation of intangible assets.

The use of ***the income approach*** implies the systematic application of the basic methods shown in figure 2. Further, the methods of the income approach are considered as independent with their own purpose and procedure.

The direct capitalization method is based on the capitalization of income for the first year and the assumption that the

amount of income will be the same in the following forecast years. The situations to be considered are typical for business entities at the maturity stage of the development cycle.

The cash flow discounting method is based on the assumption that the recipient of the asset will not pay for the intangible asset an amount that exceeds the expected investment proceeds from its implementation in the production process. Also, the right holder will not waive the exclusive rights to the intellectual property rights for an amount that does not correspond to the discounted value of the expected future income from the intangible assets ownership.

A method of calculating real license fees is used when the licensor does not use the patented development by himself, but waives this right by transferring the result of intellectual activity for exclusive use in favor of the licensee – grants an exclusive license. In some cases, the licensor may enter into competition with the licensee, for example, when there is a need to satisfy the growing market demand for products manufactured on the basis of the analyzed intangible asset. In this case, the final value of the transferred rights will be influenced by the volume of transferred rights, the degree of the risk from investing in this asset, the royalty rate, etc.

A profit advantage method in is applied in cases where it is possible to establish an advantage in profit obtained through the use of the IP in question. This advantage is considered to be the additional profit due to the innovation that is received by the business entities producing the product in contrast with business entities selling identical products but not having rights to such an intellectual property object. With the lack of information, a comparative analysis can be performed by comparing production indicators within the business entity before and after the implementation of the innovation.

Cost advantage method. In some cases, the use of intangible assets provides an opportunity to save on costs. Costs can be optimized by creating «growth points» in saving time on the implementation of technological processes, energy resources, labor as well as raw materials. The calculation of the cost benefit is performed for the useful life period of the asset in question.

Sales volume advantage method is used in cases where the implementation of the assessed asset makes it possible to increase sales volumes. This situation is typical for:

– increasing gross output through the promotion of progressive developments while maintaining production costs;

– sales of goods under a well-known trademark;

– an increase in quality characteristics or optional properties that appear when the product is used by consumer while maintaining the cost of sales, final costs or sales revenue (due to additional properties, sales volume increases).

The calculation of additional profit from the increased sales volume is performed for the useful life period of rights to intangible assets.

Operational costs reduction method. In some cases, the introduction of an innovative intangible asset into the production process makes it possible to save on operating costs. The use of the method to save in operating costs involves performing calculations of savings before the expiration of the property rights complex for the asset in question.

Royalty exemption method assumes that the asset protected, for example, by a patent or a certificate, is not assigned to the licensee by right of ownership, but is provided in exchange for periodic percentage payments to a licensee – royalties.

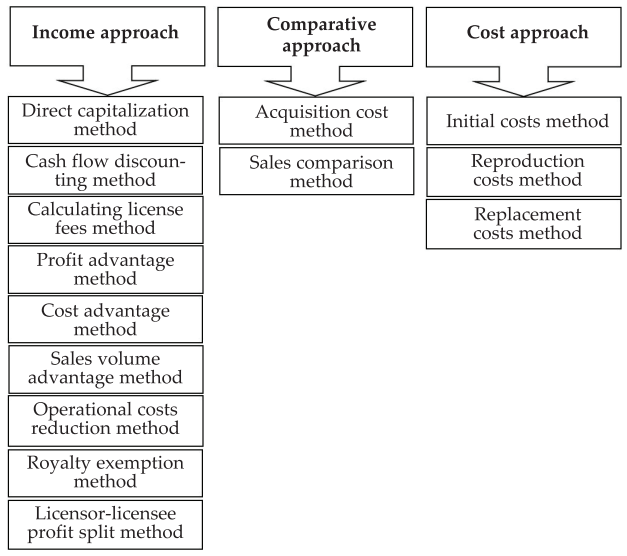

Fig. 1. Approaches used in the assessment of intangible assets (in the order of decreasing priority)

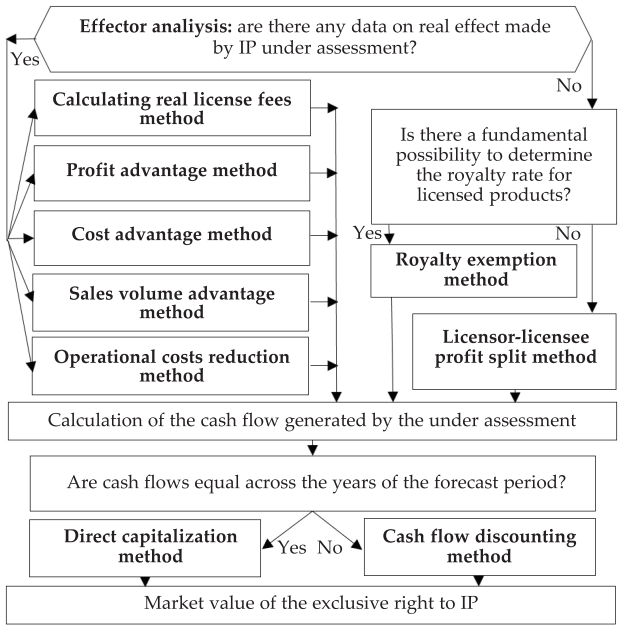

Fig. 2. Income approach methods used in calculating the value of intangible assets [16]

Licensor-licensee profit split method. This method involves calculating the additional financial flows planned to be received by a licensee from the use of the intangible asset until the expiration of property rights. After that, they are redistributed between the parties to the license agreement. That is, when using a method of allocating the licensor's share in the licensee's profit, the calculated value is the share of the copyright holder in the additional financial flows of a licensee.

Let us consider the main methods of valuing intangible assets used within the framework of ***a comparative (market) approach.***

Acquisition cost method. This method is based on the concept that an intangible asset is purchased on a competitive market at a cost that reflects its market value. The known market value can then be used to calculate the market value of comparable assets, with adjustments being made to enable

comparison of the intangible asset in question and its analogue on a competitive market.

In the process of analyzing the acquisition of intangible assets, valuation coefficients are calculated, which usually represent the purchase price of the intangible asset divided by a certain amount of income from the use of the acquired intangible asset [16].

Sales comparison method. The method is based on the collection and analysis of market information on transactions with similar objects. Asset valuation using market data is more correct, since the method in question guarantees the use of reliable information to the maximum extent [16].

Within the framework ***of a cost approach***, we will consider three main methods to assess intangible assets.

Initial costs method. This method is based on the historical cost of intangible assets, which consists of costs actually incurred by a business entity, with the amount to be determined on the basis of financial statements.

*Reproduction costs method a*ssumes the coincidence of the cost of rights to an intangible asset and the costs of its copy plus the company's profit added to them.

Replacement costs method is used in conditions where it is not possible to reproduce an exact copy of the intangible asset under consideration. The methodological approaches of the method under consideration consist of consolidating the costs associated with an intangible asset with the key parameters similar to the object of assessment. Subsequently, the cost of the intangible asset under assessment is the subject to adjustments for loss of value due to its economic, technological and functional types of obsolescence, since the replacement object created with modern technical and technological solutions is able to demonstrate better technological capabilities and greater commercial potential.

It should be noted that due to the unjustified application of approaches to valuation under consideration, the value of intangible assets is often underestimated. This situation is especially relevant for business entities related to the oil and gas production industry [14].

The applicability of the approaches under study can be justified by the characteristics of the intangible asset. It is noted [17] that the basis for assessing intangible assets lies in the theory of relationship between the risk of investing in an intangible asset and its ability to generate income. The authors [18 and 19] believe that the key approach to assess intangible assets is the income approach, since that is namely this approach that allows taking into account the entire set of risks and the probable profitability of the asset under consideration with a high degree of probability. The authors of [20] substantiate the priority of applying the approaches considered when assessing all types of intangible assets (fig. 3).

The data presented in figure 3 clearly illustrate that the income approach is the most preferable while performing assessment works in relation to patented solutions.

In the course of further work on the article, the group of authors attempted to apply one of the income approach methods considered above to assess the market value of a patent related to oil and gas production. The methodological basis for performing calculations by the method of allocating the licensor's share in the licensee's profit was the information presented in the work [16].

Fig. 3. Priority of approaches to assess the market value of patents and technologies [20]

According to global practice, the share of a copyright holder in the additional financial flows of the licensee is no less than 10% and no more than 50%.

Initially, when an innovative development has no technical design, a copyright holder can count on no more than 10% of the additional financial flows of a licensee. This is due to the fact that the innovative development is not yet provided with a patent and legal protection at this stage. It should also be noted that in a competitive market, the sale of goods already mastered in production may be unprofitable in 20-50 cases out of 100. After receiving patent and legal protection, a copyright holder's share in the additional financial flows of the licensee may reach 35%. In the case of industrial development, the transfer of rights to a patented development allows a licensor to claim half of the additional profit of a licensee.

It should be noted that the assignment of rights is not enough for the effective use of the patented development; technical support from a licensor is also necessary. It is the provision of comprehensive assistance in the development of the licensed object that will provide a licensor with additional arguments to increase the amount of the license fee. The breadth of the rights being assigned also affects the total amount specified in a license transfer agreement. The assignment of the entire range of rights, all other things being equal, allows a licensor to maximize the share of the additional financial income of a licensee.

The method of allocating the licensor's percentage of the licensee's profit for the purpose of establishing the value equivalent for which the intangible asset can be sold in a competitive market involves the use of the following algorithm:

– license agreement is concluded for the time interval to be fixed;

– a quantitatively expressed portion of the licensee's additional profit, expected to be paid to the licensor, is stipulated;

– the amount (in value terms) of the planned license fees to be paid is justified;

– calculation of the total costs associated with legal means of ensuring the fulfillment of obligations under the concluded license agreement is carried out;

– convincing evidence is provided for the additional financial revenues associated with the introduction of innovative solutions for the assigned rights into the technical and technological process, minus the total costs associated with legal means of ensuring the fulfillment of obligations under the concluded license agreement;

– a value equivalent is established which an intangible asset can be sold for in a competitive market by capitalizing cleared license payments projected to be received during the period of the license agreement validity.

The mathematical expression to establish the value equivalent which an intangible asset can be sold for in a competitive market, when the regularity of payments coincides with the calendar year, is as follows:

$$C_{ouc} = \sum_{i=1}^{n} \frac{\left(APl \cdot \Delta D_i - C_i\right) \cdot \left(1 - TP\right)}{\left(1 + d\right)^i} \quad (1)$$

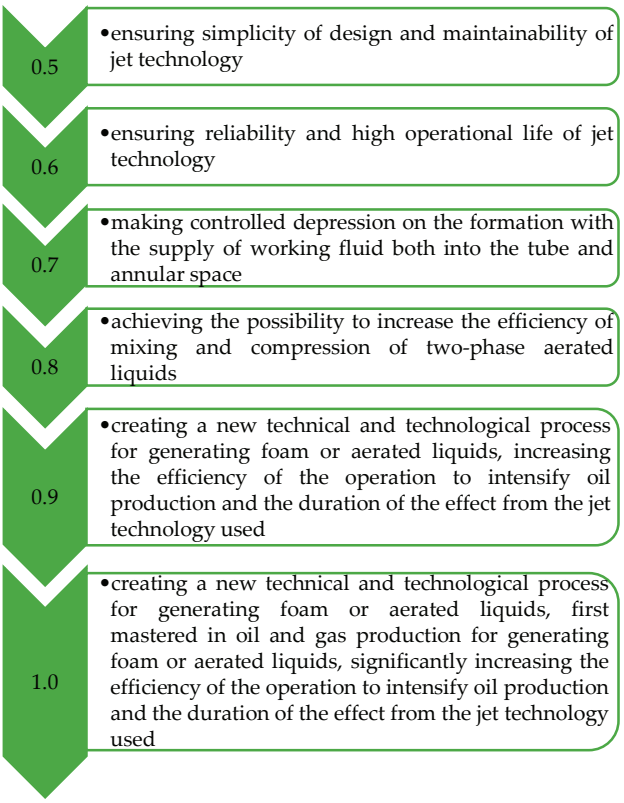

Fig. 4. Substantiation of the coefficient values depending on the result achieved by the implemented innovative technical and technological solution (K_1)

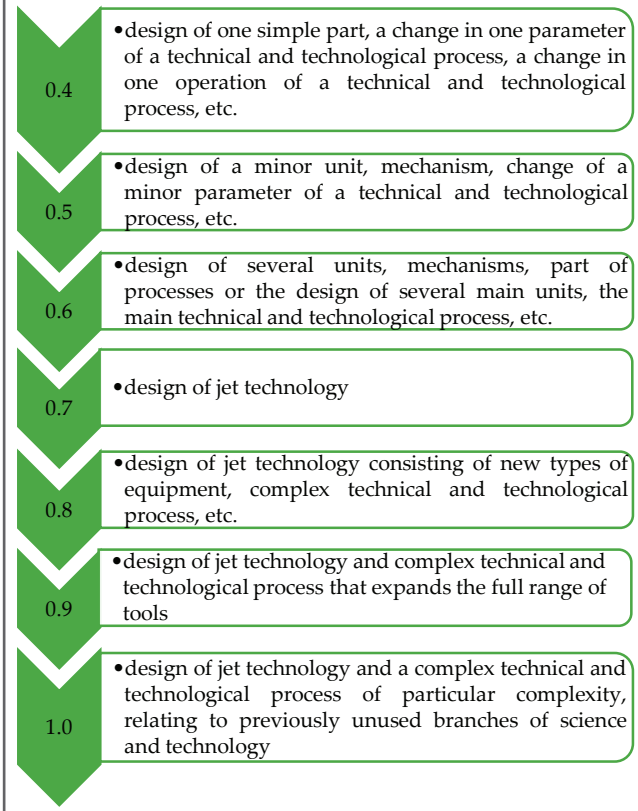

Fig. 5. Substantiation of the coefficient values depending on the complexity of the technical and technological problem being solved (K_2)

where AP_l is the quantitative portion of the licensee's additional profit expected to be paid to a licensor, unit fraction; ΔD_i – annual additional financial benefits associated with the introduction of innovative solutions for transferable rights into the technical and technological process, rubles; C_i – annual costs associated with legal means of ensuring the fulfillment of obligations under the license agreement, rubles; TP – tax rate paid on the profit received, %; d – interest rate that allows the expected future financial flows to be converted to the current monetary equivalent, %; n – time interval which the license agreement is concluded for, years.

In certain cases, it is permissible to use elements of qualimetric analysis, which allows the qualitative characteristics of a patented innovation to be translated into quantitative measurement.

The amount of additional financial income expected from the introduction of the innovative solution under consideration into the production process:

$$P_{IPI}^{US} = \Delta P_{US}^{Lsee} \quad (2)$$

where ΔP is the quantitatively expressed share off a licensor in the additional profit of a licensee, unit fraction; L_{see} – a licensee; P_{IPI}^{US} – profit from usage of intellectual property items.

In determining a licensor's quantitatively expressed share of the licensee's additional profit, the following mathematical expression is used:

$$\Delta = K_1 \cdot K_2 \cdot K_3 \quad (3)$$

where K_1 – a coefficient depending on the result achieved by the implemented innovative technical and technological solution; K_2 – a coefficient depending on the complexity of the technical and technological problem being solved; K_3 – is a coefficient that depends on the degree of novelty of the technical and technological solution.

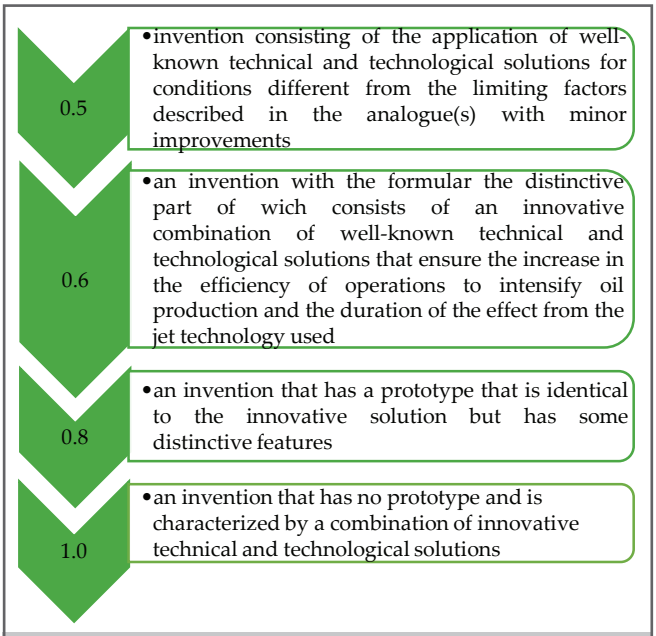

Fig. 6. Substantiation of the coefficient values depending on the degree of novelty of the technical and technological decisions (K_3)

Further calculations are performed with the information provided in patent № 2131023 «A method for developing, studying wells and intensifying oil and gas inflows and an instrument for its implementation». Figures 4, 5 and 6 the

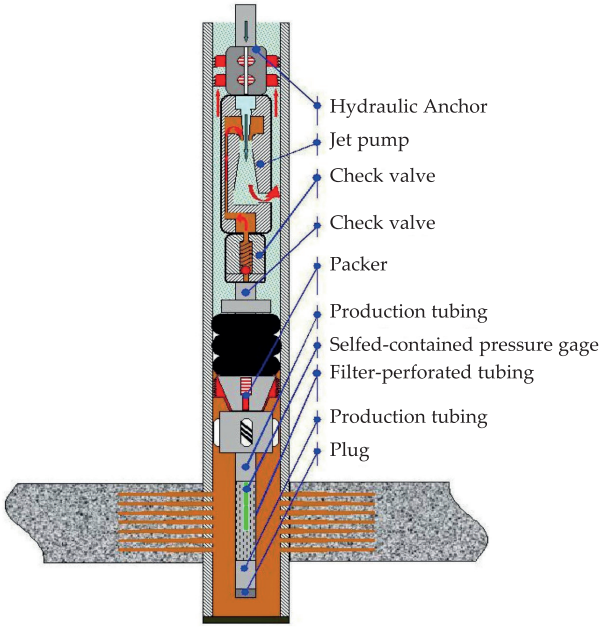

Fig. 7. Layout diagram of a jet pump in a well [21]

authors give the values of the coefficients K_1, K_2 and K_3, which can be applied when establishing the cost equivalent which intangible assets related to jet technology and used in oil and gas production to form aerated liquids or foam can be sold for in a competitive market.

The use of inkjet technology allows:

– create a given depression on the formation and, if necessary, control the period of its creation and its magnitude without the use of nitrogen-generating and compressor units;

– carry out recording of pressure recovery curves (PRC) during well development;

– conduct remote monitoring of pressure fluctuations during exploration and cleaning of the bottomhole formation zone.

The work [21] describes the technology for performing works on development and hydrodynamic studies of well R-91, Russkaya area, formation PK1-7, perforation interval 863-872, 873-875, 877-880 m. The process of well development was carried out on weakly cemented reservoirs saturated with high-viscosity oils.

The well depth is 982 meters, the artificial bottomhole is 852 m. A production casing with a diameter of 168 mm and a wall thickness of 10.5 mm was lowered to a depth of 980 meters. The production casing was pressure tested at 11.5 MPa, no defects were found. Perforation was created by the PK-105S perforator at depths of 863-872, 873-875, 877-880 m. A total of 250 holes were created (20 holes per running meter). Before perforation, the well was filled with a 5% aqueous solution of C_aCl_2. The adhesion of the casing to the cement stone is satisfactory. According to the results of well geophysical surveys (WGS), the productive interval is recommended for testing as oil-saturated.

During the first day of well development, the installation of underground equipment was performed with a jet pump, and the assembly was lowered on tubing into the planned well interval according to the scheme shown in figure 7.

At 14:00-15:00, the packer was installed and pressure tested at 100 kgf/cm^2. The packer was found to be leak-proof. From 15:00 to 23:50, the well was being developed and surveyed for nine hours. Four development modes were used at operating pressures of 15-40 kgf/cm^2. The results are presented in table 2. Development was performed in formation PK_{1-7}, perforation intervals were as follows: 863-872, 873-875, 877-880 m.

Let us consider the second, third and fourth days of well development with by means of a jet pump. The pressure build-up was recorded for 25 hours until 01:20 on the third day.

From 01:20 to 07:20, the well was developed. Two development modes were implemented at operating pressures of 30-25 kgf/cm^2. The results are presented in table 2. The pressure build-up was recorded from 07:20 to 15:20. From 15:20 to 11:00 of the following day, the well was converted to a clay solution γ=1.2 g/cm^3. Then, the assembly was lifted and reservoir fluid samples were collected from under the filter. The well and jet pump operating modes are presented in table 4, 5. Oil inflow was obtained. The amount of hydrocarbons collected was 2.3 m^3. The data processing results are

Operating modes of well 91-R of the Russkoye field [21] — **Table 2**

Date	Strat time	End time	Duration hours, min	Working pressure kgf/cm^2	Flow rate m^3/day			Fluids	Sand content in the working fluid, dens	Accumulated sample, m^1
					fluids	oil	water			
23.10	14:30	15:00	0:30	100						
23.10	15:00	18:00	3:00	15	1.11	1.11	0.00	Technical water + oil	-	0.14
23.10	18:05	20:10	2:05	25	2.42	2.42	0.00	Technical water + oil	-	0.35
23.10	20:10	23:10	3:00	30	3.06	3.06	0.00	Technical water + oil	-	0.73
23.10	23:10	0:10	1:00	40	4.08	4.08	0.00	Technical water + oil	1.03	0.90
	24.10 0:10	25.10 1:20	25:10:00							
25.10	1:20	4:20	3:00	30	6.24	6.24	0.00	Technical water + oil	-	1.68
25.10	4:20	7:20	3:00	25	4.85	4.85	0.00	Technical water + oil	-	2.29
	25.10 7:20	25.10 15:20	8:00:00							

presented in tables 3-5 and figures 8-11.

The results of testing and interpretation of the obtained materials allow formulating the following conclusions. The obtained oil inflow has a density of 0.93 kg/m^3, dynamic viscosity of 182 cP, flow rate of 6.1 m^3/day with a depression of 21.5 kgf/cm^2. Reservoir pressure at a depth of 863 m is 81.85 kgf/cm^2, temperature is 16.7 °C, and reservoir pressure according to the pressure build-up curve was 83.19 kgf/cm^2. Hydraulic conductivity is 0.93 D*cm/cP. Permeability is 17.077 mD. Skin effect is 1.4 (reservoir properties of the near-wellbore zone of the formation are improved). The productivity coefficient was 0.13 m^3/day/kgf/cm^2. During the studies by means of a transient filtration method after recording the pressure recovery curve, an increase in well productivity was observed. The productivity coefficient according to the final studies was 0.19 m^3/day/kgf/cm^2. When creating a depression of 30.59 kgf/cm^2, the presence of sand in the working fluid was observed, with a content of 1.03 g/l. With a subsequent decrease in depression to 21.45 kgf/cm^2, sand removal ceased.

Table 3

Results of the research during the development of well R-91 [21]

Working pressure kgf/cm^2	Operating mode time, hours	Pressure kgf/cm^2			Depression, kgf/cm^2	Flow rate m^3/day			Productivity m^3/day/kgf/cm^2	Sand/water content gr/l	Formation temperature, °C	Permeability, D	Skin-factor
		Pbh	Pf.meas.	Pf.calc.		fluids	oil	water					
15	3:00	76.00			7.19	1.1	1.1	0.0	0.13	-	16.68	0.017	-1.4
25	2:05	66.60			16.59	2.4	2.4	0.0		-	16.67		
30	3:00	61.22			21.97	3.1	3.1	0.0		-	16.76		
40	1:00	52.60			30.59	4.1	4.1	0.0		1.03	16.80		
КВД	25:10		81.84	83.19		-					16.66		
30	3:00	61.74			21.45	6.2	6.2	0.0	0.19	-	16.88		
25	3:00	69.15			14.04	4.9	4.9	0.0		-	16.88		
КВД	8:00		79.89								16.84		

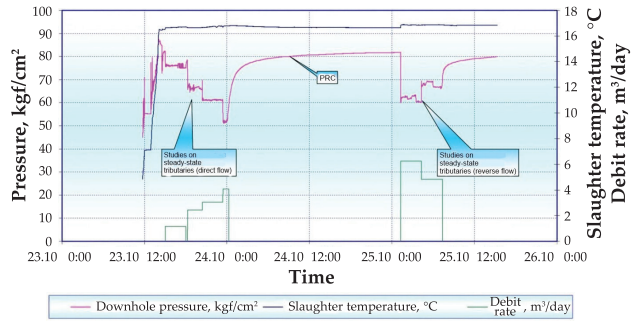

Fig. 8. Diagram of change in bottomhole pressure and temperature [21]

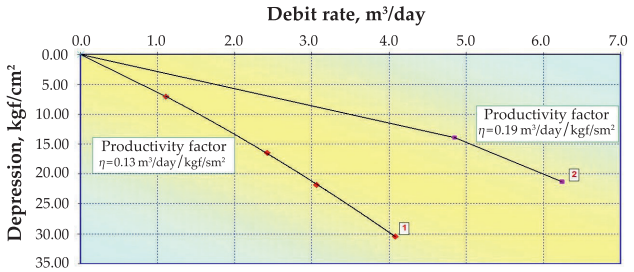

Fig. 9. Indicator diagram: well R-91 [21]

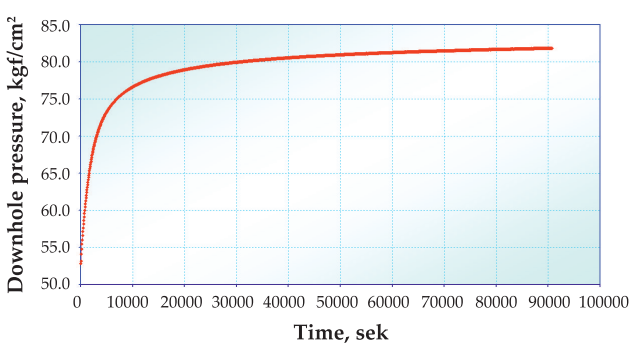

Fig. 10. Change in bottomhole pressure during pressure build-up, which was recorded over 27 hours: Russkoye field, well 91-R, formation PK1-7, perforation interval 863–872, 873–875, 877–880 m [21]

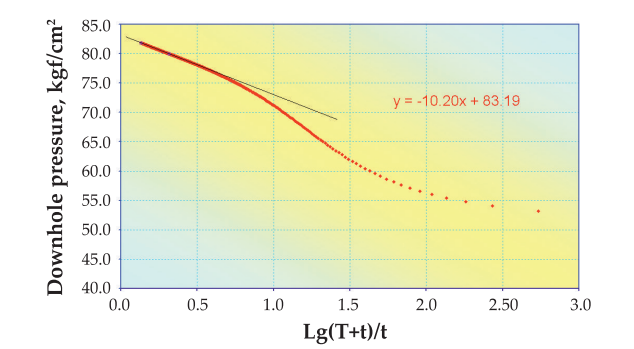

Fig. 11. Pressure recovery curve: Russkoe field, well 91-R, formation PK1-7, perforation 863 – 872, 873 – 875, 877 – 880 m [21] (processing by D. Horner's method, recorded over 27 hours)

The technical result of the invention under consideration is the expansion of operational capabilities and reduction of the time required to develop the well [21].

All further calculations are performed taking into account the implementation of the patented innovation with the current status. The additional cash inflows to a licensee are assumed to be due to an increase in the flow rate. The information available to the patent holders allows assuming that the increase in profit from the sale of additionally received products can be accepted at the level of 6 mln rubles per year

Table 4
Results of the research during the development of well R-91 [21]

Oil field	Russkoye
Well	91-P
Layer	$П к_{1-7}$
Perforation interval	863 – 872, 873 – 875, 877 – 880 m
Date	24.10-25.10.
Total research time PRC, hour	25:10
Number of instrument runs	1
Depth of measurement, m	864
Temperature at the depth of measurement, °C	16.7
Manometer	МИКОН-107-03 №1840
Data for calculations	
Flow rate before shutdown, m³/day	Q=4.1
Time of well operation with constant flow rate before shutdown, sec	T=32400
Effective formation thickness, cm	h=10000
Oil volumetric coefficient	b_o=1.1
Oil density, t/m³	ρ=0.94
Oil viscosity, cP	μ_o=183
Wellbore radius by bit, cm	r_w=11
Calculation of parameters:	
Tangent of the angle of inclination of the tangent	i=tg α=10.196
Formation pressure, measured by PRC, kgf/cm²	$P_{f.meas.}$=83.19
Hydraulic conductivity, Dcm/cP	ε=2.12 Qb_0/i=0.933
Formation permeability, D	$k=\mu\varepsilon/h$=0.017077
Skin-factor	S=1.151 ($P_{max/i}$–lgT)= = -1.40

Table 6
Initial data for performing calculations

Indicator	Units of measurement	Value
Additional profit	rub.	6000000
The tax rate paid on the profit received [10]	%	25
Contribution of intangible assets	%	35
Fees associated with maintaining the right protection in force [23]:		
for the 9th year (conditionally)	rub.	6000
for the 10th year (conditionally)	rub.	6000
for the 11th year (conditionally)	rub.	8000
Bid discounting	%	28

Table 5
Data from processing PRC by means of D. Horner's method [21]

t, sec	Pressure, kgf/cm²	$\lg\frac{T+t}{t}$	ΔP, kgf/cm²
0	52.85		
60	53.17	2.73320	0.320
120	54.11	2.43297	1.260
180	54.81	2.25768	1.960
240	55.45	2.13354	2.600
300	56.04	203743	3.190
360	56.60	1.95904	3.750
420	57.15	1.89289	4.300
480	57.66	1.83569	4.810
540	58.15	1.78533	5.300
600	58.65	1.74036	5.800
660	59.12	1.69976	6.270
720	59.57	1.66276	6.720
780	60.02	1.62878	7.170
840	60.44	1.59738	7.590
900	60.85	1.56820	8.000
960	61.26	1.54095	8.410
1020	61.66	1.51541	8.810
1080	62.04	1.49136	9.190
1140	62.41	1.46866	9.560
1200	62.78	1.44716	9.930
1260	63.13	1.42674	10.280
1320	63.47	1.40731	10.620
1380	63.80	1.38878	10.950
1440	64.13	1.37107	11.280
1500	64.44	1.35411	11.590
1560	64.74	1.33784	11.890
1620	65.03	1.32222	12.180
1680	65.32	1.30719	12.470
1740	65.60	1.29271	12.750
1800	65.87	1.27875	13.020
1860	66.12	1.26527	13.270
1920	66.39	1.25225	13.540
1980	66.64	1.23964	13.790
2040	66.88	1.22743	14.030
2100	67.11	1.21560	14.260
2160	67.34	1.20412	14.490
2220	67.56	1.19297	14.710
2280	67.78	1.18214	14.930
2340	67.97	1.17161	15.120
2400	68.17	1.16137	15.320
2460	68.37	1.15139	15.520

for the useful life period of the intangible asset in question (3 years).

For clarity, we present the initial data in table 6.

According to the information provided in figures 4-6, we establish the values of the coefficients based on the technical and technological characteristics of the intangible asset under consideration.

Let's calculate the cost of a patented development.

In figure 12 we consider the dynamics of a current monetary equivalent of the licensor's financial inflows.

Table 7

Values of coefficients based on technical and technological characteristics of the intangible asset under consideration

Indicator	Value
K_1	0.7
K_2	0.6
K_3	0.8
Δ	0.336

Table 8

Calculation of the cost of patented development

Indicator	Units of measurement	Forecast period		
		2025	2026	2027
Additional profit	rub.	6000000	6000000	6000000
Quantitatively expressed share of a licensor in the additional financial inflows to a licensee	rub.	2016000	2016000	2016000
Licensor›s income from the use of an intangible asset	rub.	604800	604800	604800
Fees associated with maintaining legal protection in force	rub.	6000	6000	8000
Licensor›s income from the use of an intangible asset	rub.	598800	598800	596800
Expenses for tax paid on profit received	rub.	149700	149700	149200
Net profit	rub.	449100	449100	447600
Discounting	-	by the end of the year		
Discounted net profit	rub.	350860	274110	213430
The result of the implementation of an intangible asset for a licensor (cumulative total)	rub.	350860	624970	838400
Cost equivalent of exclusive rights to an intangible asset (taking into account rounding)	rub.	840000	-	-

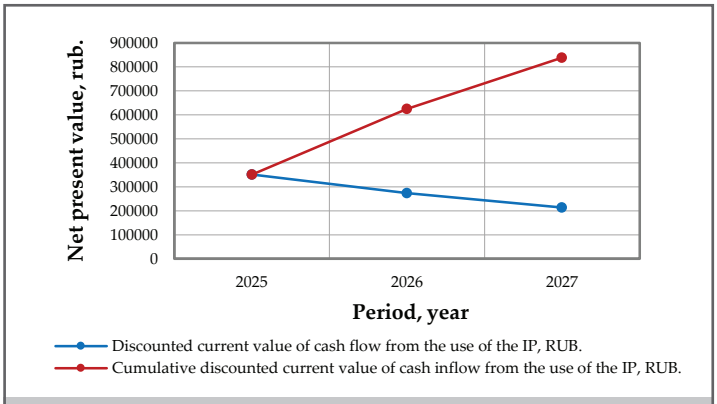

Fig. 12. Dynamics of a current monetary equivalent of licensor's financial inflows

Conclusions

1. In modern economic conditions, the management of intangible assets is a key element of the corporate governance system of economic entities focused on the production and use of various types of innovative equipment and technologies. Thus, achieving the strategic goals of economic entities in the oil and gas industry, including a steady increase in competitiveness and market capitalization, is only possible in case of organizing an effective management system of intangible assets.
2. The practical value of the methodological approach proposed in the article to perform calculations with the purpose to establish the cost equivalent which an intangible asset can be sold for in a competitive market consists in the fact that it can be applied for all patented developments related to jet technology

used in oil and gas production to generate foam or aerated liquids. It should be also noted that the possibility of applying the methodological approach under consideration to other types of patents related to the oil and gas industry, subject to the introduction of empirical amendments to the justification of the values of the coefficients K_1, K_2 and K_3, shown in figures 4-6.

3. The use of the proposed methodology will allow taking into account the full range of specific features of the implementation of a separate intangible asset into the production process. From the point of view of the authors, the methodological approach described in this article makes it possible to use the primary indicators in calculations which affect the cost of intangible assets, contributing to the increase in profits by a licensee during the development of oil and gas wells by means of jet technology.

References

1. Mazur, N. Z., Popova, N. V., Demyanets, E. A. (2024). The value of intangible assets of enterprises of the Russian Federation. *VKO-Intellect LLC*. https://www.vko-intellekt.ru/media-center/velichina-nematerialnyh-aktivov-predpriyatij-rossii/

2. Kryukov, V. A., Tokarev, A. N. (2021). Analysis of the knowledge base in the oil and gas sector in Russia: patents for inventions. *Voprosy Ekonomiki*, 3, 84-99.

3. Ayerbe, C., Azzam, J., Boussetta, S., et al. (2023). Revisiting the consequences of loans secured by patents on technological firms' intellectual property and innovation strategies. *Research Policy*, 52(8), 104824.

4. Cappelli, R., Corsino, M., Laursen, K., et al. (2023). Technological competition and patent strategy: protecting innovation, preempting rivals and defending the freedom to operate. *Research Policy*, 52(6), 104785.

5. Li, L., Xin, D., Yang, X., et al. (2025). How does patent portfolio structure affect patent value in different technological environments? Evidence from Chinese high-tech industries. *Technological Forecasting and Social Change*, 215, 124127.

6. Arora, A., Cohen, W., Lee, H., et al. (2023). Invention value, inventive capability and the large firm advantage. *Research Policy*, 52(1), 104650.

7. (2024). Global Innovation Index. WIPO. https://www.wipo.int/edocs/pubdocs/ru/wipo-pub-2000-2022-exec-ru-global-innovation-index-2022-15th-edition.pdf

8. Kalinin, D. V., Pomulev, A. A. (2024). Analysis of the development of the intangible assets market: Russian and foreign realities. Humanities, *Socio-Economic and Social Sciences*, 4, 211-217.

9. (2024). Federal State Statistics Service. https://rosstat.gov

10. Tax Code of the Russian Federation. Part two: official text according to Federal Law of 05.08.2000 No. 117-FZ. https://www.nalog.gov.ru/html/sites/www.eng.nalog.ru/Tax%20Code%20Part%20Two.pdf

11. Kartskhia, A. A. (2015). Intellectual property rights and technology transfer (at oil and gas enterprises). *Moscow: Publishing Center of the Gubkin Russian State University of Oil and Gas.*

12. Civil Code of the Russian Federation. Part four: official text according to Federal Law of 18.12.2006 No. 230-FZ. https://new.fips.ru/upload/medialibrary/Doc_Content/4-civil-code-of-the-russian-federation-part-four.pdf.

13. Volynets-Russet, E. Ya. (1992). Domestic and foreign trade in inventions and know-how under licensing agreements. Book 1. *Moscow: INTERAC.*

14. Kaverzin, S. A., Akopov, A. S. (2023). Methodological aspects of calculating the cost of exclusive rights to intellectual property in the oil and gas industry. *Problems of Economics and Management of the Oil and Gas Complex*, 2(218), 24-33.

15. Order of the Ministry of Economic Development of Russia dated 14.04.2022 No. 200 «On approval of federal valuation standards and on amendments to someorders of the Ministry of Economic Development of Russia on federal valuation standards». https://www.wipo.int/wipolex/en/legislation/details/21858.

16. Leontiev, B. B., Mamadzhanov, H. A. (2012). Evaluation of intangible assets of high-tech enterprises. *Moscow: INITs «PATENT».*

17. Baruch, L. (2001). Intangibles: management, measuring and reporting. *Brookings Institution Press.*

18. Lekarkina, N. K. (2017). Application of income approach methods to assess intellectual property. *Economic Scientific Journal «Investment Assessment»*, 1(5), 21-34.

19. Zubareva, V. D., Gradus, A. E., Martynova, O. A. (2020). Development of methods for assessing the value of a business. *Problems of Economics and Management of the Oil and Gas Complex*, 4(184), 26-29.

20. Smith, G. V., Parr, R. L. (2000). Valuation of intellectual property and intangible assets. 3rd Edition. *John Willey & Sons Inc.*

21. Verisokin, A. E. (2022). Development of a set of technical means and technological solutions for hydraulic fracturing and development of oil wells. PhD Thesis. *Stavropol: North Caucasus Federal University*.

22. Shlein, G. A., Chernov, E., Yu., Semenenko, G. D., et al. (2017). Method for development, well research and stimulation of oil and gas inflows and device for its implementation. *RU Patent 2131023.*

23. (2008). Decision of the Government of the Russian Federation No. 941 of December 10. (As amended up to Decision of the Government No. 1676 of October 13, 2020). *Russian Federation*.