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Risks

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## Article

# Determining Economic Security of a Business Based on Valuation of Intangible Assets according to the International Valuation Standards (IVS)

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**Abstract:** This work considered the economic security of an enterprise with regard to the valuation of intangible assets according to the International Valuation Standards (IVS). This study is essential due to a growing number of companies with intangible assets (trademarks, patents, know-how, etc.) as their main value. This study included analysis of the impact created by the value of intangible assets and intellectual property on company capitalization and economic security plus a regression model. An algorithm was developed to determine the economic security of a business based on the valuation of intangible assets according to the IVS. The suggested algorithm can allow a company to manage its intangible assets effectively using the IVS, which, in turn, will provide the required level of economic security for further development and achievement of strategic goals by the business entity.

**Keywords:** economic security of companies; valuation of intangible assets and intellectual property; International Valuation Standards (IVS); legal disputes over intellectual rights

## 1. Introduction

The issues of providing business entities with economic security in a time when multiple internal and external threats are being faced are of top priority today. According to the World Intellectual Property Organization (WIPO), intellectual property accounts for over 75% of all earnings in the world economy ([World Intellectual Property Organization 2017](#)).

Companies are always investing in intangible assets and intellectual property in attempts to outrun their competitors ([World Intellectual Property Organization 2017](#)).

A considerable growth in the number of cases on the rights for intangible assets and intellectual property heard by the Court of Intellectual Rights of the Russian Federation is evidence of growing losses caused by the violation of rights in this sphere. According to the latest survey of the cases related to settling disputes on intellectual rights, 742 cases of this category were considered in 2018 in Russia, with 710 of them being about providing or terminating legal protection of the results of intellectual activity and means of identification. The growth rates as of the first six month of 2019 amounted to 14.5% against the same period of the previous year ([Superior Court of Arbitration 2018](#)).

According to the statistics of the United States District Courts, the total number of cases on copyright, patents, or trademarks was 12,268 in 2019, while in 1990 the number of cases was 5700 ([Courts 2019](#)).

This is due to the fact that the internal structure of economic security of any business entity includes three primary components: economic independence, economic resilience and self-development ([Radyukova and Shamaev 2011](#)).

At present, there are many different approaches that are based on the assessment of individual components of the security of a company's activities, and there is no structured methodology that includes intangible assets and intellectual property.

The purpose of the study was to develop an algorithm to determine the economic security of businesses based on valuation of intangible assets in accordance with the IVS.

In order to accomplish the purpose of the study, the following objectives were set:

- Based on literature review, to define the position of intangible assets in the activities of economic entities and the availability of approaches that can be used to assess the impact of intangible assets and intellectual property on economic security of companies;
- To consider the impact produced by intangible assets on the value and economic security of business entities;
- To develop methodology to determine the economic security of a business based on the valuation of intangible assets using the IVS.

The paper is structured as follows: literature review, description of the applied models and methods, substantiation of the applied data, specification of the research results and reliability analysis of the calculated research results. The paper also details an algorithm for determining the economic security of businesses based on the valuation of intangible assets according to the IVS, along with discussion of the results and conclusion.

## 2. Literature Review

A universal algorithm for determining the economic security of enterprises based on intellectual property has not been developed so far. Starting from the 1980s, foreign scholars conducted major scientific research on the whole range of questions related to the role of intellectual capital for business development. They note a considerable effect produced by intangible assets on company security (Barth et al. 2001). American economists V. Andonova and Ruiz-Pava highlight that companies are highly dependent on their intangible assets. The authors also conclude that intangible assets are a major factor in the productivity of enterprises and determine their competitive advantages in the external environment (Andonova and Guillermo 2016). According to the International Valuation Standards 2020, section IVS 210, an intangible asset is defined as: "a non-monetary asset that manifests itself by its economic properties. It does not have physical substance but grants rights and/or economic benefits to its owner".

Tsai et al. (2016) present a study that is based on comparison of various types of machine learning for intangible assets. Clausen and Hirth (2016) in their work introduce a profit indicator, related to the value of intangible assets based on the productivity of intangible assets. Gu and Li (2015) in their study investigate the matters related to investing in companies based on intangible assets. Vasconcelos et al. (2019) presented work aimed at studying the relationship between the intangible assets, macroeconomic environment and market value of public companies in Germany, the UK and Portugal. They also investigated the impact of intangible assets on the market value of companies using sensitivity tests. In their research, the authors Montresor and Vezzani (2016) highlight the innovative impact of intangible investments and claim that via intangible investments companies acquire knowledge assets that increase their innovativeness. Matos et al. (2018) formulated a hypothesis that future results of many companies will depend on intangible assets. They carried out analysis of intangible assets for a number of European Union countries.

The research by Basso et al. (2015) shows the contribution of intangible assets in the creation of the value of companies using the methodology suggested by Gu and Li.

In his research, Nejati (2016) explains the main components of intangible assets, namely human capital, structural capital and relational capital.

Russell (2016) considers the intangible assets of pharmaceutical companies and compares the value of these assets in terms of their significance.

In their research, [Pastor et al. \(2017\)](#), [Bontis \(2001\)](#), [Bouteiller and Karyotis \(2010\)](#) and [Pastor et al. \(2017\)](#) carried out analysis and review of the literature dedicated to intangible assets and their valuation as well as the examples of methods that can be used to evaluate individual intangible assets. The work by [Plaskova et al. \(2019\)](#) carried out analysis, based on which a clear definition of an innovative asset as an element of an organization's intangible assets was given. Proposals were made to create a solid business image and investment attractiveness of an organization. Authors [Boj et al. \(2014\)](#) look at intangible assets and intellectual capital as the key drivers creating value and competitive advantages for organizations ([Rodionov et al. 2018a](#)) They suggest methodology for defining, measuring and managing the relevance of intangible assets in achieving the strategic goals of an organization ([Bouteiller and Karyotis 2010](#)).

In the method described by [Kaplan and Norton \(2004\)](#), a firm initiates the most important processes and determines human, information and organizational capital necessary for these processes ([Rodionov et al. 2018b](#)).

[Del Giudice and Paola \(2017\)](#) consider intangible assets and intellectual property from the perspective of the fact that they ensure competitiveness, prosperity and growth of the enterprise.

Based on the literature review it can be concluded that the issues concerning the impact created by intangible assets on economic security of companies have not been extensively studied to date. Moreover, not enough attention is paid to economic security on the basis of intangible assets.

According to the data presented in the survey conducted by Brand Finance GIFT, the Top 100 Companies by Total Intangible Value, among 100 large companies, more than 50 have intangible assets exceeding 90% of the value of the entire business. Examples of these companies are Johnson & Johnson, Visa Inc., The Procter & Gamble Co., Anheuser-Busch InBev., Comcast Corp., Mastercard Inc., Novartis AG, Amazon.com Inc., and Microsoft Corp. ([Brand Finance 2019](#)). Thus, many business entities carry out their activities only because they have trademarks, patents, new technologies, intangible assets and intellectual property ([Chernogorsky 2018](#)).

Accordingly, new R&D, advanced technologies and know-how are becoming more and more actively involved in business processes, which increases the importance of intellectual property and intangible assets, so determining economic security in this field is becoming increasingly important. At the same time, it was observed that to date no algorithm has been developed for determining the economic security of a business based on valuation of intangible assets in accordance with the IVS.

At present, there are many different approaches that are based on the assessment of individual components of the security of a company's activities.

In addition, it should be noted that the presented approaches do not have a structured methodology. Some proposed methods have the following disadvantages:

- There is no possibility of practical implementation due to the absence of assessment criteria or an established scale of values;
- There is no approach to assessing business security that would take into account all the components of the economic security of an enterprise;
- The assessment of the company's security is based only on the threats or risks of its implementation;
- Underestimation of the impact of intangible assets on the economic security of companies.

Accordingly, a distinctive feature of this study is the special attention paid to intangible assets and intellectual property and their impact on the economic security of companies.

### 3. Models and Methods

In the course of the study, we identified the parameters that could be used to judge the factors that affect the value and economic security of business entities.

The indicators of companies that are not interdependent act as factor characteristics,  $X$ . These characteristics include revenue, intangible assets, intellectual property, fixed assets, assets under construction, financial investments, current assets and long-term and short-term liabilities.

Capitalization or the value of business entities (the resulting characteristic,  $Y$ ) is understood as the product of the market value of one company's share (share price) and the number of shares in circulation.

The imbedded Excel package "Data Analysis" and statistics data analysis package "Stata" were used for modeling.

In the course of the study it was established that there is a ratio between the resulting indicator and variables. Its direction was defined, as well as the correlation ratio and adequacy of the model obtained, which implies the degree to which the theoretical model that was built to describe the relationship between the characteristics reflects the actual dependence between these characteristics, i.e., whether the model is practically admissible.

In order to check the presence of heteroscedasticity of random errors in the regression model obtained according to the initial values of the characteristics in logarithmic form, the White test was used. The test is based on checking a time series for heteroscedasticity.

An important accompanying problem is to verify the causal link between the time series of the factor and resulting characteristic, which was settled using the Granger causality test. The test can be used to answer the question: Is it true that change in the value of intangible assets and intellectual property ( $X$ ) will entail change in the company capitalization ( $Y$ )? It was checked using a linear regression model of  $Y$  values on previous  $X$  and  $Y$  values.

In other words,  $Y$  values are presented in the following form:

$$Y_i = u_i + \sum a_k y_{i-k} + \sum b_k x_{i-k} + E_i \quad (1)$$

$Y_i$  is the value of variable  $Y$  at time  $i$ ;

$X_i$  is the value of variable  $X$  at time  $i$ ;

$k$  is the time delay (in our case, a lag).

If in the regression obtained coefficients  $k$  of the formula can be neglected, it is believed that the previous  $X$  values do not help to predict  $Y$  and, consequently,  $X$  is not the cause of  $Y$  according to the Granger causality test.

Based on the model obtained, an algorithm determining the economic security of businesses was suggested. The uniqueness of the algorithm is in the fact that it unites all the basic functions of intangible assets and intellectual property that provide economic security. In addition, the algorithm is versatile and can be used by companies operating in different industries.

#### 4. Data

The largest companies were chosen as objects of the research, since they are clearly indicative representatives of the oil industry among Russian companies whose shares are listed on the stock market and that represent 90% of the market in the sector.

The analytical data posted on the official websites of Russian organizations formed the information basis for the research. The financial and economic indicators of the Russian companies whose shares are listed on the OJSC Moscow Stock Exchange and the Russian Trading System (RTS) were the empirical basis of the research.

In addition, the totality of indicators was determined from the existing indicators of the financial statements of the business entities over the last seven years for each company operating in the oil sector.

#### 5. Results

The results of the calculations and the regression model built for the oil industry are presented below.

### 5.1. Adequacy Analysis of the Calculated Research Results

The indicators of companies, which are not interdependent among themselves, are used as factor signs “ $x$ ”. These features are revenue, intangible assets, intellectual property, fixed assets, construction in progress, financial investments, current assets and long-term and short-term liabilities. By capitalization or the value of business entities (resultant attribute “ $Y$ ”) we mean the market value of one share of the company (share price) per the number of shares in circulation. Data from financial statements for the last five years were used for calculations. For this study, annual data were used.

The tightness of the relationship between linearly dependent features was determined using a linear correlation coefficient ( $r$ ), the calculation of which is automated using statistical data analysis packages. The linear model of pair regression between the value of intangible assets and company capitalization has the following form:

$$Y = -1.946987x_1 + 307.4673x_2 - 0.4629237x_3 - 2.445406x_4 - 0.4796452x_5 + 6.288961x_6 - 0.1429317x_7 - 103000000 \quad (2)$$

The regression coefficient under  $x$  shows that if the value of intangible assets and intellectual property increases, the market capitalization of the company increases too. Input data for the computational model are presented in Appendix A.

The model was checked for adequacy. The results presented in the Tables 1–4.

**Table 1.** Regression analysis data of the relationship between the value of intangible assets ( $x_2$ ) and the capitalization of Russian companies.

Source	Coefficient	Std. Error	t-Ratio	p-Value ( $p > t$ )
const	307.4673	52.09164	5.90	0.004
l_Int_rus	−1.03000000	5.4900000	−1.88	0.134

Thus, the result of 0.004 means that the hypothesis is confirmed as the result was less than 0.134.

**Table 2.** Regression analysis data of the relationship between the value of intangible assets and the capitalization of Russian companies.

Sum Squared Resid	43,566,000,000,000,000			
R-squared	0.9971	Adjusted R-squared	0.9922	
F(7, 6)	113.93	p-value (F)	0.0001	

Since the significance level  $ap$  ( $p$ -value), calculated for coefficients  $a_0$  and  $a_1$  is lower than the set significance level  $a = 0.01$ , both these coefficients are recognized as non-random (i.e., typical for the general population).

The value of the determination index  $R^2$  (R-squared in the table) is equally 0.9971. This value is over 0.5, which is evidence of the good approximation of the source (actual) data using the built linear function of relation.

**Table 3.** The regression output  $p$ -value of each variable.

Source	$p >  t $
x1	0.007
x2	0.004
x3	0.073
x4	0.095
x5	0.436
x6	0.001
x7	0.828
_cons	0.134

The adequacy of the regression model to the actual data was also established by Fisher's ratio test, which evaluates the statistical significance (non-randomness) of the determination index as typical, so the linear model of relation between characteristics X and Y is to a greater degree applicable to the general population of enterprises as a whole. Then, a heteroscedasticity test was used. The presence of heteroscedasticity leads to the following negative effects: the estimations of the standard errors of regression coefficients are displaced, the estimations of regression coefficients using the method of least squares are ineffective and *t*-statistics of regression coefficients are inadequate.

**Table 4.** The results of the heteroscedasticity test.

Source	chi2	df	p
Heteroscedasticity	12.00	11	0.3636
Skewness		7	
Kurtosis		1	
Total		19	

As a result of the test, it was revealed that in the majority of cases heteroscedasticity is satisfactory, so general statistical methods can be used.

According to the results of the test, it was concluded that the *p*-value is higher than the significance level chosen as 5% ( $0.3336 > 0.05$ ), so hypothesis zero about the lack of heteroscedasticity was not rejected, i.e., the random disturbance dispersion does not depend on X and the regression model (3) detailed above is homoscedastic. This proves the adequacy of the statistical valuations of the quality of the linear regression model. Calculations were made according to the Granger test for the period from 2013 to 2019 with the time lag being 1.

To study the directions of the causal relationships between the intangible assets and capitalization, the Granger test was used, where *x*1 is the intangible assets of the company. If it is  $> 0.05$ , it cannot be claimed that the hypothesis "A is NOT the Granger cause of B" is true. Thus, capitalization is dependent on intangible assets, since the coefficient is 0.224 and 0.997.

Typically, the Granger test tests two null hypotheses: "*x* is not the cause of *y* by Granger" and "(*Y* is not the cause of *X* by Granger". The *p*-values are small, so we accept the hypothesis that X1 is the Granger cause of Y1. Further, when the situation is reversed, *p*-values are greater than 0.05; therefore, we reject the hypothesis that Y1 is the Granger cause for X1.

According to the above information it can be concluded that despite industry specific features, which affect the quantitative values of intangible assets and intellectual property, the value of business entities and their level of economic security are affected.

## 5.2. Algorithm to Determine Economic Security of a Business Based on Valuation of Intangible Assets According to the IVS

According to the results of the study, an algorithm was developed to determine the economic security of businesses. This algorithm is based on a multi-stage comprehensive analysis of intangible assets and intellectual property.

As an example, one of the large oil companies represented on the Russian market was considered. At the first stage the company performance was preliminarily analyzed considering the specifics of the sector where it operates. The performance analysis was carried out on the example of the Neft Y company, for which indicators for the period 2017–2019 were analyzed. The main indicators of the financial status and performance of Neft Y were selected and grouped according to the qualitative characteristics in the period analyzed.

The company performance is defined by the following indicators:

- The net assets exceed the equity capital, and an increase in the net assets was observed during the analyzed period;



- A positive change in the organization's own capital in relation to the total change in the organization's assets;
- A growth in revenue by 94.4% was observed during the analyzed period;
- The share of self-cost in revenue was 91.08–93.49 % during the analyzed period;
- Profits grew by 49% during the analyzed period, and net profit was obtained (2,366,408 thousand rubles);
- A growth in fixed assets and intangible assets was observed;
- Borrowed money is actively used in the company's operations.

Based on the above analysis, it can be concluded that positive dynamics of the main indicators (revenue, net profit) are observed in the performance of Neft Y. The company actively involves intangible assets in its operations.

At the second stage, more profound analysis of the indicators was carried out.

Firstly, in Block 1 we analyzed the existing intangible assets, including the rights for the results of intellectual activity that are not accounted for in books, as well as the efficiency of the intangible assets management system of the business entity. According to the conducted analysis, Neft Y has the following intangible assets: a license for exploration and production of raw hydrocarbons and a patent. Thus, intangible assets are applied in the operations of the company, which allows it to use new technologies and explore deposits for producing raw hydrocarbons.

In Block 2, investments were calculated.

In this block, investments in intangible assets and intellectual property were calculated. The value of intangible assets and intellectual property was calculated according to the IVS to achieve a high quality of calculations along with transparency and reliability. Since Neft Y acquired a new license for exploration and production of raw hydrocarbons, the value of the required investments was estimated, as detailed in Section 5.

In Block 3 the sources of the effect were analyzed.

In order to determine the source of the effect (benefits, profits) from using intangible assets and intellectual property, it is important to carry out a comprehensive study, which represents a legal and engineering study.

The legal study includes defining the title documents based on which the rights for intellectual property are vested.

In the engineering study, the quantitative and qualitative technological and engineering characteristics and parameters of the goods produced due to the presence of intellectual property are established.

When the sources of the effect were analyzed, the following intangible assets were identified for Neft Y: a license for exploration and production of raw hydrocarbons and a patent for a gravel filter. The patent is a title document. The invention is specific to the oil and gas industry and can be used to install gravel filters and to overhaul boreholes. The validity period of the patent is 20 years. Neft Y has a registered trademark, which is not accounted for in books. Thus, the trademark of Neft Y can be accounted for in books according to the market value.

Stage 3.1. Using intangible assets in business activities (calculating the annual income from using them). In this case it is assumed that the business entity is the holder of exclusive rights due to which the business entity has a right to produce unique goods and services.

Stage 3.2. Using intangible assets in commercial turnover, license for intangible assets. According to the license contract, the holder of the exclusive right (licensor) grants the other party (licensee) the right to use the intellectual property. The transfer of non-exclusive rights is another source of income from applying intellectual property.

Neft Y has not made license contracts so far but plans to consider the possibility of granting non-exclusive rights for the use of the patent for the gravel filter.

Stage 3.3. Using intangible assets when exclusive rights belong to three parties. In this case the business entity uses intangible assets in its activities that belong to the right of use of a non-exclusive



license. Prior to making a license contract, a feasibility study has to be conducted to make sure it is reasonable to conclude this contract and to adequately calculate the price of the right of use.

Neft Y lacks such contracts, so no analysis was performed at this stage.

Stage 3.4. Using intangible assets as a collateral for attracting investments.

A mandatory condition for collateral is the state registration of the above list of assets. In order to obtain the collateral, the market value of the asset has to be defined. In this case, special attention must be paid to the quality of the valuation report, which will be used as a basis for taking a decision about the collateral. It is the IVS that ensure the quality, transparency, fairness and reliability of the valuation. This is extremely important for taking investment decisions and for the purposes of collateral. The registered trademark and the patent for the gravel filter can be the subject of collateral for the Neft Y company.

Stage 3.5. Using intangible assets to make a payment in the business entity's equity capital.

Exclusive rights for intangible assets can be introduced into the company's equity capital. All intangible assets are introduced into the equity capital of the business entity at market value calculated in the valuation report that is prepared according to the IVS. Increasing the equity capital helps to attract investments for the activities of the company.

In Block 4 the current expenses of the business entity were analyzed.

Stage 4.1. Analysis and calculation of patent taxes to maintain the patent in force.

Stage 4.2. Tax analysis and calculation.

Periodic (current) payments for the use of rights for the results of intellectual activity and rights for individualization means (in particular, the rights emerging from patents for inventions, useful models, industrial samples) are included in the composition of the company's expenses. Thus, due to an increase in expenses, the size of the profit tax goes down.

In addition to the income obtained by business entities due to intangible assets, it is reasonable to account for the tax benefits for the rights holder.

Tax benefits include reduction in the amounts of taxes and an effective increase in the cash flow of the business entity. For some objectives of valuation, such as financial statements, the tax benefit from depreciation should be included in the valuation when applying the income approach to intangible assets ([International Valuation Standards 2020](#)).

Thus, intangible assets give the company real tax benefits due to depreciation, which is in many tax jurisdictions. The calculation of results are presented in the Table 5.

**Table 5.** The profit tax calculated prior to and after the intangible assets were accounted for and depreciated.

Item	2019 (without Accounting for the License for Intangible Assets)	2019 (Accounting for the License for Intangible Assets)
Revenue from selling goods, products, work and services (in current prices), thousand rubles	41,785,958	41,785,958
Full self-cost of sold goods, work, services, thousand rubles	38,666,550	38,761,413
Depreciation of fixed assets	118,266	118,266
Depreciation of intangible assets	50	94,913
Earnings before interest and tax (EBIT)	2,958,010	2,863,147
Profit tax, thousand rubles	591,602	572,629
Difference in profit tax for one year including and excluding the depreciation of intangible assets, thousand rubles		18,973

Compiled by the authors.

Thus, the profit tax due to the depreciation of the business entity's intangible assets can be 18,973 thousand rubles lower per year.

#### Stage 4.3. Analyzing and calculating royalty fees.

The company paying royalty fees to the authors for using intellectual property is one of the most important issues. Royalty fees were not calculated in this study because the company lacks patents wherein the authors have the right to receive royalty fees.

#### Stage 4.4. Analyzing and calculating payments under license contracts.

Payments under license contracts can be defined by one of the following options: royalties (payments represent a percentage of the licensee's revenue from the products sold), a lump sum payment (a single payment, which represents a fixed amount) and a combined payment (part of the amount is paid in one installment, and the second part represents payments in form of royalties).

#### Stage 4.5. Expenses related to risks in the sphere of intellectual rights (legal expenses).

Legal expenses in the sphere of patent disputes can amount to substantial costs that business entities bear in case of litigation. These expenses arise if legal disputes are dealt with.

#### Stage 4.6. Expenses related to loan payments in case intangible assets are used as collateral.

In this case, expenses related to payment interest on loans arise only if the business entity has a loan and occur according to the terms of the contract.

In Block 5 the value of the effect was calculated.

The effect from intangible assets and intellectual property can be expressed in the ways described below.

Stage 5.1. Calculating the market value of intangible assets. The market value of the asset is determined according to the IVS. The calculation of the market value of the license for production of raw hydrocarbons is presented as an example in Section 6 and Table 7.

#### Stage 5.2. Calculating the profits from using intangible assets and intellectual property.

Earnings from the use of intangible assets and intellectual property can be formed by regular royalty payments, depreciation deductions of intangible assets, tax benefits and collateral benefits.

Receiving regular royalty fees is possible in case a license contract is made to transfer non-exclusive right of use of the patent for the gravel filter. In case the license contract is concluded, Neft Y can receive annual income amounting to, on average, 1.91% from the earnings formed with the application of the above patent. Thus, if a medium company in the oil and gas sector applies the patent, it can bring the holder of the exclusive ownership rights 612,350 thousand rubles, on average, with the average earnings being 32,103,215 thousand rubles and the average value of the royalty rate being 1.91%.

Below is given the calculation of the amount of license fee for use of the patent for one year Table 6.

**Table 6.** The calculated royalty rate (annual payment).

Name	2017	2018	2019
Revenue	21,495,399	33,028,289	41,785,958
Gross profit	1,917,073	2,148,678	3,119,408
Pe = (Gross profit/Revenue), %	8.92%	6.51%	7.47%
The average value of Pe		7.63%	
Licensor's share in the licensee's profit		25%	
Royalty rate $R = D \times \frac{P_e}{1+P_e}$		1.91%	

Compiled by the authors.

## 6. Valuation of Intangible Assets According to the IVS

In order to implement the algorithm determining the economic security of a business at the investment stage, it is necessary to appraise the investments required for acquiring or creating intellectual property and intangible assets.

The market value of the intellectual property and intangible assets is determined according to the IVS. The IVS are key guidelines for carrying out qualitative valuation all over the world. Applying the IVS gives us a high quality, reliable assessment which is internationally recognized (IVSC 2020).

The market value of the license for the right to produce raw hydrocarbons for Neft Y based on IVS 210 Intangible Assets (IVS 210 Intangible Assets) was calculated using a comparative approach.

According to the IVS, corrections were introduced into the calculations to reflect the specific features of the intangible assets that were evaluated. The method of comparative transactions was used in terms of the comparative approach according to IVS 210 (IVS 210).

In order to estimate the interest discount of Urals oil price to Brent oil price on the markets of Western Europe and the USA, the average level of oil prices for the period 2012 through 2018 was used. The average value according to agency Platts was 1.2%. The average oil prices were according to the source <https://ru.investing.com>.

The average value of the specific indicator of the resource value (price of the license/recoverable resources) was calculated based on the results of the tenders and auctions for obtaining licenses for exploration and production of raw hydrocarbons ([www.torgi.gov.ru](http://www.torgi.gov.ru)). The average Urals oil price on the world market as of the tender/auction date was used in the calculations.

After the calculations were made, the corrected value of the stock was 85.957 rub./t. The calculation of results are presented in the Table 7.

**Table 7.** The results of the calculated market value of the license.

Deposit	The Quantity of Resources by Category C1 as of 30 March 2020, thousand t	The Quantity of Resources by Category C2 as of 30 March 2019, thousand t	Data on the Extracted Oil Since 30 March 2020 till the Valuation Date, thousand t	Extracted Oil Resources as of the Valuation Date, Reduced to Category C1, thousand t	Corrected Value of Resources, rub./t	Market Value of Resources as of the Valuation Date, thousand rub.
Deposits (investments of Neft Y)	54,717	986	0	55,210.0	85.957	4,745,665
Total:	54,717	986	0	55,210.0		4,745,665

Source: data of the customer, authors' own calculations.

An algorithm for determining the value of intangible assets according to the IVS is presented above. It was considered on the example of Neft Y and represents a sequence of actions to be taken to determine the value of the license for production of raw hydrocarbons. This structure is part of the algorithm for determining economic security of a business, because intangible assets are one of the major components that provide economic security of economic entities.

## 7. Discussion and Conclusions

This study analyzed the impact that the value of intangible assets and intellectual property has on capitalization of companies and their level of economic security, based on calculated values. The study relies on pair correlation relationships between the factor and performance characteristics. The impact of revenue, intangible assets, intellectual property, fixed assets, assets under construction, financial investments, current assets and long-term and short-term liabilities was analyzed.

The calculated results of the study are presented for the example of the oil and gas sector. The effect of intangible assets and intellectual property on the company value and economic security were determined.

An algorithm was developed to determine economic security based on valuation of intangible assets according to the IVS. It includes the entire cycle of the enterprise's use of intangible assets and intellectual property to calculate economic security. The algorithm includes analysis of the business entity's activities, which consists of two stages (preliminary analysis and in-depth analysis of indicators). Five interrelated blocks are presented: 1—analysis of the intangible assets and intellectual property existing in the enterprise; 2—calculation of the investments necessary for intangible assets and intellectual property; 3—analysis of the sources of the effect (possible earnings from the intangible assets and intellectual property are identified as well as the ways they can be used to attract investments in the company and increase the value of the company's assets); 4—possible expenses of the business

entity, as well as the possible options for reducing them. This section presents possible benefits in terms of profit tax due to depreciation deductions on the company's intangible assets. Thus, in the presented algorithm, qualitative assessment of the value of intangible assets and intellectual property according to the IVS is the major component revealing the economic security of business entities.

The multiple stages of the suggested algorithm make it versatile and suitable for application by companies that use intangible assets and intellectual property to different extents.

The uniqueness of the presented algorithm is due to the fact that it contains a full set of stages to manage intangible assets and intellectual property within which the values of the assets are defined in accordance with the International Valuation Standards. This is an essential component of the algorithm that determines the economic security of businesses.

The algorithm can be used to evaluate the company's activities in a new way, to prevent risks and use new possibilities related to the application and valuation of intangible assets and intellectual property according to the IVS.

The practical significance of the research is that the results of the study may be used in the operations of modern companies that apply intangible assets and intellectual property in their activities to determine sustainable development and form an effective system for economic security management due to the use of intangible assets.

Further research will involve goodwill accounting and valuation according to the IVS aimed at determining the economic security of companies.

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## Appendix A

**Table A1.** Research results for the oil and gas industry (annual data, yearly data).

Name	Average Data Values for the Period 2012–2019 (Annual Data)			
	X1	X2	X3	X4
	Revenue, Thousand Rubles	Intangible Assets and Intellectual Property Assets (Results of Research and Development, Unfinished R&D), Thousand Rubles	Fixed Assets, Thousand Rubles	Unfinished Construction Objects, Thousand Rubles
PJSC “NK” LUKOIL “	289,492,597	949,960	13,404,602	1,828,806
PJSC “GAZPROM”	4,262,855,065	15,753,276.38	7,054,326,754	704,993,665.6
PJSC TATNEFT	527,673,919.3	1,573,121	182,396,433.4	69,466,968.75
PJSC ANK “Bashneft”	576,570,420.9	2,046,907.625	133,885,790	14,934,543.88
OJSC “Surgutneftegas”	1,081,006,001	663,165.625	760,351,258.4	701,595,646.4
PJSC “Varyeganneftegaz”	30,764,814.13	416,054.25	28,743,199.25	1,814,514.375
PJSC “Gazprom Neft”	1,386,778,553	2,602,433.25	4,521,554.875	1,424,129.875
PJSC “Saratov Oil Refinery”	13,138,640.13	48,927.125	14,435,942	2,895,163.625
JSC “Slavneft-YANOS”	26,025,383.38	113,698.5	38,464,365.5	4,252,928.75
JSC “YATEK”	4,832,172.25	547,987.125	7,218,803.375	3,093,899.375
PJSC “Transneft”	800,467,224.3	5,555,425.875	58,474,417.5	0
OJSC “Slavneft-Megionneftegaz”	148,234,764.8	564,772.75	79,140,407.13	8,773,602.125

**Table A2.** Research results for the oil and gas industry (annual data, yearly data).

Name	Average Data Values for the Period 2012–2019 (Annual Data)			
	X5	X6	X7	Y
	Financial Investments, Thousand Rubles	Current Assets, Thousand Rubles	Long-Term Liabilities, Thousand Rubles Short-Term Liabilities, Thousand Rubles	Short-Term Liabilities, Thousand Rubles
PJSC “NK” LUKOIL “	1,216,580,860	602,968,488	751,789,453	2,716,558,602
PJSC “GAZPROM”	2,650,084,376	2,230,145,862	3,674,378,484	3,680,639,431
PJSC TATNEFT	134,775,785.9	301,011,229.3	137,405,115.8	963,896,305
PJSC ANK “Bashneft”	284,629,828.3	199,385,990.5	253,651,130.5	372,745,599
OJSC “Surgutneftegas”	1,550,931,337	959,366,193.5	196,086,680.3	1,185,722,089
PJSC “Varyeganneftegaz”	370,500	5,661,556.375	12,541,222.88	12,968,679
PJSC “Gazprom Neft”	761,421,464	577,021,391	1,017,116,814	1,106,601,590
PJSC “Saratov Oil Refinery”	7016	10,919,966.63	6,889,963.875	9,359,777
JSC “Slavneft-YANOS”	4,042,305	17,082,490.13	27,459,440.63	26,003,573
JSC “YATEK”	1,873,254.5	3,708,462.5	7,323,651.375	12,648,765
PJSC “Transneft”	739,792,902.5	243,060,328.5	889,485,084.9	1,073,188,572
OJSC “Slavneft-Megionneftegaz”	14,063,027.25	82,743,736.13	68,577,707	65,391,992

Source of information: Financial statements of companies. Trading results.

**Table A3.** Research results for the oil and gas industry (annual data, yearly data).

Name	Indicator Value, Thousand Rubles			Change in Indicator	
	2017	2018	2019	Thousand Rubles (rp.4–rp.2)	±% ((4-2): 2)
Revenue	21,495,399	33,028,289	41,785,958	+20,290,559	+94.4
Expenses for ordinary activities	19,578,326	30,879,611	38,666,550	+19,088,224	+97.5
Share of expenses in revenue	91.08%	93.49%	92.53%	92.37%	
Profit (loss) from sales (1-2)	1,917,073	2,148,678	3,119,408	+1,202,335	+62.7
Other income and expenses, except for interest payable	31,616	−545,957	−161,398	−193,014	↓
Earnings before interest and tax (EBIT) (3 + 4)	1,948,689	1,602,721	2,958,010	+1,009,321	+51.8
Percentage to be paid	–	–	–	–	–
Change in tax assets and liabilities, income tax, etc.	−388,987	−419,949	−591,602	−244,410	↓
Net profit (loss) (5-6 + 7)	1,559,702	1,182,772	2,366,408	+764,911	

**Table A4.** Analysis of indicators of the company (annual data, yearly data).

Name	Indicator Value					
	in Thousand Rubles				in% to the Balance Currency	
	31 December 2016	31 December 2017	31 December 2018	31 December 2019	At the Beginning of the Analyzed Period (31 December 2016)	Final Analyzed Period (31 December 2019)
Fixed assets	3,148,338	3,010,241	3,481,836	5,913,312	27.4	30.2
Intangible assets	3200	2900	2700	2500	–	–
Inventory	1,711,525	2,375,860	3,658,070	3,040,297	14.9	15.5
Receivables	2,672,876	7,415,999	7,238,580	7,561,534	23.3	38.6
Cash and short-term financial investments	477	1,597,704	360	1,177,512	<0.1	6
Long-term liabilities, total including	296,364	323,625	502,022	852,148	2.6	4.3
Borrowed funds	–	–	–	–	–	–
Short-term liabilities *, total	4,559,180	8,603,374	10,704,511	6,678,911	39.7	34.1

\* Short-term, or current liabilities, are liabilities that are due within one year or less. They can include payroll expenses, rent, and accounts payable, money owed by a company to its customers.

## References

- Andonova, Veneta, and Ruíz-Pava Guillermo. 2016. The role of industry factors and intangible assets in company performance in Colombia. *Journal of Business Research* 69: 4377–84. [CrossRef]
- Barth, Mary E., Ron Kasznik, and Maureen F. McNichols. 2001. Analyst Coverage and Intangible Assets. *Journal of Accounting Research* 39: 1–34. [CrossRef]
- Basso, Leonardo Fernando Cruz, Juliana Albuquerque, Saliba de Oliveira, Herbert Kimura, and Erica Sumoyama Braune. 2015. The impact of intangibles on value creation: Comparative analysis of the Gu and Lev methodology for the United States software and hardware sector. *Investigaciones Europeas de Direccion y Economia de La Empresa* 21: 73–83. [CrossRef]
- Boj, Jorge Juan, Raul Rodriguez-Rodriguez, and Juan-Jose Alfaro-Saiz. 2014. An ANP-multi-criteria-based methodology to link intangible assets and organizational performance in a Balanced Scorecard context. *Decision Support Systems* 68: 98–110. [CrossRef]
- Bontis, Nick. 2001. Assessing knowledge assets: A review of the models used to measure intellectual capital. *International Journal of Management Reviews* 3: 41–60. [CrossRef]
- Bouteiller, Christophe, and Catherine Karyotis. 2010. The evaluation of intangibles: Introducing the optional capital. *Investment Management and Financial Innovations* 7: 85–92.
- Brand Finance. 2019. Global Intangible Finance Tracker. November, p. 34. Available online: [https://brandfinance.com/images/upload/gift\\_2.pdf](https://brandfinance.com/images/upload/gift_2.pdf) (accessed on 13 November 2019).
- Chernogorsky, Sergey. 2018. A Model of Economic Growth, Including Taxation and Public Sector. Available online: <https://elibrary.ru/item.asp?id=38654012> (accessed on 25 April 2018).
- Clausen, Saskia, and Stefan Hirth. 2016. Measuring the value of intangibles. *Journal of Corporate Finance* 40: 110–27. [CrossRef]
- Courts. 2019. *Annual Report, U.S. District Courts—Copyright, Patent, and Trademark Cases Filed During the 12-Month Periods Ending June 30, 1990, and September 30, 1995 Through 2019*. Washington: Federal Courts & the Public.
- Del Giudice, Vincenzo, and Piefrancesco De Paola. 2017. The value of intellectual capital in shipping companies. *Green Energy and Technology*, 231–39. [CrossRef]
- Gu, Feng, and John Q. Li. 2015. Innovation in information systems and valuation of intangibles. In *Intangibles, Market Failure and Innovation Performance*. Basel: Springer International Publishing, pp. 291–306. [CrossRef]
- International Valuation Standards. 2020. International Valuation Standards. Available online: [www.ivsc.org](http://www.ivsc.org) (accessed on 19 January 2020).
- IVSC. 2020. Nicholas Talbot, The International Valuation Standards Council, Article Covid-19 and the Valuation Profession. UK, March 2020. Available online: <https://www.ivsc.org/news/article/statement-in-relation-to-the-covid-19-pandemic> (accessed on 29 March 2020).
- Kaplan, Robert S., and David P. Norton. 2004. Measuring the Strategic Readiness of Intangible Assets. *Harvard Business Review* 82: 52–63. [PubMed]
- Matos, Florinda, Matos Oliveira, and Valter Vairinhos. 2018. The relation between companies' investments in intangibles and innovation. Paper presented at the European Conference on Knowledge Management, ECKM, Italy, Padua, September 7; vol. 1, pp. 545–54.
- Montresor, Sandro, and Antonio Vezzani. 2016. Intangible investments and innovation propensity: Evidence from the Innobarometer 2013. *Industry and Innovation* 23: 331–52. [CrossRef]
- Nejati, Ramin. 2016. Management of Intangible Assets A Value Enhancing Strategy in Knowledge Economy. *Research Journal of Humanities and Social Sciences* 7: 54. [CrossRef]
- Pastor, Damian, Josef Glova, Frantisek Lipták, and Viliam Kováč. 2017. Intangibles and methods for their valuation in financial terms: Literature review. *Intangible Capital* 13: 387–410. [CrossRef]
- Plaskova, Natalia Stepanova, Natalia Alekseevna Prodanova, Alexander Sergeevich Samusenko, Elmira Arsenova Erzinkyan, Karine Alexandrovna Barmuta, and Rustem Adamovich Shichiyakh. 2019. Investment decisions formation: Innovative assets. *International Journal of Engineering and Advanced Technology* 9: 2913–16. [CrossRef]
- Radyukova, Yana Yurievna Yu, and Ivan Nikolaevich Shamaev. 2011. As a multilevel system of elements and relationships. *Journal of Cleaner Production* 2: 194–98.

- Rodionov, Dmitry Grigorievich, Konnikov Evgeny Alexandrovich, and Konnikova Olga Nikolaevna. 2018a. Approaches to Ensuring the Sustainability of Industrial Enterprises of Different Technological Levels. *The Journal of Social Sciences Research* 3: 277–82. Available online: <https://ideas.repec.org/a/arp/tjssrr/2018p277-282.html>, (accessed on 19 January 2018).
- Rodionov, Dmitry Grigorievich, Tatiana J. Kudryavtseva, and Angi E. Skhvediani. 2018b. Human Development and Income Inequality as Factors of Regional Economic Growth. *European Research Studies Journal* XXI: 323–37. Available online: <https://ideas.repec.org/a/ers/journal/vxxiy2018ispecial2p323-337.html> (accessed on 19 June 2018).
- Russell, Marion. 2016. The Valuation of Pharmaceutical Intangibles and Drugs Mark Russell the University of Queensland. *Journal of Intellectual Capital* 17: 484–506. [CrossRef]
- Superior Court of Arbitration. 2018. *Report on Work Intellectual Property Court (First Instance)*. Moscow: Intellectual Property Court Russia.
- Tsai, Chih-Fong, Yu-Hsin Lu, Yu-Chung Hung, and David C. Yen. 2016. Intangible assets evaluation: The machine learning perspective. *Neurocomputing* 175: 110–20. [CrossRef]
- Vasconcelos, Thudichum, Dorian Forte, and Leonardo Fernando Cruz Basso. 2019. The impact of intangibles of German, English and Portuguese companies: From 1999 to 2016. *Revista de Administracao Mackenzie* 20. [CrossRef]
- World Intellectual Property Organization. 2017. *Intangible Capital in Global Value Chains*. Report. Geneva: World Intellectual Property Organization.

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