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**Nataliia Svishchova**

# DEVELOPMENT OF THE COMBINED APPROACH TO THE VALUATION OF INTELLECTUAL PROPERTY OBJECTS

*The object of this research is a combined approach to the valuation of intellectual property. The paper compares the traditional approaches to valuation: profitable, market and cost, and identified the shortcomings of each. During the work the methods of analysis and synthesis of scientific literature were used to highlight the disadvantages and advantages of traditional approaches, statistical and comparative methods for estimating the value of patents in one industry. Mathematical modeling was also used to develop the formula of the combined approach. Researchers raised the issue of determining the pricing factors that are taken into account when determining the calculation parameters and dependent coefficients of adjustment of the value of intellectual property. Researchers presented methodological recommendations for calculating the integrated coefficient of influence of qualitative and quantitative factors, taking into account the type of object and the features of standardized approaches to evaluation.*

*As a result of the analysis of approaches the improvement of the combined approach for definition of cost of object of intellectual property is offered. The development takes into account the purpose of the assessment and the availability of complete, reliable and objective information, as well as the affiliation of the intellectual property to a particular industry and the impact of technological development of this industry. On the basis of the proposed coefficients of adjustment of the value of intellectual property objects, the value of industrial property according to the patent of Ukraine UA85101 and some inventions of the power engineering industry of enterprises of Kharkiv region (Ukraine) was calculated. The best result for the patent owner of JSC «Ukrainian Energy Machines» are the calculations obtained on the basis of the combined approach, taking into account the traditional profit approach and the integrated coefficient. According to the studied model, the value of industrial property UA85101 is 26930 USD. These calculations assume the best economic effect of using the rights to this patent in the company, or obtaining income from the sale of a license for this patent using a lump sum or royalty. The practical applicability of the study allows industrial enterprises to assess the possibility of improving the efficiency of intellectual property management, which provides maximum benefit from the commercialization of innovations.*

**Keywords:** *industrial property, valuation of intellectual property, combined approach to valuation.*

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## 1. Introduction

Like any property, intellectual property (IP) has value. In the absence of an efficient technology market with a large number of buyers and sellers and free access to information, determining the market value of a technology is a difficult task. According to the law of value, operating in a market economy, the value of goods is determined by the amount of socially necessary labor spent on their production and sale. This can be applied to traditional tangible goods and this means that their market value is determined by the average cost of production borne on average by different producers of similar goods in the industry. There are traditional approaches to estimating the value of intangible assets based on costs incurred, projected future profits or comparison of objects analogous to the occupied market segment [1, 2]. There is a growing interest in investing in innovative technologies in the world. The ability not only to create a new product, but also to properly protect it in accordance with current legislation, evaluate, without loss, and apply with maximum profitability – the main issues of business leaders.

Japanese researchers have shown that the accumulation of high-quality patents can help new firms avoid bankruptcy in commodity markets, although the acquisition and protection of IP rights is expensive, especially for small firms, due to high fixed costs [3]. To date, any financial system related to IP does not actually conduct an objective and reliable assessment of IP to raise funds by providing technical advantages and patent rights [4]. It is proposed to generalize the methods of assessment of IP objects and to expand them by adapting to world

standards from the standpoint of their varieties, taking into account the processes of their creation, implementation, write-off and commercialization [5]. Therefore, the chosen topic is relevant in the global space of IP rights assessment.

*The object of this research* is a combined approach to the valuation of objects of intellectual property rights (IPR). And *the aim of research* is to develop a combined approach to IPR assessment, adjusted for the integrated coefficient of influence of qualitative and quantitative factors on the cost of IPR, taking into account the type of IPR and the features of standardized approaches to evaluation.

## 2. Research methodology

Methods of analysis and synthesis of scientific literature, statistical and comparative methods, as well as mathematical modeling were used during the work. Thus, it is established that the protective results of intellectual activity are individual in nature, are created by specific individuals and can not be measured by the amount spent on their creation of socially necessary labor [6]. The results of intellectual activity can be inventions, utility models, industrial designs, computer programs, databases, literary, musical and artistic works, etc. An individual talented inventor in a short time and at relatively low cost can make a scientific discovery or invention that has a pioneering, breakthrough character. Conversely, a large creative team can work for a long time to create an innovation that has a narrow scope. It is obvious that determining the value of these developments by the amount of costs incurred for their creation will not reflect their significance and will not be perceived by the market.

Thus, the cost approach does not correspond to the very nature of intellectual property as a special commodity and can not be used as a basis for determining the market value of its objects.

Another basis must be chosen to determine the market value of intellectual property. The chosen model should correspond to the diversity of IPR in different areas of activity, taking into account the life cycle, the degree of their use, novelty and determine their commercial and practical significance in relation to each other. It seems that such an objective criterion for allocating the market value of intellectual property should be the economic effect (income, profit), which the user of this property expects to receive over a period of time [7–9]. The market value of intellectual property for its various objects cannot be the same and calculated in advance. It will have a different meaning each time, taking into account the rights granted to the buyer to use it [10]. For different purposes and conditions of use of intellectual property in business, it is recommended to use a combined approach, which takes into account all three approaches to the valuation of property. The basis should be considered a profitable approach that corresponds to the nature and specificity of intellectual property as a special product of the market.

Set out in Table 1 comparative analysis allows to identify the advantages and disadvantages of each approach to evaluation for further formation and improvement of the combined approach.

Often available information on economic characteristics and conditions of sale is often unavailable or incomplete, so the application of a market approach can only outline the range in which the market value of the appraised object is likely to be [12–14]. Comparing the results of the evaluation carried out with the use of the cost approach, with the results obtained with the use of market and profit approaches can be a kind of indicator of the market. Yes, if the value of the appraised object in the cost approach is higher than that calculated in the other two approaches, it will mean that competition in the market is low and prices may increase in the near future. If on the contrary – it is possible to expect increased competition and lower prices.

**Table 1**

Advantages and limitations of existing approaches to IPR valuation

| Approaches | Most often applicable | Benefits | Limitation |
|---|---|---|---|
| *Cost approach* – a set of valuation methods based on the cost of reproducing the initial value of intellectual property as part of the intangible assets of the enterprise, taking into account their further improvement or replacement | For IPR, property rights to which are valued cannot make a profit immediately.<br>For unique IPR, which are sold very rarely or not at all.<br>Is the main in the case of determining the tax base | Use of primary accounting documentation.<br>Objective cost estimation.<br>High accuracy of price determination | It does not take into account a number of important factors (profit from commercialization, investment risks, income growth potential, etc.).<br>Costs incurred are not always accurately correlated with market success.<br>The need to accurately estimate the cost of creating a similar object of intellectual property and its depreciation under the condition of relative equilibrium of supply and demand in the market |
| *Comparative (market) approach* – a set of valuation methods based on determining the value of intellectual property by comparing with the value of analogues for which there is information about prices and conditions of patent agreements | When an efficient market is formed and there is access to a representative sales database of similar IPR.<br>For large-scale production and a developed target market segment | Based on real market conditions.<br>Reflects the current practice of buyer-seller relations | Difficulty in obtaining the source data, lack of access to the necessary information and understanding that there are no such IPR.<br>The need to amend taking into account existing trends.<br>Lack of coefficient n of future benefits.<br>The need to consider only transactions that meet the definition of market value, i. e. those that were in no way affected by non-market factors |
| *Income approach* – a set of valuation methods based on future income associated with the use of IPR | When the value of the appraised object can be equated with capital (investment of a certain size) | Takes into account expectations and future benefits.<br>Takes into account the contribution of IPR to the capital of the enterprise as a business asset | The difficulty of forecasting future benefits.<br>Subjectivity in the evaluation, as the evaluation is conducted by employees of the enterprise |

**Note:** compiled by the author based on [11]

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The use of the income approach in IPR estimates is associated with certain limitations, as it is difficult to make additional income due to lack of information on the use of IPR in licensed enterprises and during the calculation period [15, 16]. The buyer of the license often hides or creates such information in order to reduce the price of IPR during the coefficient n of the seller's commercial offer [17]. For this reason, the price of IPR calculated on the basis of a profitable approach may be uncompetitive compared to the real market price of a similar IPR.

The application of the income approach is associated with the need to have detailed data on the conditions of creation and coefficient n of a new facility based on IPR in the future (income, expenses, profit) for a long period. The required figures for calculations can be obtained only in the presence of a business plan, investment project or its feasibility study.

## 3. Research results and discussion

The proposed approaches to the economic evaluation of intellectual property do not fully cover the possibilities of evaluation. In addition, there is a need to take into account the rapid growth of technologies and the reduction of their useful life, and in general, the life cycle of intellectual property. There is a need to use an improved evaluation tool – a combined approach.

Ukrainian scholars provide the following wording: «The combined approach to determining the value of different IPs and intangible assets (ITA) integrates three main approaches (cost, income and market), each of which uses a unified set of valuation principles. Given the variety of specific characteristics of scientific and technical activities, areas and conditions of their use in practice, it is advisable to calculate the cost of IPR according to several methods based on the integrate coefficient n generalization of commercial attractiveness of IPR and their implementation» [18, 19].

The model of the combined approach to valuation determines the detail of calculations for other approaches, adjusted for the integrated coefficient, which is formed specifically for a particular IPR, taking into account the life cycle and type of IPR, security, implementation stage, etc. Mathematical approach can be mastered by the following formula:

$$B_{IPR}^{comb} = B_{IPR}^{j} \cdot K_{integr}^{i}, \quad (1)$$

where $B_{IPR}^{comb}$ – the cost of IPR in an integrated approach; $B_{IPR}^{j}$ – the value of IPR, obtained by income, cost or market approach; $K_{integr}^{i}$ – integrated coefficient of influence of qualitative and quantitative factors on the value of the assessed IPR.

As noted, the calculation of the value of IPR, patent or license for a specific scientific and technical development is to determine the amount of expected profit from its use based on the analysis of certain pricing factors, i. e. adjusting for selected coefficients. The procedure for calculating the integrated coefficient takes into account the division by type of IPR and the uniqueness of the initial approach to the evaluation of IPR, so for two specific IPR the number of selected coefficients can be quite different.

Accounting for pricing factors is carried out when determining the quantitative values of the parameters that are proposed to be included in the calculation formulas for the cost of IPR. Table 2 provides a list of calculation parameters and shows the pricing factors that should be taken into account when determining them for different IPRs.

The system of correction factors for adjusting the value of IPR to clarify the value obtained by calculating the cost, income and market approach is presented in Table 3.

Methodical recommendations for calculating the integrated coefficient of influence of qualitative and quantitative factors on the cost of IPR, taking into account the type of IPR and the features of standardized approaches to evaluation are summarized in Table 4. The table shows a system of 15 coefficients, which are improved in accordance with the objectives of this study. Different numbers of the coefficients are used for the invention, utility model and industrial design, as well as for the cost, income and market approach to IPR valuation.

**Table 2**

Pricing factors taken into account when determining the calculation parameters and dependent coefficients of IPR value adjustment

| Pricing factors | Dependent adjustment factor | Type of IPR |
|---|---|---|
| Scientific and technical level of the industry and the importance of innovation in the country | Innovation index coefficient | Invention, utility model, industrial design |
| Technological complexity and novelty of innovative solution | The coefficient of the level of technology, the coefficient of technical and economic significance, the coefficient of complexity and relevance of the innovative solution | Invention |
| The rate of artificial moral and functional aging of the technological component of IPR | Coefficient of functional and artificial moral aging | Invention, utility model |
| Stage of the IPR life cycle | Life cycle coefficient | Invention, utility model |
| The amount of investment in the purchase and implementation of IPR | Coefficient of production readiness, coefficient of risk of industrial development, coefficient of complexity and adaptability of artistic and design decision to industrial production | Invention, utility model, industrial design |
| Security of an innovative solution | Coefficient of novelty and uniqueness of IPR, coefficient of originality and aesthetic perception of industrial design | Invention, utility model, industrial design |
| The regime of the chosen legal protection, the territory of distribution and the scope of the transferred rights | Coefficient of reliability of the provided legal protection (volume and territory of exclusive rights) | Invention, utility model, industrial design |
| The results of negotiations with potential buyers and analysis of information on existing transactions for similar objects | Market demand coefficient | Invention, utility model, industrial design |
| Planned production volumes using IPR | Issue volume coefficient | Invention, utility model, industrial design |

**Note:** supplemented by the author on the basis [18, 19]

**Table 3**

System of correction factors for adjusting the cost of IPR

| Coef-ficient | The name of the coefficient | The range of possible values based on the method of expert assessments or calculation methods |
|---|---|---|
| $K_1$ | Innovation index coefficient | $K_1 = 1 + \left(\frac{M_P}{C_t}\right);\ 1 \le K_1 \le 2,$ where $K_1$ – the coefficient of the innovation index; $M_P$ – the place of the country where the IPR assessment is conducted, in the ranking of countries according to the Innovation Index in the year $t$; $C_t$ – the total number of countries in the ranking in the year $t$ |
| $K_2$ | Coefficient of technical and economic significance | $0.4 \le K_2 \le 1.5$ |
| $K_3$ | Coefficient of prior art | $1 \le K_3 \le 1.3$ |
| $K_4$ | Coefficient of complexity and relevance of an innovative solution | $0.2 \le K_4 \le 1.25$ |
| $K_5$ | Coefficient of functional aging | $K_5 = 1 - \frac{T_v}{T_n};\ 0 \le K_5 \le 1,$ where $K_5$ – coefficient of functional aging; $T_v$ – validity of the security document in the settlement period, year; $T_n$ – nominal validity of the security document, year |
| $K_6$ | Coefficient of artificial moral aging | $K_6 = \frac{T_{IPR}}{T_{(IPR-1)}};\ 0 \le K_6 \le 2,$ where $K_6$ – coefficient of artificial moral aging; $T_{IPR}$ – term of work of this IPR, year; $T_{(IPR-1)}$ – term of work of the previous general coefficient of IPs of this type, year |
| $K_7$ | Life cycle coefficient | $0.5 \le K_7 \le 1.5$ |
| $K_8$ | Coefficient of production readiness | $K_8 = \frac{T_i}{T_i + T_m + T_r};\ 0 \le K_8 \le 1,$ where $K_8$ – coefficient of production readiness; $T_i$ – the working time of IPR or equipment manufactured using IPR; $T_m$ – time spent on maintenance; $T_r$ – time spent on repair work |
| $K_9$ | Risk coefficient of industrial development | $0.3 \le K_9 \le 1.4$ |
| $K_{10}$ | Coefficient of complexity and adaptability of artistic and design solutions to industrial production | $0 \le K_{10} < 1$ |
| $K_{11}$ | Coefficient of novelty and uniqueness of IPR | $0.5 \le K_{11} \le 1.4$ |
| $K_{12}$ | Coefficient of reliability of the provided legal protection | $0.6 \le K_{12} \le 1.2$ |
| $K_{13}$ | Coefficient of originality and aesthetic perception of the indus-trial design | $0.25 \le K_{13} \le 0.8$ |
| $K_{14}$ | Market demand coefficient | $K_{14} = \frac{N}{V};\ 0 \le K_{14} \le 1,$ where $K_{15}$ – market demand coefficient; $N$ – the number of IPR used, pcs.; $V$ – volume of innovative products, USD |
| $K_{15}$ | Issue volume coefficient | $0.3 \le K_{15} \le 1$ |

**Note:** supplemented by the author based on the study [19]

**Table 4**

Methodical recommendations for calculating the integrated coefficient for adjusting the cost of IPR, determined by different approaches

| IPR | $K_1$ | $K_2$ | $K_3$ | $K_4$ | $K_5$ | $K_6$ | $K_7$ | $K_8$ | $K_9$ | $K_{10}$ | $K_{11}$ | $K_{12}$ | $K_{13}$ | $K_{14}$ | $K_{15}$ | $K^i_{int}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Cost approach* | | | | | | | | | | | | | | | | |
| Invention | – | – | + | + | + | + | + | – | – | – | – | – | – | – | – | $K^b_{int} = K_3K_4K_5K_6K_7$ |
| Useful model | – | – | – | + | + | + | + | – | – | – | – | – | – | – | – | $K^b_{int} = K_4K_5K_6K_7$ |
| Industrial design | – | – | – | – | + | + | – | – | – | + | – | – | – | – | – | $K^b_{int} = K_5K_6K_{10}$ |
| *Market approach* | | | | | | | | | | | | | | | | |
| Invention | – | – | + | + | + | + | + | + | + | – | + | + | – | + | – | $K^p_{int} = K_3K_4K_5K_6K_7K_8K_9K_{11}K_{12}K_{14}$ |
| Useful model | – | – | – | – | – | – | + | – | – | + | – | – | – | + | – | $K^p_{int} = K_7K_{10}K_{14}$ |
| Industrial design | – | – | – | – | – | – | – | – | + | + | – | + | + | + | + | $K^p_{int} = K_9K_{10}K_{12}K_{13}K_{14}K_{15}$ |
| *Income approach* | | | | | | | | | | | | | | | | |
| Invention | + | + | – | – | – | – | + | – | + | – | + | + | – | + | – | $K^n_{int} = K_1K_2K_7K_9K_{11}K_{12}K_{14}$ |
| Useful model | + | – | – | – | – | – | + | – | + | – | + | + | – | + | – | $K^n_{int} = K_1K_7K_9K_{11}K_{12}K_{14}$ |
| Industrial design | + | – | – | – | – | – | – | – | – | + | – | + | + | + | + | $K^n_{int} = K_1K_{10}K_{12}K_{13}K_{14}K_{15}$ |

**Note:** supplemented by the author based on the study [18]

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The method of IPR assessment based on a combined approach, which takes into account the peculiarities of innovative products as industrial property and the application of traditional approaches to valuation can be illustrated by the example of the invention «Vertical Hydraulic Machine», patentee JSC «Ukrainian Power Machines» (Kharkiv, Ukraine).

The general model of variance estimation of IPR according to the combined approach, which is based on the cost approach and in the peculiarities of the specific type of IPR, can be represented by the following formula:

$$B_{IPR}^{A} = K_{int}^{b} \cdot B_t, \quad (2)$$

where $B_{IPR}^{c}$ – estimated cost of IPR under the combined approach based on the cost approach; $K_{int}^{b}$ – integrated coefficient, which is calculated in the cost approach and takes into account the quantitative and qualitative characteristics of the value of a particular type of IPR; $B_t$ – annual total costs of IPR in the year $t$ of the calculation period.

Valuation of industrial property «Vertical Hydraulic Machine» (patent for invention UA85101) cost method is presented in Table 5.

Determining the commercial value of IPR using a comparative approach requires a developed market for the sale of innovative products, the availability of institutions that collect information on such agreements and is complicated by the need to compare products with unique characteristics. Therefore, the traditional model of determining the value of an intellectual product within a comparative approach by adjusting the value of similar objects should be supplemented by an integrated factor that takes into account competitiveness factors, IPR life cycle and overall investment risk.

The proposed model for calculating the value of IPR taking into account the comparative analysis and corrected for the integral coefficient will look like:

$$B_{IPR}^{r} = K_{int}^{r} \cdot B_a, \quad (3)$$

where $B_{IPR}^{r}$ – estimated cost of IPR on the combined approach based on the market (comparative) approach; $K_{int}^{r}$ – integrated coefficient, which is calculated in the market (comparative) approach and takes into account the quantitative and qualitative characteristics of the value of a particular type of IPR; $B_a$ – the value of the comparable analogue object at the valuation date.

**Table 5**

Calculation of the value of industrial property UA85101 based on the cost approach using the integrated coefficient

| Name of items and cost items | Part of the total cost estimate, % | Numerical value |
|---|---|---|
| Development costs are given, including: | – | – |
| 1. Material costs, thousand USD: | – | – |
| – raw materials, semi-finished products and components | 43.96 | 8.31 |
| – depreciation | – | – |
| – staff training costs | – | – |
| 2. Labor costs of inventors, thousand dollars: | 36.58 | 6.92 |
| – working time, people/hours | – | 2890 |
| – average cost per person/hour, USD | – | 2.4 |
| The costs of patenting are given, including: | 3.97 | 750 |
| 1. Costs for registration coefficient $n$ of rights, USD | – | 535 |
| 2. Expenses for maintaining the validity of the patent, USD | – | 215 |
| 3. Costs for the specification of rights, thousand dollars | – | – |
| The costs of marketing research, thousand dollars | 6.61 | 1.25 |
| The costs of implementation, thousand dollars | 8.88 | 1.68 |
| Total investment in development, legal protection, promotion and implementation | 100 | 18.9 |
| Coefficient of prior art | – | 1.1 |
| Coefficient of complexity and relevance of an innovative solution | – | 0.9 |
| Coefficient of functional aging | – | 0.75 |
| Coefficient of artificial moral aging | – | 0.95 |
| Life cycle coefficient | – | 1.5 |
| Integral coefficient calculated for inventions according to the cost approach ($K^{b}_{int}=K_3K_4K_5K_6K_7$) | – | 1.06 |
| Cost estimation of IPR taking into account the integrated coefficient for adjustment of the cost approach, thousand dollars | – | 20.04 |

**Note:** compiled by the author on the basis of [20] and calculated according to its own developments

A patent search was conducted to determine the analogous object for the IPR under assessment. The most suitable for comparison object of similar purpose and comparative utility may be the invention «Hydraulic Machine», the patent owner of the International Technological University «Mykolaiv Polytechnic» (Mykolaiv, Ukraine), a patent for a utility model UA126790. When estimating the cost of the invention «Vertical Hydraulic Machine» by the comparative method, let's build the Table 6.

The profitable approach has a very developed network of methods related to determining the commercial value of scientific and technical developments. Adjustment to the integral coefficient turns the general model into the formula:

$$B_{IPR}^{I} = K_{int}^{I}\left(GI \cdot \sum_{t=1(0)}^{n(n-1)} \frac{1}{(1+r_t)^t}\right), \quad (4)$$

where $B_{IPR}^{P}$ – estimated cost of IPR under the combined approach on the basis of the income approach; $K_{int}^{P}$ – integrated coefficient, which is calculated in the profit approach and takes into account the quantitative and qualitative characteristics of the value of a particular type of IPR; $GI$ – annual net gross income in the base year, USD; $r_t$ – discount rate per year $t$; $n$ – forecast term, years; $t$ – settlement period from 1 to $n$ or from 0 to ($n$–1), years.

The calculation of the cost of «Vertical Hydraulic Machine» (patent of Ukraine UA85101) by the income method is presented in Table 7.

**Table 6**

Calculation of the value of industrial property UA85101 on the basis of comparison with the analogous object UA126790

| Evaluation element | Analog object | The object being evaluated |
|---|---|---|
| Name of the intellectual property object | Hydraulic Machine | Vertical Hydraulic Machine |
| Patent owner/manufacturer | International Technological University «Mykolaiv Polytechnic» | JSC «Ukrainian Power Machines» |
| The cost of products manufactured using IPR, thousand dollars | 22.82 | 31.36 |
| Volume of sold products manufactured using IPR, pcs. | 26 | 24 |
| Royalty rate, % | 5 | |
| Trend of growth of production made with the use of IPR, % | 3 | 11 |
| Market value of IPR, USD | 14.67 | searching |
| Territory of exclusive rights | Ukraine | Ukraine |
| Availability of legal protection | patent | patent |
| Residual useful life | 6 years | 7 years |
| Field of application | Engineering | Hydraulic Engineering |
| Coefficient of prior art | – | 1.1 |
| Coefficient of complexity and relevance of an innovative solution | – | 0.9 |
| Coefficient of functional aging | – | 0.75 |
| Coefficient of artificial moral aging | – | 0.95 |
| Life cycle coefficient | – | 1.5 |
| Coefficient of production readiness | – | 0.9 |
| Risk coefficient of industrial development | – | 1.2 |
| Coefficient of novelty and uniqueness of IPR | – | 1.2 |
| Coefficient of reliability of the provided legal protection | – | 1.0 |
| Market demand coefficient | – | 0.87 |
| Integral coefficient calculated for inventions according to the cost approach ($K_{int}^{r}=K_3K_4K_5K_6K_7K_8K_9K_{11}K_{12}K_{14}$) | – | 1.19 |
| Valuation of IPR taking into account the integrated coefficient for adjusting the comparative (market) approach, thousand dollars | – | 17.45 |

**Note:** compiled by the author on the basis of [20] and calculated according to its own developments

**Table 7**

Calculation of the value of industrial property UA85101 based on the income approach using the integrated coefficient

| Financial reporting indicator | Value | | | | |
|---|---|---|---|---|---|
| | 2017 | 2018 | 2019 | 2020 | 2021 |
| Planned sales volume, units | 5 | 5 | 2 | 4 | 7 |
| Unit price, thousand USD | 30.43 | 30.60 | 31.36 | 31.36 | 31.80 |
| Revenue from sales of products, thousand USD | 152.2 | 153.0 | 62.7 | 125.4 | 222.6 |
| Cost of production, thousand USD | 27.84 | 28.54 | 27.94 | 29.02 | 29.31 |
| Profit, thousand USD | 12.95 | 10.30 | 6.84 | 9.37 | 17.43 |
| Tax rate, % | 18 | 24 | 26 | 28 | 30 |
| Net income, thousand USD | 2.33 | 2.47 | 1.78 | 2.62 | 5.23 |
| Discount rate, % | 14.5 | 18 | 22 | 17.5 | 11 |
| Discount rate | 0.87 | 0.85 | 0.82 | 0.85 | 0.9 |
| Market valuation of IPR with a profitable approach, thousand USD | 22.44 | | | | |
| Innovation index coefficient | 0.64 | | | | |
| Coefficient of technical and economic significance | 1.0 | | | | |
| Life cycle coefficient | 1.5 | | | | |
| Risk coefficient of industrial development | 1.2 | | | | |
| Coefficient of novelty and uniqueness of IPR | 1.2 | | | | |
| Coefficient of reliability of the provided legal protection | 1.0 | | | | |
| Market demand coefficient | 0.87 | | | | |
| Integral coefficient calculated for inventions on a profitable approach ($K_{int}^{p}=K_1K_2K_7K_9K_{11}K_{12}K_{14}$) | 1.2 | | | | |
| Valuation of IPR taking into account the integrated coefficient for adjusting the profit approach, thousand USD | 26.93 | | | | |

**Note:** compiled by the author on the basis of [20] and calculated according to its own developments

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According to the data in Tables 5–7, the cost characteristics of the object of industrial property «Vertical Hydraulic Machine» (patent for invention UA85101) have the following meanings:

– the cost of IPR, determined using the cost approach adjusted for the integrated coefficient is 20,040 USD;
– the value of IPR, determined using the market (comparative) approach, adjusted for the integrated coefficient is 17,450 USD;
– the value of IPR, determined using a profitable approach adjusted for the integrated coefficient is 26,930 USD.

Analysis of the calculation results shows that the best result for the patent owner of JSC «Ukrainian Energy Machines» are the calculations obtained on the basis of a combined approach given the traditional profit approach and the integrated coefficient. This ensures the best results from the use of the rights to this patent in your company, or the proceeds from the sale of a license for this patent using a lump sum or royalty. However, if there is a need for another form of commercialization of this IPR (for example, full sale of rights to it in case of exhaustion of opportunities for independent use of this patent) there is a need to clarify the results.

The method of valuation of intellectual property on the basis of an integrated coefficient, taking into account the main characteristics of scientific and technical products, allows to adjust the results of calculating the value of innovations obtained by traditional valuation methods, selected depending on certain objectives.

Similar calculations according to the example of the patent UA85101 were performed for some IPRs in the field of energy engineering of enterprises of Kharkiv region (Ukraine), which are collected in Table 8.

**Table 8**

Calculation of the cost of individual IPRs in the field of energy engineering of enterprises of Kharkiv region on the basis of traditional approaches using the integrated coefficient

| Number | Patent number | Integral coefficient calculated for a particular IPR within the approach | | | Adjusted valuation using the approach, thousand USD | | |
|---|---|---|---|---|---|---|---|
| | | $K^b_{int}$ | $K^r_{int}$ | $K^p_{int}$ | $B^b_{IPR}$ | $B^r_{IPR}$ | $B^p_{IPR}$ |
| JSC «ELEKTROVAZHMASH PLANT» | | | | | | | |
| 1 | UA94806 | 1.2 | 0.89 | 1.3 | 4.00 | 4.97 | 5.57 |
| 2 | UA115656 | 1.31 | 1.4 | 1.39 | 7.40 | 7.68 | 11.46 |
| 3 | UA115597 | 0.94 | 1.1 | 1.1 | 13.45 | 10.33 | 13.89 |
| 4 | UA120526 | 1.04 | 1.3 | 1.12 | 12.50 | 11.43 | 13.30 |
| 5 | a201902407 | – | – | – | – | – | – |
| PJSC PIVDENKABEL PLANT PJSC | | | | | | | |
| 6 | UA7888 | 0.87 | 0.64 | 0.92 | 1.34 | 1.03 | 1.40 |
| JSC «Ukrainian Power Machines» | | | | | | | |
| 7 | UA85101 | 1.06 | 1.19 | 1.2 | 20.04 | 17.45 | 26.93 |
| 8 | UA87338 | 1.1 | 1.27 | 1.4 | 3.53 | 4.09 | 3.92 |
| 9 | UA122172 | 1.23 | 1.44 | 1.2 | 5.03 | 5.45 | 6.79 |
| 10 | a201810020 | – | – | – | – | – | – |
| SKB UKRELEKTROMASH LLC | | | | | | | |
| 11 | UA70215 | 1.1 | 1.23 | 1.3 | 26.04 | 26.88 | 30.03 |
| 12 | UA104703 | 1.3 | 1.12 | 1.15 | 26.35 | 25.44 | 29.02 |
| SE «Kharkiv Aggregate Design Bureau» | | | | | | | |
| 13 | UA84648 | 0.8 | 1.2 | 0.95 | 3.54 | 3.11 | 3.70 |
| PJSC «HEMZ-IRES» | | | | | | | |
| 14 | UA78853 | 1.12 | 1.34 | 1.1 | 2.72 | 2.99 | 2.75 |
| SE «Research Institute «HEMZ» | | | | | | | |
| 15 | UA29224 | 1.4 | 1.19 | 1.1 | 9.66 | 9.41 | 10.32 |

**Note:** compiled by the author on the basis of enterprise data [20–23] and calculated according to own developments

To ensure competitiveness in today's market, business leaders need to focus on effective investment, and the most appropriate tool in this case is the highest valuation of IPR. Innovative products, the contribution of new technologies and IPR to real production facilities require careful coefficient *n*. Limitations for the application of this study may be the lack of information on the market for new products, the difficulty of comparing the international and national segments of the industry and the specifics of each IPR.

Further improvement of the proposed method is possible by developing a valuation model not of a single patent, but of a patent portfolio. Most often, intellectual property rights are not transferred separately, but in combination with other rights or services. Taken together, this provides a monopoly on the production of a new product or the use of new technology.

## 4. Conclusions

Intellectual property must be managed as carefully and carefully as tangible assets. This assessment suggests the need to improve the efficiency of intellectual property management, which provides maximum benefit from the commercialization of innovations, and reduce the impact or avoid the negative consequences of incompetent intellectual property. The adjusted value of the estimated IPRs, taking into account the specifics of a particular type of intellectual property and the original source of the valuation method used, requires further verification for reliability and accuracy. The final step is to establish a single IPR price, which will be recommended to the patent owner for inclusion in the company's statutory fund or to search for potential licensees.

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