THE CALCULATION OF THE COST OF INTANGIBLE ASSETS BASED ON INTELLECTUAL PROPERTY

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ABSTRACT
The article considers approaches to valuation of intellectual capital and intangible assets as well as the approaches to valuation of cost of work on creation of new technologies, such as normative, adaptive, program-target and programmatic. The method of calculating the cost of intangible assets created through intellectual property and aimed at improving the technologies operating in the market, and the creation of a fundamentally new product or fundamentally new technology is proposed. These intangible assets are focused at improving as technologies, existing on the market, and creation of fundamentally new products or innovative technology. This method of calculating the value of IA, which are the result of innovative projects, can be used to determine the price of the contracts for research and development. In this case, its main component is the expected result of the placing on the market created by the intangible assets. Thus, the method is a tool for promoting the creation of a market promising results of scientific-research and experimental-designing works.


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1. INTRODUCTION
Intellectual capital (IC) includes all any of the knowledge of the company i.e. ideas, innovations, know-how, knowledge owned by employees of the organization, the knowledge base of the company, the electronic network and the database based on it – that allows one to
respond to changes in the market situation faster than competitors. That is, intellectual capital is a set of explicit and implicit knowledge. The main feature is that this is the knowledge that the company can turn into a profit. The assessment of intellectual capital is formed on the basis of the results of its future use.

The intellectual capital, in Edvinsson’s interpretation [1], includes two components. The first one is human capital, i.e. the totality of knowledge, practical skills and creative abilities. It is not the property of the company and is described in detail in the economic literature. The second component is structural capital. Structural capital includes trademarks, documented business processes and everything that ensures the productivity of the staff. Structural capital is the property of the company. It consists of consumer capital (relationship capital) and organizational capital. This approach could be find in the other researches’ works [2, 3]. The structure of the IC in accordance with this concept can be presented in the form shown in the Table 1.

### Table 1 The structure of intellectual capital

<table>
<thead>
<tr>
<th>Human capital</th>
<th>Intellectual capital</th>
<th>Structural capital</th>
<th>Consumer capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of employees</td>
<td>Technical and software</td>
<td>Intellectual property (patents, licenses, etc.)</td>
<td>Customer relations</td>
</tr>
<tr>
<td>Skills</td>
<td>Organizational structure of the enterprise</td>
<td></td>
<td>Customer information</td>
</tr>
<tr>
<td>Creative ability</td>
<td>Management strategy</td>
<td></td>
<td>History of customer relations</td>
</tr>
<tr>
<td>Moral values</td>
<td></td>
<td></td>
<td>Goodwill</td>
</tr>
<tr>
<td>Work culture</td>
<td></td>
<td></td>
<td>Brand (awareness, loyalty, attitude)</td>
</tr>
</tbody>
</table>

Sveiby K. offered his interpretation of intellectual capital [4]. It identifies IC with intangible assets (IA). Intangible assets are valuable for the company, although they have a different form of presentation than the physical objects. The value and importance of the Intangible Assets were apprised many years ago. These were the patents, copyrights and trademarks. However, only a few companies have tried to give a monetary evaluation of Intangible Assets.

Intangible assets include: market assets (service marks, product marks, corporate name, business cooperation, licensing and franchise agreements, etc.); intellectual assets (patents, software, design rights, trade secrets, know-how, trademarks); human assets (education, qualifications, skills and abilities of employees); infrastructure assets (corporate culture, management concepts and management processes, relationships, etc.).

The scheme of the IC [4] contains three elements: the competences of the employees (human capital); internal structure; external structure (customer capital, and relationship capital).

### 2. METHODOLOGY OF THE RESEARCH

If IC capital is put in a row with other factors of production, there is a problem of its appraisal. Traditional methods of economic valuation and measurement, based on the principles of accounting, have ceased to be adequate to the conditions of today. For example, traditional accounting practices treat a trademark as an intangible asset that, by analogy with a tangible asset, loses its value in the course of its use and transfers its value in parts to a manufactured product. In this regard, Intangible assets are accounted according to the same rules as tangible assets, depreciation rates are applied to them and their write-off is made. At
the same time, the trademark or brand in the process of their exploitation not only does not lose its value, but, on the contrary, it is often increased. And many elements of intangible assets are not reflected in the balance sheets, including relations with consumers, staff qualifications, knowledge base, etc.

Such researchers of knowledge-based economic intellectual capital as Edvinsson L. [1, 5], Sveiby K. [4], Stewart T. [6], Broking E. [7] and others have developed a number of methods to assess intellectual capital.

In particular, Sveiby identifies 26 methods of evaluation and measurement of intellectual capital, grouped into four categories [4]:

1) methods of direct measurement of intellectual capital (Direct Intellectual Capital methods – DIC). It is based on the identification of intellectual capital and the monetary valuation of individual assets or components of intellectual capital, after which the integrated assessment of the intellectual capital of the company;

2) methods of market capitalization (market Capitalization Methods – MCM), when the difference between the market capitalization of the company and the equity of its shareholders is calculated. The obtained values regarded as the value of its intellectual capital or intangible assets;

3) The return on assets methods (Return on Assets methods – ROA). The ratio of the company's average pre-tax income for a certain period to the company's tangible assets — the company's ROA-is compared with the same for the industry as a whole. To calculate the average additional income from intellectual capital the difference is multiplied by the tangible assets of the company. Further, by direct capitalization or discounting of the received cash flow, it is possible to determine the value of the company's IC;

4) scoring methods (Scorecard Methods – SC). The various components of intangible assets or intellectual capital are identified, the indicators and indices are generated and capitalized in the form of scoring or as graphs. The use of SC-methods does not imply a monetary valuation of intellectual capital. These methods are similar to methods of diagnostic information system.

All known methods of IC assessment are divided into the four categories. It should be noted the relative proximity of DIC – and SC-methods, as well as MSM – and ROA-methods. In the first two cases, the movement comes from the identification of intellectual capital of the individual components of intellectual capital, and in the remaining – from the integral effect [8, 9].

None of the methods meets all objectives of the evaluation, so the choice of methodology depends on the tasks and situation. For example, methods of scoring and methods of direct measurement of IR are usually the most suitable for studying the company.

In order to obtain the value from intellectual capital, companies need to manage information flows between different types of capital that make up intellectual capital. The purpose of management of the intellectual capital of the enterprise is to achieve the maximum result from its use while minimizing the cost of its development.

Evaluation of the effectiveness of the management system of intellectual capital is the calculation of a set of indicators. This is due to the fact that the process of intellectual capital management involves the implementation of a large number of functions, the quality of which is difficult to assess. In addition, such indicators can be used as benchmarks in the development of the company's strategy for the creation, acquisition and use of intellectual
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capital. Methodological problems of accounting, analysis, management and evaluation intellectual capital and intangible assets are also considered in the works of domestic researchers [10].

Approaches to the valuation of intangible assets.

Intangible assets can be divided into three main groups:

- Intellectual property (IP).
- Organizational expenses.
- Goodwill.

IA includes: industrial property, rights to secrets (know-how) and copyright objects.

Industrial property includes inventions, utility models, industrial designs, trademarks, breeding achievements.

The objects of copyright include: computer programs, databases, topology of integrated circuits, scientific public lectures.

Organizational costs include fees for lawyers for drafting constituent documents, services for the registration of the company and others. Costs for re-registration of constituent documents, the production of new seals and stamps intangible assets are not included.

Goodwill is accounted in an enterprise’s books only when a purchase of another enterprise. Business reputation can be defined as the difference between the purchase price of the acquired enterprise and the value of the balance sheet of all its assets and liabilities.

The market value standard is not always applicable to intangible assets, as market value is the most probable price at which an object can be disposed of in an open market in a competitive environment. But for some intangible assets it is difficult to talk about the fair price of the transaction, because the market of such objects is underdeveloped.

For the valuation of intangible assets, the same approaches that are traditionally used for the evaluation of objects are mainly applicable cost, revenue and comparative. However, with respect to intangible assets, the use of these approaches has its own specificity in intellectual capital, since intangible assets are rather unusual object for evaluation [11, 12].

Key in the evaluation of intangible assets is often a profit approach. It is based on the net inflow that the owner of the valuation object (intangible assets) expects to receive. When assessing intangible assets under the income approach, a method is sought to allocate income related to the assessed intangible assets in order to determine the value of intangible assets using the conventional methods of income approach (capitalization or discounting) [13].

In the practical intellectual capital of program-target planning and management of the development of new technologies there are a number of approaches to determine the cost of work on their creation. The most frequently used and well-proven both in our country and abroad are normative, adaptive, program-target and program.

The normative approach provides for the establishment of a certain standard to determine the cost of work in the creation of new technologies as a percentage of the total cost of research and development (R&D). In fact, all leading foreign countries make use of a normative approach in one form or another. The normative approach is quite simple to
implement, but it has low accuracy and can only be used to estimate the amount of work to develop new technologies.

The adaptive approach is based on determining the share of financing for the creation of new technologies in a specific promising direction from the total cost of R&D, depending on the goals set out in the development strategy of the enterprise.

Compared with the normative approach, the adaptive approach determines the necessary costs depending on the development strategy of the enterprise. However, its practical application requires more raw data. The program-target approach provides for full-scale research and development on the whole set of directions contained in the list of promising technologies for the enterprise.

A program approach – to determine the value of new technology creation and development involves extending the financing of new technologies over a period of time, taking into account the overall dynamism of the intellectual capital of R&D financing.

However, the considered approaches do not take into account the emerging market price and technical characteristics of the intellectual capital of the new technical intellectual capital and technology and the relevant trends.

In connection with this proposed methodically capital calculation of the cost of intangible assets created based on intellectual property and rates of the contract for their development [14, 15, 16 17, 18].

3. RESULTS OF RESEARCH
Calculation of the value of intangible assets created on the basis of the IA and aimed at improving the technologies operating in the market.

To calculate the value of intangible assets on the basis of the intangible assets used to improve the technical level of the product or process, the following procedure is used, which is a capitalization of the method of parametric indices. The following stages are implemented within the calculation procedure:

1. On the basis of the set of technical characteristics the intellectual capital of the best analogues of products and the original technology is formed a set of indicators i in the form of the vector \( P_{i,k0} \), “ideal” at the moment the state of the basic production technology of the considered sample technical intellectual capital.

2. Compares characteristically capital unique and original technology with characteristically capital of the “ideal” specimen, it is calculated parametric index:

\[
SP_{ik} = \frac{P_{ik}}{P_{i,k0}}
\]  

At the same time, each technology of analogues of the original technology is assigned the corresponding numbers \( k = 1, 2, \ldots, n \); the original technology has the number \( n + 1 \); i – technical characteristics of the intellectual capital of the technical intellectual capital (in the practical intellectual capital of marketing and benchmarking is usually used no more than five main characteristics of intellectual capital), \( n \) – the number of analogues in the market. Reference model, characterized by the best performance among the analogues on the market, is assigned the number \( k_0 \).

3. Calculates the sum of the parametric index technology unique and original technology:
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\[ \sum w_i \cdot SP \]  \hspace{1cm} (2)

where:

\[ w_i \] – weight coefficient \( P_i \) of the technical indicator, adopted in practice, the intellectual capital of marketing.

4. The economic effect is determined by the original technology in relation to each \( k \) of \( n \) analogues. It is characterized by a coefficient of technical improvement:

\[ C_{ef,k} = \frac{\sum_{i=1}^{n} SP_{i+1w_i}}{\sum_{i} SP_{iw_i}} - 1 \]  \hspace{1cm} (3)

where:

\[ k = 1, 2, \ldots, n. \]

The economic effect caused by differences in the technical level of products is manifested in the change in the price of analogs: the price increases if the coefficient of technical improvement meets the condition:

\[ C_{ef,k} > 0 \text{ for } k = 1, 2, \ldots, n. \]

5. Intellectual capital forms the number of \( k_{min} \) – analog item with the lowest price of \( P_{k_{min}} \) in the market.

Then the additional revenue from the sale of the product on the market will be:

\[ AR = N \times P_{k_{min}} \times \left( \frac{\sum_{i=1}^{n} SP_{i+1w_i}}{\sum_{i} SP_{i{k_{min}}w_i}} - 1 \right) \]  \hspace{1cm} (4)

where:

\[ N \] – physical volume of production.

6. Additional net profit obtained by improving the technological level of products is equal to:

\[ ANP = N \times P_{k_{min}} \times \left( \frac{\sum_{i=1}^{n} SP_{i+1w_i}}{\sum_{i} SP_{i{k_{min}}w_i}} - 1 \right) \times r \times (1 - f) \]  \hspace{1cm} (5)

where:

\[ r \] – the profitability ratio, taken, for example, for high-tech industries is equal to 0,2;
\[ f \] – tax rate.

7. In the distribution of additional net profit between the licensee and the licensor, the ratio of the cost of exploration and technological development to the total cost, including additional development of technologies and production organization, is used as per (1:4:16) [19], which is determined by the licensee's cost factor (\( k_{cl} \)).

If the licensee conducts both exploratory research and technology development,
When conducting only exploratory research:

$$K_{e1} = \frac{1 + 4}{1 + 4 + 16} = \frac{5}{21} \approx 0.24$$

(6)

In the development of technology:

$$K_{e1} = \frac{4}{21} \approx 0.20$$

(8)

8. The additional net profit from the implementation of the m-th sample of technic intellectual capital and, improved on the basis of the IA at the time $t_m$, is described by the equation:

$$ANP(t_m) = N_{m_{\text{max}}} \times P_{k_{\text{min}}} \times \left( \sum_i SP_{i_{\text{min}}wi} - 1 \right) \times r_m \times (1 - f_m) \times (1 - \frac{4}{T_m^2} (t_m - \frac{T_m}{2})^2)$$

(9)

where:

- $N_{m_{\text{max}}}$ – maximum physical volume of production sold on the market;
- $P_{k_{\text{min}}}$ – the price of the m-th sample of technical intellectual capital and the market;
- $T_m$ – total life time of production of a particular kind.

$$t_m = t_{m0} + \Delta t_m$$

(10)

where:

- $t_{m0}$ – the beginning of the commercialization of the m-th sample of technical intellectual capital in relation to the time of market entry pioneer model the intellectual capital;
- $\Delta t_m$ – the time period of commercialization of the original technology, measured in years.

9. Commercialization of products is carried out within $\Delta t_m$ years, therefore, taking into account the discount determined by the equation:

$$E_m = R_{\inf.m} + R_{\text{risk.m}} + R_{\inf.m} \times R_{\text{risk.m}}$$

(11)

where:

- $R_{\inf.m}$ – the inflation index at the time of commercialization of the m-th sample;
- $R_{\text{risk.m}}$ – the risk index from the implementation of the m-th sample of the improved technical and intellectual capital, the ratio to calculate the additional net profit from the implementation of the m-th sample of the technical and intellectual capital received by the licensee (researcher, developed by the intellectual capital of the technology and a specialist in engineering and production organization), depending on the coefficient of $k_{\text{cln}}$ is described by the the:

$$ANP(F_m) = \sum_n N_{m_{\text{max}}} \times P_{k_{\text{min}}} \times \left( \sum_i SP_{i_{\text{min}}wi} - 1 \right) \times r_m \times (1 - f_m) \times k_{\text{cln}} \times (1 - \frac{4}{T_m^2} (t_m - \frac{T_m}{2})^2) \times (1 + E_n)^n$$

(12)
where:

\[ t_m = t_{m0} + \Delta t_m; \]
\[ F_m = T_m - t_{0m}. \]

10. To determine the cost of creating a technology to improve the m-sample of technic intellectual capital and take into account the additional profit obtained through its commercialization in the ratio:

\[ E_m = ANP(F_m) \times (1 + r_m)^{-1} \tag{13} \]

where:

\[ r_m \] – profitability of scientific and technical activities.

Thus, the licensor at the conclusion of the contract for the development of technology and/or exploratory research of engineering works and the organization of production should provide for the payment to the licensee of an amount equal to the \( F_m \), in which the \( Z_m \) is the cost of carrying out the relevant work.

4. DISCUSSION

In the case of production of the radically new products or new technologies the value of intangible assets is determined by the equation:

\[ S_m = V_m \times N_E \times k_{c1m} \tag{14} \]

where:

\[ V_m \] – expected revenue from the m-sample technology intellectual capital sold on the market, created on the basis of OIP;

\[ N_E \] – the knowledge-intensive sector of the market, within which it is expected to sell radically new products.

The value of the cost of work on the creation of technology in the m-sample at the profitability of \( E_m \) is determined by the equation:

\[ E_m = V_m \times N_E \times k_{c1m} \times (1 + r_m)^{-1} \tag{15} \]

The licensee at the time \( t_m \) from entering the market receives a profit, determined by the following ratio:

\[ P_{r1}(t_m) = V_m \times r_m \times (1 - f_m) \times k_{c1m} \times \left(1 - \frac{4}{T_m^2} \left(t_m - \frac{T_m}{2}\right)^2\right) \times (1 + E_m)^{-n} \tag{16} \]

\( E_m \) defined in paragraph 9-of the procedure of calculating the value of intangible assets.

Example. Evaluation of the effectiveness of the antiviral drug “Triazavirin”

The comparison of the competitive advantages of Triazavirin with the domestic drug Arbidol and imported Tamiflu (USA) is illustrated by the data presented in the Table 2.
Table 2 The Comparison of competitive advantages of drugs in the state segment

<table>
<thead>
<tr>
<th>Items</th>
<th>«Arbidol»</th>
<th>«Tamiflu»</th>
<th>«Triazavirin»</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effectiveness</td>
<td>30</td>
<td>38</td>
<td>75</td>
</tr>
<tr>
<td>of treatment, %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Side effect</td>
<td>Allergic reaction possible</td>
<td>Possible nau sea, vomiting, dizziness</td>
<td>Not detected</td>
</tr>
<tr>
<td>Spectrum of action</td>
<td>Influenza a, B virus strains, acute respiratory viral infection (SARS)</td>
<td>Influenza a, b virus strains</td>
<td>All strains of influenza virus, SARS, hemorrhagic fever</td>
</tr>
<tr>
<td>Contra indications</td>
<td>Children under 2 years, “use of the drug during pregnancy is possible only in cases where the intended benefit to the mother exceeds the potential risk to the fetus and newborn”</td>
<td>Children under 1 year, pregnancy, lactation during breastfeeding, chronic renal failure</td>
<td>Not detected</td>
</tr>
</tbody>
</table>

The characteristics of the analogues are described by the system of indicators in the Table 3 [20, 21].

Table 3 Parametric indices of analogues and original technology of antiviral drugs of selective action

<table>
<thead>
<tr>
<th>Number indicator’s(s)(i)</th>
<th>Name of indicator</th>
<th>Parametric index (SP_{ik})</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>«Arbidol» (SP_{i1})</td>
<td>«Tamiflu» (SP_{i2})</td>
</tr>
<tr>
<td>1</td>
<td>Effectiveness of treatment</td>
<td>0.3</td>
</tr>
<tr>
<td>2</td>
<td>Side effect</td>
<td>0.75</td>
</tr>
<tr>
<td>3</td>
<td>Spectrum of action</td>
<td>0.75</td>
</tr>
<tr>
<td>Σ (SP_{ik})</td>
<td>1.8</td>
<td>1.13</td>
</tr>
</tbody>
</table>

The coefficient of technical perfection, which is determined by the economic effect, is calculated by the Equation (3), where \( k = 1; 2 \).

The calculation of this coefficient is carried out in relation to the original drug to the most effective analogue, in our case it is “Arbidol”. Assuming that the weight coefficient \( w_i = 1/3 \) for all indicators, we obtain:

\[
C_{ef,k} = 2.75 / 1.8 – 1 = 0.53
\]

Additional revenue per year is determined as follows (by the Equation 4), where \( N – \) physical volume of production per yea, \( P_{kmin} – \) the lowest price analogue.

For \( N = 57,143 \) pieces/year, \( P_{kmin} = 600 \) rubles/pac.

\[
AR = 57,143 \times 600 \times 0.53 = 17,828,62 \text{ thousand rubles.}
\]

Additional net profit excluding discount is equal to by the Equation (5), where \( f – \) the ratio of taxation was adopted \( f = 0.2 \) (profit tax); \( r – \) return on investment ratio, assumed \( r = 0.2 \) for high technology.

\[
ANP = 57,143 \times 600 \times 0.53 \times 0.2 \times (1 - 0.2) = 2,852,6 \text{ thousand rubles.}
\]
Additional profit from the completed contract will be (by the Equation (5))

$$\sum w_i \cdot SP_i$$  \hspace{1cm} (17)

$$AP(F) = \sum_{n=1}^{F} N_n \times P_{\text{min}} \times C_{\text{ef}}, \times r_n \times (1 - f) \times k_{\text{cl}} \times (1 + E)^n,$$  \hspace{1cm} (18)

where $k_{\text{cl}}$—the ratio of additional profit distribution between the licensee and the licensor is accepted $k_{\text{cl}} = 0.25$ (development of technology);

$F$—period of commercialization, accepted $F = 5$ years;

$E$—discount rate.

It is assumed to bring the drug to the market with the intellectual capital of the finished package price $\text{pack} = 1000$ RUB, discount $E_m = 0.32$.

The calculation assumes-the intellectual capital to draw annual sales for 5 years equal to the production of the proposed original drug “Triazavirin” 57 143 pieces of packages per year.

In General, the additional profit from the completed contract is characterized by Equation (12):

For this option-in the calculation equation $AP_1(F)$ only the complex remains dependent on time $(1+E)^n$.

Result of $\sum_{n=1}^{F} (1+E)^n$ are summarized in Table 4.

<table>
<thead>
<tr>
<th>Year, $n$</th>
<th>$(1+0.32)^n$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.758</td>
</tr>
<tr>
<td>2</td>
<td>0.574</td>
</tr>
<tr>
<td>3</td>
<td>0.434</td>
</tr>
<tr>
<td>4</td>
<td>0.329</td>
</tr>
<tr>
<td>5</td>
<td>0.219</td>
</tr>
<tr>
<td>$\sum_{n=1}^{F} (1 + E)^{-n}$</td>
<td>2.314</td>
</tr>
</tbody>
</table>

Additional profit from the completed contract will be:

$$AP_1(5) = 57 \ 143 \times 1000 \times 0.53 \times 0.2 \times (1 - 0.2) \times 0.24 \times 2.314 = 2691,122 \text{ thousand rubles.}$$

5. CONCLUSIONS

The paper considers various methods of economic evaluation of intellectual capital and intangible assets:

1) Methods of direct measurement of IR (Direct Intellectual Capital methods – DIC).
2) Market capitalization methods (Market Capitalization Methods – MCM),
3) Methods of return on Assets (ROA).
4) Scoring methods (Scorecard Methods – SC).
It is shown that traditional methods based on the principles of accounting cannot take into account many elements of intellectual capital and intangible assets, in particular the scale and level of quality of interaction with consumers, staff qualifications, knowledge base, etc.

Analysis of methods of valuation of intangible assets (intellectual value, organizational expenses goodwill showed that the standard approaches such as cost income and comparative meet with many difficulties, because the NMA is a non-standard object for evaluation. These methods do not take into account the price and technical characteristics of the products formed in the market. In this regard, a fundamentally new method of valuation of intangible assets created on the basis of the OIC, which are fundamentally new to the market, or improving products on the market. The use of this method orient the manufacturer to organize the production of competitive products for the market.

The method of intellectual capital appraisal formulated in the result of innovative projects. It can be used to determine the price of the R&D contract. In this case, its main component is the expected result of the commercialization of the created intangible assets. Thus, the method of intellectual capital is a tool to stimulate the creation of the economically perspective R&D products.

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