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Monetary valuation of intellectual human capital in innovative activity

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Monetary valuation of intellectual human capital in innovative activity

JEL Classification: *O31, M52, J33*

Keywords: *intellectual human capital, value, valuation, innovation activity.*

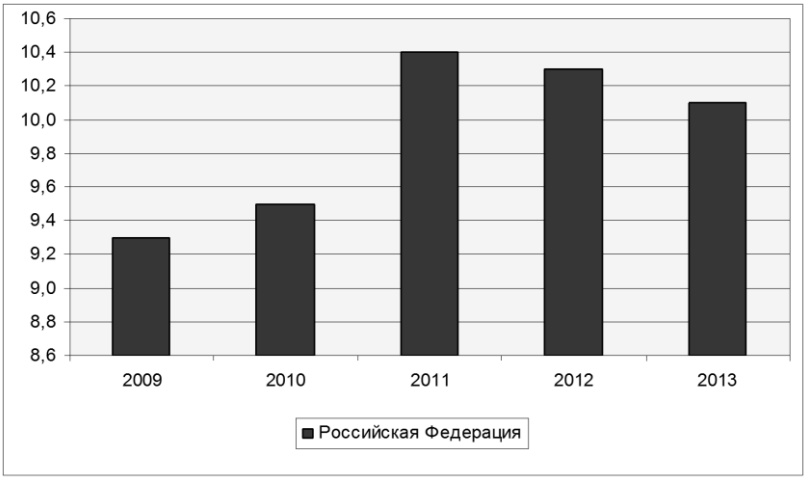
Abstract: The article views the structure of an organization's intellectual human capital, which integrates both employees' intellectual, professional and personal abilities to perform innovation activity and their results achieved in the process of this activity. The authors prove the role of intellectual human capital in improving an organization's innovation activity. Basing on the cost, income, expert and psychological approaches, the article develops the intellectual capital monetary valuation model focused on an increase in the objectivity of measuring its value by means of the individual intellectual and performance report. The application of this model is aimed at activating the innovative development of social and economic entities by increasing the quality and efficiency of intellectual human capital.

Introduction

In the light of the recent external political challenges, the increase in the efficiency of Russia's innovative activity is one of the necessary conditions to transit to a new economic policy focused on accelerating socio-economic development, on technological renovation and knowledge economy.

In the present time, the problem of organizations' low innovation activity is extremely urgent. According to the official statistical data, the percent of organizations that implement technological, organizational and marketing innovations is 10.5% and tends to decrease (fig.1).

Figure 1. The share of organizations that implement technological, organizational and marketing innovations in the total number of surveyed organizations in the reporting year (%)



Source: In accordance with the official statistical data of the Rosstat, "Science and innovations" (2014)

This situation mostly deals with the unsatisfied condition of intellectual human capital integrating two interrelated elements – intellectual potential and the results of the innovation activity of labour resources. As evidenced by the Global Competitive Report 2014-2015, Russia is ranked 53rd out of 144 countries, in part due to its weak positions based on the human factor-related indicators: Quality of the educational system – 83; Quality of management schools – 104; Availability of scientists and engineers – 70; Country capacity to retain talent – 103; Country capacity to attract talent – 92; Reliance on professional management – 85; Cooperation in labor-employer relations – 89; Firm-level technology absorption – 98; Capacity for innovation – 66. This generally shows the Russian society's weak capacity to efficiently use the existing knowledge and create some new knowledge.

Thus, it is of high priority to change to the human-oriented concept of innovative activity management to increase the competitive power of the Russian economy in the global market. This suggests applying a new model of integrated intellectual human capital measurement, which would reconcile the interests of both the employee and the manager in distributing earnings from the use of individual intellectual capital, and which would foster the motivation of the personnel to innovation activity, thus increasing the innovation activity of the organization.

A distinctive feature of this model must be associated with not only personnel cost accounting but also the estimation of such parameters as the contribution of each employee in an innovative product, the degree of implementation of intellectual and personal potential in the process of innovation, the harm from the absence of a worker.

The objective of this research is to develop the intellectual human capital model of monetary evaluation focused on intensifying the innovation activity of an organization. The aforementioned objective has defined the following tasks of the research:

1) To expand the terms of "innovation activity" and "intellectual human capital" from the standpoint of the human-oriented management concept;
2) To prove a significant role of intellectual human capital in increasing the innovation activity of an organization;
3) To propose the intellectual human capital model of monetary evaluation, taking into account employees' social and psychological characteristics;
4) To determine the areas of application for the proposed model.

Methodology of the research

Many research works have been devoted to the issues on how human, social and intellectual capital influences innovation activity (Wu, Wann-Yih, 2006; Teo, Stephen T. T., 2014; Ugalde-Binda, Nadia, 2014; Lu, Wen-Min, 2014; Carraro, Carlo, 2014). This article gives the authors' view on the structure of an employee's intellectual capital and on its monetary valuation as a key factor of the efficiency of a company's innovation activity.

We suppose that the employee's intellectual capital contains two interrelated elements; the one is a genetic or natural component (intelligence) and the other is a manmade component that has been obtained in a development process (the results of intellectual and innovation activity). These components ensure the employee's success and, as a result, the organization's efficiency, which is reflected in achieved social and economic benefit in respect of an individual or a business in general (promotion at work, competitive advantages, bonuses, yields from implemented items of intellectual property, a higher business value, etc.).

1. To achieve social benefits (recognition of his true value by colleagues, satisfaction with the quality of work), the employee should demonstrate his intellectual abilities, personal qualities, professional knowledge, and position-related skills. Here, only non-financial evaluation based on socio-psychological methods and expert evaluation techniques seem to be possible. But these must be accounted for as a special coefficient in the monetary evaluation of an employee's intellectual capital. This coefficient is defined as the arithmetic mean of two indicators – i.e., the indicator of the employee's intellectual potential and the indicator showing the employee's personal contribution in the organization's innovative development.

The integral indicator of the employee's IPI *(Intellectual potential of an individual)* is proposed to calculate by formula 1:

$$IPI = \sum_{i=1}^{6} k_i A_i , \quad (1)$$

Where *Ai (i = 1..6)* – point-based valuation of the types of intellectual potential (sensorial, emotional, thinking and logical, creative, socio-cultural, and economic); *ki (∑ki=1)* – weight coefficient.

In determining weights, it is recommended to use the simplified approach - all types of intellectual potential are equal – and the expert approach - weight depends on the importance degree of intellectual potential determined by experts in respect of each separate position and/or situation), which ensures the adjustment of the indicator to various evaluation objectives.

The procedures of valuating the types of individual intellectual potential (*Ai)* are based on applying the authors' personality questionnaire (O. Loseva, 2014, pp 91-107).

To make the *IPI* integral evaluation with formula 1, all types (*Ai)* must have a similar range of changes. To meet this goal, it is recommended to apply the approach from quality statistics (V. Vasilyev, 2004, pp. 153-168). Each type of intellectual potential is described as a set of attributes (*Xj*); e.g., concerning the content-related field of sensorial intellect perception, such attributes include integrity, constancy, apperception, and emotional overtones.

To determine the quality of each property, it is necessary to set a quality standard taken as a number of quality categories. In this case, it is suggested to choose five categories corresponding to the degree of manifestation of this or that attribute that belong to a definite type of intellectual potential: "low" – 1; "below average" – 2; "medium" – 3, "above average" – 4, "high" – 5.

Each type (*Ai)* is estimated as the arithmetic mean of the values of definite attributes:

$$A_i = \frac{\sum_{j=1}^{m} X_j}{m}, \tag{2}$$

Where *X*– value of an attribute; *m* – number of attributes.

In turn, the attribute (*X)* is also estimated as the arithmetic mean of the points gained in answering those test questions that serve to determine a degree of manifestation of the attribute *(X)* in the respondent. Thus, all types of intellectual potential receive quality-related valuation ranging from 1 to 5.

Analogically, the indicator *(At)* is calculated by the following formula based on the expert approach:

$$At = \sum_{i=1}^{p} k_i J_i , \tag{3}$$

Where *p* – number of key indicators that reflect the non-financial results of an employee's labour activity influencing his success in achieving social benefits (p≤20 is recommended); *Ji* – point-based valuation of a definite indicator, which is made by experts on the basis of attestation or testing (it is recommended to apply the same grades as for the structural components of the intellect - from 1 to 5); *ki* – weight coefficients set by experts in respect of the importance of a definite indicator for a definite position at the current stage of the organization's development in accordance with the principle "the higher the importance, the higher the range", while *Σki*=1.

The indicators can be associated with the following groups:

1) Position-related characteristics: length of employment and education degree; professional competence; quality of work; responsibility and discipline; initiative;
2) Personality-related characteristics: educational activity (capacity for learning, self-education and training of other people); communication abilities; leadership skills; observance of both social standards and principles of corporate culture; level of work motivation; loyalty; commitment to an organization, its values, interests, aims, etc.;
3) Contribution to an organization's innovative development: number of experiences of participation in innovative projects, seminars and presentations over the period (*t*); number of rational proposals and novelties made over the period (*t*); number of applications for patent made over the period (*t*); number of instructions, technologies, methods developed over the period (*t*), etc.

The indicator's number and content can vary from the type of an organization's activity. The period (*t*) is determined by the frequency of attestation and is, as a rule, 1 year.

As the indicators (*IPI*) and (*At*) are calculated via expert valuation techniques, it is necessary to determine the degree of consistency of experts' opinions in choosing the indicators and weights using the concordance coefficient by formula 4. Experts' opinions are concordant if w≥0.75.

$$w = 1 - \frac{\sum_{i=1}^{m}\sum_{j=1}^{m}\sum_{k=1}^{n}\left|x_{ik} - x_{jk}\right|}{nm(m-1)(K-1)}, \tag{4}$$

Where m – number of matrix lines (number of experts); n – number of matrix columns (attributes); K – number of chosen levels of quality; x – qualitative analugue of a quantitative indicator that is determined by interval scaling.

2. Economic benefit deals with earning income by an employee from his intellectual activity. First of all, it is necessary to highlight two interrelated roles of an employee – a holder and an owner of intellectual capital. Being only an owner of intellectual capital, the employee is entirely a functional element of the system, whose status doesn't deal with the possibility to participate in management, including a special influence on distributing income from using his intellectual capital. The employees' labour is an intellectual and routine process that produces information on already known knowledge. In this case, the employee himself is considered entirely as a hired worker and receives wage compensation for his labour with no claims as to a part of profit. The employee as an owner of intellectual capital directs it to generating new knowledge and practices his unique experience, thus being capable of claiming to receive monopoly earnings. The only difficulty deals with the fact that in executing innovative projects one and the same employee with definite intellectual abilities and professional and personal qualities can be both an owner of intellectual capital (a generator of ideas, a holder of unique experience) and a hired worker implementing the ideas and experience of other people.

We think that the valuation of an employee must take into account both his value as a hired worker and his profit from using his own intellectual capital despite the risk of double-counting because this valuation is intended primarily for managing purposes (the formation of the mechanism for motivating and encouraging innovation activity, for improving HR-management, etc.).

In practice, an organization's management staff should trace investments (expenses) in the elements of intellectual human capital, on the one hand, and the profit which has been gained by it from such investments, on the other hand. This may evidence the reason to use the financial models based on both the cost approach and the income approach in evaluating the economic benefit of an employee.

The aforementioned approaches are a methodological basis for developing the human intellectual capital model of valuation.

Paragraph

Measuring human intellectual capital is an integral part of the process of innovation activity management. We suppose that the human-oriented concept is the most adequate technique for managing innovation activity; its peculiar features can be formulated, analyzing both the evolution of the concepts as a result of social development and the changes of the prevailing type of economy: industrial economy → information economy → knowledge economy (Table 1).

Table 1. Evolution of innovative activity management concepts

Characteristics	Tech-oriented	Information-oriented	Human-oriented
Economic prerequisits:			
Stage of social/economic development	Industrial	Postindustrial (information economy)	Postindustrial (knowledge economy)
Main productive force	Technics, objects of labour	Technology, tools of labour, sciences	Human intellect, knowledge
Main types of innovative resources	Material, financial	Informative and communicative	Intellectual, human
Prevailing type of innovative behavior	Passive	Passive and active	Active
Prevailing types of innovations	Product-related, technical	Technological, managerial, informative	Social, cognitive
Theoretical approaches to management:			
- Name of approach	Factor-related, functional	Functional, systemic	Systemic, situational
Characteristics of management providing the interrelation "Human being ↔ Innovative process":			

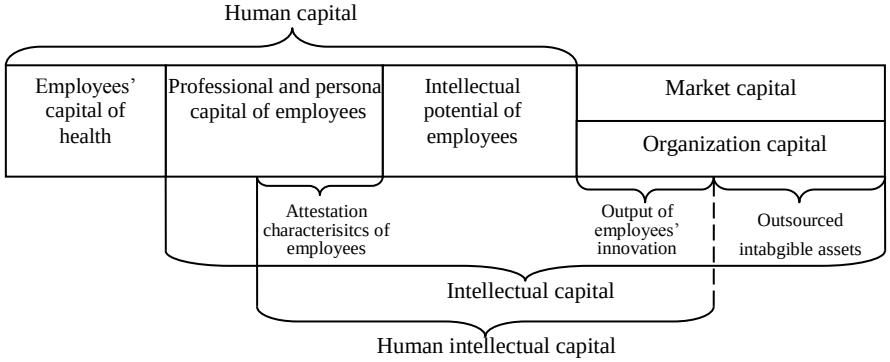
- Innovative activity of employees	Low	High in high-tech industries	High in all spheres of activity
- Prevailing methods of motivation	Material	Material, organizational	Moral and psycological
- Priorities in employee valuation	Professional skills, knowledge	Social and psychological peculiarities, needs, motives	Intellectual abilities, satisfied quality of labour
- Employee development management	Professional traning	Professional training, social and psychological development	Development of intellectual and innovative potential
- Accounting of innovative activity results	Not performed	Performed at the level of groups, communities	Performed at the level of individual
Characteristics of management providing the interrelation “Human being ↔ Human being”:			
- Prevailing style of management	Authoritative	Democratic	Democrtic and delegating
- Character of interrelations	Superior - inferior	Collegial and collective	Collaborating and personal
- Forms of activity organization	Individual	Group	Team
- Involvement of innovative activity in management	Practically no involvement	Executors are involved in management	Participative management

The application of the concept of human-oriented innovative activity management needs a broader meaning of the term “innovative activity” and a different understanding of the term “human capital” as a part of an organization’s intellectual capital.

We propose to consider innovative activity as a set of actions done by the participants of not only an innovative project but also any process related to the use of the human intellect for the development of the socio-economic system. Basically, we mean intellectual and innovative activity.

To encourage employees’ innovative activity and to use their intellectual potential to the full extent for the development of an organization, it is reasonable to extend the understanding of an employee’s intellectual capital. We suppose that this concept should include not only the employee’s intellect, gained knowledge, abilities and skills (i.e., inalienable capital) but also the products of his intellectual and innovative activity – formalized knowledge and information as well as developed productive relationships with his colleagues and the organization’s outer environment (i.e. alienable capital). As a result, the organization oriented to innovative development is recommended to consider intellectual human capital (human IC) as an independent type of capital that will contain the components of an organization’s human and intellectual capitals in their traditional understanding (fig.1). In the figure, the dashed line means that, together with the traditional approach referring created and legally registered intangible assets to an organization’s intellectual capital, it is proposed to use the approach characterizing the belonging of both the given objects and other intellectual results, which haven’t been legally registered, to an employee (a group of employees), i.e., to intellectual human capital. Such an approach enables one to evaluate the performance efficiency of employees, creative teams and divisions and to determine return on their intellectual potential, thus developing more accomplished mechanisms of motivation, encouragement and controlling in respect of innovative activity.

Diagram 1. Intellectual human capital in the structure of human and intellectual capitals of an organization.



Thus, human IC integrates both the intellectual and attestation characteristics of human capital and the results of its innovative activity that, after their formalization and alienation, are incorporated in corporate and market intellectual capital.

This understanding allows considering human IC as the main factor of a higher innovative activity of an organization. Innovation is a result of idea transformation into research projects, new and upgraded hi-tech or socio-economic solutions that are recognized after being in every-day use. Therefore, innovation (idea) is one of the forms of the intellect of a person/a group of people with a further implementation in the results of intellectual and innovative activity and their use in practice. A significant role of human IC is determined by the nature of the innovative process itself. Moreover, at the different stages of the life cycle of an innovative product, a major role is played by the different types of intellectual human capital:

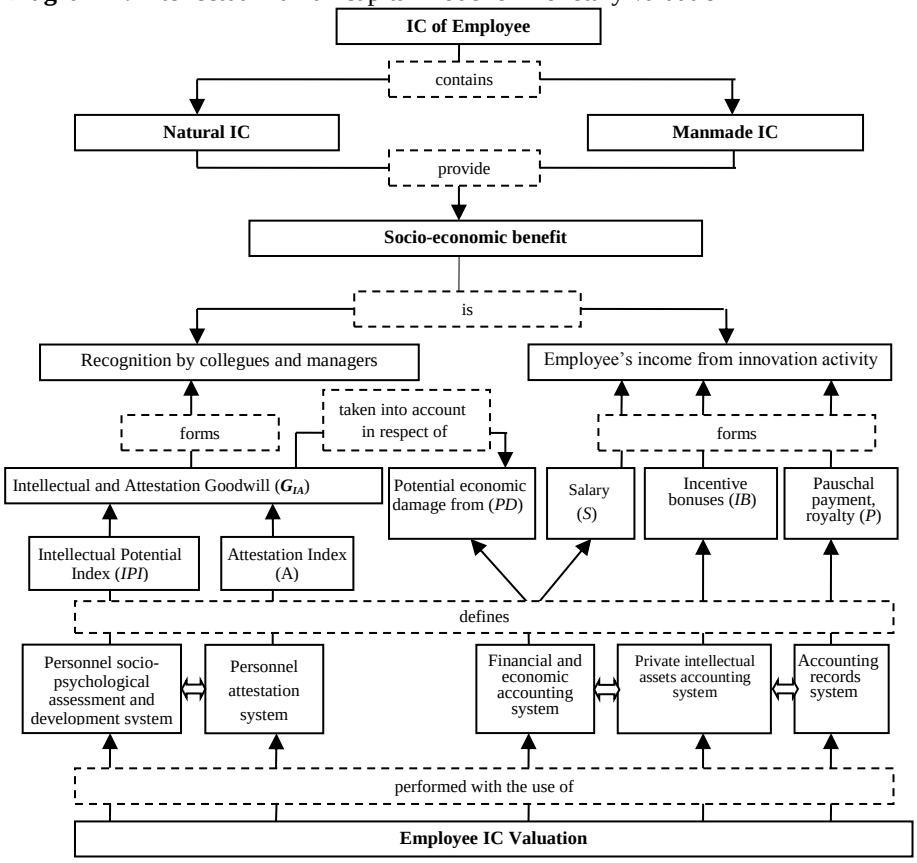
1) The intellectual capital of an employee (a group of employees) is the most important for generating innovative ideas;
2) The condition of the intellectual capital of an organization (including small business entities) defines the success of implementing and commercializing innovations;
3) The quality of the intellectual capital of a region (a country in general) and the level of the development of innovative culture significantly influence the frequency of the occurrence of new innovations and the duration of the innovation cycle.

On the basis of the foregoing, the level of the innovation activity of an organization can be expressed by the value of intellectual human capital, which will also be the integral indicator of this organization.

The model for evaluating an employee's intellectual capital is given hereinafter (Diagram 2).

In order to increase benefits from individual intellectual capital, this model should be primarily applied in respect of specialists-innovators being idea generators and unique experience holders as well as top managers and intellectual workers. The value of individual intellectual capital will be characterized by the value of an employee, which is variable and depends primarily on his efficiency within a definite period of time (as a rule, per year). On the other hand, these are the achieved results that influence the readiness of the managers of an organization for expenditures with the aim of not only retaining a valuable employee but also creating conditions to develop their creativity potential.

Diagram 2. Intellectual human capital model of monetary valuation



If fact, for the organization, the value of the intellectual capital of the employee (i) is the aggregate amount of expenses (real and potential) and is determined within the period of time (t) by the following formula:

$$V_i(t) = ED + S + IB + P + PD \cdot G_{IA} \quad (5)$$

- ED – expenses for the development of an employee per period (t), including as follows:

1) Expenses for professional advanced training, career promotion programs;

2) Expenses for the socio-psychological assessment of an employee's intellectual potential;

3) Expenses for the development of an employee's intellectual abilities (training courses, intellectual potential development programs, couching).

- S – Salary of an employee for executing his job-related duties per period (t). It includes a basic rate of compensation in accordance with an employee's qualification and education level, status allowance for position-related difficulty, individual bonuses (premiums) for efficient work in accordance with position-related instructions, and excludes social benefits and subsidies, collective allowance following the results of an organization's work, allowance for labour conditions and risks;
- IB – Incentive bonuses and payments to an employee for his contribution in the development of an organization, including innovations (participation in innovation projects, rational proposals, formalization of knowledge by methodological development, etc.), the amount of which can be determined on the basis of an employee's share participation in the distribution of an organization's benefits per period (t);
- P – Profit of an employee from items of intellectual property legally aliened and created individually or in a team;
- PD – Potential damage, i.e., valuated aggregate costs borne by an organization in case of an employee's possible termination of service as of the end of the period (t):
  - Expenses of an organization for the search of the equivalent employee (expenses for independent search, recruiting agencies, advertisements, etc.);
  - Economic damage experienced by an organization per period related to the replacement of an employee, who has left, to a new one (a decrease in product volume and quality, expenses for a new employee's training and adaptation, retraining of another employee);
  - Economic damage from changes in the systemic impacts of synergy and the emergence of the members of a group, which an employee has belonged to;
  - Damage from an employee's move to competitors related to the possibilities of the loss of a part of market segments, a competitor's higher sales and his stronger influence in the market (valuation of damage from transferring formalized intellectual projects and copyright in items of intellectual property to a competitor, from disclosing commercial secrets, etc.).

Potential damage must be adjusted for the coefficient (G_{IA}), which depends on the intellectual and attestation index (IA):

$$IA = \frac{1}{2}(IPI + At) \quad (6)$$

Determining the indexes (IPI) and (At) is given hereinabove in the research methods section.

As a result, G_{IA}=0.5 if IA <2.5; G_{IA} =1 if 2.5≤ IA <3.5; G_{IA} =1.5 if 3.5≤ IA <4.5; G_{IA} =2 if IA≥ 4.5.

The most challenges deal with valuating payments to an employee (P) for creating items of intellectual property (IPI). They must account for IPI creation and implementation expenditures, on the one hand, and for the prospective value of income from IPI commercialization, on the other hand.

At the first stage, the analysis is conducted in respect of expenditures on creating, registering and protecting an employee's items of intellectual property:

$$ET = T \cdot p \cdot k_d, \quad (7)$$

Where ET – expenditures of an employee's toil;

T – expenditures of time for IPI development, creation and registration expressed as hours;

p – price for an employee's working hour related to either producing or other activity performed by him;

k_d – coefficient of intellectual product complexity based on public, industrial or corporate standards.

In a second stage, it is necessary to calculate an anticipated production volume for those innovative products that have been created with the use of IPI, taking into account return on the investments of both an organization and employee. As a rule, the availability of the share of an employee's expenditures in overall expenditures for IPI creation increases the market cost of a product, which should be accounted for in planning production volume [**Błąd! Nie można odnaleźć źródła odwołania.**, p.123].

In a third stage, it is necessary to calculate the sums of anticipated earnings from IPI selling in royalty form, using the following formula:

$$P_R = \sum_{i=1}^{t} c_i \cdot q_i \cdot \frac{R}{100}, \tag{8}$$

Where P_R – anticipated royalty income (the fixed portion of sales value);

c_i – IPI market cost in the year (i) (with regard to price indexation);

q_i – quantity traded in the year (i);

R – royalty rate, % (remuneration of an invention stipulated in a contract with an organization, based on existing standard rates in a definite industry and for a definite type of products;

t – period of contract validity (IPI useful life).

In a fourth stage, it is necessary to calculate an employee's income from royalty payment measured as the difference between royalty income and an employee's expenditures:

$$NP = PR - ET, \tag{9}$$

Where NP – earnings from royalty payment (total net profit (P)). This can be paid to an employee as a lump sum; nevertheless, the necessity to pay a significant amount prior to the receipt of real profit as well as a higher risk related to the IPI commercialization result in an organization's possible refusal to make a lump-sum payment to its employee. Also, an employee has no access to the information on implementing his invention/know-how). A more preferable payment is periodical discounted cash flows calculated as follows:

$$PR_i = NP_i \cdot D_i, \tag{10}$$

Where PR_i – profit of an employee given as royalty in the year (i);

D_i – coefficient of discounting in the year (i) calculated with the following formula:

$$D_i = \frac{1}{(1 + 0.01 \cdot r)^i}, \tag{11}$$

Where r – discount rate in % measured via the cumulative method:

$$r = Rf + Rp, \tag{12}$$

Rf – risk-free rate of return for an innovative project, which is usually given as the safe-deposit rate of the most reliable banks;

Rp – premium paid by an organization for IPI implementation and commercialization risks (from 1 to 10%);

The quantitative evaluation of the component (Rp) shows the probability of both unfavorable dynamics in the innovation process and negative results of innovation activity; and this is determined via the expert approach as the sum of probabilities in each group of risk factors:

- Scientific and technical risks;
- Project regulatory support risks;
- Commercial offer risks;
- Entrepreneurial activity risks that deal with the probability of lower earnings insufficient to defray entrepreneurial expenses.

Thus, in formula (5) the component (P) is either a single lump-sum payment or a series of payments to an employee as royalty over the period (t).

The coefficient (G_{IA})

Formula (5) contains the indexes characterizing the value of an employee as an organization's hired worker and as an owner of intellectual capital (P, IB). We suppose that the ratio of these two index groups allows defining the efficiency of an employee's innovation activity:

$$K = \frac{P + IB}{S + ED}, \quad (13)$$

If this value exceeds 1, this means that payments to an employee as to the owner of intellectual capital are higher than expenses for this employee as for a hired worker, thus his innovation activity being efficient.

Conclusions

Thus, the valuation of an employee's intellectual capital is associated with element-by-element monetary evaluation of his innovation results by means of combining the cost model and the income model accounting for innovation activity risks as well as intellectual and attestation characteristics.

This model should be used for determining effects from an employee's intellectual and innovation activity and, as a result, for proving stimulating bonuses, and for taking management decisions aimed to increase both the efficiency of an employee's performance and development as well as to develop the system of his motivation. Moreover, the model is recommended for use in further valuation of an organization's intellectual human capital. The development of methodology and intellectual human capital valuation practice at the micro-level is oriented to the possibility to implement his intellectual potential by each employee, to provide a growth of innovation activity to an organization, thus improving a personal competitive power in the conditions of knowledge economy. At the mezzo-level, this method allows creating a scientific and methodological basis for the development and monitoring of programs to increase the quality of human capital performance in the regional system of innovation and to encourage small and medium-sized businesses in innovative activity.

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