

The Model of Human Intellectual Capital Valuation in Innovation Theory

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Abstract: The study views the structure of an organization's human intellectual capital that integrates both employee's intellectual, professional and personal abilities to perform innovation activity and their results achieved in the process of this activity. We prove the role of human intellectual capital in improving an organization's innovation activity. Basing on the cost, income, expert-based and psychological approaches, the article develops the intellectual capital monetary valuation model focused on increasing the objectivity of measuring its value by taking into account individual intellectual and performance characteristics. The application of this model aims to activate the innovative development of social and economic entities by increasing the quality and effectiveness of human intellectual capital.

Key words: Intellectual capital, model of monetary valuation, innovation activity, effectiveness, structure

INTRODUCTION

In the context of the recent foreign policy challenges, increasing the effectiveness of innovation in Russia is one of the necessary conditions for a transition to a new economic policy aimed to speed up socio-economic development, technological renovation and knowledge economy. The problem of organization's low innovation activity is currently of high urgency. According to official statistics, the percentage of organizations introducing technological, organizational and marketing innovations doesn't exceed 10.5% and continues to decrease (Fig. 1).

Such a situation is generally predicated on the unsatisfactory condition of human intellectual capital that incorporates two interrelated components, i.e., intellectual potential and the results of labour force's innovation activity. According to the Global Competitiveness Report 2014-2015, Russia is ranked 53rd out of 144 countries in part due to its low indicators related to human factors: Quality of the education 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 indicates Russia's weak capacity to use the existing knowledge effectively and to create new knowledge.

In this context, it is of high urgency to transit to the human-oriented concept of the management of innovation activity in order to increase the competitive power of Russian economy in the global market. This deals with implementing a new model for the integrated assessment of human intellectual capital which will ensure that an employee and a manager share common interests while distributing income from using individual intellectual capital and which will foster incentives for personnel to undertake innovation activity, thus intensifying the innovation activity of an organization.

The main feature of this model must be associated not only with staff accounting but also with the assessment of such parameters as the extent of every employee's contribution to an innovative product, the degree of the realization of intellectual and personal potential in innovation activity and the loss from an employee's departure.

Thus, this study aims to develop a monetary valuation technique for the assessment of human intellectual capital focused on intensifying the innovation activity of an organization. The aforementioned aim has determined the following research objectives:

- To extend the terms of 'innovation activity' and 'human intellectual capital' from the position of the human-related management concept
- To prove the importance of human intellectual capital in increasing the innovation activity of an organization

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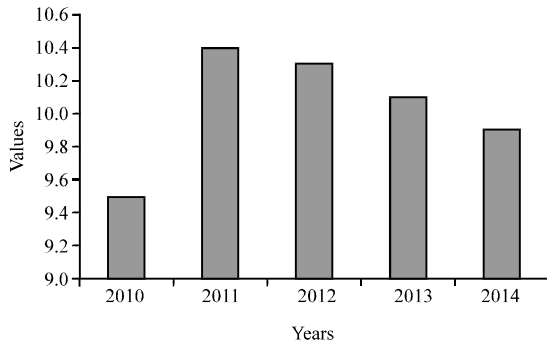


Fig. 1: The rosset report, science and innovation (2015)

- To propose the model of human intellectual capital monetary valuation, taking into account employee’s social and psychological characteristics
- To determine the areas of application for the proposed model

MATERIALS AND METHODS

A number of studies have been devoted to the issues on how human, social and intellectual capital influences innovation activity (Wu *et al.*, 2008; Teo *et al.*, 2014; Binda *et al.*, 2014; Lu *et al.*, 2014; Carraro *et al.*, 2014). In this study, the researchers propose their personal view on the structure of an employee’s intellectual capital and on its monetary valuation as a key factor for the effectiveness of a company’s innovation activity.

We suppose that the intellectual capital of an employee is based on two interrelated components: a genetic or natural component (intellect) and a man-made component (the results of intellectual innovation activities). They provide an employee’s success, thus resulting in the effectiveness of an organization which manifests as achieved social and economic benefit for a person or a business in general (an advanced position at work, competitive advantages, bonuses, income from implementing the items of intellectual property, a higher business value, etc).

To achieve social benefits (fellow-worker’s and manager’s awareness of the true value of a definite employee, satisfaction from the quality of work efforts), an employee should show his intellectual abilities, personal qualities, professional knowledge and position-related skills. In this context, only non-financial assessment is considered to be possible via socio-psychological methods and expert evaluation techniques. But, it should

be taken into account in the monetary valuation of an employee’s human capital as a special coefficient that is defined as the arithmetic average of the two indicators the intellectual potential of an employee and his personal contribution to an organization’s innovation development. The integral indicator of the Intellectual Potential of an Individual (IPI) is proposed to determine as given in Eq. 1:

$$IPI = \sum_{i=1}^6 k_i A_i \tag{1}$$

Where:

- $A_i (i = 1..6)$ = Point-based valuation of the types of intellectual potential (sensorial, emotional, thinking and logical, creative, socio-cultural and economic)
- $k_i (\sum k_i = 1)$ = Weight coefficient

To determine weights, the simplified approach-all types of intellectual potential are equal-and the expert-based approach-weight depends on the importance of a definite type of intellectual potential determined by experts for a definite position and/or situation-are recommended to be applied which ensures the adjustment of the indicator to various valuation objectives.

The procedures for the assessment of the types of individual intellectual potential (A_i) are based on using the researcher’s personality questionnaire (Dresvyannikov *et al.*, 2014).

To do the IPI integral valuation with Formula 1, all A_i must ultimately have the same variation range. To achieve this goal, it is recommended to apply the approach adopted by quality statistics (Krasilnikov and Vasilyev, 2004). Every type of intellectual potential is described as a set of attributes (X_j), e.g., as for the area of the perception of sensory intellect such attributes include integrity, constancy, apperception and emotional coloring.

To determine the quality of each attribute, it is essential to set a quality standard treated as a number of quality categories. In this case, it is recommended to choose five categories corresponding to the intensity of the attribute that belong to a definite type of intellectual potential: ‘low’-1; ‘below average’-2; ‘medium’-3; ‘above average’-4, ‘high’-5. Every type of A_i is estimated as the arithmetic average of the value 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

The attribute X is in turn estimated as the arithmetic average of points gained from answering those questions that are supposed to determine the intensity of the attribute X in a respondent. Thus, all types of intellectual potential are qualitatively valued in the range from 1-5. Analogically, the assessment indicator (A_t) is calculated via the expert-based approach, using Eq. 3:

$$A_t = \sum_{i=1}^p k_i J_i \quad (3)$$

Where:

p = Number of key indicators that reflect an employee's non-financial labor results influencing his success in achieving social benefits (p = 20 is a recommended value)

J_i = Point-based valuation of a definite indicator done by experts on the basis of assessment or testing (it is recommended to apply the same range as for the structural components of intellect-from 1-5)

k_i = Weight coefficients that are set by experts in respect of how important a definite indicator is for a definite position at the current stage of an organization's development under the principle 'the higher the importance, the higher the range' while $\sum k_i = 1$

The following groups are proposed to be treated as indicators: position-related characteristics: length of employment and education degree; professional competence; quality of work; responsibility and discipline; initiative.

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 corporate culture principles; level of work motivation; loyalty; commitment to an organization, its values, interests, aims, etc.

Contribution to an organization's innovation development: number of instances of participating 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 number and content of indicators may vary according to an organization's activity type. The period

(t) is defined as the frequency of assessment and equals, as a rule, 1 year. As far as IPI and A_t are calculated via expert valuation techniques, it is necessary to determine the degree of the consistency of expert's opinions when choosing indicators and weights using the concordance coefficient by Eq. 4. Expert's opinions are considered to be consistent if $w = 0.75$:

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

Where:

m = Number of matrix lines (number of experts)

n = Number of matrix columns (attributes)

K = Number of chosen quality levels

x = Qualitative analogue of a quantitative indicator which is determined by interval scaling

Economic benefit is associated with an employee's income from his intellectual activity. First of all, two inter-related roles of an employee should be highlighted: an employee as a holder of intellectual capital and an employee as an owner of intellectual capital. Being only a holder of intellectual capital, an employee is entirely the functional element of a system and his status doesn't deal with the possibility to be engaged in managing or with any special influence on distributing income from using his intellectual capital. An employee's labor is an intellectual routine, the product of which is information about the existing knowledge. In this case, an employee himself is considered as a hired worker and he receives remuneration for his labor in the form of salary, without claiming some share of profits. An employee as an owner of intellectual capital uses it to generate new knowledge and brings his unique experience to practice, thus having the right to receive a monopoly profit. The difficulty deals with the fact that when implementing various innovation projects, one and the same employee, who possesses intellectual abilities, professional skills and personal characteristics, can perform both as an owner of intellectual capital (a generator of ideas, a holder of unique experience) and as a hired worker introducing ideas and other people's experience.

In our point of view, when finding the cost of an employee, it is necessary to take into account both his value as a hired worker and his income from using his own intellectual capital, even if there is a possibility to run into the problem of double counting, since this valuation technique is primarily for management purposes (such as

the establishment of a mechanism for motivating and stimulating innovation activity, for improving HR-management, etc).

In practice, an organization's management staff should monitor investments (expenses) in the elements of human intellectual capital, on the one hand, and those benefits which it has gained from the investments made, on the other hand. This proves the relevance of implementing the financial models that combine the cost and income approaches for evaluating the economic benefit of an employee.

The aforementioned approaches have established a methodological basis for developing a monetary valuation method to assess human intellectual capital.

RESULTS AND DISCUSSION

Monetary model of human intellectual capital valuation in innovation activity: Human intellectual capital valuation is an integral element of the process of innovation activity management. We suppose that the most relevant concept is the human-oriented concept of innovation activity management, the peculiar features of which can be formulated by analyzing the evolution of the concept resulted from social development and changes in the prevailing type of economy: industrial economy→ information economy→ knowledge economy (Table 1).

Implementing the human-oriented concept of innovation activity management requires both the concept of innovation activity to be extended and another definition of human capital as a part of an organization's intellectual capital to be introduced.

Innovation activity is to be considered as a set of activities carried out by the participants not only of an innovation project but also of any other project related to applying human intellect in developing a socio-economic system. Basically, it is referred to as intellectual innovation activity.

Both to encourage employees to perform innovation activity and to use their intellectual potential to the maximum extent for the development of an organization, it is reasonable to extend the concept of an employee's intellectual capital. We think that the term should include not only an employee's intellect, knowledge obtained, skills and abilities (i.e., inalienable capital) but also the products of his intellectual innovation activity-formalized knowledge and information as well as developed productive relationships with his colleagues and the outer environment of an organization (alienable capital). As a result, an organization focused on innovation

development is recommended to distinguish human Intellectual Capital (human IC) as a separate type of capital which will include the components of an organization's human and intellectual capitals in their traditional understanding (Fig. 2). In the diagram, the dashed line means that together with the traditional approach that assigns created and legally registered intangible assets to an organization's intellectual capital, it is proposed to apply an approach, according to which both such items and all other intellectual know-hows that haven't been legally registered belong to an employee (a group of employees), thus, being attributed to human intellectual capital. This approach allows assessing the performance effectiveness of employees, creative teams and divisions, defining the results of their intellectual potential and developing more accomplished mechanisms to motivate, stimulate and control innovation activity.

As a result, human IC combines the intellectual and assessment characteristics of human capital and the results of its innovation activity which are integrated into organizational capital and market capital, after their formalization and alienation.

This understanding allows human IC to be considered as the main factor for increasing an organization's innovation activity. Innovation is the result of transforming ideas into research works, know-how, new or upgraded hi-tech or socio-economic solutions which gain public recognition by being applied in every-day life. Thus, innovation (an idea) is one of the manifestations of a person's or people's intellect which is further translated into the results of intellectual innovation activity with their application in practice. A significant role of human IC is determined by the nature of innovation process. Moreover, at different stages of the life cycle of an innovative product, a key role is assigned to different types of human intellectual capital: An employee's/a group's intellectual capital is mostly important for generating innovative ideas. The condition of the human intellectual capital of organizations (including those being small business enterprises) defines the successful implementation and commercialization of innovation; both the level of the development of a region's/a country's innovative culture and the quality of its human intellectual capital generally influence the frequency of the occurrence of new innovation and the duration of an innovative cycle.

Therefore, the level of an organization's innovation activity can be expressed by the value of human intellectual capital which will also be an integral indicator for this organization. The model for assessing an employee's intellectual capital is given

Table 1: Evolution of the innovation activity management concept

Characteristics	Technology-oriented	Information-oriented	Human-oriented
Economic prerequisites			
Stage of social/economic development	Industrial	Postindustrial (information economy)	Postindustrial (knowledge economy)
Main productive force	Technical equipment, items of labor	Technology, tools of labor, science	Human intellect, knowledge
Main types of innovation resources	Material, financial	Informative and communicative	Intellectual, human
Prevailing type of innovation behavior	Passive	Passive and active	Active
Prevailing types of innovation	Product-related, technical	Technological, managerial, informative	Social, cognitive
Theoretical approaches to management			
Name of approach	Factor-related, functional	Factor-related, functional	Factor-related, functional
Characteristics of management providing the interaction 'human being-innovation proces's			
Innovation activity of employees	Low	High in high-tech industries	High in all areas of activity
Prevailing methods of motivation	Material	Material, organizational	Moral and psychological
Priorities in employee valuation	Professional knowledge, skills	Social and psychological peculiarities, needs, motives	Intellectual abilities, satisfied quality of labor
Employee development management	Professional training	Professional training, social and psychological development	Development of intellectual and innovative potential
Analysis of innovation activity results	None	Performed at the level of groups, communities	Performed at the level of individual
Characteristics of management providing the interaction 'human being-human being'			
Prevailing style of management	Authoritative	Democratic	Democratic and delegating
Character of interaction	Superior-inferior	Collegial and collective	Collaborating and personal
Forms of activity	Individual	Group	Team
Involvement in innovation activity management	Practically no involvement	Executors are involved in management	Participative management

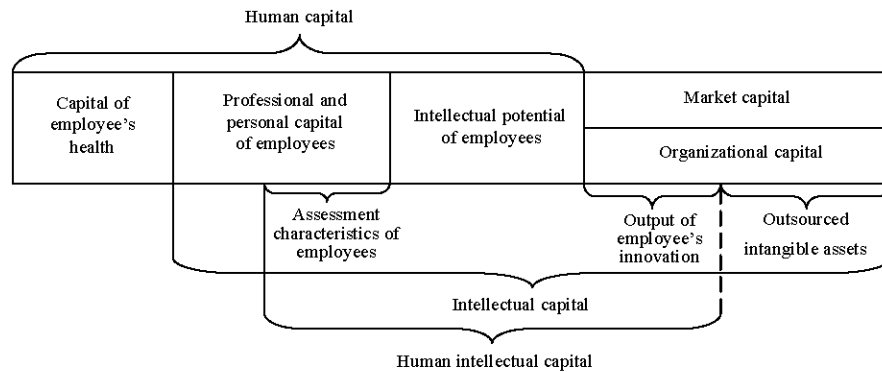


Fig. 2: Human intellectual capital in the structure of an organization's human and intellectual capital

hereinafter. Figure 3 In order to improve return on individual intellectual capital, this model should be primarily applied in respect of specialists-innovators, who generate ideas and hold unique experience as well as of top managers and knowledge workers.

The cost of individual intellectual capital will indicate an employee's value which is a variable and depends primarily on his effectiveness for a definite period of time (as a rule, per year). On the other hand, the results achieved will influence the readiness of managers for extra expenditures with the aim of not only retaining a valuable employee but also creating conditions in order to develop his creative potential. In general, in

respect of an organization, the value of the intellectual capital of employee no. i is expressed in terms of the aggregate measure of expenses (real and potential) and is determined for the period of time (t) by the following equation:

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

- ED-Expenses for an employee's development per period (t) as follows
- Expenses for advanced professional training, career promotion programs
- Expenses for the socio-psychological assessment of an employee's intellectual potential

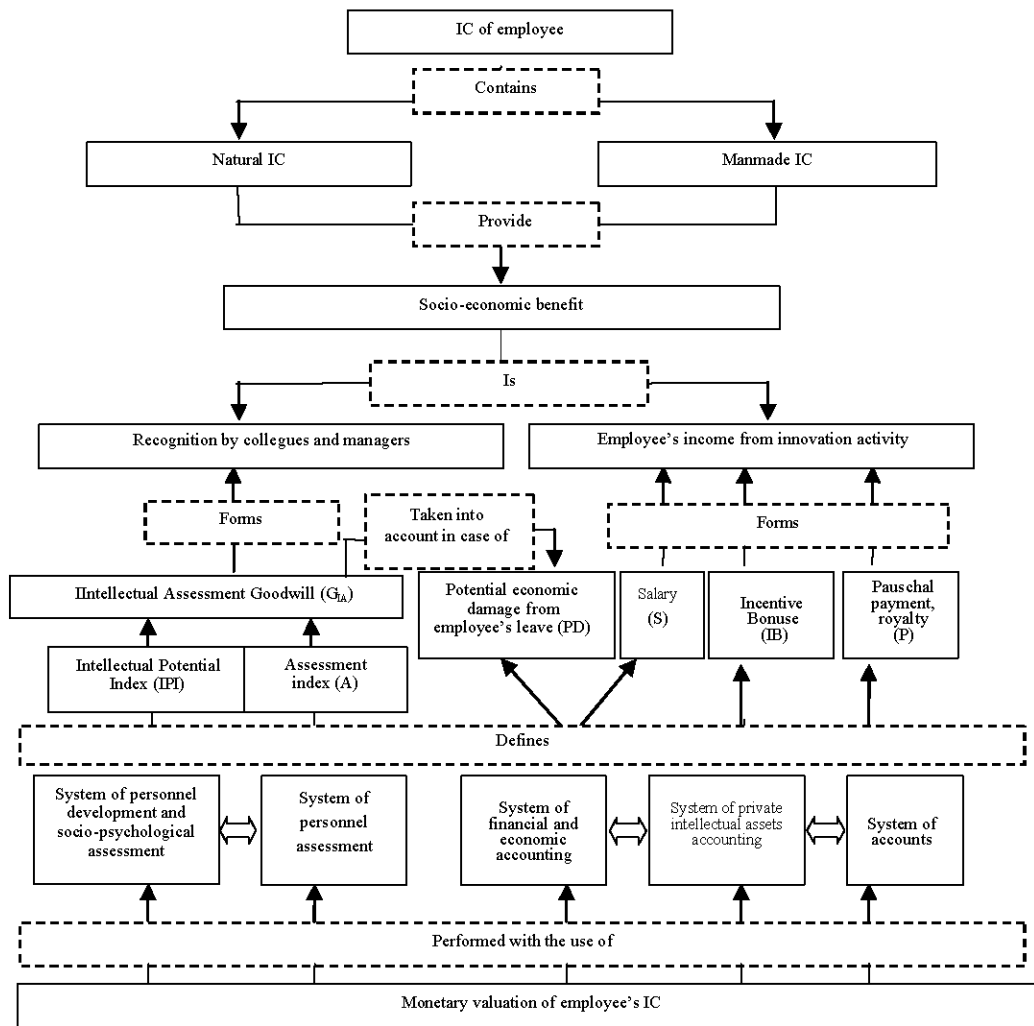


Fig. 3: The model of monetary valuation of human intellectual capital

- Expenses for the development of an employee's intellectual abilities (training courses, intellectual potential development programmes, coaching)
- S-Salary of an employee for executing his job-related duties per period (t). It includes a basic rate of remuneration in accordance with an employee's qualification and educational level, status allowances for position-related difficulty and individual bonuses (premiums) for effective work in accordance with position-related instructions. It excludes social benefits and subsidies, collective bonuses according to the results of an organization's work and allowances related to labor conditions and risks
- IB-Incentive bonuses and payments to an employee for his contribution to the development of an organization, including innovation (participation in innovative projects, rational proposals, formalization of knowledge by means of methodological development, etc). This value can be determined on the basis of an employee's share participation in the distribution of an organization's profit per period (t)
- P-Profit of an employee from intellectual property items legally alienated and created either individually or in a team
- PD-Potential damage which is expressed in terms of the appraised sum of expenses borne by an organization in case a worker leaves employment as of the end of the period (t)
- Expenses of an organization for searching for an 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, another employee's retraining)

- Economic damage from both changes in the systemic impacts of synergy and the emergence of the members of the group, to which an employee has belonged

Damage from an employee's move to competitors which relates to the possibility to lose some share of the market, a competitor's higher sales and his stronger

influence in the market (the monetary valuation of damage from transferring both formalized intellectual projects and copyright in intellectual property items to a competitor, from disclosing commercial secrets, etc). Potential damage must be adjusted for the coefficient (G_{IA}) which depends on the Intellectual Assessment index (IA):

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

The techniques for defining the indexes IPI and At have been discussed 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 $IA \geq 4.5$. The most challenging task deals with the assessment of payments to an Employee (E) for the Items of Intellectual Property (IIP) created by him is. They should take into account IIP creation and application expenses, on the one hand, and prospective income from IIP commercialization, on the other hand. At the first stage, the analysis is conducted in respect of expenses for creating, registering, and protecting an employee's IIPs:

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

Where:

ET = Expenditures of an employee's toil

T = Time spent on IIP development, creation and registration expressed in terms of hours

p = Price per 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 the second stage, it is necessary to calculate an anticipated production volume related to those innovative products that have been created with the use of IIP, taking into account return on the investments of both an organization and its employee. As a rule, if an employee has a share of expenditures in the common IIP creation expenditures, this increases the market cost of a product and should be accounted for in planning production volumes.

In the third stage, it is necessary to calculate the amounts of anticipated earnings from IIP selling in the form of royalty, using the following Eq. 8:

$$P_R = \sum_{i=1}^t c_i \cdot q_i \cdot \frac{R}{100} \quad (8)$$

Where:

P_R = Royalty income planned (the fixed portion of sales value)

c_i = IIP's market cost in the year (i) (with regard to price indexation)

q_i = Quantity traded in the year (i)

R = Royalty rate (%) (remuneration for an invention stipulated in a contract with an organization with regard to existing standard rates in a definite industry and for a definite type of products)

t = Period of contract validity (IIP's useful life)

In the 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:

$$NP = PR - ET \quad (9)$$

where, NP is 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 IIP commercialization would result in an organization's possible refusal to make a lump-sum payment to its employee. At the same time, an employee has no access to the information on implementing his invention (know-how). A more preferable method of payment is periodical discounted cash flows calculated as follows:

$$PR_i = NP_i \cdot D_i \quad (10)$$

Where:

PR_i = Profit of an employee, given as royalty in the year (i)

D_i = Coefficient of discounting in the year (i) which is calculated with the following equation

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

where, r is discount rate in percentage, measured via the cumulative method:

$$r = R_f + R_p \quad (12)$$

Where:

R_f = Risk-free rate of return on an innovative project which is usually given as the deposit rate of the most reliable banks

R_p = Premium paid by an organization for IIP implementation and commercialization risks (ranging from 1-10%)

The quantitative assessment of the component (R_p) shows the probability of unfavorable dynamics in regard to the innovation process and that of negative results in regard to innovation activity and this is determined as the sum of probabilities in each group of risk factors via the expert approach:

- Scientific and technical risks
- Risks related to legal support for a project
- Commercial offer risks

Entrepreneurial activity risks that deal with the probability of lower earnings insufficient to defray entrepreneurial expenses. Thus in Eq. 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}): Equation 5 contains the indexes characterizing the value of an employee both as an organization's hired worker (ED, S) and as an owner of intellectual capital (P, IB). We suggest that the ratio of these two index groups allows the effectiveness of an employee's innovation activity (IAE) to be defined:

$$K_{IAE} = \frac{P+IB}{S+ED} \quad (13)$$

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

CONCLUSION

Thus, assessing an employee's intellectual capital is associated with the element-by-element monetary valuation of his innovation results by means of combining the cost model and the income model with due account for innovation activity risks and intellectual assessment characteristics.

The model is aimed to determine the efficiency of an employee's intellectual innovation activity, thus proving

stimulating bonuses and making management decisions focused on increasing the efficiency of an employee's performance and development and on improving the system of his motivation.

RECOMMENDATIONS

Moreover, the model is recommended for use in further valuation of an organization's human intellectual capital. Developing methods for human intellectual capital valuation and improving the process at the micro-level is oriented both to providing each employee with the possibility to realize his intellectual potential and to triggering an organization's innovation activity, thus increasing its competitive power in the conditions of knowledge economy. At the mezzo-level, such methods will create a scientific and methodological basis for developing and monitoring the programs which are aimed at raising the quality of human capital performance in the regional system of innovation and at encouraging small and medium-sized businesses to undertake innovative activity.

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