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INTELLECTUAL POTENTIAL ASSESSING METHODOLOGY OF AN INNOVATION-ORIENTED ENTERPRISE

Purpose. Development and deepening of scientific and methodological foundations, elaboration of practical recommendations in the context of assessing innovation-oriented enterprise employees' intellectual potential level.

Methodology. The results of scientific research were obtained using general and special methods: inductive logic, deduction, dialectical cognition; economic-statistical and sociological methods; analysis and synthesis; non-parametric modeling; expert-point evaluation; multidimensional scaling.

Findings. We formed a theoretical and methodological platform for evaluating the intellectual potential of innovation-oriented enterprise employees. The fundamental principles of the technology for assessing this potential, which are based on the modern management paradigm, were highlighted. The analysis and evaluation of the intellectual potential of innovation-oriented enterprise employees was carried out on the basis of an expert method using mathematical and statistical tools to ensure the consistency of expert assessments, in particular the Kendall concordance coefficient and the Pearson consistency criterion.

Originality. Our study developed scientific and methodological approach to assessing the level of innovation-oriented enterprise's employees' intellectual potential. The main difference between the methodologies was a multi-level assessment: at the professional level — expert assessment of professional qualification potential level significance, taking into account the consistency of expert opinions; at the creative level — expert assessment of creative potential level indicators significance, taking into account the consistency of expert opinions. As a result, taking into account the expert approach, an integral (taxonomic) index was calculated. In general, this makes it possible to increase the effectiveness of innovation-oriented management enterprises' intellectual potential.

Practical value. The implementation of the proposed methodology makes it possible to solve the managerial problems of identifying potential abilities and opportunities (reserves) of employees, forming study groups, developing training programs, motivating employees to professional and intellectual achievements and demonstrating innovative activity

Keywords: *innovative development, assessment principles, intellectual potential, creative potential, professional qualification potential*

Introduction. Currently, the Ukrainian economy is in a controversial situation. On the one hand, the country has significant intellectual potential; on the other hand, it has low innovation activity. In this regard, the intellectual potential of an innovative enterprise managing issue becomes especially relevant, since in modern economic conditions, intelligence and creativity are the defining characteristics of innovative ideas generation and the viability of an innovative enterprise in general [1]. In this context, the effectiveness of managing the enterprise's intellectual potential is largely determined by the presence of an adequate system for assessing the specified potential, which makes it possible to constantly monitor the intellectual potential of the enterprise's personnel and, based on its results, develop appropriate measures to increase the innovative activity of employees [2]. It should be noted that at Ukrainian industrial enterprises, the effectiveness of an employee's activity is usually determined only by his/her compe-tence. However, in modern conditions, it is necessary to take into account the level of its innovation activity (creative output). In other words, innovation activity should be evaluated in terms of the salary equivalent to its costs, thus contributing to the motivation of employees to innovative activities.

Literature review. The researchers' achievements in the assessment field of intellectual resources, processes and results of intellectual activity and the variety of approaches and methods proposed by them are of considerable scientific and practical interest, which is understandable and justified in the modern model of economic development. In [3, 4], the dominant position is that it is important to develop intellectual inventions in Ukraine, which are of particular significance in war conditions and are necessary to strengthen the security of the state. This idea is further developed by researchers [5], who rightly point out that intelligence, knowledge, and high technologies are the basis of the new economy, a source of quality of life and well-being of the country's population. A number of scientists [6] develop their idea and emphasize the crucial role of intellectual capital in the formation of intellectual potential

for building a knowledge economy. In this context, the authors of the studies [7, 8] trace the relationship between organizational knowledge and dynamic abilities of the enterprise to achieve innovative ambidexterity. Paper [9] proposes a conceptual approach to assessing the creative potential of an enterprise, study [10] suggests assessing the level of human potential, and researchers [11] analyze human capital from the perspective of activation policy as an investment. Article [12] develops a methodological approach to the effective management of the enterprise's intellectual potential based on economic instruments' phased assessment. A. Butnyk-Siverskyi in his monograph [13] presented a model approach to assessing the value of an integral intangible system and practical aspects of its application. A number of authors [14] have developed a system-integrated methodological approach to assessing organizational knowledge and determining the Index of Digital Transformation of Business Entities. At the same time, researchers [15] crystallize the problems of developing the enterprise's economic potential, focusing on the results of expert assessment of factors' impact on this indicated potential value. Noteworthy is the study [16], whose scientific contribution is to highlight the problems of experts' teamwork and the coherence of expert opinions (concordance) to develop effective solutions for developing strategies and projects. Despite significant scientific developments, the problem of assessing the intellectual potential of an enterprise focused on enhancing its innovative development remains relevant and requires further research in the direction of determining the factors influencing the creative output of employees; establishing the relationship between the creative activity of employees and the enterprise's innovative activity results; developing a methodology for assessing the level of employee creative potential, which requires systematic coverage and appropriate methodological support.

Methods. The research used general scientific and specific methods: inductive logic, deduction, dialectic, economic, statistical and sociological methods, analysis and synthesis, non-parametric modeling, expert evaluation, multidimensional scaling. Cognitive, motivational, and axiological approaches were used to solve the task.

Results. As a tool to help identify problems in managing the intellectual potential of an innovative enterprise, we'll try to develop a methodology for assessing individual intellectual potential in terms of its components: professional, qualification and creative. By individual intellectual potential we mean "the level of intellectual development achieved by an individual and the tacit knowledge accumulated as a result of practical experience that has socio-economic value" [17]. Individual intellectual potential is revealed by the following approaches: cognitive (knowledge possession) based on creative potential; motivational (readiness to use creative potential) and axiological (mastery and perception of values) approaches based on professional and qualification potential. According to our reasoning, the differentiation of the enterprise's individual intellectual potential into creative and professional-qualification potential is based on the need to take into account not only theoretical knowledge of a person, but also the qualitative characteristics of the acquired knowledge use efficiency. On the basis of the analyzed concepts, we have formulated a definition of the professional and qualification potential notion, which is understood as "an interconnected set of general and specific abilities and professional competencies of a personality acquired at a given enterprise, which are necessary for the performance of professional duties, and the creation of conditions at the enterprise for the improvement and development of his or her practical skills and experience" [17]. In our opinion, "creative potential is an interconnected complex of individual abilities to set and solve new creative tasks, produce new unique ideas and inimitable innovations, as well as to establish conditions at the enterprise for the manifestation of these creative abilities" [17].

In the process of developing the methodology for assessing individual intellectual potential, the following evaluation requirements were taken into account: objectivity; reliability; validity; predictability; accessibility and consistency; compliance with the company's objectives. To ensure these requirements, the technology for assessing this potential is based on the following principles: several assessment subjects; assessment methods set creation; systematic evaluation; development of assessment criteria; development of a system for measuring evaluation criteria; formalization of assessment activities.

The methodology for assessing the individual intellectual potential of employees of an innovation-oriented enterprise includes:

1) assessment of professional and qualification potential level;

2) assessment of creative potential level.

We consider the scheme for assessing individual intellectual potential in terms of its components − professional and creative in stages: at the micro- (employee) and meso- (enterprise) levels.

To determine the level of an employee's professional and qualification potential, we use non-financial assessment methods. The need to apply these methods is due to the fact that the structure of intellectual potential contains natural elements that are difficult to assess from a financial point of view.

Preliminarily, it is necessary to build a system of indicators on the basis of which the intellectual potential of an employee and his or her professional level are assessed and to compare these indicators with the standard, the norm that serves as a unit of measurement. At this stage of the assessment, we use professionalism tests and recommended attestation indicators standards of an individual, developed by experts taking into account job responsibilities.

Thus, we will assess the level of an employee's professional and qualification potential from the perspective of quality. For this purpose, it is necessary that all indicators that assess the level of the specified employee potential take values in the same measurement range (number of quality categories).

At this stage of the assessment, five levels of quality and their corresponding quantitative values will be adopted, as shown in Table 1.

In this context, we use the method of multidimensional scaling, which allows us to move from quantitative values that characterize the level of an employee's professional and qualification potential to qualitative values to ensure comparability of indicators.

The following formula is used to assess the level of professional qualification potential (PGP)

$$PGP = \sum_{i=1}^{n} k_i x_i,$$

where x_i is the value of the ith indicator of the employee's professional and qualification potential; $k_i \left(\sum k_i = 1 \right) -$ the weighting factor that determines the significance of the indicator.

The method of multidimensional scaling allows one not only to assess the level's quality degree of professional and qualification potential, but also to rank the company's staff by

Table 1

Correspondence between qualitative values and quantitative indicators assessment of the employee's professional and qualification potential level

Quantitative assessment x_i	Qualitative values of indicators x_i
5	High level
4	Significant level
3	Medium level
2	Below average level
1	Low level

this indicator. Using the multiple concordance coefficient (coefficient of consistency for several variables), the degree of experts' opinions consistency is determined, who establish the indicators ranks of professional qualification potential level using the following expression

$$w = 1 - \frac{\sum_{j=1}^{n}\sum_{i=1}^{m}\sum_{l=1}^{m-1}\left|x_{ij} - x_{i+l,j}\right|}{nm(m-1)(k-1)}, \qquad (1)$$

where m is the number of matrix rows (number of experts); n – the number of matrix columns (level indicators of professional and qualification potential); k – the number of selected quality levels (we have adopted 5 quality levels); x – a quantitative indicator analog of professional and qualification potential.

Based on experimental studies of real data, a table of consistency of experts' opinions depending on the coefficient w was compiled (Table 2).

The value of the concordance coefficient can range from 0 to 1 ($w = 0$ – experts' opinions do not coincide, $w = 1$ – experts' opinions are fully coherent). The assessment of employees' professional and qualification potential factual level provides generalized information about the quality of the intellectual potential professional component possessed by the enterprise from the point of view of each employee's potential capabilities in the process of intellectual and innovative activity.

The purpose of assessing the creative potential level is to optimize the creativity management of enterprise employees, identify factors that influence the manifestation of the creative component (innovation activity), and then develop measures aimed at increasing the innovative activity of employees.

First, it is necessary to build a system of indicators that assess the level of an employee's creative potential. At this stage, we use the tests: P. Torrance's to assess non-verbal creativity and S. Mednick's to assess verbal creativity. Case studies and creative tasks can be used to assess creative thinking. At this step, you will also need internal statistical information about each employee. The level of creative potential should be assessed from the point of view of quality.

At this stage, we consider five levels of quality and their corresponding quantitative values, similar to the process of assessing the level of professional potential (Table 1).

To determine the level of creative potential (CP), we use the following formula

$$CP = \sum_{i=1}^{n} k_i x_i.$$

In order to move from quantitative to qualitative values of the creative potential level signs to ensure the comparability of indicators, we use the multidimensional scaling methods. These methods can also be used to rank enterprise employees by these indicators. In this context, the degree of experts' opinions coherence and the establishment of indicators ranks of creative potential level is determined by the coefficient of multiple concordance – formula (1).

The degree of experts' opinions consistency is shown in Table 2. As a result of a comprehensive assessment, employees can get information about their latent capabilities in intellectual and innovative activities, and managers can make the best use of their employees' competencies, taking into account the performance of tasks that are not related to their main professional activities but are necessary at different stages of the innovation process. Based on the results of the assessment, a final document (protocol and report) should be created, on the basis of which the HR manager prepares personnel offer, forms a personnel reserve consisting of qualified, highly intelligent and creative employee groups, who have been assessed and shortlisted for managerial positions, and develops employee training programs.

The obtained individual values of the professional qualification and creative employees' level can be used to calculate the indicator of individual intellectual potential, subdivision of employees' group or enterprise as a whole.

The indicator for individual intellectual potential of the company's employees is calculated as the arithmetic mean of individual levels within the professional qualification and creative potential of employees using the formula

$$IIP = \frac{\sum_{i=1}^{n} PGP + \sum_{i=1}^{n} CP}{n}, \qquad (2)$$

where $\sum_{i=1}^{n} PGP$ is employees' level of professional and qualification potential; $\sum_{i=1}^{n} CP$ – level of employees' creative potential; n – the number of employees at the enterprise.

The next step, we analyze the level of professional qualification and creative potential of the employees of PJSC "TerA", on the basis of which the proposed methodology was tested.

The authors assessed the level of professional and qualification potential of employees using the expert method. At the same time, all the experts' assessments regarding the significance of the indicators for this potential level are summarized in a single table. The summary rank matrix is presented in Table 3.

The indicator given the highest score by the expert is assigned the number 1. Four experts were interviewed based upon the seven indicators through a questionnaire, which is used to compile a consolidated ranking matrix. In this context, a new ranking matrix was constructed on the basis of the assigned ranks, as shown in Table 4.

The distribution by significance of the professional and qualification potential levels is presented in Table 5.

To determine the degree of consistency among experts' opinions on the importance of each of the assessed indicators of professional and qualification potential level, we use Kendall's concordance coefficient (W) [16], which reflects the agreement of the expert group's opinions in general. This coefficient is calculated by the following formula

Table 2

The degree of experts' opinions consistency

Quantitative assessment w	Qualitative indicators
0.0	no coherence
$w < 0.65$	poor
$0.65 \leq w < 0.75$	moderate
$0.75 \leq w < 0.85$	good
$0.85 \leq w < 1.0$	high
1.0	full consistency

Table 3

Consolidated rank matrix

Professional potential indicators	Experts			
	1	*2*	*3*	*4*
Employee's educational level ($x1$)	1	1	1	1
Specialty and specialization ($x2$)	2	3	2	2
Seniority and work experience ($x3$)	3	4	5	3
Professional training and achievements ($x4$)	6	7	6	7
Professional priorities ($x5$)	7	5	7	6
Professional theoretical and practical knowledge ($x6$)	4	6	4	5
Practical skills and competencies ($x7$)	5	2	3	4

Table 4

The rank matrix

Experts → Indicators ↓	1	2	3	4	Sum of ranks	d	d²
x1	1	1	1	1	4	−12	144
x2	2	3	2	2	9	−7	49
x3	3	4	5	3	15	−1	1
x4	6	7	6	7	26	10	100
x5	7	5	7	6	25	9	81
x6	4	6	4	5	19	3	9
x7	5	2	3	4	14	−2	4
∑	28	28	28	28	112	−	388

Table 5

Ranking of indicators by significance

Ranking of indicators by significance	Sum of ranks
x1	4
x2	9
x7	14
x3	15
x6	19
x5	25
x4	26

$$W = \frac{12 \cdot S}{m^2(n^3 - n)}, \qquad (3)$$

where 12 is a constant value in the formula for calculating the concordance coefficient; S — the square of the sum of ranks; n — the number of assessed indicators of professional qualification level; m — the number of experts.

Therefore,

$$W = 12 \cdot 388 / 4^2 (7^3 - 7) = 0.8660.$$

The value of the concordance coefficient $W = 0.866$ indicates a high level of expert consistency.

To evaluate the significance of the coefficient of concordance, we use Pearson's consistency criterion (χ^2)

$$\chi^2 = m \cdot (n - 1)W, \qquad (4)$$

where n is the number of assessed professional level indicators, m — the number of experts.

Thus,

$$\chi^2 = 4 \cdot (7 - 1) \cdot 0.866 = 20.7840.$$

The obtained value of χ^2 is compared with the table value for the degrees of freedom $K = n - 1 = 6$ at a given significance level $\alpha = 0.05$. The calculated χ^2 (20.7840) is higher than the tabulated χ^2 (12.5916), so the resulting concordance coefficient ($W = 0.8660$) is not random. Therefore, the results are meaningful and their use in our study is justified.

Based on the sum of the ranks presented in Table 5, we calculate the weighting factors that determine the significance of the discussed indicators. We convert the expert survey matrix into a matrix of transformed ranks using the formula

$$S_{ij} = X_{max} - X_{ij}, \qquad (5)$$

where $X_{max} = 7$.

The resulting matrix of transformed ranks accordingly is shown in Table 6.

Employees are tested and professionalism tests are used. Employee questionnaires and internal information regarding their participation in intellectual and innovative activities are analyzed. The evaluation procedure is presented in Table 7.

Table 6

Matrix of transformed ranks

Indicators/Experts	1	2	3	4	∑	Ki
Employee's educational level (x1)	6	6	6	6	24	0.286
Specialty and specialization (x2)	5	4	5	5	19	0.226
Seniority and work experience (x3)	4	3	2	4	13	0.155
Professional training and achievements (x4)	1	0	1	0	2	0.0238
Professional priorities (x5)	0	2	0	1	3	0.0357
Professional theoretical and practical knowledge (x6)	3	1	3	2	9	0.107
Practical skills and competencies (x7)	2	5	4	3	14	0.167
Total	−	−	−	−	84	1.0
Concordance coefficient	−	−	−	−	0.8660	
Calculated χ²	−	−	−	−	20.7840	
Table-based χ² ($k = 6$, $\alpha = 0.05$)	−	−	−	−	12.5916	

Table 7

Assessment of the employee's professional and qualification potential level

Indicators	Assessment procedure
Employee's educational level (x1)	Based on the questionnaire data. In case of specialized education, 5 points are awarded, in case of non-core education, 0 points are awarded
Specialty and specialization (x2)	Based on the questionnaire data. Scoring 10 points if they correspond to the job profile, 0 points if they do not fully correspond
Seniority and work experience (x3)	Based on the questionnaire data. Professional experience of more than 5 years − 5 points, less than 5 years − 0 points
Professional training and achievements (x4)	An analysis of the employee's professional activity in the implementation of the quality management system takes place. The assessment includes the indicator "Number of proposals submitted by the employee to improve the quality of production (technology, process, etc.)". Suggestions regarding both the identified so-called "best" and "worst" practices are taken into account. For each proposal submitted, 1 point is awarded, but no more than 20 points in total
Professional priorities (x5)	Based on questionnaire data (expert opinion). If the employee's professional priorities are in accordance with the intellectual and innovative activities carried out by him/her, 20 points are awarded, if the employee has not indicated his/her professional interests, 0 points are awarded
Professional theoretical and practical knowledge (x6)	As a result of testing. The test was developed by the head in charge of operational activities. The test consists of 20 questions, with 1 point awarded for each correct answer
Practical skills and competencies (x7)	The assessment is carried out by an expert (line manager) based on the indicators presented in Table 10. The maximum score is 20 points

The assessment of employees' practical skills by their direct supervisor is presented in Table 8.

For each indicator, the scores obtained in the process of assessing the employee's professional and qualification poten-

Table 8

Evaluation of the employee's practical skills and competencies by the direct supervisor

Indicators	Scoring formula and comments
Efficiency of working time use by an employee	1. Index of working day utilization (abstraction coefficient): $$Iwd = Df/Dn;$$ where Df is average actual working day, hrs; Dn — average working day according to the norm, hrs. If $Iwd \geq 0.93$, 2 points are awarded (the employee was distracted from the main job for a little bit more than 30 minutes); $0.87 \leq Iwd \leq 0.92$ — 1 point is awarded (distraction from work for no more than 1 hour); $0.81 \leq Iwd \leq 0.86$ — 0.5 points are awarded (distraction from work for no more than 1.5 hours); $Iwd \leq 0.8$ — no points are awarded
Efficiency of information search	2. Time index for finding the necessary information: $$Iti = Tti/Tti - 1;$$ where Tti is the time spent searching for the necessary information in the base period, $Tti - 1$ — the time spent searching for information in the previous period; If $Iti \geq 0.5$, 2 points are awarded; $0.25 \leq Iti \geq = 0.49$ — 1 point is awarded; $0.1 \leq Iti \geq 0.48$ — 0.5 points; $Iti \leq 0.09$ — 0 points
Efficiency of information processing by an employee	1. Document processing time index: $$Itd = Tt/Tt - 1;$$ where Tt is the time spent processing the document in the base period; $Tt - 1$ — the time spent processing the document in the previous period; If $Itd \geq 0.5$, 2 points are awarded; $0.25 \leq Itd \geq 0.49$ — 1 point is awarded; $0.1 \leq Itd \geq 0.48$ — 0.5 points; $Itd \leq 0.09$ — 0 points
Knowledge of job duties, skills to perform them in practice	The employee has high practical skills — 2 points; has good, solid knowledge and practical skills — 1 point; has satisfactory practical skills — 0.5 points; practical skills meet the minimum requirements — 0 points
Ability and skills to apply modern means and methods in workplace	The employee has unique abilities and skills — 2 points; has good abilities and practical skills — 1 point; has satisfactory abilities and skills — 0.5 points; has practically no abilities and skills — 0 points
Ability to achieve the task performance	The employee has a high level of organizational skills, is focused and persistent in accomplishing the task — 2 points; has good organizational skills, but is not sufficiently focused — 1 point; has satisfactory ability to organize work, but does not always show persistence in completing the task — 0.5 points; an employee has a low level of organizational skills, does not seek to fulfill the assigned tasks, and performs work in violation of deadlines — 0 points
Striving to improve skills and abilities in the workplace	The employee is distinguished by an exceptional desire to improve his/her competence in practical activities — 2 points; the employee has a desire to improve skills and abilities — 1 point; the employee is not sufficiently eager to improve skills and abilities — 0.5 points; no desire to improve skills and abilities — 0 points
Initiative, ingenuity, innovation	The employee has exceptional initiative and ingenuity, strives for innovation — 2 points; regularly shows initiative and ingenuity in solving problems, has innovative thinking — 1 point; Initiative and ingenuity are not always shown — 0.5 points; no desire for innovation, no initiative — 0 points
Striving to improve the effectiveness of intellectual and innovative activities (IIA) along with the experience accumulation	The employee constantly strives to improve the effectiveness of the IIA, using the experience gained — 2 points; there is a desire to improve the effectiveness of the IIA — 1 point; does not always strive to use experience to improve the effectiveness of the IIA — 0.5 points; no desire to improve the effectiveness of the IIA — 0 points
Clarity and literacy in the expression of thought, culture of speech	The employee is characterized by the ability to express his/her thoughts clearly and concisely — 2 points; has a good ability to formulate and express his/her thoughts clearly and concisely — 1 point; does not always manage to express his/her thoughts clearly — 0.5 points; the employee is unable to formulate his/her thoughts clearly — 0 points

tial are translated into a qualitatively similar value and the corresponding quantitative value according to the developed scale:

- 0— 19 points: "very low level" — up to 1;
- 20—39 points: "low level" — from 1 to 2;
- 40—59 points: "medium level" — from 2 to 3;
- 60—79 points: "significant level" — from 3 to 4;
- 80—100 points: "high level" — from 4 to 5.

As a result of the assessment according to the indicators characterizing the level of professional and qualification potential of R&D employees, taking into account the weighting coefficients, the results are presented in Table 9.

Thus, 3 out of 10 employees participating in the assessment have a high level of professional qualification potential, and 7 employees, respectively, have a significant level.

In the process of assessing the level of creative potential, a methodological approach was used from the perspective of as-

sessing the creative activity of employees. All accumulated knowledge and skills are intellectual potential. The external expression of intellectual capacity in the practical application of intellectual potential is creative output.

The level of employees' creative potential was assessed using the expert method. The summary rank matrix is presented in Table 10.

A survey of 4 experts on seven indicators is conducted by means of a questionnaire. Based on the ranks assigned by the experts, a ranking matrix was constructed, as shown in Table 11.

In our case, the distribution of indicators of the level of employees' creative potential by the degree of significance is presented in Table 12.

To determine the degree of experts' opinions consistency regarding the significance of each of the assessed indicators of creative potential level, we calculate the Kendall's concordance coefficient using formula (3). Thus,

Table 9

Professional and qualification potential of the R&D unit employees level

Employee	x1	x2	x3	x4	x5	x6	x7	PGP level
PG1	1.43	0.68	0.62	0.07	0.14	0.43	0.67	4.04
PG2	1.43	0.90	0.47	0.10	0.14	0.32	0.50	3.86
PG3	1.43	0.45	0.31	0.05	0.07	0.32	0.50	3.13
PG4	0.86	0.90	0.31	0.10	0.18	0.43	0.50	3.27
PG5	1.14	1.13	0.62	0.12	0.11	0.21	0.67	4.00
PG6	0.86	0.90	0.78	0.10	0.18	0.64	1.17	4.62
PG7	0.57	0.68	0.62	0.12	0.18	0.43	0.67	3.26
PG8	0.86	0.90	0.78	0.07	0.14	0.54	0.50	3.79
PG9	1.14	1.13	0.62	0.10	0.11	0.32	0.67	4.09
PG10	0.57	0.90	0.78	0.10	0.07	0.32	0.67	3.41

Table 10

Summary rank matrix

Indicators of creative potential level	Experts			
	1	2	3	4
Number of registered discoveries or inventions, units. (x1)	1	2	1	1
Number of submitted rationalization proposals (ideas) to improve the company's operations, units (x2)	2	1	2	2
Number of rationalization proposals accepted and implemented, units (x3)	3	3	3	3
Employee participation in innovative projects, units (x4)	4	4	5	4
Number of speeches on the topic of research and development at international and national economic conferences, congresses, forums, round tables, scientific seminars, units (x5)	5	5	4	5
Number of scientific publications included in specialized international scientific and metric databases, units (x6)	6	6	6	7
Mentoring in the implementation of external innovation projects, units (x7)	7	7	7	6

Table 11

Matrix of ranks

Experts → Indicators ↓	1	2	3	4	Sum of ranks	d	d²
x1	1	2	1	1	5	−11	121
x2	2	1	2	2	7	−9	81
x3	3	3	3	3	12	−4	16
x4	4	4	5	4	17	1	1
x5	5	5	4	5	19	3	9
x6	6	6	6	7	25	9	81
x7	7	7	7	6	27	11	121
∑	28	28	28	28	112	−	430

Table 12

Ranking of indicators by significance

Indicators of creative potential level	Sum of ranks
x1	5
x2	7
x3	12
x4	17
x5	19
x6	25
x7	27

Table 13

Matrix of transformed ranks

Indicators /Experts	1	2	3	4	∑	Ki
Number of registered discoveries or inventions, units (x1)	6	5	6	6	23	0.274
Number of submitted rationalization proposals (ideas) to improve the company's operations, units (x2)	5	6	5	5	21	0.250
Number of rationalization proposals accepted and implemented, units (x3)	4	4	4	4	16	0.190
Employee participation in innovative projects, units (x4)	3	3	2	3	11	0.131
Number of speeches on the topic of research and development at international and national economic conferences, congresses, forums, round tables, scientific seminars, units (x5)	2	2	3	2	9	0.107
Number of scientific publications included in specialized international scientific and metric databases, units (x6)	1	1	1	0	3	0.036
Mentoring in the implementation of external innovation projects, units (x7)	0	0	0	1	1	0.012
Total	−	−	−	−	84	1.00
Concordance coefficient	−	−	−	−	0.9598	
Calculated χ²	−	−	−	−	23.0352	
Table-based χ² (k = 6, α = 0.05)	−	−	−	−	12.5916	

Table 14

Assessment of employees' creative potential level

Indicators	Assessment procedure
Number of registered discoveries or inventions, units. (x1)	For each registered discovery or invention, 10 points are awarded, but no more than 30 points in total
Number of submitted rationalization proposals (ideas) to improve the company's operations, units (x2)	For each innovation proposal submitted, 1 point is awarded, but no more than 10 points in total
Number of rationalization proposals accepted and implemented, units (x3)	For each accepted and implemented rationalization proposal, 1 point is awarded, but no more than 20 points in total
Employee participation in innovative projects, units (x4)	For each participation in an innovative project, 15 points are awarded, but no more than 20 points in total
Number of speeches on the topic of research and development at international and national economic conferences, congresses, forums, round tables, scientific seminars, units (x5)	For each presentation on the topic of the research project, 1 point is awarded, but no more than 10 points in total
Number of scientific publications included in specialized international scientific and metric databases, units (x6)	Each scientific publication is awarded 1 point, but no more than 10 points in total
Mentoring in the implementation of external innovation projects, units (x7)	For each mentorship in the implementation of an external innovation project, 1 point is awarded, but no more than 10 points in total

Table 15

Level of R&D employees' creative potential (*CP*)

Employee	x1	x2	x3	x4	x5	x6	x7	Level CP
C1	1.37	1.25	0,95	0.655	0.535	0.18	0.048	4.98
C2	0.274	1.25	0,95	0.655	0.535	0.18	0.06	3.90
C3	0.274	1.25	0,95	0.524	0.428	0.108	0.048	3.58
C4	1.37	1.25	0,76	0.655	0.535	0.18	0.06	4.81
C5	0.274	1.00	0,76	0.655	0.535	0.144	0.048	3.42
C6	0.274	1.25	0,95	0.524	0.428	0.144	0.036	3.61
C7	0.274	1.00	0,76	0.524	0.428	0.18	0.06	3.23
C8	0.274	1.25	0,76	0.655	0.428	0.18	0.048	3.59
C9	0.274	1.25	0,95	0.524	0.428	0.18	0.048	3.65
C10	0.274	1.25	0,57	0.524	0.428	0.144	0.036	3.23

$$W = 12 \cdot 430/4^2 (7^3 - 7) = 0.9598.$$

The obtained value of the concordance coefficient ($W = 0.9598$) indicates a high level of consistency in the experts' opinions. To evaluate the importance of the concordance coefficient, we will determine Pearson's consistency criterion using formula (4). Therefore,

$$\chi^2 = 4(7 - 1) \cdot 0.9598 = 23.0352.$$

The obtained χ^2 value is compared with the table value for the number of degrees of freedom $K = n - 1 = 7 - 1 = 6$, and at a given significance level $\alpha = 0.05$. The value of χ^2 calculated (23.0352) > χ^2 tabulated (12.5916) means that the obtained value of the concordance coefficient ($W = 0.9598$) is not random, the results are meaningful and their use is justified in our study.

Based on the sum of the ranks presented in Table 13, we now calculate the weighting factors that determine the significance of the indicators under consideration. The expert survey matrix is transformed into a matrix of transformed ranks using the formula (5), where $X_{max} = 7$. The matrix of transformed ranks is shown in Table 13.

Internal statistical data regarding the results of intellectual innovation activities of employees were analyzed according to the proposed indicators. The evaluation procedure is presented in Table 14.

The scores for each indicator obtained in the process of assessing the level of employees' creative potential are transformed into qualitatively close analogues and their corresponding quantitative values, as in the approach to professional and qualification potential, based on the developed interval scale. The assessment of the level of creative potential of R&D employees, taking into account the weighting coefficients, yielded certain results, as shown in Table 15.

The results of the assessment showed that 2 out of 10 employees who took part in the evaluation have a high level of creative potential, 8 employees have a significant level. Based on the results obtained, the main areas of formation and intellectual potential development of individual employees were identified and individual development programs were drawn up.

The obtained individual values for the level of professional, qualification and creative potential are used to calculate the indicator of individual intellectual potential (IIP) of the R&D unit of the enterprise. This indicator is calculated as the arithmetic mean of employees' individual levels of professional, qualification and creative potential using formula (2). The results are presented in Table 16.

The data obtained on the employees' professional, qualification and creative potential level are used by the company to solve problems in the context of human resources management, evaluation and management of intellectual potential in the context of improving the efficiency of innovation activities, and to determine the value of each employee.

Conclusions. The functioning of an innovation-oriented enterprise, which in the context of the study is understood as a

Table 16

Intellectual potential of the company's R&D department employees

Employee	PGP level	CP level	IIP level
N1	4.04	4.98	4.51
N2	3.86	3.90	3.88
N3	3.13	3.58	3.56
N4	3.27	4.81	4.04
N5	4.00	3.42	3.71
N6	4.62	3.61	4.12
N7	3.26	3.23	3.25
N8	3.79	3.59	3.69
N9	4.09	3.65	3.87
N10	3.41	3.23	3.32
TOTAL	3.74	3.8	3.77

self-learning system capable of continuous updating and development based on the effective use of existing innovations and generation of new knowledge, involves the fullest possible realization of intellectual potential, which requires its systematic assessment. In this context, assessment acts as an essential tool for effective management of intellectual potential quality in terms of socio-economic systems' innovative development and provides feedback in human-centered management of innovation activities.

The obtained results of the study are aimed at intensifying the innovative development of socio-economic entities, as they allow one:

1) at the individual level: to increase the effectiveness of the employee's intellectual and innovative activity through the targeted formation and harmonious development of the selected components of intellectual potential based on the methods and tools of reflective evaluation; to ensure the employee's competitiveness and continuous improvement in the knowledge-based economy based on effective self-governance of own intellectual capital using the model of mental experience and the model of interaction of components;

2) at the level of enterprise management: to determine the value of a particular employee and the directions of further growth based on the developed methods for qualitative and cost assessment of individual intellectual potential; to form creative teams for the implementation of innovative projects, taking into account the determination of the employees' synergistic interaction coefficient; to improve enterprise value management, taking into account the return on the intellectual component of human capital based on cost assessment models; to increase the innovative activity of employees.

The proposed approach is the basis for thinking over priorities for the development of innovation-oriented enterprises. It refers to the effective use of the intellectual potential of an enterprise as the main area of focus for the scientific society and the business community to bring the national real sector of

the economy out of the crisis and onto the path of sustainable development. Therefore, the following research is devoted to the problem of improving the mechanisms for managing the intellectual potential of enterprises by developing measures that will help to activate not only professional competencies, but also the ability to show innovative activity (creative output).

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Методика оцінки інтелектуального потенціалу інноваційно-орієнтованого підприємства

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Мета. Розвиток і поглиблення науково-методичних засад і розроблення практичних рекомендацій у контексті оцінки рівня інтелектуального потенціалу працівників інноваційно-орієнтованого підприємства.

Методика. Результати наукового дослідження отримані за використання загальних і спеціальних методів пізнання: індуктивної логіки, дедукції, діалектики, економіко-статистичного й соціологічного аналізу та синтезу, непараметричного моделювання, експертно-бального оцінювання, багатовимірного шкалювання.

Результати. Сформована теоретико-методологічна платформа для оцінювання інтелектуального потенціалу працівників інноваційно-орієнтованого підприємства. Висвітлені основоположні принципи технології оцінки цього потенціалу, що ґрунтуються на сучасній парадигмі управління. Проведений аналіз і здійснене оцінювання інтелектуального потенціалу працівників інноваційно-орієнтованого підприємства на основі експертного методу з використанням математико-статистичного інструментарію для забезпечення узгодженості експертних оцінок, зокрема коефіцієнта конкордації Кендалла та критерію узгодженості Пірсона.

Наукова новизна. У роботі розроблено науково-методичний підхід до оцінювання рівня інтелектуального потенціалу працівників інноваційно-орієнтованого підприємства. Основна відмінність методики полягає у проведенні багаторівневого оцінювання на професійному рівні: експертна оцінка значущості показників рівня професійно-кваліфікаційного потенціалу з урахуванням узгодженості думок експертів; на творчому рівні: експертна оцінка значущості показників рівня творчого потенціалу з урахуванням узгодженості думок експертів. У результаті з урахуванням експертного підходу розраховується інтегральний (таксономічний) індекс. Загалом це підвищить ефективність інноваційно-орієнтованого управління інтелектуальним потенціалом підприємств.

Практична значимість. Упровадження запропонованої методики дасть змогу вирішити управлінські проблеми виявлення потенційних здібностей і можливостей (резервів) працівників, формування навчальних груп, розробки навчальних програм, мотивації працівників до професійних та інтелектуальних досягнень, прояву інноваційної активності.

Ключові слова: *інноваційний розвиток, принципи оцінки, інтелектуальний потенціал, творчий потенціал, професійно-кваліфікаційний потенціал*