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ECONOMIC-MATHEMATICAL MODELLING OF EMPLOYEE EVALUATION IN THE SYSTEM OF ENTERPRISE KNOWLEDGE MANAGEMENT

The article determines the basic components of a knowledge management system at an enterprise. The most significant factors in the employee assessment in the selection of personnel are defined, using the expert survey and the method of constructing the majority attitude of benefits on a set of evaluated factors. Correlation between the selected factors is determined and comprehensive assessment of employees for staff selection within the knowledge management system at an enterprise is determined.

Keywords: *knowledge management; non-numerical statistics; expert survey; employee appraisal.*

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ЕКОНОМІКО-МАТЕМАТИЧНЕ МОДЕЛЮВАННЯ ОЦІНЮВАННЯ ПРАЦІВНИКА В СИСТЕМІ УПРАВЛІННЯ ЗНАННЯМИ ПІДПРИЄМСТВА

У статті визначено основні складові системи управління знаннями підприємства. Встановлено найбільш вагомі фактори оцінювння працівника при підборі персоналу з використанням експертного опитування та методу побудови мажоритарного відношення переваг на множині факторів, що оцінюються. Визначено рівень взаємозв'язку між обраними факторами та сформовано комплексну оцінку працівника при підборі персоналу в системі управління знаннями підприємства.

Ключові слова: *управління знаннями; нечислова статистика; експертне опитування; оціна персоналу.*

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ЭКОНОМИКО-МАТЕМАТИЧЕСКОЕ МОДЕЛИРОВАНИЕ ОЦЕНИВАНИЯ РАБОТНИКА В СИСТЕМЕ УПРАВЛЕНИЯ ЗНАНИЯМИ ПРЕДПРИЯТИЯ

В статье определены основные составляющие системы управления знаниями предприятия. Установлены наиболее весомые факторы оценки работника при подборе персонала с использованием экспертного опроса и метода построения мажоритарного отношения предпочтений на множестве оцениваемых критериев. Определен уровень взаимосвязи между избранными факторами и сформирована комплексная оценка работника при подборе персонала в системе управления знаниями предприятия.

Ключевые слова: *управление знаниями; нечисловая статистика; экспертный опрос; оценка персонала.*

Introduction. A necessary condition for an enterprise functioning is the availability of a relevant knowledge system and its management. Any enterprise must pay great attention to knowledge as a source of competitive advantage and added value. During the development of knowledge management system in a company an emphasis should be made to define the basic elements of this system and interrelation between them. These issues cannot be solved without the evaluation of components of the knowledge management system which requires the application of economic-mathematical modelling.

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Latest research and publications analysis. Mathematical methods have been actively and successfully used to solve economic issues by such scientists as A. Alekhin (2012), I. Blahun (2000), P. Hryhoruk (2012), V. Vitlinskyi (2003). Modelling and management of intellectual capital and knowledge management system of enterprises were considered by O. Liashenko (2007), P. Makarov (2012), V. Porohnia (2012). Despite significant achievements in modelling of knowledge management for enterprises, scholars seem to miss complex interrelated models for optimization of its further management that allows taking into account its essence, structure and peculiarities of the process of transforming knowledge into value. This requires the continuation of the research in this direction.

The object of the research is a knowledge management system at an enterprise.

The goal of the article is a comprehensive assessment of employees in the selection of staff in the knowledge management system of an enterprise using expert evaluation and the method of constructing the majority attitude of benefits on a set of factors evaluated.

Key research findings. Any company is not able to manage its intellectual capital in the absence of a system of knowledge management. Enterprise knowledge management system includes the following components in their close interaction (Borovyk, 2011):

- people who get, generate and transmit knowledge;
- processes used for knowledge spread;
- technologies that provide fast and effective people's work and processes.

In the system of knowledge management people are the key component. Joint work of people multiplies knowledge accumulated at an enterprise.

Therefore, quite important is the process of personnel recruitment with an appropriate level of knowledge and the ability for its further generation and transmission. For this it is necessary to carry out an assessment of employees, taking into account the most important factors and interrelations between them. And this can be performed the following steps:

1) in generalization of the factors of professional, intellectual and social components;

2) analysis of the entire set of factors in terms of their significance for expert assessment;

3) selection of the most essential factors and their weighting coefficients;

4) determining the correlation between the factors using expert assessment;

5) assessment for employee selection within the knowledge management system of an enterprise.

Stage 1. Generalization of the factors of professional, intellectual and social components. The following factors are selected:

1. Appropriate level of professional knowledge.
2. Education.
3. Experience in the field.
4. Age.
5. Health.
6. Self-organization.
7. The level of perception.

8. Logical (system) intelligence.
9. Emotional intelligence.
10. Creative intelligence.
11. Business intelligence.
12. Socio-cultural intelligence.
13. Conformity of socionic type of the personality with the sphere of activity and profession.
14. The level of interaction of socionic type of the personality with other members of the collective.
15. Number of published works (if applicable).

Stage 2. Analysis of the entire set of factors in terms of their significance using expert assessment. As the level of influence of each factor is different, we need to engage experts in the election of the most important of them and to determine their weight factors in assessing a potential candidate for a position. The experts were selected from the employees of the industrial enterprises in the Khmelnytskyi Oblast.

According to Bernulli's theorem, the coverage error Mg can be calculated by the formula:

$$Mg = t\sqrt{\frac{rg}{n}}, \quad (1)$$

where t is the confidence coefficient (Student's criteria) for a given level of probability (typically 0.95–0.99); r is the fraction of the sample items that have fixed feature; q is the fraction of the sample items that do not have such a feature; n is the number of the representative sample.

Data on the total population of experts for the enterprise: permissible error of representation (Mg) – 0.2; confidence coefficient (t) – 2.1; the share of absolutely qualified experts (r) – 0.90; the share of less qualified experts (g) – 0.1. Therefore, the number of the representative sample would be:

$$n = \frac{2.1^2 \times 0{,}9 \times 0{,}1}{0.2^2} = 10. \quad (2)$$

That is, the number of experts for our study is 10 persons.

Assessment of the level of influence of each factor is provided in the form of answers: "minimal impact", "noticeable influence", "medium impact", "moderate impact", and "significant impact". These polling data have non-numeric character, so we can apply the so-called methods of "non-numeric statistics" for data processing. One of the methods of data analysis of non-numeric nature is to build a majority ratio of benefits on the set of evaluated factors (Buzdalin, 2000; Sibikina, 2011).

To simplify the analysis a linguistic assessment of experts is presented in the form of number:

- minimal impact – 1;
- noticeable effect – 2;
- medium impact – 3;
- moderate impact – 4;
- significant impact – 5.

This conversion will not lead to information loss. Poll results (transcoded) are presented in Table 1.

Table 1. **Results of expert assessment,** *author's*

Factors	Expert									
	1	2	3	4	5	6	7	8	9	10
1	5	4	3	4	4	3	3	4	5	5
2	4	5	3	5	4	4	4	5	5	5
3	3	5	5	4	4	5	5	4	4	3
4	3	3	4	3	3	3	4	5	5	5
5	1	2	2	1	1	3	1	2	2	1
6	3	4	5	3	3	4	5	5	4	4
7	5	3	4	2	5	5	5	4	3	2
8	4	5	4	3	4	2	4	5	3	5
9	2	1	3	1	2	1	1	1	2	2
10	3	5	4	4	4	3	2	5	5	5
11	2	1	2	1	2	3	1	1	1	2
12	1	3	2	1	1	1	4	1	1	1
13	4	2	5	5	5	4	4	3	5	5
14	4	3	5	5	4	4	5	4	5	4
15	1	3	2	1	2	1	1	1	2	1

The dominance of one factor over another can be described by the matrix of paired comparisons:

$$A = \{a_{ij}\}_{i,j=1}^{n}, \text{ where } a_{ij} = \begin{cases} 1, & X_i \text{ dominate over } X_j \\ 0, & \text{in other case} \end{cases}. \quad (3)$$

Evaluation of the importance of the factor on the basis of linguistic assessments of the groups of respondents is performed by means of building the majority ratio of benefits on a set of factors.

Let each l of k respondents assess the importance of factor X_i by scoring value b_{li}, then the evaluation of the group of factors will be described by matrix:

$$A^l = \{a_{ij}^l\}_{i,j=1}^{n}, \text{ where } a_{ij}^l = \begin{cases} 1, & b_{li} \geq b_{lj} \\ 0, & \text{in other case} \end{cases}. \quad (4)$$

Let the matrix be:

$$C = \sum_{l=1}^{k} A^l = \{c_{ij}\}_{i,j=1}^{n}, \quad (5)$$

where k – the number of experts.

Then the scoring matrix $\tilde{A}$ of the matrix of importance of the criteria group of A according to the majority rule is defined by the correlation:

$$\tilde{A} = \{\tilde{a}_{ij}\}_{i,j=1}^{n}, \text{ where } \tilde{a}_{ij} = \begin{cases} 1, & c_{ij} \geq c_{ji} \\ 0, & \text{in other case} \end{cases}. \quad (6)$$

The essence of the majority rule is as follows:

If the number of the respondents, who think that X_i prevails over X_j, is more than the polled number of the respondents, who think conversely, final conclusion is made that X_i prevails over X_j. In other case the conclusion is made that X_j prevails.

Calculation of the number of points scored by each factor is determined by the formula:

$$H = \{h_i\}_{i=1}^{n}, \text{ where } h_i = \sum_{j=1}^{n} a_{ij}. \tag{7}$$

The matrices A^l have been built up for each expert (according to the formula (4)). There are 10 matrixes in our case. Let's present some of them:

$$A^1 = \begin{vmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{vmatrix}; \tag{8}$$

$$A^{10} = \begin{vmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \end{vmatrix}. \tag{9}$$

According to (5) the matrix C has been built up:

$$C = \begin{vmatrix} 10 & 5 & 6 & 7 & 10 & 6 & 6 & 6 & 10 & 7 & 10 & 9 & 5 & 6 & 10 \\ 7 & 10 & 7 & 9 & 10 & 8 & 5 & 9 & 10 & 9 & 10 & 10 & 8 & 8 & 10 \\ 7 & 5 & 10 & 7 & 10 & 8 & 8 & 7 & 10 & 7 & 10 & 10 & 5 & 6 & 10 \\ 5 & 5 & 4 & 10 & 10 & 6 & 6 & 7 & 10 & 7 & 10 & 10 & 5 & 4 & 10 \\ 1 & 0 & 0 & 1 & 10 & 0 & 0 & 1 & 6 & 1 & 7 & 8 & 1 & 0 & 8 \\ 4 & 4 & 6 & 8 & 10 & 10 & 7 & 6 & 10 & 5 & 10 & 10 & 5 & 6 & 10 \\ 6 & 5 & 5 & 6 & 10 & 4 & 10 & 6 & 10 & 5 & 10 & 10 & 6 & 6 & 10 \\ 5 & 7 & 5 & 8 & 9 & 6 & 6 & 10 & 10 & 7 & 9 & 10 & 5 & 5 & 10 \\ 1 & 1 & 0 & 0 & 7 & 0 & 1 & 0 & 10 & 0 & 9 & 8 & 0 & 0 & 9 \\ 8 & 6 & 7 & 9 & 10 & 7 & 6 & 8 & 10 & 10 & 10 & 9 & 4 & 5 & 10 \\ 1 & 0 & 0 & 1 & 7 & 0 & 1 & 1 & 8 & 1 & 10 & 8 & 0 & 0 & 8 \\ 0 & 1 & 0 & 2 & 7 & 0 & 1 & 1 & 5 & 1 & 6 & 10 & 2 & 1 & 8 \\ 5 & 8 & 6 & 8 & 10 & 7 & 5 & 8 & 10 & 8 & 10 & 9 & 10 & 7 & 9 \\ 6 & 7 & 8 & 8 & 10 & 8 & 7 & 7 & 10 & 7 & 10 & 10 & 8 & 10 & 10 \\ 0 & 0 & 0 & 1 & 8 & 0 & 1 & 0 & 7 & 0 & 8 & 8 & 1 & 1 & 10 \end{vmatrix} \cdot \quad (10)$$

Then, taking into account (6) and (7), scoring matrix $\tilde{A}$ and number of points scored by each factor look as follows:

$$\tilde{A} = \begin{vmatrix} 1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \end{vmatrix}; \quad (11)$$

$$H = \begin{vmatrix} 12 \\ 15 \\ 12 \\ 7 \\ 4 \\ 9 \\ 11 \\ 9 \\ 5 \\ 12 \\ 4 \\ 2 \\ 13 \\ 14 \\ 4 \end{vmatrix}. \quad (12)$$

More details on the results are shown in Table 2.

Table 2. **Weighting coefficients of the factors,** *author's*

	Factor	Weighting coefficients (w_i)	New weighting coefficients
1	Appropriate level of professional knowledge (tests)	0.090226	0.11215
2	Education	0.112782	0.140187
3	Experience in the field	0.090226	0.11215
4	**Age**	0.052632	-
5	**Health**	0.030075	-
6	Self-organization	0.067669	0.084112
7	The level of perception	0.082707	0.102804
8	Logical (system) intelligence	0.067669	0.084112
9	**Emotional intelligence**	0.037594	-
10	Creative intelligence	0.090226	0.11215
11	**Business intelligence**	0.030075	-
12	**Socio-cultural intelligence**	0.015038	-
13	Conformity of socionic type of the personality with the sphere of activity and profession	0.097744	0.121495
14	The level of interaction of socionic type of the personality with other members of staff	0.105263	0.130841
15	**Number of published works**	0.030075	-

Stage 3. Choosing the most essential factors and their weighting coefficients. Weighting coefficients of each factor is determined by the formula:

$$w_i = \frac{h_i}{\sum h_i}. \quad (13)$$

Out of the 15 factors the most significant were selected, for which $h_i \geq h_{cr}$, where $h_{cr} = 1 / 15 = 0.07$ (Figure 1).

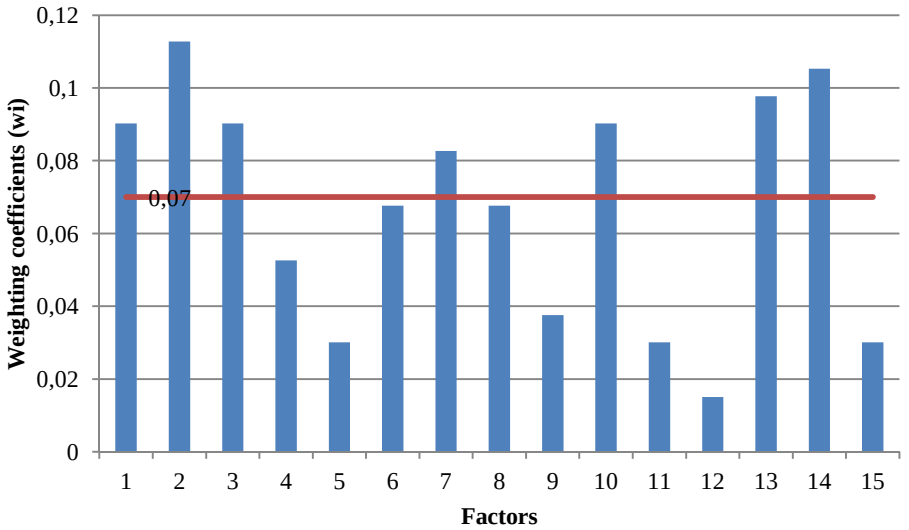

Figure 1. **Choosing the most essential factors,** *author's*

As it can be seen in Table 2 and Figure 1, the most important in carrying out employee evaluations are the factors 1, 2, 3, 6, 7, 8, 10, 13, 14. For them, new weighting coefficients are calculated by the formula, without the least important factors.

So in subsequent studies the factors have used that can be grouped into 3:

- Professional component – P (professional knowledge – P1; education – P2; experience – P3).
- Intellectual component – I (the level of perception – I1; logical (system) intelligence – I2; creative intelligence – I3; self-organization – I4).
- Social component – S (conformity of a socionic type of personality with the sphere of activity and profession – S1; the level of interaction of a socionic type of personality with other members of the collective – S2).

Stage 4. Defining the correlation between the factors using expert evaluation. After the identification and evaluation the elements in the system of knowledge management at the level of employee (while recruiting personnel) and their importance is defined, it is necessary to establish the mutual influence of elements. The influence in this context means a direct change of the state of the subordinate element when you change the state of the element, which influence (Makarov, 2012).

We must use the experts' knowledge to fill out the matrix of cause-effect relations. When filling out the following scale we use: 0 – the item does not exercise any influence; 1 – the item carries a moderate influence; 2 – the item has a significant impact. Then the matrix was purified from minor impacts. The averaged values of the experts' opinions are presented in Table 3.

The normalized matrix relative to total exposure (%) is presented in Table 4.

Then the matrix was cleared from minor impacts. Having normalized the value of relatively total amount of impact, starting with the smallest, 30 minor influences were removed, the impact of which was less than 1% (Table 5).

Let's make up the oriented graph of interrelation between elements, according to the table (Figure 2).

Table 3. **The matrix cause-effect relations,** *author's*

	P1	P2	P3	I1	I2	I3	I4	S1	S2
P1		1	1.5	0	1	0.5	0.3	0	0
P2	2		1.8	0.5	1	0.3	0.5	0.1	0
P3	1.2	1		1.1	1.2	0.4	1	0.2	0.5
I1	1.5	1.2	1.2		1	0.3	0.8	0.1	0.1
I2	1.5	1.5	1.3	0.5		0.1	0.2	0.3	0.2
I3	1	1	0.7	0.8	0.3		0.4	0.5	0.3
I4	1.2	1.4	1.3	0.7	1.4	0		0.1	0.1
S1	1.8	0.2	1.7	1	1.2	1	0.4		1.4
S2	1.7	0.1	1	0.5	0.9	1.4	0.3	1	

Table 4. **Normalized matrix,** *author's*

	P1	P2	P3	I1	I2	I3	I4	S1	S2
P1		1.80	2.69	0.00	1.80	0.90	0.54	0.00	0.00
P2	3.59		3.23	0.90	1.80	0.54	0.90	0.18	0.00
P3	2.15	1.80		1.97	2.15	0.72	1.80	0.36	0.90
I1	2.69	2.15	2.15		1.80	0.54	1.44	0.18	0.18
I2	2.69	2.69	2.33	0.90		0.18	0.36	0.54	0.36
I3	1.80	1.80	1.26	1.44	0.54		0.72	0.90	0.54
I4	2.15	2.51	2.33	1.26	2.51	0.00		0.18	0.18
S1	3.23	0.36	3.05	1.80	2.15	1.80	0.72		2.51
S2	3.05	0.18	1.80	0.90	1.62	2.51	0.54	1.80	

Table 5. **The matrix cleared from minor influences,** *author's*

	P1	P2	P3	I1	I2	I3	I4	S1	S2	
P1		1.80	2.69		1.80					6.29
P2	3.59		3.23		1.80					8.62
P3	2.15	1.80		1.97	2.15		1.80			9.87
I1	2.69	2.15	2.15		1.80		1.44			10.23
I2	2.69	2.69	2.33							7.71
I3	1.80	1.80	1.26	1.44						6.3
I4	2.15	2.51	2.33	1.26	2.51					10.76
S1	3.23		3.05	1.80	2.15	1.80			2.51	14.54
S2	3.05		1.80		1.62	2.51		1.80		10.78
	21.35	12.75	18.84	6.47	13.83	4.31	3.24	1.8	2.51	85.1

Based on the obtained estimates the index of the level of influence of each element is defined in the structure of complex indicator (Table 6).

Coefficient of impact for P1 = 1.0218, for P2 = 1.0685, for P3 = 1.0608, for I1 = 1.1901, for I2 = 1.0505, for I3 = 1.1082, for I4 = 1.4199, for S1 = 2.3802, for S2 = 1.5440.

The indices of P1, I1, I2, y3, I4 are identified using tests and are in the range from 0 to 1. P2 is identified as follows: degree qualified – 1; not qualified – 0.6; general professional on specialty – 0.8; general professional not on specialty – 0.2; general secondary education – 0.2; other – 0 (summing is not allowed). P3 is as follows: number of years of experience has to be divided into 15, and those that are more than 15, then are divided into itself. Regarding the social component, to determine S1 and S2 it is necessary to pass the test first to define the socionic type.

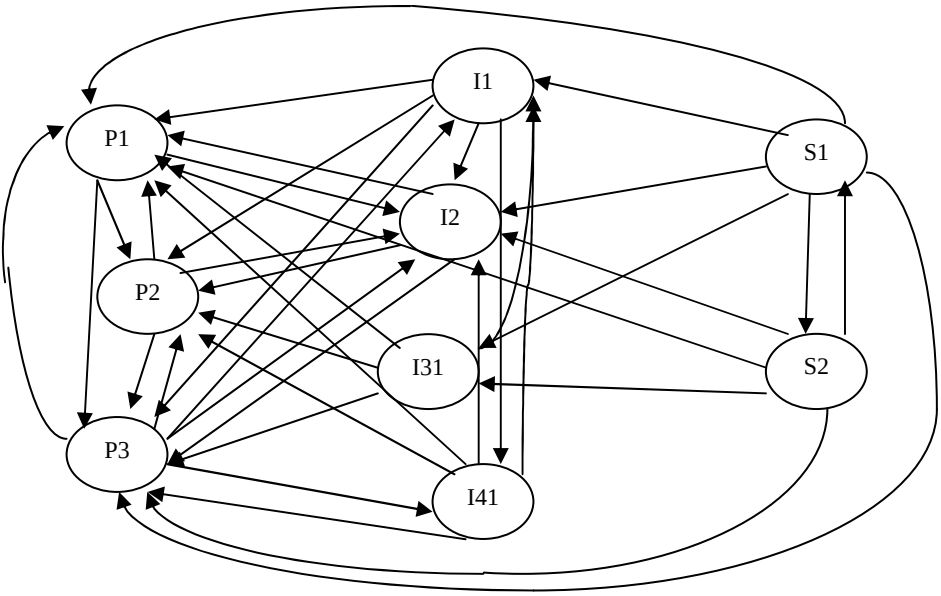

Figure 2. **The oriented graph of interrelation between the elements,** *author's*

Table 6. **The level of influence of the element in the structure of an integrated employee evaluation,** *author's*

Element	Row sum (the manner in which the element influences)	Column sum (the manner in which the element influences is influenced on)	Independence (column 2 / column 3)	Share in the total row sum	The level of influence (column 5 x column 4), %
1	2	3	4	5	6
P1	6.29	21.35	0.29	7.39	2.18
P2	8.62	12.75	0.68	10.13	6.85
P3	9.87	18.84	0.52	11.60	6.08
I1	10.23	6.47	1.58	12.02	19.01
I2	7.71	13.83	0.56	9.06	5.05
I3	6.30	4.31	1.46	7.40	10.82
I4	10.76	3.24	3.32	12.64	41.99
S1	14.54	1.80	8.08	17.09	138.02
S2	10.78	2.51	4.29	12.67	54.40
	85.10	85.10		100.00	

Stage 5. Evaluation for an employee selection in the system of knowledge management at an enterprise. By using the results of step 2 (Table 2) and step 4 (Table 6), the assessment of an employee *EA* is formed in the system of knowledge management at an enterprise:

$$EA = P + P_{\text{inf}} + I + I_{\text{inf}} + S + S_{\text{inf}}, \quad (14)$$

where P = (0.11215 P1 + 0.140187 P2 + 0.11215 P3); P_{inf} = (1.0218 P1 (P2 + P3 + I2) + 1.0685 P2 (P1 + P3 + I2) + 1.0608 P3 (P1 + P2 + I1 +I2)); I = 0.084112 I1 + 0.102804 I2 + 0.084112 I3 + 0.11215 I4; I_{inf} =1.1901 I1 (P1 + P2 + P3 + I2 + I4) +

1.0505 I2 (P1 + P2 + P3) + 1.1082 I3 (P1 + P2 + P3 + I1) + 1.4199 I4 (P1 + P2 + P3 + I1 + I2); $S = 0.121495$ S1 + 0.130841 S2; $S_{inf} = 2.3802$ S1 (P1 + P3 + I1 + I2 + I3 + S2) + 1.5440 S2 (P1 + P3 + I2 + I3 + S1).

Conclusions. The main components of the knowledge management system at enterprises are defined, which include people, technology and processes. People are the key component, so their management, namely, assessment and management of employees is an important component of knowledge management system at an enterprise. The approach proposed in this article includes the following steps: generalization of factors of the professional, intellectual and social components; analysis of the entire set of factors for their significance by using expert evaluation and the method of constructing the majority reference of benefits on a set of evaluated factors; selection of the most essential factors and their weighting coefficients; defining the level of correlation between the factors using expert assessment; assessment for the selection of employees within the knowledge management system at an enterprise.

Comprehensive assessment of employees provides consideration of all elements of professional, intellectual and social components and the analysis of their interaction.

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