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**ЕКОНОМІКА ПРАЦІ ТА УПРАВЛІННЯ ПЕРСОНАЛОМ,  
РОЗВИТОК ТРУДОВИХ ВІДНОСИН**

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**MODELLING OF COMPLEX ESTIMATION OF EFFICIENCY  
OF PERSONNEL MANAGEMENT**

*The article analyses existing approaches of evaluating the efficiency of personnel management at the enterprise. It is summarized indicators of assessment of efficiency of personnel management with the distribution into economic, social, and organizational efficiency. We have performed simulation of a complex estimation of efficiency of personnel management based on taxonomic indicator.*

*Keywords: personnel management; efficiency; assessment of efficiency of personnel management; modelling; taxonomic index.*

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**МОДЕЛЮВАННЯ КОМПЛЕКСНОЇ ОЦІНКИ ЕФЕКТИВНОСТІ  
УПРАВЛІННЯ ПЕРСОНАЛОМ**

*У статті проаналізовано існуючі підходи до оцінки ефективності управління персоналом підприємства. Узагальнено показники оцінки ефективності управління персоналом із розподілом на економічну, соціальну та організаційну ефективність. Здійснено моделювання комплексної оцінки ефективності управління персоналом на основі таксономічного показника.*

*Ключові слова: управління персоналом; ефективність; оцінка ефективності управління персоналом; моделювання; таксономічний показник.*

**Introduction.** The efficiency of personnel management is determined by two main factors: the ability of the enterprise to clearly define what behaviour of employees is needed to achieve its strategy, and the ability to apply effective managerial levers for accomplishing desired behaviour by employees. Both tasks are equally important and difficult, especially in the conditions of market transformation of the economy. The performance of the enterprise is due not primarily to material or financial resources, but the formation of the correct staff motivation, which helps to achieve the overall goal.

In this regard, the first task is to conduct a comprehensive evaluation of the efficiency of personnel management, which is a critical aspect towards achieving the strategic goals of the company.

**Analysis of recent publications.** The problem of evaluating the efficiency of personnel management is reflected in the works of many native and foreign scientists, In particular V. Vertel' [1], V. Danyuk [2], A. Zham [3], A. Kavcic [4], T. Kaynova [5], A. Kramarenko [6], O. Lukjanine [7], L. Lutay [8], A. Radique [9], A. Savchenko [10], V. Smachilo [11], D. Ulrich [12] and etc. Current approaches of evaluating the efficiency of HR management are quite diverse and often relate to the assessment of certain aspects of the staff management, for example, evaluation of staff performance, evaluation units of the office staff, evaluation of staff development. Therefore they require further development and improvement of methods of integrated assessment that will be based on quantitative and qualitative indicators of the efficiency of personnel management. **The aim of the study** is the theoretical analysis of existing and modelling of complex estimation of efficiency of personnel management taking into account economic, social, and organizational effectiveness of the particular department.

**The main results of the study.** The issues of assessing the efficiency of personnel management are quite complicated. This is due to the multidimensional nature of the process control, nonlinearity and dynamism of such resources as personnel, organizational, socio-economic and legal conditions in which management decisions are made.

The analysis of scientific sources showed different approaches to the interpretation of the effectiveness of management and allows to conclude that the management efficiency is a complex and multifaceted category that reflects the characteristic features of the economic, social, technological, psychological and other phenomena. In quantitative terms, the management efficiency is defined as the ratio of the useful result (effect) to the cost of management; the qualitative component of this comprehensive definition appears in the ratio of the result (effect) to their targets, as a control, aimed at better performance of the organization's activities, implementing its goals and

strategies to achieve certain results [2].

It is worth noting that today the methods of assessment of the personnel management system are worked enough and well-known, and among them there are those that are offered to evaluate the effectiveness of personnel management. In particular, Lutay A. and Shandruk V. [8] offer to carry out external, internal and overall evaluation of the effectiveness of the system of personnel management with the use of expert estimation.

The most widely approach, illuminated in scientific works [1; 4; 11], on the basis of which the evaluation of the effectiveness of the personnel management system is carried out with the use of indicators grouped in separate functions (subsystems) of personnel management: selection and adaptation of personnel, work organization, motivation and remuneration, assessment and staff development, personnel and promotion, retention of staff, corporate culture etc.

However, some scholars identify the efficiency rating of personnel management efficiency with evaluation of activities of subdivisions of personnel management [7; 9]. Obviously, this approach is not quite correct, since the evaluation of effective Manager (Manager) takes into account first of all his ability to encourage (motivate) employees to work more productively.

Authors A. Radique and O. Galuschak [9] justify the need of calculation of economic efficiency of the unit of personnel management. However, the practical use of the proposed indicator is very problematic, because of the difficulty of allocating the amount of the enterprise profit in terms of value received as a result of the improvement of the personnel management system.

Among the foreign scientific achievements in the field of assessment of efficiency of personnel management, D. Ulrich's [12] technique should be noted. It involves the evaluation of the effectiveness of personnel management in five ways: productivity per unit of raw materials per employee or unit of wages; the rate of speed of business processes; the costs and other results in the execution of special programs and initiatives; indicators of employees' skills, loyalty, moral climate in a team; organizational capabilities. However, the accuracy of this approach is quite controversial, because it is difficult to determine the impact on the change of the proposed indicators, the factors, which are determined by the management staff.

O. Zham [3] proposes to use indirect assessment in the process of evaluating the effectiveness of personnel management, including the determination of the specific contribution of the employee in the outcome indicators of the management apparatus implemented in the final results of the control object. One of the indirect methods is a scoring method is proposed based on the analysis of Felix – Riggs. The considered approach allows to aggregate the overall index by weighting the individual indicators with the help of expert assessments. The composition of these indicators is also determined by the expert based on the individual conditions of particular company, which significantly complicates its practical application.

In the literature there are different approaches of differentiation and evaluation of effectiveness of personnel management. In this work [10] there is the discussion of the integrated assessment of economic and social efficiency programs improvement of the system and processes of personnel management. Thus, the following approaches are available:

- economic efficiency is considered as the main indicator, and social efficiency – as a constraint, i.e., they accept only those projects, which include activities of social nature;
- calculates an integrated summary measure of economic and social efficiency, but often due to the quality of non-comparability purposes, this calculation is conditional;
- first solutions are developed and considered from the standpoint of social objectives regardless of the economic, and then the cost-effective variant is determined among the selected socio-effective options.

In the connection to intensive development of the economy that requires the creation of socially-oriented management, T. Kaynova [5] considers it is not sufficient to restrict the consideration of economic and social efficiency as different aspects of one category. Also relevant is the definition of the synthesized content of the category «socio-economic efficiency». The author proposes the following vision in this category: socio-economic efficiency of personnel management – is a component of overall efficiency, which characterizes the effect from the production activity, obtained with minimum costs and satisfaction of employees, which lead to obtaining this effect. At the same time, socio-economic efficiency includes the following items: personnel policy, intellectual capital, social capital.

However, the complexity and diversity of the object and objectives of the evaluation of the effectiveness of the company's personnel management requires consideration of a triad of components:

- economic efficiency (that characterizes the achievement of the goals of the enterprise through better use of labour potential). Criteria for evaluating the economic efficiency of personnel management should reflect the results of the work of employees;
- social efficiency (which expresses satisfaction of expectations, needs and interests of employees). The social efficiency of the enterprise's personnel management is largely determined by the organization and motivation of labour, condition of the socio-psychological climate among the staff, that is it is more dependent on the forms and methods of work with each employee;
- organizational efficiency (it assesses the integrity and the organizational design of the enterprise, as well as the effectiveness of the organizational structure of enterprise management) [6].

The study of the theoretical foundations of personnel management, in particular different techniques for the

evaluation of its effectiveness, gives grounds to draw a conclusion about the absence of a single comprehensive approach. This is obviously connected to the specific activities of each individual entity, as well as the objectives of the study, the aims and objectives of personnel management.

However, the most reasonable is the assessment methodology, combining criteria of economic, social, and organizational effectiveness relating to personnel management and it is aimed to achieve the strategic objectives of the enterprise.

For a comprehensive evaluation of the effectiveness of personnel management in the enterprise the authors propose the following groups of indicators in specific areas (table 1).

Table 1

**Indicators of integrated assessment of efficiency of personnel management, author's**

<b>Character identification</b>	<b>Indicator</b>	<b>Units</b>	<b>The direction of influence</b>
<b><i>Economic efficiency</i></b>			
X <sub>11</sub>	The productivity of workers	UAH/person	Stimulator
X <sub>12</sub>	The provision of the labour	UAH/person	Stimulator
X <sub>13</sub>	The profitability of remuneration	UAH/person	Stimulator
X <sub>14</sub>	The share of the entrepreneur in the production cost	Coefficient	Stimulator
X <sub>15</sub>	Advancing coefficient	Coefficient	Stimulator
<b><i>Social efficiency</i></b>			
X <sub>21</sub>	The ratio of average employee wages to the subsistence level	Coefficient	Stimulator
X <sub>22</sub>	The cost of HR per 1 employee	UAH/person	Stimulator
X <sub>23</sub>	Share motivational part of the payroll in total payroll	Coefficient	Stimulator
X <sub>24</sub>	The level of satisfaction of employees with their work	%	Stimulator
X <sub>25</sub>	The ratio of the amount of arrears of wages to the payroll	Coefficient	Destimulated
X <sub>26</sub>	The proportion of workers, wages which accrued within the statutory limits minimum	Coefficient	Destimulated
X <sub>27</sub>	The coverage of the collective agreement	Coefficient	Stimulator
<b><i>Organizational efficiency</i></b>			
X <sub>31</sub>	The level of perfection of organizational structure of the personnel management system	%	Stimulator
X <sub>32</sub>	The share of administrative staff	Coefficient	Stimulator
X <sub>33</sub>	Quantitative level of staff	Coefficient	Stimulator
X <sub>34</sub>	Quality of personnel staff	Coefficient	Stimulator
X <sub>35</sub>	The ratio of staff change	Coefficient	Destimulated
X <sub>36</sub>	The average number of labour discipline violations per 1 employee	Cases/person	Destimulated
X <sub>37</sub>	The proportion of employees who improved their qualifications	Coefficient	Stimulator
X <sub>38</sub>	Coefficient of effective use of working time	Coefficient	Stimulator
X <sub>39</sub>	The share of unearned work time due to temporary disability	Coefficient	Destimulated
X <sub>310</sub>	The level of industrial injuries	Coefficient	Destimulated
X <sub>311</sub>	The level of involuntary part-time employment	Coefficient	Destimulated
X <sub>312</sub>	The proportion of employees who work in conditions that do not meet sanitary-hygienic norms	Coefficient	Destimulated
X <sub>313</sub>	The share of workers participating in strikes	Coefficient	Destimulated

Quantitative indicators for the complex evaluation of the efficiency of personnel management can be obtained from the enterprise's reporting (financial, statistical, accounting, tax) and data management and accounting personnel. However, complex assessment solely on the quantitative parameters do not always adequately reflect the characteristics of various aspects of the implementation of the personnel policy. In this regard, in the process of integral assessment of efficiency of personnel management considered to be important quality indicators such as the level of satisfaction of employees with their work and level of perfection of organizational structure of the management system. In their calculation, you should use such research methods as questionnaires, survey, interviews etc.

The main problem in the modelling of integrated indicators for assessing the efficiency of personnel management is in different units of measurement typed criteria economic, social, and organizational effectiveness and the problem of their reduction to a single quantitative assessment, which often does not allow to draw valid conclusions about effective or ineffective personnel management.

In connection with the foregoing, the authors suggest in the modelling of complex estimation of efficiency

of personnel management to base on taxonomia the indicator of the level of development of the system, the nature of which is set out in the work of the Polish scientist W. Pluta [13].

Based on the initial criteria of economic, social and organizational effectiveness (table. 1) simulation of a complex estimation of efficiency of personnel management based on taxonomic indicator will consist of five stages.

The first stage is the standardization of the original data, the purpose of which is the reduction of all the original indicators into a single scale of measurement according to the equation:

$$Z_{ij} = \frac{x_{ij} - \bar{x}_{ij}}{\sigma_i} \quad (1)$$

where  $Z_{ij}$  – standardized value of  $i$ -th indicator in  $j$ -th period ( $i=1, n; j=1, m$ );  $\bar{x}_{ij}$  – arithmetical mean value of the  $i$ -th indicator for the  $j$ -th period;  $\sigma_i$  – the standard deviation of the  $i$ -th indicator.

In the second stage is the formation reference point  $Z_{0i}$  ( $z_{01}, z_{02}, z_{03}, \dots, z_{0m}$ ) based on the definition of indicators of stimulants and destimulative that positively or negatively affect the evaluation of the effectiveness of personnel management. For indicators-stimulants are selected the maximum values of the index of level of efficiency of personnel management, and for performance-destimulative – minimum:

$$\begin{aligned} Z_{0i} &= \max z'_{ij}, i \in I, \\ Z_{0i} &= \min z'_{ij}, i \in I, \end{aligned} \quad (2)$$

where  $I$  – a lot of stimulants and stimulants.

In the third step, we estimate the Euclidean distance characterizing the distance values of each indicator to the point of the benchmark:

$$d_{oi} = \sqrt{\sum_{i,j=1}^{n,m} (Z_{ij} - Z_{0i})^2} \quad (3)$$

where  $d_{oi}$  – is the Euclidean distance values to the point-model.

The fourth step is the calculation of the three taxonomic indicators reflecting the assessment of the economic, social, and organizational efficiency of personnel management ( $K_i$ ), correspondently:

$$K_i = 1 - \frac{d_{o1}}{d_o} \quad (4)$$

$$d_o = \bar{d}_o + 2 \times \sigma_o; \quad \sigma_o = \sqrt{\frac{\sum (d_{oi} - \bar{d}_o)^2}{n}} \quad (5)$$

where  $K_i$  – effectiveness evaluation according to economic ( $K_{ec}$ ), social ( $K_{soc}$ ) and organizational ( $K_{org}$ );  $\bar{d}_o$  – the arithmetic average of the corresponding Euclidean distances;  $\sigma_o$  – the standard deviation of the corresponding Euclidean distances.

The closer the value of  $K_i$  approaches to 1, the higher the respective rating of the effectiveness of personnel management.

At the fifth stage the integral indicator of the effectiveness of personnel management is determined as the arithmetic mean of the assessments of the economic, social and organizational efficiencies:

$$HR = \frac{K_{ec} + K_{soc} + K_{org}}{3} \quad (6)$$

where  $K_{ec}$ ,  $K_{soc}$ ,  $K_{org}$  – are the assessment of economic, social and organizational efficiency of personnel management.

Obtained according to this method, the integral indicator is the normalized value and ranges from 0 to 1, the closer the resulting value is to one, the higher the evaluation of the effectiveness of personnel management.

Testing of a complex estimation of personnel efficiency management carried out by the authors on the example of the personnel management system of LLC «Podilskyi gospodar» in dynamics for 2014–2016. The average number of employees is 580 persons, the main object of activity is the breeding of cattle, growing grain and technical crops, the provision of services in plant growing, landscaping, manufacturing of meat products and so on.

Most of the indicators for the complex evaluation of the personnel efficiency management are used or calculated from the data of financial and statistical statements, as well as information for internal management and personnel records. An assessment of the satisfaction level with the work carried out with the application of sociological research methods, particularly the survey of employees of LLC «Podilskyi gospodar» on the subject of satisfaction of organizational, economic and social aspects of work. The level of perfection of organizational

structure of the personnel management system is evaluated by an expert method on the basis of the analysis of this organizational structure from the position of unit availability providing functions of personnel management.

The standardized values of the original data  $x_{ij}$  are given in table. 2 (to avoid errors in the calculation of the integral index of efficiency of personnel management from the table were excluded indicators, numeric values which were 0 or 1).

Table 2

**The standardized values of the original indicators for the implementation of modelling taxonomic indicator of the effectiveness of management personnel of LLC «Podilskyi gospodar», author's**

Indicators	Years			Point a reference to calculate the Euclidean distances
	2014	2015	2016	
<b>Economic efficiency</b>				
$x_{11}$	-0,40200	-0,73644	1,13844	1,13844
$x_{12}$	1,14173	-0,42141	-0,72032	1,14173
$x_{13}$	1,05053	-0,11020	-0,94034	1,05053
$x_{14}$	-0,57735	1,15470	-0,57735	1,15470
$x_{15}$	-0,53122	-0,62228	1,15350	1,15350
<b>Social efficiency</b>				
$x_{21}$	-0,218218	-0,872872	1,091089	1,091089
$x_{22}$	excluded in order to avoid math errors			
$x_{23}$	-0,218218	1,091089	-0,872872	1,091089
$x_{24}$	-1,121243	0,321643	0,799600	0,799600
$x_{25}$	excluded in order to avoid math errors			
$x_{26}$	0,999119	0,001759	-1,000878	-1,000878
$x_{27}$	excluded in order to avoid math errors			
<b>Organizational efficiency</b>				
$x_{31}$	-0,577350	-0,577350	1,154701	1,154701
$x_{32}$	1,154701	-0,577350	-0,577350	1,154701
$x_{33}$	-1,142638	0,427154	0,715484	0,715484
$x_{34}$	excluded in order to avoid math errors			
$x_{35}$	0,973399	0,051232	-1,024631	-1,024631
$x_{36}$	excluded in order to avoid math errors			
$x_{37}$	excluded in order to avoid math errors			
$x_{38}$	1,154701	-0,577350	-0,577350	1,154701
$x_{39}$	1,151440	-0,500626	-0,650814	-0,650814
$x_{310}$	excluded in order to avoid math errors			
$x_{311}$	0,800641	0,320256	-1,120897	-1,120897
$x_{312}$	0,927173	0,132453	-1,059626	-1,059626
$x_{313}$	excluded in order to avoid math errors			

For the indicators, which are stimulants the benchmark selected maximum value, respectively, for performance-destimulative point a reference to calculate the Euclidean distances taken as the minimum value during the study period.

Exception of indicators provides some measure of uncertainty in the final numerical values of the evaluation of the effectiveness of the staff, but generally does not significantly affect the receipt of the management insights and solutions. Indeed, indicators-stimulants numeric values 0 ( $x_{22}$ ,  $x_{37}$ ) adversely affect the rating of the effectiveness of personnel management, because of the lack of relevant activities in the enterprise. Indicators-stimulators with a value of 1 ( $x_{27}$ ,  $x_{34}$ ) and indicators-dissimulators' with a value of 0 ( $x_{25}$ ,  $x_{36}$ ,  $x_{310}$ ) on the contrary positively characterizing the efficiency of personnel management, due to 100% coverage of workers by collective contract and quality compliance of staff to posts, and the lack of arrears of wages in the enterprise, violations of labour discipline and industrial injuries. Therefore, during the formation of final conclusions based on the numerical values of a complex estimation of efficiency of personnel management, the values of the indicators that were excluded from mathematical considerations should also be taken into account.

Based on the data of the partial indicators of economic, social, and organizational effectiveness the authors conducted a simulation of taxonomic indicator of the effectiveness of management personnel of LLC «Podilskyi gospodar». The simulation results of the integral indicator of assessment of efficiency of personnel management are presented in table 3.

Table 3

**The integral indicator the efficiency of personnel management of LLC «Podilskyi gospodar», author's**

Evaluation	Years		
	2014	2015	2016
<b>Economic efficiency</b>	<b>0,189</b>	<b>0,085</b>	<b>0,086</b>
<b>Social efficiency</b>	<b>0,158</b>	<b>0,430</b>	<b>0,504</b>
<b>Organizational efficiency</b>	<b>0,165</b>	<b>0,247</b>	<b>0,442</b>
<i>The integral indicator the efficiency of personnel management</i>	<b>0,171</b>	<b>0,254</b>	<b>0,344</b>

Although the increase of the personnel management efficiency to 0,344 is observed in the dynamics, but there are still significant reserves to improve the effectiveness as they do not reach the reference value 1. The average value of the integral indicator of the effectiveness of the personnel management system for 2014–2016 is amounted to 0,26, which is quite low for performance evaluation. It is connected with such problems of activity of the enterprise in the direction of the office of staff as inadequate programs funding, HR management, lack of strategic planning in the field of personnel management, personnel research system and a weak institutional culture.

Theoretically, when determining the integrated indicator it is taken into account the equivalent impact of economic, social and organizational effectiveness. But when you evaluate the efficiency of personnel management in each case there is a need to provide greater weight to one of the areas, for example economic (for example, in the case of reducing the profitability of the enterprises or the reduction of productivity and the like) or social (if there is a high staff turnover, dissatisfaction of employees due to low motivation, etc.), or organizational (if there is a significant loss of working time mismatch of working conditions, etc.). Inequality of trends and indicators, as well as their influence on the integral indicator, can be smoothed by the introduction of special significance coefficients (weight coefficients) in the formula for calculating the relevant indicator, can be identified by experts.

**Conclusions.** Thus, the use of simulation methods allows comprehensively assessing and quantitatively measuring the effectiveness of personnel management at any enterprise. And practical use of relevant results based on the partial and integral indicators gives grounds to determine bottlenecks in the field of personnel management and social policies of a business entity and, as a consequence, directly determines priority areas of funding of human resources programs. In addition, the calculation of the integral index allows to investigate the level of efficiency of personnel management in dynamics and also to compare (rank) of the company on this basis.

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