RANKING AS AN EFFECTIVE TOOL FOR QUALITY ASSURANCE OF LABOR POTENTIAL

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Introduction. The key aspect of implementing a company strategy is the development of personnel, growth of its labor potential. The degree of development and utilization of the potential of employees largely depends on the competitiveness and innovative responsiveness of the enterprise. Making decisions on the formation and development of labor potential of the enterprise must precede the stage of evaluation of the most significant, in terms of specific production, characteristics of the labor potential of different categories of workers. Therefore, it seems urgent to conduct this study, devoted to issues of evaluation and the formation of labor potential, both individual workers, groups of workers, and enterprises as a whole.

The hypothesis of scientific research is to find out how effective management of quality labor potential personnel (based on its objective assessment) can be one of the key conditions that determines the success of enterprises. The prospect of further research in this direction is to improve the system of diagnostics and planning of reserves for improving the quality of labor potential of an industrial enterprise in crisis conditions.

The purpose of the article is to deepen theoretical and methodological provisions and to develop rating tools to ensure the quality of labor potential.

During the research, **methods** of system analysis, management theory and personnel management, economics and sociology of labor, statistics, methods of expert evaluation, economic and mathematical models and methods, apparatus of the theory of artificial intelligence and the theory of neural networks were used.

Results: a dynamic model of labor potential rating was developed and investigated, which allows taking into account the inertia of labor potential and qualitatively describing in time the behavior of labor potential under the influence of investments in personnel development.

Conclusions: it is proved that the use of a dynamic model of labor potential rating will allow to specify the priority directions of enterprise development taking into account the achieved level of labor potential and the expected dynamics of its change and taking into account the characteristic features of the industry, enterprise, and certain types of activity.

Keywords: labor potential; rating; ranking; quality of labor potential; toolkit; management diagnostics.

РЕЙТИНГУВАННЯ ЯК ЕФЕКТИВНИЙ ІНСТРУМЕНТАРІЙ ЗАБЕЗПЕЧЕННЯ ЯКОСТІ ТРУДОВОГО ПОТЕНЦІАЛУ

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Вступ. Ключовим аспектом реалізації стратегії підприємства є розвиток персоналу, зростання його трудового потенціалу. Від ступеня розвитку і використання потенціалу працівників багато в чому залежить конкуренто-спроможність і інноваційна сприйнят-ливість підприємства. Прийняття рішень з приводу формування і розвитку трудового потенціалу підприємства повинен передувати етап оцінки найбільш значущих, з точки зору конкретного виробництва, характеристик трудового потенціалу різних категорій працівників. Тому видається актуальним проведення даного дослідження, присвяченого питанням оцінки і формування трудового потенціалу, як окремих працівників, так і груп працівників, і підприємства в цілому.

Гіпотеза наукового дослідження є з'ясування яким чином ефективне управління якістю трудовим потенціалом персоналом (на основі його об'єктивної оцінки) може бути однією із ключових умов, що визначає успіх підприємств. Перспективою подальших досліджень у даному напрямі є удосконалення системи діагностики та планування резервів підвищення якості трудового потенціалу промислового підприємства в кризових умовах.

Метою статті є поглиблення теоретико-методичних положень та розроблення інструментарію рейтингування для забезпечення якості трудового потенціалу. При проведенні дослідження використову-валися **методи** системного аналізу, теорії менеджменту та управління персоналом, економіки і соціології праці, статистики, методи експертного оцінювання, економіко-математичні моделі і методи, апарат теорії штучного інтелекту та теорії нейронних мереж.

Результати: Розроблено та досліджено динамічна модель рейтингування трудо-вого потенціалу, що дозволяє врахувати інерційність трудового потенціалу і якісно описати в часі поведінку трудового потенціалу під впливом інвестицій в розвиток персоналу.

Висновки: доведено, що використання динамічної моделі рейтингування трудового потенціалу дозволить конкрети-зувати пріоритетні напрямки розвитку підприємства з урахуванням досягнутого рівня трудового потенціалу і очікуваної динаміки його зміни та з урахуванням характерних особливостей галузі, підприємства, окремих видів діяльності.

Ключові слова: трудовий потенціал; рейтинг; рейтингування; якість трудового потенціалу; інструментарій; управлінська діагностика.

Formulation of the problem. The development of modern society requires a new attitude to the qualification requirements for employees of companies and enterprises. Globalization and integration processes encourage contemporary entrepreneurial structures to focus on acquiring new soft skills for employees. That is why the problems of increasing the effectiveness of social work are becoming more and more relevant in the conditions of intensification of social reproduction and contributes to the formation of some prerequisites for a new innovative model of sustainable economic development, which in the first place issues the question of the effectiveness of human participation in the production process. Such a distinction and diversity of links between different socio-economic phenomena and groups in the globalization of the formation of a new mode of production – the information economy – requires a comprehensive, systematic approach to the study of processes in the social and labor sphere, management of social and labor processes. Solving such a problem becomes possible only under the newest approach to the formation and consideration of labor potential and the development of new soft skills in the workers.

The key aspect of implementing the company's strategy is the development of personnel, the growth of its labor potential. The competitiveness and innovative responsiveness of the enterprise largely depends on the degree of development and utilization of the employee's potential. Decisions on the formation and development of labor potential of employees of an enterprise must precede the stage of evaluation of the most significant, from the point of view of concrete production, characteristics of the labor potential of different categories of workers. Therefore, it seems relevant to conduct this study, devoted to the assessment and formation of labor potential, both individual workers, groups of workers, and enterprises as a whole.

Analysis of recent publications on the problem. Modern business practice proves that adequate provision of necessary labor resources, their rational use and the optimal level of quality of labor potential of the enterprise is the basis for ensuring its development and forming a perspective.

The analysis of recent researches and publications shows that such scholars as B. Burkinsky [1], G. Dmitrenko [2], and others, have made a significant scientific and practical contribution to solving certain problem issues (aspects) in the field of formation, use and development of labor potential, V. Shcherbak [3], I. Kornienko [4], O. Mikhailenko [5], V. Smolyuk [6], O. Kharchishina [7], A. Cherep [8], L. Shvets [9], L. Shovkun [10] and others. At the same time, taking into account the information in the these works and paying tribute to the high level of scientific achievements of the above-mentioned authors, we note that insufficient attention has been paid to research on the provision of a system for rating the quality of labor potential. All this determines the relevance and feasibility of research in this direction.

It should be noted that ranking of the components of labor potential with each passing day becomes of particular relevance and requires detailed study.

The purpose of the study is deepening theoretical and methodological positions and developing rating tools to ensure the quality of labor potential of industrial enterprises.

Research results. Based on the analysis of literary sources, there is a need to open the definition of "quality of labor potential". However, in order to reveal the essence of this concept, it is necessary first of all to establish what is meant by the term "labor potential".

Thus, A. Skurp and Y. Zubrytska [8] adhere to the view that the enterprise's labor potential should be understood as the available and perspective opportunities of its employees (managerial staff, workers of the main and auxiliary production) in quantitative and qualitative terms to satisfy the needs of the enterprise (institution, organization) and realize its goals (strategic, tactical, operational, urgent, important, functioning, development) in the most effective way, with the availability of appropriate resource support taking into account the system constructs determining the economic performance of the enterprise, at present.

Taking into account this and proceeding from the results of the performed studies, in Figure 1 presents the system of basic analytical dependencies, which reveals the effectiveness of the enterprise (or system of the result "information – resource support – time – opportunities (threats) in the management system").

It is worth emphasizing here (Figure 1) that the labor potential of an individual employee is recommended to be regarded as a structural component of the labor potential of an enterprise, which, as a part of the labor force, should give a synergistic effect [8].

At the same time, it is also worthwhile to draw attention to the fact that scientist V. Smolyuk identified such key indicators for assessing the labor potential of enterprises (institutions, organizations), which are divided into [6]:

- qualitative (physical potential, qualification potential, moral and cultural potential, innovative potential, intellectual potential and socio-psychological potential);

- quantitative (number of staff, age of staff, staff qualification rate, staff turnover, employee arrival rate, employee turnover rate, use of the working time fund, labor productivity index, labor intensity index, labor productivity, wages and salaries in the cost of production, the share of profits per employee) [6].
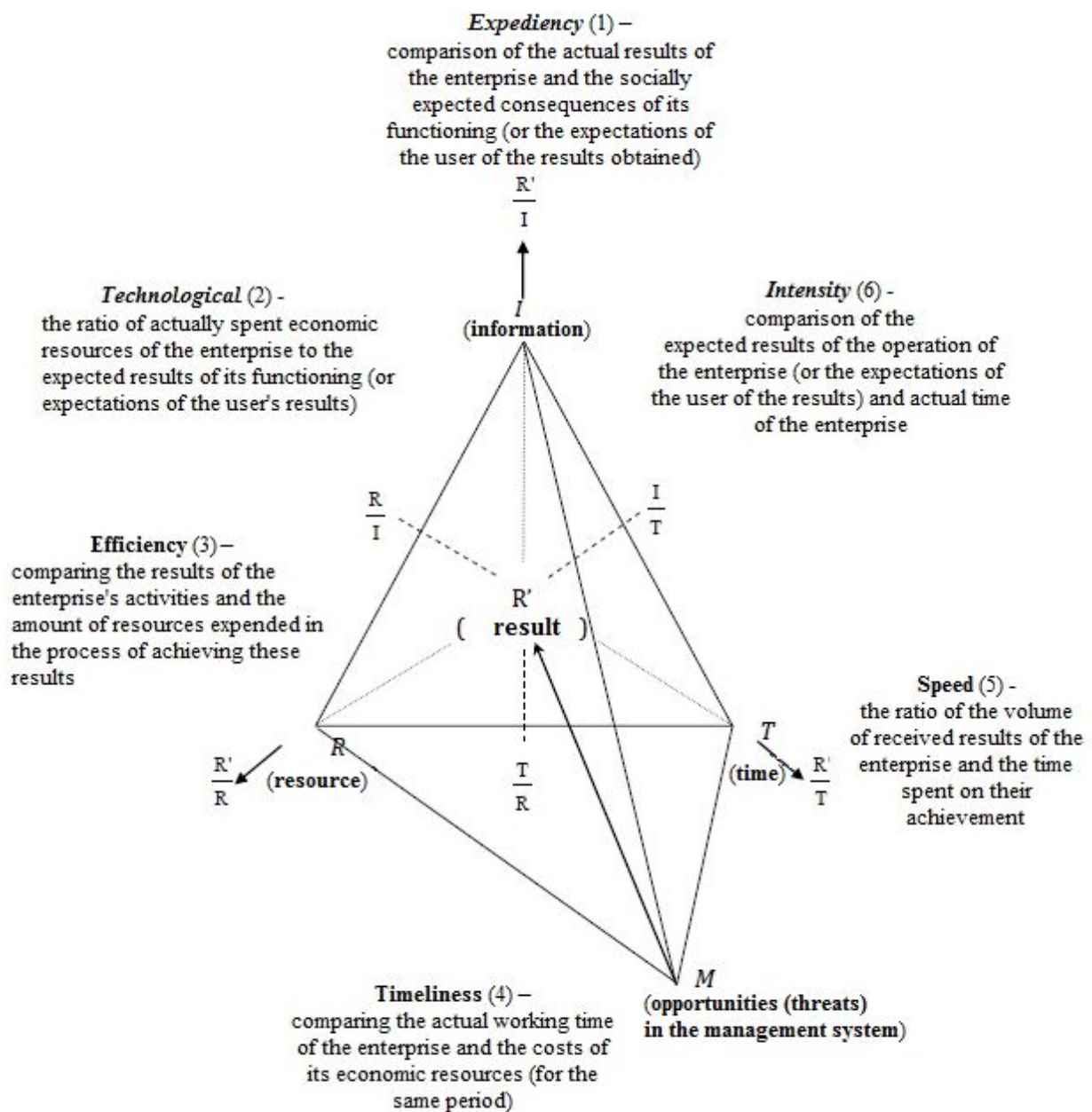
Figure 1. **The system of basic analytical dependencies, which reveals the quality of labor potential**

With regard to the quality of the labor potential of the enterprise, the results of the analysis of scientific work [2] (G. Dmitrenko, L. Rector) suggest that there are two main points of view (or 2 approaches) in relation to the concept of "quality of labor potential":

Quality is seen as the presence of essential features, properties (characteristics), features that distinguish one subject or phenomenon from others. First of all, it refers to the quality of labor potential from the standpoint of characteristics (qualities) of education and age, health indicators, etc., as well

as, ultimately, motivation for effective work; quality – a set of properties that determine the ability to meet certain needs. It is clear from this that the quality of the labor potential of an enterprise is related to its competitiveness, that is, the ability (opportunity) to best satisfy (effectively, effectively) certain (desirable) needs and / or meet the necessary standards [2].

At present, the problems of rational use of labor potential, its development as a factor of competitiveness of the enterprise has not yet found its specific place in the system of general management of the enterprise. However, it can now be argued that, like the information potential, which at the same time is closely intertwined with other types of potentials, labor potential is also an integral, important part of any of them, since the main component of any organization is the people included In this organization, the tasks for which this organization is created and there is a management that forms, mobilizes and enforces the organization's labor potential for solving the tasks that are ahead of it.

Labor potential is a set of human qualities and abilities that depend on interrelated quantitative and qualitative factors that have developed in the process of interconnection with material, technical, innovative, socio-cultural and other components of the economic potential of the enterprise.

The main components of labor potential are: education, creativity, health, morality, activity, organization, professionalism, timing (the possibility of rational use of working time).

That is why it is expedient to present an assessment of the components of labor potential. In our opinion, it is expedient to consider the labor potential of the enterprise within the framework of support of sustainable development of the enterprise and its innovative activity in terms of an integrated approach. From the standpoint of a systematic approach, labor potential is an integral part of the company's aggregate potential and, in its turn, forms an integral, dynamic socio-economic system. From the standpoint of an integrated approach, labor potential is a complex structure consisting of a set of interacting elements of varying degrees of complexity and organization. The first stage of evaluation of labor potential – an analysis of its structure – involves studying the state of each of its elements on the basis of the expert estimation method. Thus, it is possible to attribute to its main components: education; human resources (professionalism); creative potential; health; organization; timing.

The proposed methodology for estimating labor potential based on the neural network approach involves the implementation of the search procedure for the best (according to some criterion) dependence of integral estimates of the labor potential on the set of particular estimates. The use of an artificial neural network to describe this poorly formalized multifactorial nonlinear dependence ensures that the class of analytical and logical models under consideration is

virtually unlimited. In the learning process of the neural network, a learning mechanism is started which automatically adjusts the necessary network parameters. In addition, using expert estimates of integral labor potential, it is possible to conduct a procedure for verifying the quality of the received neural network.

The proposed methodology for estimating labor potential using artificial neural networks involves the following steps.

Step 1. Develop a procedure for obtaining private assessments.

Step 2. Formation of training and testing samples by collecting private assessments of specific employees of the enterprise.

Step 3. Formation of the initial configuration of the artificial neural network.

Step 4. Teaching the neural network based on the "reference" examples included in the training sample.

Step 5. Monitor the quality of training the neural network using the test sample generated at the second stage.

Stage 6. Estimation of the labor potential of the worker using a trained neural network that reproduces the work of experts.

The application of this methodology is possible to determine the need for staff training, creation of plans for individual development; for the current evaluation of activity in this workplace for a certain period of time; to identify employees able to work on complex projects; to form a personnel reserve. To implement the methodology, a package of Matlab applications, as well as Microsoft Excel.

The matrix of positioning of the labor potential of the employee is based on the results of assessing the levels of professional capacity and development potential, which provides a visual interpretation of the assessments received and the development of recommendations for the further formation of labor potential.

The proposed methodology for evaluating labor potential has been tested at three enterprises in the city of Kharkiv. A two-component model was used to assess labor potential, including a professional component and development component. The best results were obtained for neural networks with a configuration of a generalized regression network. The use of a two-component model of labor potential made it possible to construct scatter diagrams for labor potential estimates, which greatly facilitates the interpretation of the results obtained. Figure 2 shows an example of a scatter diagram for estimates of labor potential.
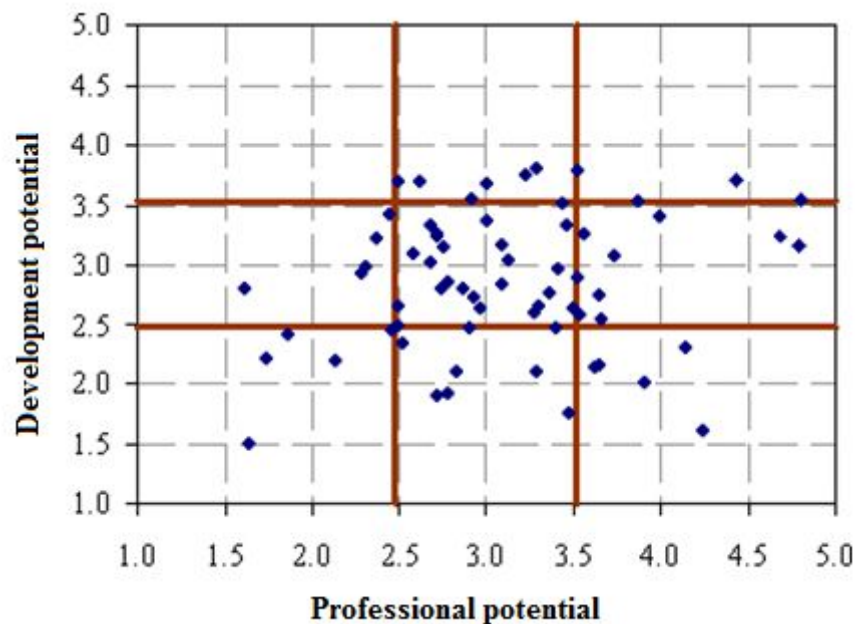
Figure 2. **Scatterplot of pairs of assessments of the labor potential of the managers and specialists of the Selprom company**

According to the results of the analysis of the obtained two-component estimates of the labor potential, a 3×3 matrix was proposed, allowing to interpret the results of the labor potential estimation. The dividing lines of the regions correspond to the values of the labor potential components 2.5 and 3.5. Table 1 shows an example of the distribution of employees in the cells of the matrix of positioning labor potential.

Table 1

Distribution of managers and specialists of Selprom company according to the labor potential positioning matrix

Development potential	3.5–5.0	Question mark 1	Reserve elite 6	Elite 4
	2.5–3.5	Problem 26	Foundation 22	Harvesting 9
	1.0–2.5	Problem 16	I do not want to learn 18	I do not want to learn 25
		1.0–2.5	2.5–3.5	3.5–5.0
		Professional potential		

According to the results of the study, the most characteristic flows were identified. The use of this matrix allows to rank on qualitatively heterogeneous groups, which will allow for each group and for each group member to

implement a specialized and, therefore, more effective set of measures for the formation and optimization of labor potential.

A dynamic model of labor potential has been developed and investigated, allowing to take into account the inertia of labor potential and qualitatively describe in time the behavior of labor potential under the influence of investments in staff development. Practice shows that labor potential is a very inertial characteristic. It is impossible to immediately increase the labor potential, making even very big efforts for this and spending a lot of money. It is obvious that the labor potential in the most general case can be considered as a certain dynamic system with inertia. Based on this hypothesis, an attempt was made to provide a theoretical analysis of the behavior of the labor potential of a person, a group of people, an enterprise, an industry, a country as a result of the costs incurred in developing or maintaining labor potential.

As an input of a dynamic system, we will consider $X(t)$ – the cost of raising and maintaining the labor potential at the proper level. As an output, we will consider $Y(t)$ – the level of labor potential. The input and output of a dynamic system are related by

$$Y(t) = k \int_0^\infty X(t-\tau) \cdot h(\tau) d\tau,$$

where k is the coefficient characterizing the efficiency of use of resources supplied to the input of the system; $h(\tau)$ is a weighting function that describes the effect of attenuation in time of return on investment in personnel or as an effect of "aging", deactivating the knowledge and skills of personnel over time.

An analysis of the behavior of the labor potential level $Y(t)$ for different variants of the input $X(t)$ and the weight function $h(\tau)$ showed that in all the considered cases a number of common features can be noted.

1) The value of labor potential is directly affected by the coefficient k, which characterizes the efficiency of investment in labor potential. This indicator is largely determined by the ability of the staff, his desire to further develop these abilities.

2) The level of labor potential is influenced by the level of expenses $X(t)$ and the rate of their change. The higher the values of these parameters, the greater the level of labor potential can be achieved. Note that due to the inertia of any dynamic system, one should not expect an instantaneous response of the labor potential to the increase in personnel costs. At negative growth rates of expenses $X(t)$, a decrease in the labor potential is observed, with positive growth rates, and at zero rates, the labor potential retains its value unchanged.

3) The type of weight function $h(\tau)$, which characterizes the speed of updating knowledge, skills, abilities and experience in any field of activity,

significantly affect the dynamics of labor potential. With an increase in the rate of updating knowledge, a decrease in the level of labor potential is observed, all other things being equal. To compensate for this, a corresponding increase in the efficiency of resource use (parameter k), the level of costs $X(t)$ and their growth rates is necessary. The analysis of this model shows that in rapidly developing industries (electronics, telecommunications, information technologies) to maintain competitiveness at the proper level, high and constantly growing costs are required to improve the labor potential. In industries where technological changes are not so significant, stabilization of personnel costs or a limited increase in such costs is allowed. However, in any case, the key to high competitiveness is maintaining the ratio:

$$\frac{\text{Cost effectiveness } (k) \text{ x Cost level } (X\,(t))}{\text{Knowledge update rate}} \text{ at a high level}$$

Thus, the developed rating matrix of the labor potential based on the results of the dynamic model study allows to specify the priority directions of the enterprise development taking into account the achieved quality level of the labor potential and the expected dynamics of its change and taking into account the characteristic features of the industry, enterprise, certain types of activities.

Conclusions. A methodology has been developed for assessing labor potential, both individual workers and groups of workers, using the apparatus of the theory of neural networks, which allows to take into account the nonlinear nature of the dependence of the aggregate estimates from a variety of individual assessments of labor potential, taking into account non-formalizable, semi-structured knowledge of experts.

A matrix has been developed for positioning an employee's labor potential based on the results of assessing the levels of professional potential and development potential, which provides a visual interpretation of the resulting estimates and the development of recommendations for the further development of labor potential. The regularity of balancing the level of the goals of the enterprise and the level of labor potential is revealed. The identified and forecasted imbalances of these two levels are the basis for the development of a personnel management program, including a policy of hiring / firing, advanced training, retraining, changes in the structure of personnel.

A dynamic rating model of the labor potential was developed and investigated, which allows to take into account the inertia of the labor potential and qualitatively describe the behavior of the labor potential in time as a result of investments in staff development.

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