

UDC 331.441.1

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QUALIMETRIC ASSESSMENT OF ENTERPRISE'S PERSONNEL INNOVATIVE POTENTIAL

Abstract. *Introduction.* Personnel innovative potential (PIP) qualimetric assessment issue is important due to the fact of insufficient attention to the problem of its level quantitative measuring based on performance which characterizes employees' innovation skills and capabilities.

Purpose of the research is development of methodology for personnel innovation potential qualimetric assessment depending on availability of staff innovative skills and capabilities.

The methods of algorithmic modeling, expert review based on a binary scale, statistical analysis, matrix method are used in this paper.

Results. Necessity of personnel innovative potential assessment using quality control methods is grounded. The algorithm and methodological approaches to the qualimetric assessment of personnel innovative potential depending on availability of personnel innovative skills and capabilities are developed. The system of performances to assess the innovative skills and capabilities of employees and the mechanism of their calculation are formed. A criteria matrix of personnel innovation potential integral level assessment was developed.

Conclusion. The set of organizational and methodological developments allowed forming the method of personnel innovative potential qualimetric assessment. It is used to assess the level of personnel innovation potential in a separate company, to make comparative analysis with its level at other enterprises and identify measures to optimize the employees' innovative skills and capabilities.

Key words: enterprise; personnel; innovative potential; qualimetric assessment.

JEL Classification: C52, M21, M54

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КВАЛИМЕТРИЧНА ОЦІНКА ІННОВАЦІЙНОГО ПОТЕНЦІАЛУ ПЕРСОНАЛУ ПІДПРИЄМСТВА

Анотація. У статті розроблено методику, побудовано алгоритм і критеріальну матрицю кваліметричної оцінки інноваційного потенціалу персоналу підприємства залежно від наявності у працівників інноваційних здібностей та можливостей. Запропоновано заходи з оптимізації інноваційних здібностей і можливостей працівників, а також рівня інноваційного потенціалу персоналу підприємства.

Ключові слова: підприємство, персонал, інноваційний потенціал, кваліметрична оцінка.

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КВАЛИМЕТРИЧЕСКАЯ ОЦЕНКА ИННОВАЦИОННОГО ПОТЕНЦИАЛА ПЕРСОНАЛА ПРЕДПРИЯТИЯ

Аннотация. В статье разработана методика, построены алгоритм и критериальная матрица кваліметрической оценки инновационного потенциала персонала предприятия в зависимости от наличия у работников инновационных способностей и возможностей. Предложены мероприятия по оптимизации инновационных способностей и возможностей работников, а также уровня инновационного потенциала персонала предприятия.

Ключевые слова: предприятие, персонал, инновационный потенциал, кваліметрическая оценка.

Introduction. One of the most important tasks to ensure quality operation and development of industrial enterprise is to improve the level of its personnel innovative potential.

Personnel innovative potential is ability of all employees and individuals to use their own set of skills and capabilities in development, implementation and usage of innovations in the enterprise activity. Accordingly, the level of this potential depends not only on professional and qualification characteristics of employees, their natural abilities and acquired knowledge and skills, but also desire and possibility of their application in innovation activity of the enterprise.

Personnel innovative potential level is effectually assessed using quality control methods. It is explained by a large number of parameters that do not characterize it through quantitative measurement, but represent within constant variability and uncertainty of a large number of factors. The qualimetric technique allows using balanced approach to the selection and construction of key performances of personnel innovative potential assessment, to quantify the parameters and adjust the mea-

suring system based on the strategic goals of the company and the needs of the interested persons.

In addition, the qualimetric method application allows to carry out with given accuracy not only the measurement of individual quality parameters of personnel innovation potential, but also to compare the performances with other enterprises.

Thus, in current economic conditions qualimetric assessment of personnel innovative potential is an urgent issue.

Brief Literature Review. Important contributions to development qualimetry as science and research methods of qualimetric assessment were made by the following foreign scholars: Azhaldov H. H., Raikhman E. P. (1972) [1], Hlychev A. V. (1976) [2]; and domestic ones – Dmytrenko G. O. (1996) [3] and others. Methodological aspects of the enterprise personnel and its management innovation potential formation are considered in the works of Bagrova I. V. & Tishchenko T. I. (2012) [2], foreign scientists Gorshenin V. P. (2006) [3], Lega K. O. (2008) [6], Fedosova R. N., Pimenov S. V. & Rodionova E. V. (2009) [7] and others. In the paper of Hadasevych N. R. (2008), a complex

assessment of personnel innovative potential is carried out using the fuzzy logic method [8] where the involvement and using of employees in innovative activity is quantitatively evaluated, and the level of personnel innovative potential is characterized in the form of numerical limits which corresponds to a linguistic expressions «high level», «average level», «low level».

Paying tribute to the works of the above mentioned scientists, we may note that in Ukraine very little attention for personnel innovative potential is given; therefore this research is conducted mainly on the basis of the Russian developments.

In modern innovation studies the issue of personnel innovative potential quantitative assessment depending on the availability of innovative skills and capabilities of employees who can be assessed only qualitatively remains unsolved. The attention is also not enough paid to the development of universal methods and techniques by which managers and all stakeholders would be able to determine the level of personnel innovation potential in comparison to the industrial branch or competitors and investigate the possibilities for its change.

Thus, the recent research analysis and the range of unresolved issues regarding the quantitative assessment of personnel innovative potential give the reasons to talk about the lack of the problem scientific disclosure, hence, the need to its careful study.

The purpose of research is to develop the method of personnel innovative potential qualimetric assessment depending on availability of staff innovative skills and capabilities.

Result. In the basis of qualimetric assessment of personnel innovative potential, there is a factor-criteria modeling that allows decomposing certain quality performances for a number of simple properties-criteria, to measure and evaluate them using ball-rank scale. In determining these properties we should consider the following: 1) each employee has the subjective properties, has his own abilities, conscious activity, values and needs that significantly affect his potential applied in innovation studies, and constantly change it; 2) each employee taking part in the innovation process is not isolated, but interacts with other employees and co-exists in a social and economic environment.

On the one hand, it complicates the selection of innovative potential of the individual employee as the object of assessment, on the other hand, it allows to expand it highlighting the organizational and labor, communication, adaptive and entrepreneurial individual properties; 3) the innovative sphere is characterized by volatility, uncertainty, dynamism which leads to the necessity of distinguishing employees innovation abilities as investigated properties of qualimetric assessment and consider them together with innovative abilities of employees development.

Qualimetric assessment of personnel innovative potential we proposed to carry out by such algorithm. (Figure).

At the first stage, the objects of personnel innovative potential qualimetric assessment are defined. They are innovative skills and abilities of individual employee which together determine his level. These innovative abilities and opportunities are considered by personnel innovative potential types: natural, organizational and labour, intellectual, creative, communicative, adaptive, entrepreneurial, motivational.

The second stage of the proposed technique personnel innovative potential qualimetric assessment is to develop the system of performances and criteria for employees' innovative skills and abilities evaluation. In construction the system of performances and criteria such approach was used: 1) only quality performances-properties were selected by professionals

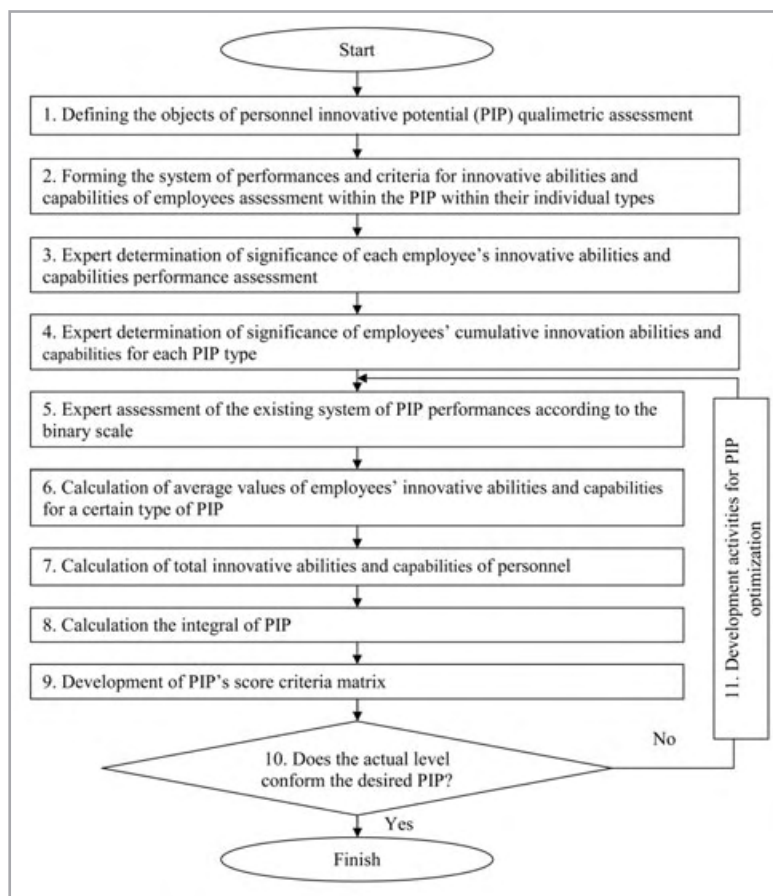


Fig.: The algorithm of personnel innovative potential qualimetric assessment method construction

Source: Developed by the author

(experts) which can be measured quantitatively with the application of scoring; 2) development the system of personnel performances-properties was done dividing them by the types of personnel innovative potential; 3) defining the criteria of qualimetric assessment was done according to the presence or absence of certain features in the employee.

The system of performances to assess innovative abilities of employees was developed within the personnel innovation potential. It is given in Table 1.

This system can be supplemented by other performance-properties of employee that characterize his innovative ability.

The system of performances to assess the innovative capabilities of employees is formed similarly to that shown in Table 1. It includes performance-properties of employee which separately characterize his capabilities to use in innovative activity physical and mental abilities, specific feelings, memory, intuition, features of mentality, mind, disposition, abilities, etc. Therefore, innovative ability of employee meets the opportunity to use it in the field of innovation.

Also, it should be noted that in order to assess the innovative capacity of the personnel, not all the performances listed in the Table 1 can be used, but only those that are most characteristic for the innovative activities of the certain enterprise.

With the developed performance system by a group of experts who are elected from among the managers of enterprises and professionals in the field of innovations, the importance of each assessment parameter of innovative skills and capabilities of employees (the third stage of the proposed method) are set. This expert determination is made within each type of innovative potential of personnel in such a way: 1) each expert carries out the rank assessment of parameters within a particular type of potential; and 2) by calculating the arithmetic mean is determined by the average rank of the individual performance; and 3) by calculating the proportion of middle-ran-

king individual performance of the amount determined by the importance performance rank.

To make qualimetric assessment of personnel innovative potential, it is also necessary to hold an expert determination of the employees' cumulative innovation skills and capabilities significance according to each its type (fourth stage). It is conducted in the same manner as the expert assessment of significance in the preliminary stage of the proposed methodology.

The fifth stage is the expert assessment of the existing indicators of personnel innovative potential by a binary scale. The essence of this assessment is as follows. Expert Group establishes the presence or absence of an innovation skill and ability of the individual worker. To do this, each expert receives a check-list for each employee whose innovative ability and potential is to be evaluated. In the check-list, there is a list of performance-properties of employee which are rated based on a binary scale: performance is set to «0» if there is a lack of innovative skills or abilities; to «1» if there are some innovation skills or abilities. It must be taken into account that innovative abilities are not certain abilities of a person, but only individual psychological characteristics of employees who expressed their willingness to take up innovative knowledge, abilities, skills and successful performance of innovation activity in enterprises. Consequently, innovative capabilities are not every capabilities, but specific conditions, favorable circumstances, resources, sources, etc., resulting into implementation of innovative abilities of employees.

Result of the expert assessment system of indicators of personnel innovative potential is the determination of the weighted average value of each performance-properties of employee, which describes his innovative abilities and capabilities.

At the sixth stage of qualimetric assessment, calculating of the average values of the innovative abilities and capabilities of each employee occurs, which corresponds to a certain type of personnel innovation potential.

$$Z_s = \sum_{i=1}^n z_i \cdot d_i ,$$

where Z_s – weighted average value of the innovative ability of the employee within the s -value of personnel innovative potential;

S – separate type of personnel innovative potential;

z_i – i -value of performance-property of the employee which characterizes his innovative abilities within s -value of personnel innovative potential;

d_i – i -value significance of performance-property of the employee which characterizes his innovative abilities within the s -value of personnel innovative potential.

$$M_s = \sum_{j=1}^k m_j \cdot d_j$$

where M_s – weighted average innovative capability of the employee within s -value of personnel innovative potential;

m_j – j -value performance-property of the employee which characterizes his innovative capabilities within s -value of personnel innovative potential;

d_j – j -value significance of performance-property of the employee which characterizes his innovative capabilities within the s -value of personnel innovative potential.

According to the rate of weighted average values of abilities and capabilities of the employees, the executives are able to identify tendencies in personnel innovative potential within its species certain in order to identify existing problems and ways of its formation improving.

Based on the results of the performed calculations, at the seventh stage, according to proposed methodology, the qualimetric assessment calculation of total innovation abilities and capabilities of the individual employees is carried out:

$$Z_p = \sum_{s=1}^8 Z_s \cdot d_z$$

$$M_p = \sum_{s=1}^8 M_s \cdot d_m ,$$

as well as the personnel:

$$Z = \sum_{p=1}^P \left(\sum_{s=1}^8 Z_s \cdot d_z \right)$$

$$M = \sum_{p=1}^P \left(\sum_{s=1}^8 M_s \cdot d_m \right) ,$$

where Z_p – cumulative innovation ability of the employee;

d_z – importance of abilities of s -value of personnel innovative potential in characterization of total innovation abilities of the employee;

M_p – cumulative innovation capability of the employee;

d_m – importance of capabilities of s -value of personnel innovative potential in characterization of total innovation capabilities of the employee;

Z – cumulative innovation ability of the personnel;

M – cumulative innovation capability of the personnel;

P – number of the employees, innovative ability and capabilities evaluated ($p = 1, P$).

Calculation of Z and M allows assessing in complex the level of personnel innovation potential, regarding

Tab. 1: The rating system to assess employees' innovative abilities

Type of personnel innovative potential	Performance-property of the employee which describes his innovative skills
Natural	Sufficient physical potentialities for innovation activity; sufficient mental makings for innovation activity; a sense for the application in innovation activity; speed and strength of memorizing a certain amount of information; intuition needed for innovation activity; temperament needed for innovation activity
Organization and labour	Labour discipline (responsibility); energy, high efficiency; perseverance in work; ability to achieve set objectives; ability to evaluate critically his work; tendency to work planning; tendency to organizational work; tendency to innovate; tendency to achieve quickly high results in adjacent areas of activity
Intellectual	Wide minded; depth and breadth of mind; critical mind; independence of mind; specificity; consistency and speed of thought; desire for innovation knowledge; tendency to learning, tendency to self-studying; tendency to logical and operational thinking; analytical skills; tendency to generalize; tendency to specification and systematization
Creative	Tendency to creativity; ability to generate ideas; tendency to abstracting, tendency to relay the idea to another object; tendency to imaginative thinking; to master technique of solving creative problems; tendency to creative independence; tendency to originality and creativity; tendency to strategic thinking
Communicative	Culture of communication; communication skills; psychological tact; flexibility in communication; ability to compromise; ability to work in team; ability to respond; ability to collect and process information; accuracy and readiness for reproduction information
Adaptive	Self-confidence; ability to «keep shock»; flexible mind; tendency to attention concentration and stability; tendency to shift attention; psychological balance in stressful situations; tendency to act in stressful situations
Entrepreneurial	Leadership skills; ability to administration; tendency to take risk; tolerance, initiative skills; organizational insight; ability to «push» own idea; ability to make decisions
Motivational	To be hard-working; desire for superiority; desire for recognition; tendency to accept various forms of motivation

Source: Developed by the author

it as the integration of innovative skills and capabilities of all employees who take or want to take part in the innovation process. Besides, it is necessary to consider compliance of innovative capabilities with innovative abilities of employees, because often not all workers who are endowed with certain abilities have the opportunity to participate in innovation activity, and vice versa, some employees with some innovative capabilities are unable to generate ideas, think creatively etc.

Based on the calculation of Z and M integral calculus of personnel innovation potential (the eighth stage), it is carried out:

$$IL_{PIP} = \sqrt{Z \cdot M} \tag{1}$$

where IL_{PIP} – integral level of personnel innovation potential.

IL_{PIP} value is between 0 and 1. Accordingly, the more there is its approaching to 1, the higher the level of personnel innovative potential is. Conversely, the closer is IL_{PIP} approaching to 0, the lower is this level.

To improve the interpretation quality of personnel innovation potential integrated level assessment results, we offer a criteria matrix (the ninth stage). Its development is based on the determination of the numerical limits of the total innovative abilities (Z) and capabilities (M) of the personnel and the basis of the personnel innovative potential appropriate level establishment in form of linguistic expressions «high», «average» and «low» (Table 2).

Further you need to assess goal achievements of qualimetric assessment of personnel innovative potential (the tenth stage). If the calculated actual level meets the desired requirements and needs of the enterprise's management, the qualimetric assessment of personnel innovative potential can be considered completely. Otherwise, it is necessary to develop measures to optimize employees' innovative abilities and capabilities and, in result, the level of personnel innovation potential.

This optimization can be directed to:

- developing of balanced policy on professional and personal mastering of staff;
- carrying out advocacy on the need of innovation development and introduction at the enterprise;
- training of the personnel on the basics of art, rationalization and invention, as well as the methods of creative problems solving;
- overcoming (reducing) personnel behavior inertia at introducing innovation and implementation a set of measures for its rehabilitation;
- enabling the fulfillment of employees, management promoting of staff at all production units to involve and participate in innovative projects;
- development and distribution of information provision in innovation, creating a fund of innovative ideas, and recognition the value of innovations;

- development of autonomy and management support for research units, creative and project teams in executing innovations;
- development of material and moral incentives of innovation and active participation of employees in the innovations implementation.

Conclusions. Thus, first developed by us method of qualimetric assessment of personnel innovative potential is based on the usage of performances which enables to assess the presence of the innovative abilities and capabilities of employees, combining the use of statistical and expert assessment methods aimed at determining the integrated level of personnel innovation potential and allows to optimize it according to the requirements of the enterprise management at a certain stage of its development.

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Received 23.02.2014

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Стаття надійшла до редакції 23.02.2014

Tab. 2: Criteria matrix of personnel innovation potential integrated level assessment

Assessment scale		Cumulative innovative ability of personnel		
		High (0,7 ≤ Z ≤ 1)	Average (0,3 ≤ Z ≤ 0,7)	Low (0 ≤ Z ≤ 0,3)
Cumulative innovative capability of personnel	High (0,7 ≤ M ≤ 1)	High	Above-average	Average
	Average (0,3 ≤ M ≤ 0,7)	Above-average	Average	Below the average
	Low (0 ≤ M ≤ 0,3)	Average	Below the average	Low

Source: Developed by the author