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## **A model of assessment the effectiveness of innovative growth of Kazakhstan's human resources**

The article considers and suggests a scheme of an integrated approach to the processes of formation and development of innovation-oriented human resources. The authors developed a model for assessing the effectiveness of using innovative growth in human resources in the Republic of Kazakhstan. The authors identified a set of interrelated economic and mathematical models. At the same time, a methodology has been developed for calculating the valuation of innovation-oriented human resources. The authors calculated the current investments in the activation of innovative development of human resources as the processes of innovation development improve and improve on the basis of the quality of human resources. The complex and a number of economic and mathematical models have been identified, on the basis of which it is possible to forecast the volume of production of innovative products, depending on the dynamics of investment changes and innovation-oriented personnel potential in the manufacturing industry. At the same time, a methodology has been developed for calculating the valuation of innovation-oriented human resources on the basis of a special coefficient (goodwill) to the cost of traditional labor, taking into account the cost of knowledge and skills. A two-level complex of models is finally formed. The main payback period for production has been determined. The main motives are deducing the estimates of the economic efficiency of human resources as an innovative factor in the development of the economy.

*Keywords:* personnel potential, innovation, methodology, assessment, main factors, resources, capital, coefficient of elasticity, process, qualification.

The mechanism of using human resources is based on the system of rules for its innovative development. At the same time, the process of formation and components of innovative development of the human resources of the organization are determined by the strategy of its future development, depending on the aggressiveness of the external environment and internal capabilities.

Therefore, according to I. Kibalyuk, the main goal of innovative development of human resources is to provide the necessary functional and production systems of the organization with the necessary staff and the required qualifications. This goal is achieved through effective human resources work in the field of hiring, assessment, labor adaptation, incentives and motivation, training, attestation, work and workplace organization, staff utilization, career planning, personnel reserve management, innovation management in personnel work, security and the release of personnel [1].

The main objective of innovative development of the human resources of the organization determines the sub-goals and principles of the personnel management system, that is, the rules, guidelines and norms that managers and specialists must follow in the process of innovative development of the human resources of the organization. Principles of innovative development of the personnel potential of the organization reflect objective tendencies, social and economic laws, scientific recommendations of social psychology and management theory.

In the conditions of market transformations, one of the decisive factors of efficiency and competitiveness of the organization is to ensure the high quality of innovative development of its human resources on the basis of the corresponding concept of the organization's long-term development. It must be borne in mind that the work with the staff does not begin with the appearance of a vacancy and does not end with a hiring. The process of working with personnel should be built in such a way that the shortest way to arrive at the desired result with respect to any issue or problem in the personnel sphere. Innovative development of human resources, in the ideal case, is formed and implemented in three stages.

At the same time, organizational and staff policy is understood as planning of the need for labor resources, formation of the structure and staff, appointment, creation of a reserve, movement in accordance with the policy of innovative development of the organization under study. The information policy determines the creation and support of a system of movement of personnel information (availability of vacancies, opportunities for professional and career growth, social issues, etc.) in connection with business processes and tasks of innovative development of the research organization.

The financial policy forms the principles of the distribution of funds, ensures the effectiveness of the labor incentive system, and determines the need for investment in the provision of technologies and projects for the long-term development of the organization under study in terms of the preparation and use of its human resources. Staff development policy is the provision of a program for prospective staff development, career guidance and staff adaptation, individual advance planning, team building, training and skills development, taking into account current trends in scientific and technological progress.

The content and specificity of innovative development programs of the personnel potential of the organization are influenced by factors of two types - external to the organization and internal. Activities on innovative development of the human resources of the organization should be aimed at determining the strategic goals of the organization, that is, when taking decisions in the field of personnel management, both the economic aspects and the needs of workers should be taken into account.

In addition, it should be aimed at determining the conditions for ensuring a balance between the economic and social efficiency of using the organization's labor resources. Provision of economic efficiency in the field of personnel management will help to realize the tasks of innovative development of the human resources of the organization, taking into account the rational use of its human resources. Social effectiveness is ensured by the implementation of a system of measures aimed at satisfying the socio-economic expectations, needs and interests of employees of the organization whose dynamics of changes are directly dependent on the achievements of scientific and technical progress in the field of personnel management.

It is quite understandable that such an understanding of the essence of innovative development of personnel potential of economic entities requires appropriate methods for assessing its effectiveness.

Moreover, the main methodological problem of assessing the effectiveness of innovative development of the human resources potential of the socio-economic system (SES) is to elucidate the characteristics of human resources, their evaluation and the actual criteria for assessing effectiveness. In addressing this problem, - according to I. Votyakova - it is necessary to proceed from the objectives of assessing the effectiveness of innovative development of human resources, the degree of influence of human resources on the investment attractiveness of SES and the market environment.

There are two groups of methods for assessing the effectiveness of innovative development of human resources: expert and instrumental. Expert methods for assessing the effectiveness of innovative development of human resources have some limitations.

Firstly, their use is possible and productive only in stable, long-running SES, where people have long been acquainted and have an established opinion about each other.

Secondly, these individual opinions can only be taken as an approximation to the objective evaluation of a given person (and yet in each case there remains some doubt in the absence of accidental or intentional misstatement of the assessment).

Thirdly, the expert survey, certification and similar measures to assess the effectiveness of innovation development of human resources, as a rule, greatly disorganize the work of the SES, change the normal situation in the team, which in turn also affects the degree of objectivity of the assessment.

Fourth, the expert evaluation is aimed at determining the actual level and «past merits», but practically does not provide information for forecasting the effectiveness of the future work of a person, his potential capabilities.

All these reasons do not allow considering this method to be an effective tool for evaluating the innovative development of the human resources potential of the socio-economic system. In addition, as noted by I. Votyakov, not only the first (expert), but also the second (instrumental) approaches to assessing the effectiveness of innovative development of human resources have certain limitations that do not allow each of them to be considered a universal means of solving the problem of effectiveness evaluation [2].

The use of certain methods of assessing the effectiveness of innovative development of human resources has its pros and cons, depending on the selection criteria. Among the main criteria include the extent to which the employee and his management are involved in the evaluation process, the time and money spent, the accuracy of the evaluation of the effectiveness of innovative development of human resources (based on experience). Understanding the limitations of individual approaches to assessing the effectiveness of innovative development of human resources, specialists are increasingly trying to find the opportunity to combine them in the framework of one evaluation technology, but in solving this problem, significant difficulties arise.

The reason for these difficulties, according to this expert, lies in the fundamental difference of both approaches.

The expert approach presupposes a view of a person as an element of the personnel potential of the SES, therefore, the evaluation of the effectiveness of innovative development of human resources is understood here as the definition of the conformity of the qualities of a person to a directly, but quite definite standard of a member of the socio-economic system.

The instrumental approach, on the other hand, considers a person outside his connections with the socio-economic system as a whole. Therefore, the evaluation of the effectiveness of innovative development of human resources here is the definition of the degree of expression of some standard human qualities. Incompatible are not evaluation procedures and methods (the questionnaire of «group assessment of personality» can be supplemented with a pair of psychodiagnostic tests), and the final, the latest, the nearest to achieving the goals, stages of assessing the effectiveness of innovative development of human resources: how to make a specific personnel decision - based on the results of testing or based on the combined opinion of the group.

Thus, a large choice of tools and methods for assessing the effectiveness of innovative development of human resources and a variety of assessment situations still do not allow solving the problem of ensuring the objectivity of assessing one person to another. Ideally, an assessment of the effectiveness of innovative development of human resources must be given: objectively - regardless of someone's private opinion or individual judgments; Relatively - relatively free from the influence of situational factors (mood, weather, past successes and failures, etc.); reliably in relation to activities - the real skill level should be assessed (how successfully a person copes with his business); predictive - the assessment should give an idea of what types of activity and at what level a person is potentially capable of; Comprehensively - not only each member of the organization is assessed, but also the relationships and relationships within the organization, as well as the staffing capabilities of the organization as a whole; accessible - the process of assessment, indicators and criteria for assessing the effectiveness of innovative development of the human resources of the organization should be clear to the assessors, observers, and the estimated.

Not always a unit of the evaluation of the effectiveness of innovative development of human resource capacity of SES is a separate employee; on the contrary, it is increasingly becoming a group. At the level of group assessment, interactions, a general creative atmosphere are better visible; there is no need to allocate a personal contribution of the employee when all participants perform heterogeneous kinds of work. Systems for assessing the effectiveness of innovation development help to identify the staff potential of SES.

In turn, when choosing criteria for assessing the effectiveness of innovative development of the human resource capacity of SES, in our opinion, several factors should be taken into account:

- Firstly, for the solution of specific problems, the results of the evaluation are used;
- Secondly, for which category of workers are the criteria established, given that they will be differentiated depending on the complexity, responsibility and nature of the activity.

The statistics of the personnel structure, as well as information on the processes of innovative development of the personnel potential of SES, provide information on the composition of the collective. At the same time, it is subdivided according to various criteria: for example, workers and employees; number of working men and women; trained, untrained and qualified without interruption from production, at the workplace; marital status, duration of work in production, etc. Information statistics informs about the innovative development of human resources and indicators of development effectiveness for a number of years, on the age and staffing levels.

The production age composition is an important detail in assessing the effectiveness of innovative development of human resources in the SES in the modern economy. This tool is of particular importance for the recruitment of personnel and the planning of training programs for personnel, to enhance the effectiveness of the implementation of relevant innovative capacity development activities. In order to gain a deeper understanding of the age structure of the collective, it is possible to compile separate age pyramids separately for different groups of untrained or trained employees, specialists, technical and commercial employees, senior officials, etc.

Changing the working time is the following information, analyzed in the framework of the evaluation of the effectiveness of innovative development of human resources. Changes in working hours include future legal, tariff and production rules not only of day and week working hours, but also annual, including taking into account holidays and days off.

Statistics of remuneration for work, as part of the evaluation of the effectiveness of innovative development of human resources, provides explanations on the issues of average earnings and salary levels in comparison with other SES, as well as on the effective development of the wage system. The statistics of the social process provide information on old-age security, grants, vacation payments and social benefits. A very

significant part of the indicators for assessing the effectiveness of innovative development of the human resources potential of the socio-economic system are particularly expressive when certain periods are identified and when a time comparison is possible.

In the conditions of market transformations, one of the decisive factors of efficiency and competitiveness of the organization is to ensure the high quality of innovative development of its human resources on the basis of the corresponding concept of the organization's long-term development. It must be borne in mind that the work with the staff does not begin with the appearance of a vacancy and does not end with a hiring. The process of working with personnel should be built in such a way that the shortest way to arrive at the desired result with respect to any issue or problem in the personnel sphere.

The main objective of innovative development of the human resources of the organization determines the sub-goals and principles of the personnel management system, that is, the rules, guidelines and norms that managers and specialists must follow in the process of innovative development of the human resources of the organization. Principles of innovative development of the personnel potential of the organization reflect objective tendencies, social and economic laws, scientific recommendations of social psychology and management theory.

It should be noted that numerous publications on the evaluation of the personnel potential of the enterprise are considered most often by the cost approach [2]. At the same time, the assessment of the effectiveness of the work of personnel is carried out in most cases with the help of traditional indicators of economic analysis: labor productivity, the fund of working time, the profitability of personnel.

However, they characterize only the production level of the work collective, not taking into account the intellectual component of the personnel of the enterprise. Therefore, the possibility of qualitative assessment of the level of development of the innovative potential of labor resources is of fundamental importance [3].

In particular, from the point of view of the accuracy of the derivation of the estimate - this opinion is clarified by P. Kalachikhin: «A unified methodological approach to the assessment of innovative potential would allow to agree on estimates of innovation potential for a set of single-level and similar objects obtained by different authors, but such an approach does not currently exist. Different authors identify the resource factor, organizational-functional factor or personality factor as the main factor of innovation potential. Resource factor indicates the availability of the necessary amount of resources for output. The organizational and functional factor is expressed in the achievement by the functional divisions of the enterprise of their production goals. The personal factor testifies to the level of professional abilities and the experience of the innovator involved in the innovation process» [4].

Therefore, in our opinion, we should pay attention to the above mentioned statement by L. Lukicheva on «the expressiveness of estimates based on time comparisons», since this means conducting research based on dynamic series of key characteristics, and this already provides an opportunity for applying more precise economic instruments - mathematical analysis and forecasting [5].

However, it should be noted that there are very few methodological developments in this direction, moreover, the developments taking place are of an extremely complicated nature, for example, in the form of differential equations and formal logic equations, etc., more theoretical than practical [6].

In this study, we take this approach, which is connected with the analysis of the dynamic series of a number of indicators and the derivation of a formalized dependence of the resultant index of innovation development on key factors, as the basis for the formation of tools for assessing the innovative effectiveness of human resources [7, 8].

With the help of this approach, we see the economic and mathematical tools in the system statement:

- the main model that determines the trend of the dependence of the volume of innovative products, on such factors as investment in fixed assets and, in fact, innovative-oriented human resources;
- auxiliary models that allow estimating the predicted values of these factors, and, thus, carry out the forecast of the resulting index for the main model.

The dependence of the estimation of the volume of production of innovative products in the theoretical plan can be represented in the form of the following three-factor model:

$$Vinn = f(Iop, Tiokp, t), \quad (1)$$

where Vinn - the volume of innovative products; Iop - investments invested in the fixed capital of the manufacturing industry; Tiokp - valuation of innovation-oriented human resources; t is a time factor, which is traditionally supplemented by the main factors, in order to exclude possible autocorrelation links between them.

In the methodological plan, the indicator of innovation-oriented human potential is of some complexity, since official statistics do not count and, accordingly, do not have such an indicator.

In this regard, we made an attempt to postpone the value evaluation of this factor on the basis of special adjustments to the value of traditional labor, which is understood as the payroll fund. Thus, the valuation of innovation-oriented human resources can be calculated by the following formula:

$$Tiokp = (1 + \alpha_{inn}) ST, \tag{2}$$

where ST is the value of traditional labor;  $\alpha_{inn}$  — goodwill or coefficient reflecting the growth of labor costs taking into account innovative factors (knowledge, skills, skills, etc.).

In a more simplified sense, this coefficient represents the share of accumulated knowledge (So) and skills (Sp), as an intangible intellectual capital, in the cost of labor, and can be estimated by the formula:

$$\alpha_{inn} = (So + Sp)/ST \tag{3}$$

Auxiliary models should be formed as trend, that is, depending on the time factor. The system for deducing models and making calculations for assessing the effectiveness of innovation-oriented human resources can be presented in the form of the scheme outlined in Figure 1.

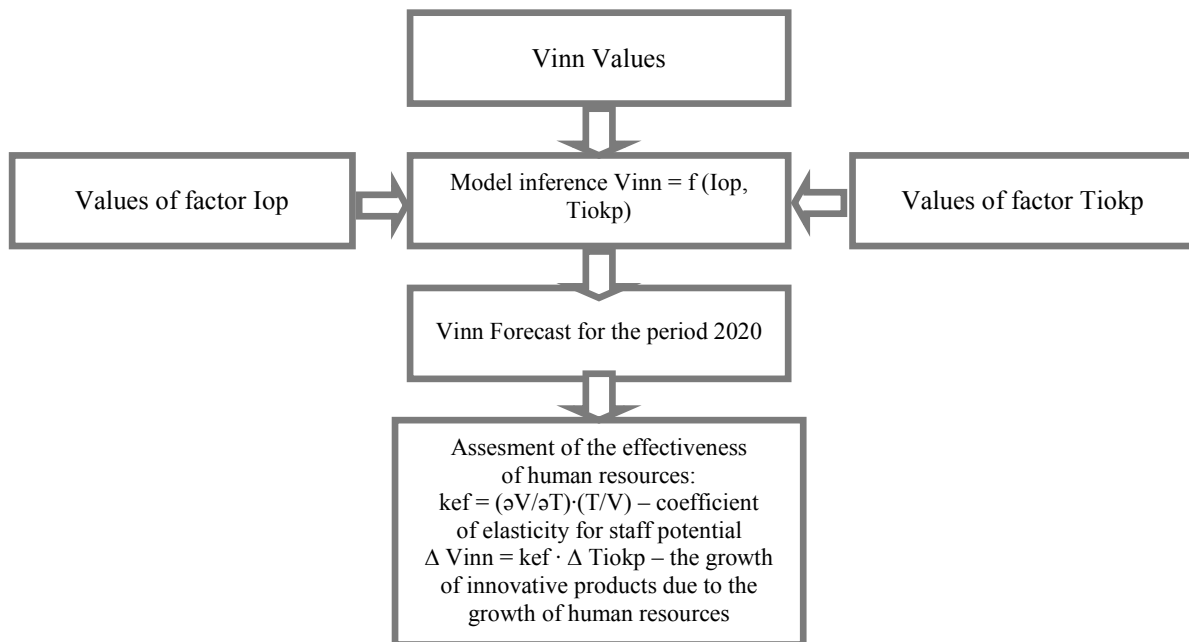


Figure 1. Methodological scheme for calculating the effectiveness estimates (developed by the author of the study)

To implement this scheme, an information base has been formed in the form of dynamic series of indicators taken as a basis for 2003-2014 (Table). At the same time, as a measure of knowledge, certainly, with some degree of conventionality, the costs for education are taken, and as a measure of skills - the costs of enterprises for retraining and training in industry.

Table

Dynamic series of indicators for the manufacturing industry in Kazakhstan, billion tenge

Year	Vinn	Iop	Tiokp
1	2	3	4
2003	65,0	131,0	184,3
2004	74,7	200,4	232,1
2005	120,4	274,3	285,9
2006	156,0	313,6	351,1

1	2	3	4
2007	152,5	322,7	468,9
2008	111,5	363,0	563,7
2009	82,6	379,5	643,3
2010	142,2	413,1	754,7
2011	236,0	481,9	908,9
2012	379,0	610,7	1065,6
2013	578,3	686,9	1160,2
2014	580,4	722,3	1280,2

Note. Sources: Data of the Committee on Statistics under the Ministry of National Economy- Access mode: <http://stat.gov.kz>

Calculations of the parameters of the theoretical factor model (1) using a standard package of statistical analysis and data processing based on the method of least squares lead to a practical choice of the following formalized model of the indicator of the volume of innovative products:

$$Vinn = 16,1694 \cdot Iop + 3,6937 \cdot Tiokp + 0,4401 \cdot t - 1,9783. \quad (4)$$

The coefficient of multiple correlation  $R = 0.9902$ , which indicates an exceptionally high connection between the volume of innovative products and the factors of investment and human capacity in industry. Graphical same illustration (Fig. 2) clearly demonstrates the high degree of approximation properties of the obtained model (4).

All this makes it possible to use the obtained economic-mathematical model with a high degree of reliability for the purposes of forecasting for the future until at least 2020.

In order to carry out the forecast of the volume of production of innovative products and evaluate the contribution of the innovation-oriented personnel potential, it is necessary to predict the values of the factors determining the content of the model (4).

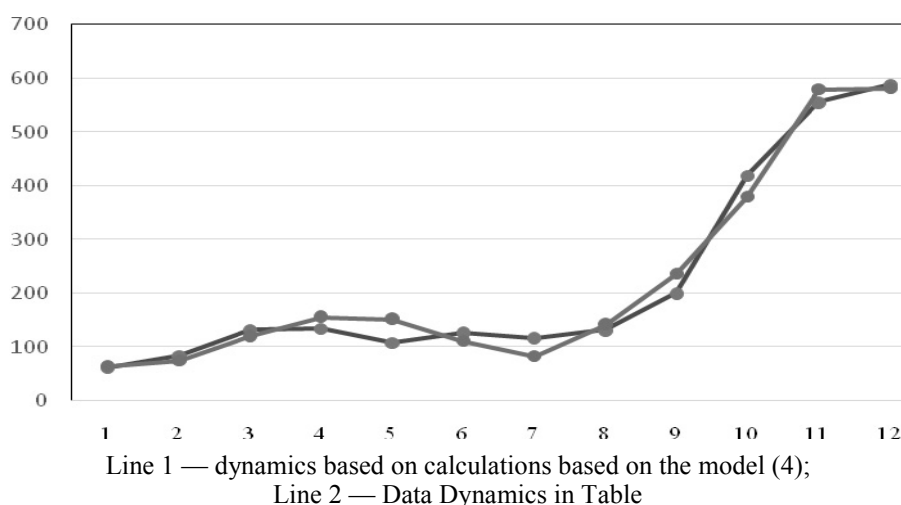


Figure 2. Graphical illustration for calculations by model (4) (based on the author's calculations)

Based on the data in Table 1, the following were derived:

a) the model of the investment factor in the fixed capital of the manufacturing industry:

$$Iop = 81,7652 + 50,2336 t, R=0,975; \quad (5)$$

b) the model of innovation-oriented personnel potential factor:

$$Tiokp = - 14,297 + 103,4675 t, R=0,9903. \quad (6)$$

The finalized two-level model complex allows forecasting investments in fixed assets, which in 2020 will amount to KZT 986 billion and innovative-oriented personnel potential, which for the same period will amount to KZT 1,848.1 billion, and on the basis of these estimates - the production volume forecast innovative products, which in 2020 may amount to KZT 978.1 billion.

It should be noted that the above methodology can also be used as a tool for assessing the results of the State Program for Industrial and Innovative Development of the Republic of Kazakhstan for 2015-2019, since the program does not include such a target indicator as the volume of production of innovative products, unlike the previous state program for the period up to 2014 of the year.

Now we can carry out an assessment of the effectiveness of innovative development of human resources. In accordance with the scheme, calculate the elasticity coefficient for the personnel potential:

$$kef = (16,1694 \times 0,4401 \times Tiokp - 0,56) \times (Tiokp / Vinn) = 0,105 \times (1848,1 / 978,1) = 0,1984 \text{ or } 0,2.$$

This indicator, according to the theory of statistical analysis, means that 1 % of the innovative increase in the personnel potential can give an effect in the form of an increase in the volume of manufactured innovative products by 0.2 %.

With the growth of innovation-oriented human potential in 2020 compared to 2014 in 44.3 %, the increase in the volume of innovative products due to this factor alone can amount to:

$$\Delta Vinn = kef \Delta Tiokp = 0,2 \times 44,3 = 8,86 \%, \text{ or } 51,4 \text{ billion tenge}.$$

Thus, current investments in the activation of innovative development of human resources can, on average, pay off in 4.6 years, and as the processes of innovation development improve and the quality of human resources on this basis improves, the payback periods will be significantly reduced.

On the whole, the conducted research and the results obtained make it possible to conclude: despite the prevailing view that investment in social projects, which can be attributed to those associated with raising the level of education and qualification, are ineffective because of the time-consuming economic returns from investments, investments in building innovation-oriented human resources have a higher return and are comparable in efficiency with investment projects in breakthrough realities economy.

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Санг-Кю Ли, А.Н. Рамашова

## Қазақстанның кадрлық әлеуетінің инновациялық өсуін пайдалану тиімділігін бағалау үлгісі

Мақала авторлары инновациялық-бағытталған кадрлық әлеуетті қалыптастыру мен дамыту үдерістеріне кешенді көзқарастың сызбасын қарастырып ұсынды. Сонымен қатар Қазақстан Республикасындағы адам ресурстарының инновациялық өсуін пайдалану тиімділігін бағалаудың үлгісін жасады, бір-бірімен байланысты экономикалық және математикалық үлгілерді анықтады. Инновациялық-бағдарланған кадрлық әлеуетті бағалауды есептеу әдістемесі әзірленіп, инновациялық даму процестері жақсарып, жетілдірілу жағдайында, кадрлық әлеуеттің инновациялық дамуын

жандандыруға ағымдағы инвестициялардың әсерінен болатындығы дәлелденіп, есептеп шығарылды. Инвестициялық өзгерістердің динамикасына өңдеу өнеркәсібінде инвестициялардың өзгеру динамикасы мен инновациялық-бағытталған кадрлық әлеуетке байланысты инновациялық өнімді өндіру көлемін болжауға мүмкіндік беретін экономикалық және математикалық үлгілердің (модельдердің) кешенді және бірқатар түрлері анықталды. Сондай-ақ, білім мен дағдылар құнын ескерумен, дәстүрлі еңбек құнын есептеудің арнайы есептік коэффициенті (Гудвилл) негізінде инновациялық-бағытталған кадрлық әлеуеттің бағалау әдістемесі жасалды. Модельдердің екі деңгейлі кешені құрастырылды. Өндірістің негізгі өтелу мерзімі анықталды. Экономиканы дамыту факторы ретіндегі кадрлық әлеуеттің экономикалық тиімділік бағаларын шығаруға мүмкіндік пайда болуы қарастырылды.

*Кілт сөздер:* кадрлық әлеует, инновациялар, әдіснама, бағалау, негізгі факторлар, ресурстар, капитал, икемділік коэффициенті, процесс, біліктілік.

Санг-Кю Ли, А.Н. Рамашова

## Модель оценки эффективности использования инновационного роста кадрового потенциала Казахстана

В статье рассмотрена и предложена схема комплексного подхода к процессам формирования и развития инновационно-ориентированного кадрового потенциала. Авторами разработана модель оценки эффективности использования инновационного роста кадрового потенциала в Республике Казахстан. Выявлен комплекс взаимосвязанных экономико-математических моделей. При этом разработана методика расчетов стоимостной оценки инновационно-ориентированного кадрового потенциала. Авторами были рассчитаны текущие вложения в активизацию инновационного развития кадрового потенциала по мере совершенствования процессов инновационного развития, на основе качества кадрового потенциала. Выявлен ряд экономико-математических моделей, на основе которого возможно осуществлять прогнозирование объема производства инновационной продукции в зависимости от динамики изменения инвестиций и инновационно-ориентированного кадрового потенциала в обрабатывающей промышленности. При этом разработана методика расчетов стоимостной оценки инновационно-ориентированного кадрового потенциала на основе специального коэффициента (гудвилл), с учетом стоимости знаний и навыков. Окончательно сформирован двухуровневый комплекс моделей. Определены основные сроки окупаемости на производстве. Выделены главные мотивы выведения оценок экономической эффективности кадрового потенциала как инновационного фактора развития экономики.

*Ключевые слова:* кадровый потенциал, инновация, методика, оценка, основные факторы, ресурсы, капитал, коэффициент эластичности, процесс, квалификация.

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