DOI: 10.31897/PMI.2018.4.421

UDC 378: 331.101.262

EFFICIENCY OF MANAGEMENT OF HUMAN CAPITAL ON THE EXAMPLE OF TECHNICAL UNIVERSITIES OF ST. PETERSBURG

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The emerging innovative infrastructure of higher education institutions, the regulatory and methodological framework, effective contracts, new approaches to the training and management of scientific and pedagogical personnel testify to the innovative nature of management in higher education. It is the quality of the human capital of universities that is of decisive importance for the realization of all innovations in the system of higher education. Therefore, the subject of research is a qualitative characteristic of management, which is the effectiveness of human capital management at the university. The goal is to justify the model of effective management of the human capital of the university in accordance with its general direction of development. The methodology of the study includes the justification of several provisions and the argumentation of conclusions based on the use of general scientific and special methods of analysis – dialectical, situational, and using the coevolutionary (system-process) approach. The conducted analysis of the personnel policy of the Saint-Petersburg Mining University and the Saint-Petersburg State University of Aerospace Instrumentation demonstrated the results of effective human capital management, which is confirmed by the statistics. However, the existing problems of an objective evaluation of management effectiveness made it necessary to supplement indicative methods with index methods. The resulting model included index methods for assessing the effectiveness of human capital management. This model is applicable to the assessment of capital investments in the staff of the university, which in turn allows you to assess the effectiveness of human capital management. Thus, the system process for assessing the effectiveness of human capital management in higher education institutions based on the presented model will allow finding problem zones and bottlenecks in the management of their human capital in a timely manner, which will ensure timely management response to problems in the field of human capital.

Key words: human capital; scientific and pedagogical staff; personnel; efficiency; control; indicative methods; index methods; technical university; effective contract

***Hot to cite this article*:** Alekseeva I.A., Gildingersh M.G. Efficiency of Management of Human Capital on the Example of Technical Universities of St. Petersburg. Journal of Mining Institute. 2018. Vol. 232, p. 421-427. DOI: 10.31897/PMI.2018.4.421

Introduction. The main task of technical universities, as part of the national innovation system, is to provide personnel for the development of the innovative economy. The formation and development of the human resources potential of technical universities has a significant impact on the quality and level of graduate training, their compliance with the requirements of the professional standard, which in turn contributes to the effective development of the national innovation system. In this regard, the effective management of the human capital of technical universities acquires special significance.

Modernization of Russian higher education is also a large-scale innovative project, which requires organizational, scientific, methodological and personnel support for innovative transformations. Obviously, the willingness of human capital to perceive process innovations will determine the effectiveness of these transformations. Consequently, the key to increasing the efficiency of the whole system is the human factor and the degree of its application.

Formulation of the problem. The problem of an objective assessment of the effectiveness of human capital management in higher education institutions is especially relevant in connection with the ongoing modernization of the system of higher education. Such an assessment will allow timely development of effective methods for managing human capital, which along with the traditional - administrative, economic, socio-psychological, will be complemented by innovative methods, including investment, design and other methods.

Social and economic efficiency characterizes the effectiveness of the entire system of higher education. Economic efficiency is the main goal; however, the limiting factor is social efficiency, which also needs to be considered as the goal of the whole system.

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The presence of two interacting management tools (operation management and development management) characterizes any educational systems as complex social objects. Therefore, the system of higher education, depending on its goals and the dynamism of the environment, acquires a level of adaptive properties and corresponding levels of self-organization and self-development of adequate complexity. In this regard, socio-economic efficiency is considered as a generalized measure of the quality of the educational system, i.e. the quality of the joint functioning of all subsystems, namely the subsystem of trainees (students, graduate students), teaching (scientific and pedagogical cadres) and managers (supervisors), providing together both management and development of the higher education system. This development presupposes the development of scientific and pedagogical personnel, i.e. carriers of human capital. Traditional ways of its rational use include career management, as well as professional development and re-qualification. Horizontal and vertical movements of personnel, being tools for the rational use of this resource, also reflect the degree of correspondence of the position with the whole system of higher education. Career movements of scientific and pedagogical personnel are also considered from the point of view of professional development, meaning the process of qualitative increase in professional knowledge, skills and habits.

Discussion. The conceptual foundations of the theory of human capital were laid down in several works of Nobel laureates in economics G.Becker, S.Kuznets [8, 9]. A separate branch of human capital concept is the theory of educational capital, which was developed by T. Schultz [10]. Russian scientists shared this concept. S.A.Diatlov [2] noted that human capital is characterized by innovative turnover. Some researchers considered human abilities as a category for investment [3], and the quality of life was presented as an integral indicator. The evaluation criterion for human capital was analyzed in [4]. V.Potemkin [7] emphasizes the key role of the human factor in providing effective activity, modern researchers determine the place of human capital in the innovative development of the economy [1]. Several studies are devoted to the study of the features of the management of human capital in educational organizations. Thus, the optimal volume of the scientist's investment in human capital in the works of V.G.Dimond was linked with the life cycle, M.D.Garner analyzed the procedure for hiring teachers and their career growth, U.O.Rosen contributed to the explanation of the difference in labor productivity and level remuneration of scientists. Many modern authors also assign the leading role to human capital [8, 11, 12].

Thus, the analysis of the categorical apparatus showed that, on the one hand, human capital is disclosed based on classical methodology as one of the factors of production. On the other hand, based on Marxist methodology, human capital is viewed because of the development of society. On the third hand, developing the ideas of the neoclassical approach, human capital is viewed as a static quantity described by the concepts of «income» and «investment». Thus, generalizing the approaches to human capital and considering it from the point of view of the institutional approach, as an element of a more general system, it is possible to formulate the definition of the human capital of the institution.

The human capital of the university is a set of accumulated knowledge, skills, motivations, expressed in the system of professional competence, education and intellect, culture, health, consciously used by man in his activity, designed to ensure high quality of training of graduates. This category is considered as a structural element of a more global system, by which we understand the system of higher education.

The coevolutionary approach to performance management should form both performance indicators and the pay model, as well as an integrated human capital management system based on management functions. Managing the effectiveness of human capital is directly dependent on the level of organizational culture and socio-psychological climate. It determines the effectiveness of the university's activity precisely the organizational culture, emphasizing the nature and focus of internal relations and motivation. The intellectual capital of the university is reproduced thanks to

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human capital, which is the subject of implementing strategies that form the human resources and innovation potential of the university.

Research. New approaches to managing human capital form new ways to improve the effectiveness of the entire system of higher education. As noted by several experts, positive changes are due to the transition of universities to the conclusion of effective contracts with scientific and pedagogical workers. An effective contract is an addition to an employment contract with an employee, in which his job responsibilities are defined, the terms of payment of labor, performance indicators for which the employee is assigned incentive payments are specified. As our analysis of effective contracts used in various universities in St. Petersburg has shown, the problem is the development of objective performance indicators (Table 1).

Table 1

Comparative analysis of effective contracts used by universities in St. Petersburg

Indicators	Saint-Petersburg State University of Aerospace Instrumentation	Saint-Petersburg State University of Economics	Admiral Makarov State University of Maritime and Inland Shipping	Saint-Petersburg Mining University
Performance Indicators	26	19	10	22
Analyzed period, considered during calculation of incentive payments	Semester	Academic year	Academic year	Academic year
The number of increasing coefficients	No	No	25	No
Maximum number of points per one indicator	10	60	No, the allowances are set in absolute terms, % or coefficient of the official salary	20
Maximum number of points	30	246	300 % of official salary	140
One-point value	Depending on the financial capacity of the university	Depending on the financial capacity of the university	The minimum payment amount is 1000 rubles.	Depending on the financial capacity of the university

For example, in a few technical universities it is noted that often employees seek to overfulfill certain indicators to the detriment of their basic duties. As Table 1 shows, the effective contracts of various universities in St. Petersburg are close, which does not make them unique in view of the specificity of their human capital, does not take into account the specifics of the university teaching staff (faculty), contracts are developed in a template with a small correction for quantitative indicators. Therefore, it is impossible to consider this instrument as an effective one. We analyzed the advantages and disadvantages of this management tool from the point of view of the employer and the employee and presented them in Table 2.

Thus, by simplifying the control over the performance and quality of the duties assigned to each employee, an effective contract acts as an effective management tool, increasing the motivation for self-development and self-realization of scientific and pedagogical personnel at low costs of the institution. However, and with the calculation of the amount of incentive payments for scientific and pedagogical workers, problems arise.

Distribute the incentive fund can be proportional to the number of points scored - according to established performance criteria. However, there are no guarantees of a real increase in the wages of an employee, because, firstly, the cost of each performance criterion is not determined in advance, and secondly, there is subjectivity in the evaluation of the result, since the evaluation is conducted by the employer. The amount of incentive payments depends on the amount of funding the university for the year in which the payment is assigned, not the previous year, but the current.

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Table 2

Effective contract: advantages and disadvantages

Object	Advantages	Disadvantages
Teaching employee	• The list of duties and responsibilities is clearly stated • Priority direction of realization of labor function for the worker can be fixed • The remuneration of labor, depending on the complexity of the work, is declared as differentiation • Declared equity in remuneration	• A "standard" agreement is offered that is the same for all employees and is an attachment to the employment contract, so an individual approach is not implemented • There is no clarity in the mechanism for setting incentive payments • It is not known in advance the cost of each indicator, the criterion of effectiveness
Employer	• The scope of duties of each employee is defined and specified • There are opportunities to improve the quality of educational services • By concentrating the employee on a certain activity, there are opportunities to increase labor productivity and personalize management	• There is a need to normalize the activities of teachers, especially extra-curricular • Possible reduction in the quality of the educational process due to the concentration of teachers on more "profitable", "short-term" work to the detriment of main activity • The term of effective contract conclusion does not coincide with the budget financing of the university, which complicates the process of establishing the size of the labor incentive fund

It is very relevant for the leadership of universities to develop time standards for educational, extracurricular, research, methodological and other work. Normalizing the work of scientific and pedagogical workers is the most important task. However, it is impossible to form an effective, fair system of labor remuneration without determining the level of labor costs for conducting various types of activities by human capital. Rationing should meet the principles of fairness and objectivity, scientific validity of norms. To do this, it is necessary to conduct a comprehensive study by photographing the workplace and other methods of calculating the hourly rate to implement these principles.

Licensing control, state accreditation, performance monitoring is actively used tools of the external and internal system for evaluating the effectiveness of the higher education system and assessing the activities of the university staff in the framework of implementing an effective contract. For example, a normative approach cannot be an efficiency criterion, although it forms prerequisites for improving the quality of educational services. The expert method is characterized by the subjectivism of the experts themselves and depends on the level of their competence or deliberate bias. An indicative approach is characterized by the formation of a narrow picture of the activities of the system, focusing on the assessment of external performance.

It seems that it is the indicator method that can supplement the indicative approach, allowing to compare the different in dimensions indicators and form common indices by multiplying (dividing) the individual indicators. The methodology of the Balanced Scorecard includes the assessment of key groups of key activities: the quality of education, stakeholder satisfaction, staff performance, management effectiveness.

The experience of several technical universities in St. Petersburg, in our opinion, is effective, which manage their human capital, the personnel policy of which is aimed at investing in personnel. This practice brings tangible results. A competent personnel policy is proved by several indicators and statistics on the status of the teaching staff of universities, carriers of human capital.

In the St. Petersburg Mining University by the date of April 1, 2017, there were 622 full-time teachers, including 115 Doctor of Science degrees and 465 Candidates of Science degrees. Thus, among full-time teachers there were 93.2 % with academic degrees and titles, including 18.2 % of Doctor of Science degrees. There were 101 part-time teachers, including 28 Doctor of Science degrees, 68 Candidates of Science degrees. The proportion of full-time teachers was 87.4 % of the total number of teachers. Considering part-time teachers, the faculty members with academic degrees and titles was 93.5 %, including 19.8 % of Doctor of Science degrees. Among the teachers of the

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university are 95 academicians and corresponding members of various international and Russian academies, 10 laureates of state prizes of the Government, 27 are honored scientists of the Russian Federation, honored workers of higher education. In general, the percentage of faculty members with academic degrees and titles at the university was 93.5 %. At the graduating departments, the faculty with academic degrees and titles was 98.8 %. The lowest percentage of teachers with academic degrees and titles was at the departments of foreign languages – 64.8 % and physical education – 40 %. At the Mining University a target program was developed to increase the percentage of teachers with academic degrees. The average age of faculty members is 48 years. For the period 2012-2016 the average output of intramural literature, per one full-time teacher, was 5.2 pp. They published monographs, textbooks and teaching aids in volume 3236.8 pp. [5].

The level of education at the St. Petersburg State University of Aerospace Instrumentation is provided by a high qualification of the teaching staff, which trains specialists in accordance with the requirements of federal state educational standards. The total number of university academic staff as of 1.04.2017 was 739 people, including 58 % of full-time employees, 18 % of internal part-time workers and 23 % of external part-time employees. The number of teachers with academic degrees was73.6 %, including full-time – 44%, among them Doctor of Sciences – 21 % [6].

To assess the development of human capital, we propose to use a system of integrated indicators that characterize the development of human capital on the example of a technical university. Thus, the proportion of employees having a scientific degree in SPSUAI is 74 %, which is higher than the value of the indicator with a high development of the university 70 %. At the same time, the share of Doctor of Science degrees (Professors) is 21 %, which is also higher than with a high development of the university in 20 %, and the share of candidates per 1000 students is 35 people, which is lower with a high development of the institution for 10 people. The number of publications per 100 teachers is 3, and the value of the indicator with high development of the university is equal to 6. The share of research work in the general income of the university was 4 %, while this indicator with high university development is 5 %. The share of external R&D per staff member was 6 %, and with high development of the university this indicator is 8 %.

Thus, the analysis of indicators allows us to conclude that there is a positive dynamic in the development of human capital under the conditions of innovative changes, but fragmentation and the lack of systematicity in building these processes require the development of fundamentally new management methods based on a coevolutionary approach (system-process). There are problems in finding a balance between traditions and innovations in higher education institutions, between the existing model of educational and scientific activity and its change under the influence of the ongoing modernization of the system of higher education. One of the main problems is to find an effective tool for managing the human capital of the university, as well as adequate methods for assessing the effectiveness of management.

Managing the effectiveness of human capital can be carried out centrally, decentralized and based on a mixed model. Most of the universities we have studied use a mixed model with a centralized way of establishing performance criteria. In our opinion, it is advisable to introduce detailed performance indicators that will be established by structural subdivisions.

Performance criteria are probabilistic (stochastic) indicators, since they characterize efficiency in terms of ensuring that the actual quality of education corresponds to what is required, which is the social norm and the goal of the educational system. It seems advisable to develop and use in the evaluation of the effectiveness of the higher education system such indicator as KPI (Key Performance Indicator), which allows to monitor the business activity of employees, subsystems and the whole system in general. An integrated index can implement this estimate. It consists of indices of innovation intensity, the index of intellectual development of personnel, the index of professional development of personnel, the educational level of personnel, the information and communication index.

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To describe the essence of this complex assessment, we will analyze the content each index.

The index of innovation intensity includes the following indicators:

• intensity of development and assimilation of innovations;
• number of staff engaged in research and development;
• the time of innovation implementation;
• level of staff physical condition.

The index of intellectual development of personnel has the following indicators:

• share of intellectual labor;
• level of creativity of workers;
• flexibility and adaptability;

The index of professional development of personnel consists of the following indicators:

• experience in the implementation of innovative projects;
• the level of management democracy and self-organization (including the presence of project teams, a high corporate culture, a healthy socio-psychological climate);
• incentive policy for initiative workers;

The educational level of personnel includes the following indicators:

• educational structure of personnel;
• level of self-education of staff;
• set of specific knowledge, skills, abilities;
• professional competence.

The information and communication index has the following indicators:

• information support of innovation;
• communication development of the organization;
• availability of necessary information.

Conclusion. The complexity of the evaluation process is obvious, we can conduct it in correlation with the innovative potential of the institution. Thus, fundamentally new approaches and methods in the management of human capital create the necessary basis for a systematic and continuous improvement of its management processes, thereby increasing the efficiency of the functioning of the higher education system. The effectiveness of human capital management in technical universities should be evaluated by the presented integral index, which will provide objective assessment of the feasibility of investing in the human capital of the university. The capabilities of the integrated index lie in the complexity of the assessment, which allows to evaluate all the effects of such investments, which is the advantage of this tool.

The change of the traditional paradigm for the higher education management for innovative one occurs in conditions when the successful work of any university is impossible without the constant development and motivation of its human capital. Undoubtedly, in these conditions, the problems of effective human capital management in the system of higher education acquire special relevance. Evaluation of the effectiveness of human capital management in technical universities in the context of innovative changes, carried out in this article, revealed several trends: the proximity of effective contracts of different universities, the lack of an objective comprehensive assessment of the effectiveness of human capital management at universities. This allowed us to formulate a comprehensive assessment model and several recommendations on improving the effectiveness of human capital management in conditions of innovative development of higher education institutions, using the main achievements of scientific thought that develop within the framework of the theory of human capital.

REFERENCES

1. Grechko M.V. Innovative development of the economy on the basis of human capital management: monograph. Rostov-na-Donu: IPO PI YuFU, 2012, p. 124 (in Russian).
2. Dyatlov S.A. Fundamentals of the theory of human capital. St. Petrsburg: SPbUEF, 1994, p. 234 (in Russian).

DOI: *10.31897/PMI.2018.4.421*

3. Il'inskii I.V. Investment process in the sphere of education: institutional and structural analysis. St. Petrsburg: SPbGIEU, 2000, p. 156 (in Russian).
4. Kritskii M.M. Human capital. Leningrad: Izd-vo LGU, 1999, p. 345 (in Russian).
5. Report on self-examination of the St. Petersburg Mining University as of April 1, 2017. Rezhim dostupa: spmi.ru/sites/default (data obrashcheniya 12.02.2018) (in Russian).
6. Report on self-examination of the St. Petersburg State University of Aerospace Instrumentation. Rezhim dostupa: docs.guap.ru/common/so_2017.pdf (data obrashcheniya 12.02. 2018) (in Russian).
7. Potemkin V.K. Innovative management in personnel work. St. Petrsburg: SPbGUEF, 2003, p. 101 (in Russian).
8. Aera D.E. Higher education, human capital and the knowledge economy. LAP, 2017, p. 134.
9. Becker G.S. Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education – Third Edition-Chicago and London. The University of Chicago Press, 1992, p. 345.
10. Schultz T.W. Investment in Human Capital: The Role of Education and of Research. New York: Free Press. 1971, p. 345.
11. May B.A. Human Capital. Challenger of Russia. Libs, 2013, p. 122.
12. Knondoker A.M. Human Capital and Industrial Development. LAP, 2011, p. 128.

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The paper was received on 13 March 2018.
The paper was accepted for publication on 18 June 2018.