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STRATEGY OF HUMAN RESOURCES MANAGEMENT IN THE TRANSITION TO INDUSTRY 4.0 TECHNOLOGIES

M. M. Gayfullina (a)*, I. V. Burenina (b), S. F. Sayfullina (c)
*Corresponding author

(a) Ufa State Petroleum Technological University, 450062, Kosmonavtov str. 1,Ufa, Russia, marina_makova@list.tu
(b) Ufa State Petroleum Technological University, 450062, Kosmonavtov str. 1,Ufa, Russia, iushkova@yandex.ru
(c) Ufa State Petroleum Technological University, 450062, Kosmonavtov str. 1,Ufa, Russia, sofia-ufa@yandex.ru

Abstract

The purpose of the article is to systematize existing researches in the field of modern technologies of the human resources management and develop a methodological approach to the formation of a strategy for effective human resources management in the transition to industry 4.0 technologies. This approach is based on methods of logical analysis, grouping and comparison, generalization, as well as methods of multivariate factor analysis. The research subject is the problem of the effective human resource management in the conditions of introduction of Industry 4.0 technologies. The object of the study is presented by efficiency indicators of the human resources use. The authors developed a matrix of strategy selection for the effective human resource management of enterprises based on the ratio of the integral efficiency indicator of the human resources usage and indicator of the company's readiness to implement Industry 4.0 technologies (it is measured using an integral index of the company's innovative development). As an example, the authors use the oil company "Bashneft" experimentally testing the proposed approach. In the process of calculations, the average efficiency of human resources usage and the average level of the innovative development of the company were determined. The obtained research results can be used for improving the approach to the human resources management of enterprises in the context of their development and strategy formation of the human resources management under conditions of industry 4.0 technologies.

Keywords: Human resources, strategy, human resources management, Industry 4.0, digitalization, company.

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1. Introduction

The relevance of this study is determined by the growing need for a transformation of approaches to the human resources management of enterprises in the conditions of the accelerated innovative development and transition to Industry 4.0 technologies. Improving the economy efficiency and the formation of innovative ways of its development are impossible without digital tools and restructuring the economy on the basis of various digital mechanisms and technologies. One such tool is the introduction of Industry 4.0 technologies. The analysis of specific management situations shows that in the vast majority of cases, any significant strategic changes in the organization can begin only through the human factor. Effective implementation of Industry 4.0 technologies requires tools that can be used for the effective human resources management in the new environment.

2. Problem Statement

The research issues on industry 4.0 technologies and their impact on global changes in the sectors of the world economic complex are disclosed in the scientific works of domestic and foreign researchers. Among the researchers involved in the human resource management topic, including the context of innovation and technology development of Industry 4.0, the authors considered the works by Mohan (2017), Mani (2017), Intarakumnerd (2017), Raineri (2017), Baker (2015), Pater and Lewandowska (2015), Machado, Winroth, and da Silva (2019), Sony (2018).

The variety of approaches and points of view on the formation of an effective strategy of the human resources management shows that there is not still any single concept on the efficiency and methodology for its definition. In addition, despite the fact that Industry 4.0 technologies are penetrating deeper both into production and management processes of modern enterprises, the issues of the strategic human resource management remain practically unexplored in the context of the usage of Industry 4.0 technologies.

3. Research Questions

The study summarizes and systematizes approaches to assessing the effectiveness of the human resources management of enterprises. The authors also systematized approaches to assessing the innovative development level of enterprises. Based on the results of systematization, an approach to the assessment of the innovative development level of enterprises is proposed, with help of which the readiness degree of enterprises to the introduction of Industry 4.0 technologies can be estimated. Based on the ratio of the efficiency of the human resources usage in the company and the readiness indicator of the company to implement Industry 4.0, the authors offer the choice of a strategy for the human resources effective management at enterprises.

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4. Purpose of the Study

The aim of the study is to develop a methodological approach to the formation of a strategy for the effective human resources management of enterprises in the transition to industry 4.0 technologies. Research objectives are:

- systematization of existing research works in the field of modern technologies usage in the sphere of human resources management;

- identification of specific features of the enterprise development in the conditions of introduction of industry 4.0 technologies;

- development of recommendations on the choice of an effective strategy of the human resources management by the implementation of Industry 4.0 technologies.

Recommendations for selecting a strategy for the effective human resource management at the enterprise are formed based on the ratio of the integral indicator of usage efficiency of human resources and the integral index of the enterprise's innovative development.

5. Research Methods

Methodological aspects of the formation of the human resources management strategy at the enterprise have not yet received proper coverage in the scientific literature. The analysis of existing methods for the formation of an effective strategy of the human resources management showed that the majority of them do not take into account the complex influence of external and internal factors on the usage efficiency of human resources, and the strategic development of the company. In addition, the impact of Industry 4.0 technologies on changing approaches to the human resource management of enterprises remains largely unexplored.

We have proposed a method for the formation of an effective HR management strategy in the context of the Industry 4.0 implementation based on the integral efficiency indicator of the human resources usage and the level of the enterprise innovative development.

The conducted analysis of theoretical and methodological materials on the issues of the human resources efficiency at enterprises showed that the usage of only one performance indicator is not enough and it is necessary to take into account various aspects of enterprises' human resources. Taking this aspect into account, we propose an integral efficiency indicator of the human resources usage.

The calculation sequence of the integral efficiency indicator of the human resources usage in the oil company includes six main stages. At the first stage, the calculation of individual indicators (reflecting the usage efficiency of human resources of the company) is carried out. While selecting the indicators proposed for calculating the effectiveness of the human resource management, the works of different researchers were studied and systematized: Boon, Eckardt, Lepak, and Boselie (2018), Van Esch, Wie, and Chiang (2018), Yu (2017), Gayfullina, Nazimova, and Makov (2018). The most general system of private indicators of the HR management efficiency (among approaches proposed by different researchers) includes such indicators as labor productivity, average monthly wage, the ratio of the rate of labor productivity growth and wages, staff turnover, average seniority in the company, capital-labor, the increased educational level of the staff.

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At the second stage, using the correlation and regression analysis, significant efficiency indicators of the HR usage are identified. The choice of indicators (that are advisable to include in the calculation of the integral indicators of the human resources usage efficiency) is determined through the calculation of the closeness of relations between certain efficiency indicators and net profit, since this indicator (net profit) most fully characterizes the enterprise's efficiency.

Since performance indicators have different measurement units, they were standardized through the calculation of indices of indicators changes at the third stage of our research. At the fourth stage, using the expert method, the weighting coefficients of the indicator significance were calculated. Here, when setting the weight coefficients, it is possible to take into account the industry specifics of the enterprise. At the fifth stage, the calculation of the integral indicator of the efficiency of the human resources usage at the enterprise was carried out. The formation of the integral criterion is proposed by the weighted average formula:

$$I_{HR} = \sum_{i=1}^{n} HRi * d_i, \quad (1)$$

where HRi is the standardized value of the i-th criterion of the human resource efficiency usage;

d_i is the weight coefficient of significance of the i-th criterion.

At the sixth stage, we determined the degree of the human resources usage efficiency in the oil company. The efficiency level of the human resources usage is characterized as: high at $I_{HR} \geq 1,2$; average – at $1,0 \leq I_{HR} < 1,2$; low – at $I_{HR} < 1,00$.

The degree of the enterprise's readiness to the introduction of Industry 4.0 technologies is proposed to be assessed through an integral indicator of the innovative development. In the selection of indicators that determine the readiness degree enterprises to implement industry 4.0 technologies and affect the formation of the effective human resource management strategy, the research results by such authors as Machado, Winroth, and da Silv (2019) , Burenina et al., (2017), Suseno, Standing, Kiani-Mavi, and Jackson (2018), Gobble (2016) et al. were studied and systematized.

The most common system of private indicators of the enterprise innovative development, proposed by various researchers, includes the following indicators: the share of costs for technological innovations in the volume of shipped products of organizations; the share of innovative products in the total volume of shipped products; the share of costs of industrial production organizations for the purchase of machinery and equipment related to technological innovations in the total investment in fixed assets; the level of automation of management processes, etc. The formation of the innovative development indicators of an enterprise is also proposed to evaluate with the weighted average formula:

$$I_{IN} = \sum_{j=1}^{m} IN_j * k_j, \quad (2)$$

where IN_j is the standardized value of the j-th indicator of the company's innovative development;

k_j is the weighting factor of the significance of the j-index.

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The choice of indicators included in the calculation of the integral indicator is also made using the correlation and regression analysis through the calculation of the closeness of relations between certain indicators of the innovative development and net profit. Standardization is also carried out through the calculation of indices of indicators changes, and the calculation of weights – using the expert method.

The innovative development level and readiness of the enterprise to implement Industry 4.0 technologies is determined on the basis of the scale: high at $I_{IN} \geq 1,2$; average – at $1,0 \leq I_{IN} < 1,2$; low – at $I_{IN} < 1,00$.

In the scientific literature, there is a sufficient number of classifications of human resource management strategies. Taking as a basis the typology of strategies by Armstrong (2011) (he distinguished between such strategies as a strategy for the formation of high-commitment, a strategy for the formation of high efficiency, a strategy of the maximum involvement), we made some changes in the names and contents of these strategies in terms of modern requirements to enterprises by the introduction of Industry 4.0 technologies. The recommended strategy of the human resources management is determined based on the ratio of I_{HR} and I_{IN}. The strategy selection matrix is given in Table 01.

Table 01. Matrix of the selection of the human resources management strategy

Value of I_{HR}	**Value of I_{IN}**		
	$I_{IN} \geq 1,2$	**$1,0 \leq I_{IN} < 1,2$**	**$I_{IN} < 1,00$**
$I_{HR} \geq 1,2$	knowledge management strategy	knowledge management strategy	development strategy
$1,00 \leq I_{HR} < 1,2$	knowledge management strategy	development strategy	resource-oriented strategy
$I_{HR} < 1,0$	development strategy	resource-oriented strategy	resource-oriented strategy

The knowledge management strategy is recommended for companies that are characterized by a high level of the innovative development, which characterizes the readiness to implement industry 4.0 technologies, and a high efficiency level in the usage of human resources. The strategy assumes a high level of the staff participation in the development, implementation and dissemination of innovations in different areas, the creation and use of databases to accelerate learning and reduce the number of errors, the creation of active channels of information exchange that improves relationships between employees, the integration of staff training into the workflow through gamification.

The development strategy is focused on increasing the innovative development level of the enterprise through the implementation of large-scale investment development projects that affect the growth of the company technological development, the labor productivity growth, the quality of performed work and obtaining added value. In the field of the human resources management, the strategy involves the growth of personnel training costs, expanding the range of human resources competencies (professional, information, organizational, social and personal, etc.) and the development of material incentives for employees.

The resource-oriented strategy in the human resources management assumes the increase in expenses on the development of socio-personal competences of the staff (discipline, responsibility,

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diligence), support the required level of professional competences (education, qualifications) and the development of non-monetary forms of motivation.

6. Findings

The approbation of the developed methodological approach was carried out on the example of the oil company "Bashneft", which occupies the 6th place in terms of the oil production in Russia and the 4th place in terms of refining. Using the tools of the correlation and regression analysis, a correlation matrix was constructed and the correlation coefficients between the indicators of the human resource efficiency and the resulting factor – net profit, as well as the correlation coefficients between the indicators of the innovative development of the company and net profit were analyzed using the Chaddock scale. Step-by-step regression (step-by-step regression analysis) was used to select indicators that affect the resulting indicator. Based on the results of the correlation and regression analysis, a system of individual indicators of the human resource efficiency and individual indicators of the innovative development of the considered oil company was formed. The integral indicator of the efficiency of the human resources usage was 1,05 (IHR), and the integral indicator of the innovative development IIN = 1,12 (2016). Thus, according to the results of 2016, “Bashneft” is characterized by an average efficiency level in the human resources usage and an average level of the innovative development. The recommended strategy for this company should be aimed at achieving high development rates, which involves the expansion of investments in new technologies, as well as increasing the motivation degree of staff to work, training for the development of competencies.

7. Conclusion

Having studied theoretical and practical aspects of the strategic human resources management, it can be concluded that in modern conditions of the companies development we need to form new approaches and strategies to the human resources management, taking into account the motivation to improve the efficiency of the labor activity, revise the system of development, training and advanced training of employees in the organization. In general, in the Russian management practice today, there is a lack of competent employees who are prepared for the specifics of the innovation activities, understand the logic of the innovation process at the present level of Industry 4.0. As one of the key functions of the HR management strategy of a company (in terms of Industry 4.0 technologies implementation) we can mark the improvement of the innovative development level of enterprises and getting through this effect innovations with the growth of the competence level of the staff and attachment degree of the personnel to the organization. In this regard, there is a growing need for developing not only management approaches, but also tools for their implementation, allowing to increase the staff productivity.

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