UDC 338.1:658.31
DOI 10.31521/2313-092X/2021-1(109)-1

Ukrainian Black Sea Region Agrarian Science
Vol. 25, No. 1

Industrial enterprises intellectual resources management in a knowledge-based economy

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Abstract. The article substantiates the theoretical provisions, scientific and practical recommendations for the industrial enterprises management in the formation of knowledge-based economy intellectual resources have been developed. The content and the main elements of the infrastructure-reproductive approach to the management of industrial enterprises intellectual resources are revealed. The classification of industrial enterprises intellectual resources management organizational levels is offered. The types of personnel policy that correspond to a certain level of the enterprise intellectual resources management organization are identified. The results of the study can be used to develop tools, methods, systems and mechanisms for managing the intellectual resources of industrial enterprises, aimed at maximizing the innovation effect, needed to ensure sustainable innovation at the current level

Keywords: knowledge-based economy, industrial enterprise, innovative development, intellectual potential, intellectual resources management, the effect of innovation, intellectual and innovative activity of personnel

INTRODUCTION

The imperative of advancing intelligence development has become an imperative not just for existence but for the survival of civilization in the socio-economic transformation conditions. The origins of this problem are that the economic basis of modern society is characterized by the existing sector of high-tech, knowledge-intensive industries.

An industrial enterprise in a knowledge-based economy is an innovative enterprise, which is the most complex research and production system that ensures the implementation of "research- production" consistently ascending cycles. An integral part of production and economic activity of such an enterprise is the integration of intellectual activity, which is enhanced by the intellectual abilities of staff aimed at producing new knowledge (intellectual product) and innovation activity in the transformation field of various intellectual products into innovative products and its further commercialization directly or in warehouse of finished goods (services). Management of intellectual resources is becoming an urgent need for modern industrial enterprises, determining their innovative activity and competitiveness on the basis of providing the intellectual staff capabilities necessary reproductive level, the development of its innovative competencies. Therefore, an innovative industrial enterprise should consider the management of intellectual resources as a constant strategic priority.

Industrial enterprises inevitably become dependent on the intellectual capabilities of staff. Thus, in the world of hi-tech technologies, the attention of leading companies managers is focused on the use of employees creativity and knowledge in an innovative project team. Under these conditions, in the field of economics and human resources management, an increasingly common problem is the lack of innovative and competent workers in many areas of industry [1, 2]. In such conditions, the desired result of industrial enterprises human resource management is, first of all, high-quality staff development aimed at innovative result in the

Article's History:
Received: 21.08.2020
Revised: 03.01.2021
Accepted: 23.02.2021

Suggested Citation:
Ostrovska, H. (2021). Industrial enterprises intellectual resources management in a knowledge-based economy. *Ukrainian Black Sea Region Agrarian Science*, 25(1), 4-10.

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format of knowledge-based economy, that is improvement of professional knowledge, skills, experience, raising the professional qualification level on this basis and its integration into professional competencies in the modern innovation sphere. Therefore, it is necessary to review and rethink the conceptual guidelines for the management of industrial personnel on a new principled basis in terms of priorities for innovative economic development. In this context, attention is focused on the need to increase the scientific focus on industrial enterprises intellectual resources management (IEIRM) and the development of the employee innovative competencies on this platform.

It should be noted that international and domestic theory and methodology of human resource management are represented by various concepts focused on personnel management aspects. These concepts are due to technological and structural changes in economy on an innovative basis, but do not give a clear vision of the management specifics in the development of personnel innovative competence and intellectualization aimed at industrial enterprises solving diversification and technological modernization in a knowledge-based economy, that is current scientific problem. Thus, the lack of ability to ensure industrial personnel effective management in the new economic environment on the basis of traditional approaches has identified the main idea of the study aimed at developing the theory and intellectual resource management methodology based on the infrastructure-reproductive approach.

The purpose of the article is to deepen the methodological principles and develop recommendations for the industrial enterprises intellectual resources management on the basis of infrastructure-reproductive approach in a knowledge- based economy formation. The choice of research methods is based on the consideration objectivity and comprehensiveness, consistency (in terms of formal and mathematical logic) principles, as well as sufficient justification. In accordance with these principles, a wide range of general scientific research methods (general logic, theoretical, empirical) was used, which made it possible to systematize the idea of the employees intellectual resources managing specifics.

LITERATURE REVIEW

Scientific ideas of such domestic scientists as V. Heyets and A. Gritsenko, H. Pylypenko and N. Fedorova, O. Butnik-Siversky, N. Bryukhovetskaya and I. Buleyev, B. Andrushkiv, O. Kuzmin and L. Lipych, V. Petrenko, I. Moyseenko, Y. Sytnyk, A. Nalyvayko and O. Grebeshkova, L. Maliuta and R. Sherstiuk are aimed at thorough research of business entities ntellectual resources management methodological and applied aspects.

In particular, V. Heyets, A. Gritsenko, H. Pylypenko and N. Fedorova actively study the problems of social and class transformations and the formation of a new education, science and innovation quality as components of the reconstructive development of Ukrainian economy [3, 4]. O. Butnik-Siversky substantiates intellectual resources as one of the main factors in the processes of the economy socio-economic development intensification [5]. N. Bryukhovetskaya and I. Buleyev develop mechanisms for innovative development of domestic industrial enterprises [6]. O. Kuzmin and L. Lipich consider methodological aspects of the intellectual potential management concept as a tool to increase the competitiveness of the enterprise [7]. B. Andrushkiv summarizes the directions of the enterprise intellectual potential effective use as an entering the European economic space ways [8]. The creation of effective mechanisms for attracting intellectual resources and the peculiarities of their development are studied by V. Petrenko. With, the researcher confirms that the effective use of intellectual resources in today's information economy contributes to a higher level of social welfare [9]. I. Moyseenko in his works strengthens the role of intellectual resources in the context of industrial enterprises innovative activity in Ukraine [10]. S. Ilyashenko, Y. Sytnyk, A. Nalyvayko and O. Grebeshkova cover the intellectual resources activation in the context of the knowledge management modern paradigm [11, 12, 13]. L. Maliuta and R. Sherstiuk outline the realities and prospects of the industrial enterprises intellectual potential effective use in a knowledge-based economy [14, 15]. S. Kis outlines the problems of management activity intellectualization and enterprise personnel intellectual activity intensification [16].

Nevertheless, issues related to the industrial enterprises intellectual resources management remain insufficiently researched, or debatable up to this day, which necessitates their further study to ensure their effective use.

RESULTS

In the current socio-economic transformation, determined by the technological factor, the advanced development of intelligence has become the dominant factor of the knowledge-based economy. Today's economy is, first of all, an effective sector of high-tech industries, which relies more on the resources of the intellectual component [17]. Thus, the strategic importance of modern industrial enterprises intellectual resources increases.

The study of the industrial enterprises intellectual resources management (IEIRM) specifics allowed us to conclude that there is a sufficient variety of approaches to management in this area. The reason for turning to the personnel management methodological experience, on the one hand, and the experience of managing the intellectual resource component (intellectual capital and intellectual potential), on the other, is the specific intellectual resources economic nature as an object of management. This necessitates the need to take into account in this kind of studies, firstly, the staff

intellectualization genesis as a result of intellectual resources synthesis such as knowledge, skills, abilities, experience, competencies, abilities, and secondly, the inseparability of these resources from staff as a carrier – not in the form of passive nature "packaging", but the one that significantly affects the qualitative aspect of intellectual resources at the collective level.

The proposed infrastructure-reproductive approach in the context of enterprises intellectual resources management study allows to consider the personnel intellectualization as an object of management, focusing, firstly, on its reproducible nature of the managed process, and secondly, on its infrastructural place and role in the innovation cycle, focused on creating conditions for the formation and development of such necessary in today's innovative employees competencies. With, the personnel intellectualization reproductive cycle structure includes five stages: forecasting and planning of intellectual resources; formation of intellectual resources (personnel selection, selection, as well as the creation of a personnel reserve for the enterprise innovative plans implementation); development of intellectual resources, based on the enterprise innovative development program; use of intellectual resources in innovation processes, ensuring the innovative activity of employees; transformation of intellectual resources into the enterprise economic potential. The advantage of this approach is that it distinguishes the possibility of research and solution on its basis quite specific problems in the enterprises intellectual resources management, due to the need and feasibility of balanced reproduction and innovative competence of employees (Table 1).

Table 1. *The main elements of the infrastructure-reproductive approach to the enterprise intellectual resources management in a knowledge-based economy*

Element	Characteristic
Type	Program-targeted, focused on innovative results
Purpose	Development of intellectual resources management organization in the conditions of knowledge-based economy
Tools	Economic evaluation of the enterprises intellectual resources indicators management
Opportunities	– organizational management environment influence integration; – economic assessment of management efficiency and quality; – structuring the object of management and systematization of the management specifics characteristics; – methodical support of enterprises intellectual resources management; – modeling of systems and management mechanisms that allow to algorithmize the organization management
Advantages	– contributes to the reduction of fragmentation and segmentation in the theory and methodology of enterprises intellectual resources management; – focused on resource provision of the innovation process; – object of management, presented in the reproductive-infrastructural interpretation; – universal in relation to various categories of industrial enterprises workers; – due to the conditions of innovative economic development
Limitation	Internal level of industrial enterprises

The disclosed elements make it possible to specify the content of the infrastructure-reproductive approach as a specialized and focused on the study of industrial enterprises intellectual resources management and the formation of appropriate management systems.

The use of the proposed approach in the context of the enterprises intellectual resource management the sample study (Table 2), allowed to obtain results to supplement the theory of personnel management development elements, consisting in the classification of industrial enterprises intellectual resource management organizational levels, as well as identifying types of personnel policy, corresponding to a certain level of enterprises intellectual resources management organization.

Table 2. *The main characteristics of the sample industrial enterprises*

Classification criterion	Characteristics of the enterprise
The size of the enterprise	The number of staff is more than 1 thousand people
Appointment in the conditions of economy innovative development	– commercialization and serial production of new products; – industrial familiarization of new technologies
Type of innovation	– grocery; – process
Innovation strategy	Evolutionary change of products, technologies(violent (power) strategy)
The ability to ensure the creation, perception, consolidation and development of innovations	Technological (with marketing elements)

The classification of different industrial enterprises intellectual resources management organizational levels by coverage of the personnel intellectualization reproductive process elements is given in the Table 3.

Table 3. *Organizational levels of intellectual resources management by the personnel intellectualization reproductive process covering elements*

The level of IEIRM management organization	Criterion of the IEIRM management organization level	IEIRM control elements
Passive: the reproductive process of intellectualization cannot be organized	Representation in the enterprise personnel policy not less than one element of IEIRM	1. Development of the enterprise intellectual resources
Moderately active: the reproductive process of intellectualization is difficult to organize	Representation in the enterprise personnel policy not less than two elements of IEIRM	1. Formation of the enterprise intellectual resources. 2. Development of the enterprise intellectual resources.
Active: the reproductive process of intellectualization can be organized under the condition of enterprise intellectual resources Management functions development	Representation in the enterprise personnel policy not less than three elements of IEIRM	1. Formation of the enterprise intellectual resources. 2. Development of the enterprise intellectual resources. 3. Use of the enterprise intellectual resources.
Focused-active: the reproductive process of intellectualization is organized and effective as an infrastructure of the innovation process	Representation in the enterprise personnel policy complete elements set of IEIRM	Balanced rational presentation to the enterprise intellectual resources management at all stages of the personnel intellectualization reproductive cycle

The content of enterprises intellectual resources management different organization levels is specified in terms of effective management critical conditions, which include two types of conditions: necessary and sufficient. The necessary condition characterizes the quality level of intellectual resources and the completeness of their use in the innovation process. By this criterion

$$EIR=EIRa=EIRq, \quad (1)$$

where *EIR* – the enterprise intellectual resources; *EIRa* – intellectual resources that are actually used in the innovation process; *EIRq* – intellectual resources of the required quality, based on the need to achieve innovative goals of the enterprise.

Sufficient condition allows us to optimize the ratio of economic results from the use of intellectual resources in the innovation process and the cost of their formation and development.

Thus, the use of enterprise intellectual resources efficiency (K_{eire}) in the innovation process is greater than 1.

Characteristics of enterprises intellectual resources management organizational levels under critical conditions of effective management necessity and sufficiency, revealing a certain organizational optimum in management achievement degree are given in the Table 4.

Table 4. *Organizational levels of the enterprise intellectual resources management under effective management necessity and sufficiency critical conditions*

Organizational level	Characteristics according to the criteria of necessity and sufficiency conditions
Passive	1) irregular, unfocused formation and development of enterprise intellectual resources; 2) the enterprise intellectual resources are not fully used, but the level of their actual use meets the production needs (the enterprise is inactive in the context of innovation); 3) $K_{eire} < 1$
Moderately active	1) unreasonably high costs for the formation and development of the enterprise innovation sphere intellectual resources, which do not determine the investment return; 2) underutilization of the enterprise intellectual resources; 3) $K_{eire} < 1$
Active	1) total use of the enterprise intellectual resources, the quality level of which, however, does not meet the resource needs of the enterprise in the innovation sphere or the enterprise intellectual resources actual use level is lower than the intellectual capabilities of staff; 2) $K_{eire} \leq 1$
Focused active	1) optimal ratio between the quality level of the enterprise intellectual resources and the completeness of their use in the innovation sphere: EIR = EIRa = EIRq; 2) $K_{eire} > 1$

From the solving problems point of view on the innovative economic development trajectory formation, it becomes necessary the focused active level of the enterprises intellectual resources management, presented by a single set of interconnected elements formed on the principle of intellectual resources reproducible balance for industrial enterprises innovative development. In accordance to the intellectual resources management organization levels, we consider the industrial enterprises personnel policies types in terms of innovative economic development (Table 5).

Table 5. *Identification of industrial enterprises personnel policy types in a knowledge-based economy*

The level of *EIR* management organization	Type of personnel policy
Passive	Passive, non-innovation-oriented: passive innovation-oriented direction of all personnel policy elements
Moderately active	Moderately active innovation orientation: a) personnel policy is focused on providing the company with highly qualified personnel; b) personnel policy passive innovation orientation in many areas is preserved
Active	Active innovation orientation: personnel policy is aimed at the formation and development of professionals innovative team capable to ensure the innovative development of the enterprise
Focused active	Focused active innovation orientation: personnel policy, formed on the principle of the enterprise intellectual resources reproducible balance in the interests of ensuring its stable innovative development

The prospect of intellectual resources managing on the basis of infrastructure reproductive approach will avoid many typical problems in management practice, which lead to inefficient use of intellectual potential in terms of innovative economic development. As a result of the industrial enterprise intellectual resources management organizational integration into the management system, such administrative results become achievable.

1. Increasing the focus and systematization of the enterprise intellectual resources formation and development periodicity (up to continuity).

2. Optimization of costs for the enterprise intellectual resources formation and development.

3. Ensuring the complete use of intellectual resources, the quality level of which meets the enterprise needs in innovation field.

4. Creating working conditions that eliminate the underutilization of intellectual resources and, consequently, reduce the subsequent associated economic and moral-psychological losses for individual employees, the workforce and the enterprise as a whole.

Let's note, that the inefficient reproduction of intellectual resources in the innovation sphere, which is essentially a mismatch between the potential of employees and the needs of the enterprise in innovative development, is mainly due to multiple discrepancies: between the growing needs of the enterprise in innovative development and the existing professional level employees; in cases of irrational arrangement of executors on workplaces in the innovative project; in the absence of the necessary motivation or motivational fatigue of employees; in case of dissatisfaction with work, etc.

CONCLUSIONS

The transition to a knowledge-based economy involves profound institutional transformations, rethinking the conceptual approaches and industrial values of "technogenic" culture, and the new culture values emergence of informational and "homogeneous" nature, which emphasizes the role and importance of interdependent information and human resources.

An actual modern economy problem in connection with the highlighted trends is the formation of a new platform that provides stable positive dynamics in the vector of the economy innovative development and digitalization. One of the main factors in creating such an innovative platform is the labor-groups innovation, the mass and scale of which will allow it to form the appropriate effect, which is determined mainly by intellectual resources, namely their effective and purposeful formation, development and use in innovation processes. Moreover, this effect becomes a determining factor in the deep transformation of existing or the birth of new economy institutions.

The main target of modern industrial enterprises intellectual resources management should be the achievement and stabilization of their required reproduction level, due to the needs of the enterprise in innovative development in accordance with the knowledge-based economy stage. This guideline determines the sequence of problem solving, tools, the order of resource allocation in the internal management process, aimed at innovative results. In this regard, the need to find adequate management approaches that allow develop the necessary management systems and mechanisms, required in the implementation of domestic economy innovative development promising directions.

The long-term continuation of the study tendencies may be: further development of theoretical and systemic ideas about the specifics of intellectual potential development managing as a reproductive process, improving methodology, methods, organizational procedures and tools for evaluating the effectiveness of management.

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Управління інтелектуальними ресурсами промислових підприємств в умовах економіки, заснованої на знаннях

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Анотація. У статті обґрунтовано теоретичні положення та розроблено науково-практичні рекомендації щодо питань управління інтелектуальними ресурсами промислових підприємств в умовах становлення економіки, заснованої на знаннях. Розкрито зміст та сформовано основні елементи інфраструктурно- відтворювального підходу до управління інтелектуальними ресурсами промислових підприємств. Запропоновано класифікацію організаційних рівнів управління інтелектуальними ресурсами промислових підприємств за охопленням елементів відтворювального процесу інтелектуалізації персоналу. Ідентифіковано типи кадрової політики, що відповідають певному рівню організації управління інтелектуальними ресурсами підприємства. Результати дослідження можуть бути використані для розробки інструментів, методів, систем, а також механізмів управління інтелектуальними ресурсами промислових підприємств, спрямованих на максимізацію ефекту новаторства, необхідного для забезпечення стабільного інноваційного розвитку на сучасному рівні

Ключові слова: економіка, заснована на знаннях, промислове підприємство, інноваційний розвиток, інтелектуальний потенціал, управління інтелектуальними ресурсами, ефект новаторства, інтелектуально-інноваційна активність персоналу