UNIVERSIDAD & SOCIEDAD
Presentation date:July, 2025
Date of acceptance: August, 2025
Publication date: September, 2025

INDUSTRIAL

ECONOMY AND ARTIFICIAL INTELLIGENCE: REAL SITUATION AND DEVELOPMENT DIRECTIONS

ECONOMÍA INDUSTRIAL E INTELIGENCIA ARTIFICIAL: SITUACIÓN REAL Y DIRECCIONES DE DESARROLLO

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Suggested citation (APA, seventh ed.)

Bagirov, M. S. (2025). Industrial economy and artificial intelligence: real situation and development directions. *Universidad y Sociedad, 17*(5). e5402.

ABSTRACT

The industrial sector remains a cornerstone of economic development, and the advent of artificial intelligence (AI) promises a transformative "fourth" and emerging "fifth" industrial revolution by enabling predictive decision-making, real-time optimization, and the convergence of cyber-physical systems, Internet of Things, and AI-based analytics in smart factories. Despite numerous pilot successes, the widespread adoption of AI in industry is hindered by fragmented systems integration, uneven data quality and management, and limited trust in "black-box" algorithms, as well as a lack of unified frameworks to observe and coordinate AI and digitalization efforts across diverse industrial contexts. This study aims to clarify AI's capabilities and developmental trajectories in the industrial economy by systematically evaluating its applications, strategic directions, and improvement stages. It was found that the integration of AI and digitalization yields significant productivity gains, particularly in predictive maintenance, supply chain optimization, and automated quality control. However, heterogeneity of platforms, data-governance challenges, and operator skepticism persist. Sectoral analyses reveal advanced uptake in discrete manufacturing (automotive, electronics) versus slower adoption in metallurgy and chemicals due to legacy systems and safety concerns. To accelerate a just and resilient transition, coordinated public-private R&D investment but also human-capital development. We also believe that future research should focus on scalable cyber-physical AI architectures, energy-efficient algorithms, defensive AI for cybersecurity, and governance models that balance innovation with ethical, legal, and social safeguards. This unified perspective supports stakeholders in designing strategic action plans, regulatory policies, and rapid intervention protocols, thereby maximizing AI's transformative potential in industrial economies.

Keywords: Industry, Industrial economy, Artificial intelligence, Digitalization processes.

RESUMEN

El sector industrial sigue siendo un pilar fundamental del desarrollo económico, y la llegada de la inteligencia artificial (IA) promete una cuarta revolución industrial transformadora y una quinta revolución industrial emergente, al permitir la toma de decisiones predictiva, la optimización en tiempo real y la convergencia de sistemas ciberfísicos, el Internet de las Cosas (IoT) y la analítica basada en IA en fábricas inteligentes. A pesar de los numerosos éxitos de los pilotos, la adopción generalizada de la IA en la industria se ve obstaculizada por la integración fragmentada de sistemas, la calidad y la gestión desiguales de los datos, la poca confianza en los algoritmos de "caja negra", así como la falta de marcos unificados para observar y coordinar las iniciativas de IA y digitalización en diversos contextos industriales. Este estudio busca esclarecer las capacidades y las trayectorias de desarrollo de la IA en la economía industrial mediante la evaluación sistemática de sus aplicaciones, direcciones estratégicas y etapas de mejora. Se ha constatado que la integración de la IA y la digitalización genera importantes aumentos de productividad, especialmente en el mantenimiento

predictivo, la optimización de la cadena de suministro y el control de calidad automatizado. Sin embargo, persisten la heterogeneidad de las plataformas, los desafíos de gobernanza de datos y el escepticismo de los operadores. Los análisis sectoriales revelan una adopción avanzada en la fabricación discreta (automotriz, electrónica) frente a una adopción más lenta en la metalurgia y la química debido a los sistemas heredados y las preocupaciones de seguridad. Para acelerar una transición justa y resiliente, se requiere una inversión coordinada público-privada en I+D, así como el desarrollo del capital humano. Asimismo, creemos que la investigación futura debe centrarse en arquitecturas de IA ciberfísicas escalables, algoritmos energéticamente eficientes, IA defensiva para la ciberseguridad y modelos de gobernanza que equilibren la innovación con salvaguardas éticas, legales y sociales. Esta perspectiva unificada apoya a las partes interesadas en el diseño de planes de acción estratégicos, políticas regulatorias y protocolos de intervención rápida, maximizando así el potencial transformador de la IA en las economías industriales.

Palabras clave: Industria, Economía industrial, Inteligencia artificial, Procesos de digitalización.

INTRODUCTION

The industrial economy has traditionally been the engine of productivity, employment, and the generation of added value in nations, establishing complex value chains that link raw materials, production processes, and international markets (Oqubay, 2025). Currently, artificial intelligence (AI) is poised to be the next great wave of innovation, comparable in magnitude and scope to previous industrial revolutions, incorporating advanced algorithms and cyber-physical systems capable of making predictive decisions and optimizing processes in real time. The term AI, coined by McCarthy (2007), and is classically defined as "the science and engineering of making intelligent machines." Beyond this initial formulation, deep learning has consolidated a family of methods capable of extracting complex patterns from large volumes of data in the last decade (LeCun et al., 2015). These techniques are pillars of the so-called Industry 4.0, where the convergence of cyber-physical systems, the Internet of Things (IoT), and AI-based data analytics promotes smart factories with predictive maintenance, supply chain optimization, and automated quality control (Jan et al., 2023).

Although pilot success stories abound, the widespread implementation of AI systems in industry faces significant challenges. A recent study by Windmann et al. (2024) reviews the literature on AI integration in industrial systems and highlights three major barriers:

Systems integration: The heterogeneity of platforms and protocols hinders the uninterrupted flow of data between machinery and AI algorithms.

Data quality and management: The lack of standards for data collection, labeling, and cleansing limits the effectiveness of predictive models.

Trust and acceptance: The opacity ("black box") of many algorithms reduces the trust of operators and decision-makers.

At the sector level, discrete manufacturing—especially automotive and electronics—leads adoption, with established predictive maintenance applications that can reduce unplanned downtime costs. However, industries such as metallurgy and chemicals show a slower pace of integration due to legacy control systems and safety risks associated with critical processes. It is widely recognized that AI has conflicting effects on economic growth. On the one hand, it amplifies total factor productivity, driving the agglomeration of productive service activities. A study using data from 27 Chinese provinces (2006–2019) concluded that "AI directly promotes the agglomeration of productive services and, indirectly, by increasing productivity" (Xie & Yan, 2024).

However, there is also a dark side to this transformation, which lies in the potential for job displacement and increased wage inequality. As various authors warn, AI can lead to job displacement or unemployment, which may cause slower economic growth. In addition, this technology can create inequality, as those who own and control AI technology can benefit disproportionately from its economic gains (Kalai et al., 2024). In particular, the automation of routine tasks—both manual and cognitive—leads to a polarization of the labor market, where the highest-paid positions require high-level skills and the lowest-paid ones concentrate on physical tasks with little technological substitution.

Furthermore, the rapidity of AI advancement clashes with the reaction speed of regulatory systems. For example, the EU legislative process began in 2021 with the proposed AI Act, which will gradually come into force until 2026, while the United States has opted for a decentralized approach through federal agencies (Comunale & Manera, 2024). The main regulatory challenges include:

- Establishing interoperability standards to ensure fair competition and data portability.
- Defining clear liability frameworks for AI system failures in industrial environments.

- Promoting transparency and the adoption of explainable AI (XAI) techniques to strengthen trust and accountability.

Moreover, public investment in R&D and training is essential to reducing skills gaps and ensuring a just transition to a digitalized industrial economy. Therefore, notable development directions and lines of research are:

1. Cyber-Physical AI (CPS AI) integration: to delve into scalable architectures that unify cyber-physical systems with AI platforms, ensuring low latencies and high reliability (Lee et al., 2025).
2. Promoting data sharing initiatives under governance frameworks that balance innovation with the protection of intellectual property and privacy.
3. Resilience and cybersecurity: defensive AI techniques are being investigated to anticipate and mitigate attacks, as well as real-time response protocols (Kalai et al., 2024; Lee et al., 2025).
4. Algorithmic sustainability: to design low-energy and efficient AI models for training and deployment in resource-limited environments (Shaamala et al., 2024).

Considering the case of Azerbaijan, the industrial sector has played a leading role in the formation of the country's economic system and in its progress in accordance with planned and forecasting processes. The industrial sector, which is distinguished by its characteristics of playing a leading role at both theoretical and practical levels, is praised with specific manifestations in terms of "intra-industry and inter-industry relations," "domestic and international relations," and other tandems and aspects. The relevant field, which includes metallurgy, the processing industry, and other areas, is distinguished by a rather rich history of development. The transformation of craftsmanship into an independent direction of activity as a result of the social division of labor, and its progressive and thoughtful development in subsequent periods, formed the basis for the emergence of industrial monopolies in later stages.

At the beginning of the 19th century, it was possible to form internal constituent areas within the industry, with expectations related to occupation and other characteristics. As a result, at that time, subjects of activity were created in the territory of Azerbaijan that specialized in oil extraction, sericulture, food processing, and a number of other areas. The active penetration of "creative thinking" into the time periods and the activity process resulted in the emergence of progressive production and circulation funds, packaging means, methods, and mechanisms of realization. By the end of that century and the beginning of the 20th century, it was possible to classify the activity that would later be called "organized industry" (Ustyuzhanina & Komarova, 2022, p. 47).

A number of stages in the activity of our country's industry, which is in a stage of development and progress, their passing specifications, and the execution of works require a comprehensive approach to the issue. In this regard, the preparation of the "Artificial Intelligence Model" of Azerbaijan and the launch of a strategy distinguished by the necessary systematicity and other qualitative characteristics are considered expedient. It should be noted that the establishment of artificial intelligence in individual countries varies in its scale and forms. It should cover a number of items, including the following:

- Artificial intelligence, distinguished by its relevance to the generalized scale of the country's economic system;
- Intellectual opportunities that are of significant importance at the sectoral level;
- Realities manifested in the field of artificial intelligence, which differ in relation to an individual field of activity, administrative-territorial unit, or product (work, service, good), etc. (Swan, 2017, p. 54).

Then, the aim of this paper is to clarify the capabilities and development trajectories of artificial intelligence in the industrial economy by systematically assessing its applications, strategic directions, and stages of improvement. Through observation, grouping, comparative analysis, induction, deduction, and balancing techniques, the research synthesizes both theoretical and empirical insights into AI-driven industrial processes.

DEVELOPMENT

Management, development and improvement of artificial intelligence in industry

The balanced and justified development of the economic system of our country, which is considered one of the important components and necessary directions of progress in the modern era, encompasses many directions, factors, methods, and mechanisms. Among the proposed specifications and level expressions, the tandem of "industry – artificial intelligence" retains its importance, as do the requirements that may arise in the current period and in prospective time periods.

The observation of artificial intelligence capabilities in industry requires the implementation of necessary assessment and analysis work, as well as the execution of efforts aimed at simplifying complex situational aspects. In our opinion, in order to provide a clearer view in this

direction, there is a need to express the following items within a single classification:

1. Regulation of artificial intelligence and its use based on legal and regulatory requirements;
2. Determination of norms and regulations, standards, and operational needs for the "research object" in question, reflecting necessary and additional planning and forecasting steps within unified business classifications;
3. Fulfillment of the requirements of each representative of the "state policy – economic entities – control and regulatory affairs" series regarding activities promoting artificial intelligence;
4. Ensuring coordinated activity within our country in general, including within the economic system, especially in industrial units;
5. Preparation of action plans thoroughly designed at the level of "goals – tactical moves" in order to ensure the systematicity of artificial intelligence outcomes;
6. Implementation of multidimensional assessments of domestic scientific research and experimental work in the mentioned direction, as well as international experimental results, in accordance with the principles and realities of diversification, etc. (Chernyshev & Kantieva, 2022, pp. 115–116).

This classification clarifies the most important possible scenarios that may arise in the field of "industrial – artificial intelligence opportunities". Approaching the core of the problem from different angles creates conditions for the emergence of various combinations and different quantitative-qualitative situations. As can be seen from the classification, the first place at the conceptualized level is occupied by the formation of legal and regulatory foundations and related operations. Thus, any activity (operation, step considered appropriate to be taken, etc.) expresses a set of actions that are accompanied by regulatory aspects. In artificial intelligence and field-scale intellectual opportunity research, the importance of revealing and systematically studying strategic and tactical insights remains.

Generalized ideas and thoughts allow us to characterize the approach to the concept of "strategy" in terms of complexity and systematicity, harmony and optimality, organization and manifestation-transformation, scale orientation, and other parameters. The work of Porter (2011, p. 42) allows us to characterize the object of research from various prisms. According to the scientist, strategy:

a) Is a purposeful program of activities and development prepared at macro and micro scales, presented as a single set of multiple business, social, and other goals;
b) Is an important content manifestation of the process of defining and summarizing perspective goals, based on specific organizational and management tools such as planning and forecasting, taking into account spheres and directions such as product production, work, and service provision;
c) As the final expression of goals, objectives, desires, and needs, strategy is also represented by its own characteristics and classifications;
d) Clarifications are made regarding the object and unit of the strategy object based on methodological foundations such as systematic observation, individual and multi-factor grouping, comparative analysis and evaluation, use of quantities, balancing, etc.

On the other hand, the specifications of the directions and objects in which we intend to express our views are associated with various considerations by representatives of the scientific and experimental research community. For example, the characterization of industrial strategies in allows us to combine the following items into a single classification and make the necessary generalizations:

1. In order to clarify the goals of industrial activities, their strategic goals and tactical moves adapted to them are set;
2. Necessary planning actions related to strategic desires and needs, as well as tactical steps, are systematized in the database;
3. The implementation of the strategy is organized in stages, including the time frames for these stages of activity;
4. The necessary tools and mechanisms of digitalization are used in the mentioned direction;
5. Consistency of differentiation and diversification coefficients is ensured across the classification components used;
6. A unified examination of individual and corporate interests, project planning goals, digitalization-incubation methods, computer programs, and coding-control specifications of objects considered necessary for use during activities is conducted;
7. Information arrays with coordinated quantitative and qualitative content are created, taking into account the characteristics of field subjects, etc. (Macgret & Macmillan, 2022, pp. 192–193).

On the other hand, the economic policy of the state affects the degree of activity in the use of artificial intelligence, taking into account the field, object, time, administrative-territorial (economic), and other parameters. Giving priority to any specific factor or group of factors creates conditions for the differentiation of specific items in the

composition of the artificial intelligence capabilities of the object of observation and research. In terms of the parameters that are important for studying the mentioned spheres and directions it is appropriate to individualize the following items:

sector or enterprise of the economic system (in our example, primarily industry);

- the sphere in which intellectual activity is applied (production-processing, supply-procurement, transport-logistics, sales-exchange, etc.);
- the degree of readiness of products, works, and services (semi-finished products, work in progress, finished goods, product, and commodity);
- the use of intellectual opportunities based on different configurations of organization and subsequent implementation of international activities (fully or partially foreign-capitalized, implementation of work on the basis of joint business commanders, etc., in a specific way);
- stages of work execution and other specifications.

The advancement and application of the capabilities of artificial intelligence in industry consist of the fact that the relevant activities are carried out in such directions as nanotechnologies, digitalization (individual coding), the creation and use of an inclusive environment, etc., which are composed of similar tools and implementation mechanisms. Although each of the components in question differs significantly in importance, the necessary usage configurations for the constituent elements consist of the organization of planning activities.

The assessment of the capabilities of artificial intelligence and the study of their specific manifestations in quantitative and qualitative terms from different perspectives have revealed numerous features. Among them, one of the realities that stands out for its high importance is the use of creative qualities and abilities, knowledge, and skills inherent to artificial intelligence, as well as their systematic and interconnected application. The trajectory of the spread of artificial intelligence covers both material and non-material directions. At the same time, it contributes to the comprehensive and rapid enrichment of individuals and, on this basis, of society within certain time intervals.

J. Moker, who is distinguished by his original thoughts and progressive ideas in the relevant field, in his work "Instrument of Wealth: Technological Creativity and Economic Progress" (Moker, 2023, p. 262), draws attention to the numerous components existing in this sphere. Among them, the representation of the following elements is considered one of the needs of the modern era:

- advanced material objects and their justified and purposeful use;
- individual movements and the achievement of their complex formation;
- the instilled pioneering function and advanced movements;
- the gradual replacement and complementation of artificial intelligence objects;
- the identification of issues and the taking of necessary steps aimed at improving harmonization, efficiency, and optimization, and based on the principles of systematic activity coordination, among others.

In addition to the listed elements and directions, digitalization features also play an important role in the transition of artificial intelligence to higher business stages. In this regard, digitalization, which is still implemented within a narrow framework, occupies the first place in practice. Among the results of borderless scientific and applied research, the problems of the lawful and logical use of digitalization are found in the works of many scientists and practitioner-researchers. Among them, the work entitled "The Law of Successful Innovation" (2017) by authors C. Christensen and K. Dillon stands out for its significance. This work, which is scientifically and theoretically based and also has journalistic aspects in some cases, focuses on digitalization in an innovative context as a necessary organizational tool, a means of innovation in management, and an important component in increasing the business level of subjects. The work also approaches digitalization from the standpoint of many criteria. Thus, the processes of clarifying the components involved in digitalization primarily bring together representatives of comparison and analysis. Among them, the following aggregates are represented:

1. theoretically based norms, normative elements, prototypes and standards;
2. their experience and the massification of their responses over time;
3. deviations in the quantitative levels of comparisons and their causes;
4. meeting the requirements of "economic sector - creative subject", etc.

It is worth noting that digitalization activity is characterized by a high tendency toward the application of modern

technology and technical means. In international research spaces, depending on the technical and other conditions of the object, it is described using only numbers or a "number-letter combination" tandem. The difference in approach lies not only in the direct and indirect representation of information units and arrays in the field of application, but also in their specific participation in electronic information processing.

Programming related to digitalization processes is opening up to different structures and orientations based on different goals. The programming activity performed encompass:

1. The "precepts" and "news" of the research dictate the formation of different situations, which in turn affect the enrichment of the methods and sequences of use of the emerging principles and mechanisms;
2. It affects the flexibility of using programming objects;
3. It creates conditions for the growth of the user base, qualitative expressions of their activities, etc. in the field of "digitalization - programming".

The rapid development of digitalization processes in the last twenty years cannot be ignored. The relevant processes that began with the individual marking of objects (finished products, raw materials, goods, structures and details) have now expanded in the world's leading, especially industrially developed countries, on the one hand, and have moved to the expression of entire technical and technological processes on the other hand. Additionally, individual aspects of important elements of activity directions affect the content of digitalization (Arkhipova & Kuchmaeva, 2021, p. 156). The specification of the object of digitization paves the way for the selection of appropriate digitization tools, methods and means. Taking into account the specifications of the object of digitization, observations are carried out in horizontal and vertical directions. Thus, the designation of digital expressions used in supply and procurement processes and the designation of expressions (barcodes) used in finished goods differ in many ways.

Digital numbering, which has individual meaning, is paving the way for the emergence of digital classifications in the modern stage of the economy. The reflection of local production, as well as general activity processes through the corresponding numbers or their "sets", creates conditions for the participation of another grouping factor in the recording of these processes. The use of digitalization methodology in "customer-contractor" relations is distinguished by a number of its own features, among which it is necessary to pay special attention to the following:

1. formalization of orders with precise numerical expression in addition to name and purpose;
2. interconnection of commodity coding and digital expression systems;
3. subjecting document forms to special digitalization for the purpose of formalizing purchase and sale (exchange) transactions;
4. implementation of specific registration of primary documents formalized through digitalization techniques and technologies into specific generalizing documents, etc.

The assessment of the possibilities of artificial intelligence and digitalization draws attention to the existence of necessary regulatory elements. Although various forms of regulation are encountered in operational practice, legal, technical, economic, organizational and other groups are distinguished among the most widespread.

Systematically organized regulatory activity has been studied in different works and research sources from the perspective of artificial intelligence and digitalization, for example Bagirov (2023) where a multi-level classification of regulation was applied. The route in question primarily reflects the movement from general regulation to its main groups. Each of the groups, in turn, is selected by dividing it into constituent elements. For example, the composition of the legal-regulatory complex is mainly described through the following sources:

- Laws of the Republic of Azerbaijan;
- Charter and Bylaws;
- Legal norms and regulations, business regulations and standards;
- Legislative orders, decrees and presentations, instructions and guidelines;
- Other sources of various aspects of legal regulation activity, represented as participants in the processes of establishing artificial intelligence.

In addition to the legal regulatory level, the application and implementation of artificial intelligence in technical, economic, organizational, structural, constructional, effective intra-subject allocations and other aspects must also maintain its purposefulness, efficiency and operational response capabilities, and must also clearly demonstrate itself at the theoretical and experimental levels.

At the same time, it is worth noting that:

1. Optimal representation of artificial intelligence in any business environment, along with systematic justification of its participation, strengthens the thinking and realities of the staff;

2. Planned and thoughtful steps taken in accordance with the research and learning stages will not only create conditions for expanding the capabilities of artificial intelligence, but will also create conditions for a clearer demonstration of its capabilities, which will in turn create conditions for enriching positive results;
3. Artificial intelligence capabilities, methods, and mechanisms that exceed the boundaries of scientific-practical, logical, harmonious, and other parameters have the potential to cause more harm than good for the sphere in which they are represented.

The characteristics and properties of artificial intelligence, about which opinions are expressed, create conditions for the emergence of different views within different situations and in the presence of components. Thus, the article provides approaches to the possibilities of artificial intelligence in the industrial field from different perspectives. The "mathematical-logical" plane evaluates the use of the possibilities of artificial intelligence from different planes. It is worth noting that, as in other fields and directions, the study of the tools and mechanisms of artificial intelligence by observing them "directly" or inversely can lead to considerable differences in meaning and content. Then, the artificial intelligence system, which is considered one of the important reasons for its creation, aims to expand human capabilities to think, create, process and innovate, apply, improve, transform and adapt into a single complex, among other capabilities.

Features and development of databases and infrastructure formation in industry

As one of the important constituent elements of each activity, the information system constitutes its formation capabilities and characteristics. The need in question expresses a number of components in a collective manner. Among its constituent elements, the creation of computing tools and infrastructure that meet the requirements is considered to be among the indispensable components. The activity complex in question consists of an infrastructure that expresses the parts that receive, process and finalize information.

The formation of a database is accompanied by the principles of adherence to certain goals. This activity is carried out in parallel with the creation of specialized DATA-information units. In determining the business and practical capabilities of any "center", it is envisaged to use the configuration of related DATAs based on the principles of coordination and dependence. The existence of the set goals clarifies the characteristics of the intended tactical moves and methodological methods. On the other hand, the use of information infrastructure in industrial and economic units in conjunction with its use of common electronic computing tools meets the requirements of the expediency parameter.

The development of the information market in the industrial sector also implies the rules and methods, principles and mechanisms of organizing digitalization. The content, direction and characteristics of the process in question are intended to clarify the general points and specifications about digitalization. Thus, the different aspects that emerge on the basis of various characteristics are necessary to respond to many aspects.

As the Russian scientist, Professor of Moscow State University V. Litvinenko also supports, the factors and signs of digitalization processes, their configurations subject to individual shaping, combine different aspects and characteristics, among which the most important ones and those that form a unity with the subject can be listed as follows (Litvinenko, 2023, pp. 221–222):

- Providing a systematic view and approach to the requirements of the "artificial intelligence - digitalization" tandem at the industrial level;
- determining strategic goals of digitalization activities in industry depending on their goals and objectives;
- applying appropriate transformation processes to the program depending on the results of its activities, and as a result, transferring the digital tools and means used in the industrial production stage to subsequent stages of use;
- purposeful use of digitalization elements on a general and individual business scale;
- subordinating digitalization rules and application diversification to the needs of artificial intelligence;
- assessing the possibilities of interoperability of "blocks" representing digitalization activities;
- digitalization processes should adapt to the technical and technological capabilities of the industry, both in general and at the level of individual entities, and should contribute to its development and modernization;
- theoretical and experimental implementation of different forms of intellectual thought development based on the capabilities of the "search - use" system;
- the use of different "object references" in the digitalization of objects by referring to different variations of numbers and combinations, etc.

Each item that finds expression in the classification should be individually examined and characterized by concluding thoughts and ideas. The implementation of content analysis on items, in addition to ensuring the sequence of activities, brings its purposefulness to the practical level within the intended framework. Another interesting point

is addressed in the textbook "Production Technologies", authored by Y. Roshina and D. Lisovskaya, which was released in 2021. In the comparison carried out in the context of "Information Flow - Complex Digitalization", some issues are studied more comprehensively, which primarily create conditions for the realization of the following items (Roshchina & Lisovskaya, 2021, p. 223):

1. to ensure more active information exchange;
2. systematization of existing information by type;
3. to assess the information steps implemented in a way that meets the requirements of a single experimental design;
4. transfer of information to the digitalization level that will meet the needs of the manufacturer, etc.

Knowledge and skills of human resources and artificial intelligence

Among the leading elements of the topic, issues related to human resources are of particular importance. Clarification of numerous problems in this area is of great significance, among which it would be appropriate to specifically mention the following:

a) Implementation of various programs to systematize the knowledge and skills of human resources in the field of artificial intelligence and maintain their complexity;
b) Establishing ethical and other rules for personnel and implementing continuous improvement measures for them;
c) Resorting to special planning and programming activities for the purposeful development of the intellectual potential of creative people, etc.

The stated classification items imply the expectation of many important points and innovations in the formation of personnel potential. In terms of content, the distribution of these items on the basis of material and moral-psychological aspects creates conditions for the emergence of different situations depending on the circumstances. The assessment of personnel potential in terms of artificial intelligence requirements aims to clarify the abilities of individuals with "creative" and "rich work experience."

This requires organized steps to coordinate and interconnect both artificial intelligence and digitalization. The organized assimilation of the latest achievements of science and technology and their purposeful use require the configuration and other enrichment of the composition, content, and character of "needs-opportunities" for modern workers. The "creative individual" who directs their intellectual knowledge and skills in the business sphere, taking into account the special foundations of their formation, must at the same time comply with the requirements of inclusiveness and other parameters.

The expression of human resources should be improved on the basis of constant enhancement of the complex of their knowledge and skills, methods and mechanisms of activity, and, if necessary, transformed. It should not be overlooked that another classification is used in the division of innovative technologies into components. Thus, in the work of Kashapov and a group of other scientists published in 2023, the following sequence is observed in the important classification: "General technological foundations →innovative technologies used in the current period → technologies for knowledge-education and practical use." Its main goal is to show that the technologies used are distinguished primarily by their educational nature, and after their mastery by employees, to ensure their transition to practical levels (Kashapov et al., 2023, p. 109).

In the work by Duffie (2022, p. 274), special attention is paid to the capabilities of artificial intelligence, the activity of virtualization, and the specifications of the organization of business activity. The application of a systematic approach to the issue, along with the joint, mutually coordinated application of artificial intelligence and digitalization processes, allows for the emergence of individual aspects in research processes, as well as the demonstration of individual approaches. According to the author, the expansion of the theoretical, experimental, and other possibilities of the potential of "a person distinguished by an individual creative way of thinking" in the formation of a way of thinking allows for methods of comprehensive and systematized solutions to numerous issues, among which it would be appropriate to especially mention the following items:

- Increasing the level of application of numerous technical and technological capabilities;
- Progress, optimization, and improvement in the field of information collection and subsequent use for harmonious progress;
- The use of the capabilities of employees who are distinguished by individual mental, logical, and sociological qualities for assessment;
- Different realities of specialization of mental capacity utilization configurations through the application of approaches;
- Combining the activities of the world's leading experts in the field of "artificial intelligence," whose opinions and insights are discussed by recognized scientists and "centers" in a single space, providing a link to the creation of relevant DATA-information blocks, etc.

Thus, the constant improvement of the potential of personnel representing various structural divisions of economic entities, along with the correction of their business and socio-ethical qualities within a time frame, should be enhanced with the help of numerous related tools and means. Among the special directions, the acquisition of new career goals and the implementation of complex assimilation-educational work on modern components and elements of creative qualities (including the holding of special conferences and other scientific, organizational events) are also of particular importance.

CONCLUSIONS

In the modern era, the requirements of the "industrial economy - artificial intelligence" tandem have gone through many stages of development and improvement, reaching higher levels. Artificial intelligence, whose initial outlines were clarified by John McCarthy and his associates in 1956, has undergone numerous classifications and improvements in subsequent periods. The constant modernization of technical means and technologies and the use of methods and mechanisms that make people's lives easier when put into real operation once again confirm the importance of artificial intelligence advancements. Since 2000, the more advanced representation of artificial intelligence and digitalization, the 4th industrial revolution, and mass informatization processes have led to the emergence of modern directions of thought in the field of clarifying the content and essence of many research objects, as well as providing a new perspective on the ideas that suggest they are superior to human capabilities. The use of progressive mechanisms emerging in the field of machines and technology leads to the daily change of requirements in the mentioned sphere. Thus, the technical possibilities and capabilities, which are considered as one of the objects of contact, bring to the fore the necessity and foundations for making new discoveries. On the other hand, new technical and technological possibilities also clarify the content and directions of the needs of the "worker-human" who can regulate them in the modern era.

Regarding the most important subjects addressed in this research, it is relevant to highlight some important elements to consider in AI development:

- The worker-human is moving away from the traditional "linear" way of thinking by making revolutionary innovations in their way of thinking. Therefore, it is relevant to ensure a transition from a monodirectional way of thinking to multifactorial and multidirectional assessment and analysis work that is distinguished by complex foundations in the process of self-awareness;
- Determining the priorities of induction or deduction mechanisms depending on the situation;
- Addressing the capabilities of artificial memory, which has a capacity tens of thousands of times greater than human memory;
- Ensuring the necessary, high-quality expressions of the "human-machine" unity, etc.

Although currently the world is focusing on the generally accepted fourth and fifth levels of technological development, the corresponding indicator is represented differently in individual countries. Therefore, one of the problems that should be evaluated as a result is the systematization and complexity of digital information emerging in the field of artificial intelligence. In this regard, the importance of the following points is undeniable:

d) Formalization of work carried out in the field of artificial intelligence at the international information level in a unified manner;

e) Applying the same methods of formatting the rules for registering and using that information;

f) Clarifying the status of the content and objects of artificial intelligence-related digitization information, their administrative-territorial and economic location, and the level of expression of the intellectual work performed;

g) Planning, programming, and forecasting of steps involving artificial intelligence based on symptomatic examination;

h) Subjecting digital-coding information to various classification criteria and organizing systematization activities for data from different sources on those research-observation objects into appropriate DATA;

i) After performing a classification of the collected digital information, assessing the possibilities for its actual use;

j) Combining artificial intelligence steps into a single package that will expand the technical and technological capabilities of the industry, etc.

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