drugs and the creation of personalized treatment plans. In social life, it provides support through chatbots and helps to identify psychological problems.
Along with these opportunities, the development of AI poses challenges, such as automation, which can threaten jobs, as well as ethical and security issues. Therefore, it is important to create effective regulatory mechanisms to ensure the ethical use of artificial intelligence.

The formation of AI requires efforts in mathematics, biology, psychology and cybernetics, as well as in philosophy. The role of philosophy goes beyond establishing ethical foundations for human interaction with AI; it involves understanding its role in the fate of civilization. This understanding is key to coordinating efforts in developing a model of AI that meets the task of cooperation with human intelligence and society. It depends on understanding the dynamics of how we think about AI. [1]

Unlike humans, who think naturally, robots only imitate the process of thinking, which allows them to remotely control gadgets and make predictions for various industries. An AI system has a limited amount of processed data and is usually used to perform routine tasks. It works at high speed, performing up to 10 million operations per second, and can implement complex AI programs. However, it can only be trained on large amounts of data, and it is not capable of abstract thinking, which, due to its low adaptability, limits its ability to solve problems and correct failures. [3]

It is therefore important to note that emotions, intuition, and social influences play a significant role in shaping individual actions and choices, highlighting the complex interaction between rational thinking and other cognitive and affective processes. At the same time, the rapid development of artificial intelligence, ethical dilemmas in biotechnology, and the spread of information are forcing us to rethink the concept of human intelligence and its relationship to the evolving world.

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CRISPR-Cas: A GENETIC REVOLUTION
(CRISPR-Cas: ГЕНЕТИЧНА РЕВОЛЮЦІЯ)

У публікації розглядаються основні аспекти її застосування в сільському господарстві, зокрема покращення врожайності, якості культур, стійкості до хвороб і гербіцидів. Описано також її роль у вдосконаленні селекційних методів, прискоренні процесу доместикації та впровадженні нових підходів до регуляції генів. Обговорюються перспективи технології та можливі виклики, пов'язані з її ефективністю, нормативним регулюванням і сприйняттям суспільством.

Ключові слова: *CRISPR-Cas, редагування геному, біотехнологія рослин, стійкість до хвороб, стійкість до гербіцидів, генна регуляція, селекція гібридів, стале сільське господарство, генетична модифікація, сільськогосподарська біотехнологія.*

The publication discusses the main aspects of its application in agriculture, including improving yields, crop quality, disease and herbicide resistance. It also describes its role in improving breeding methods, accelerating the domestication process and introducing new approaches to gene regulation. The prospects of the technology and possible challenges related to its effectiveness, regulatory framework and public perception are discussed.

Keywords*: CRISPR–Cas, genome editing, plant biotechnology, disease resistance, herbicide resistance, gene regulation, hybrid breeding, sustainable agriculture, genetic modification, agricultural biotechnology.*

CRISPR–Cas genome editing technology has revolutionized plant molecular biology, offering high specificity, programmability, and efficiency. It allows for precise genetic modifications in crops, facilitating the creation of varieties with beneficial traits such as increased yield, improved quality, and enhanced resistance to diseases and environmental stressors. This system is derived from an adaptive immunity mechanism found in bacteria and archaea, utilizing sequence-specific nucleases to induce double-strand breaks in DNA, which are repaired through homology-directed repair or non-homologous end joining. Compared to earlier genome editing techniques like zinc-finger nucleases and TALENs, CRISPR–Cas9 is more efficient and easier to use due to its RNA-guided mechanism [1].

One of the key applications of CRISPR–Cas in agriculture is increasing crop yield. Scientists have successfully manipulated genes controlling plant growth and development, leading to higher grain production in rice and wheat. Alterations in genes that regulate tiller number and panicle size have also contributed to yield improvements in cereals. Beyond yield, CRISPR–Cas has been applied to improve crop quality by adjusting starch composition in rice and maize, enhancing cooking and nutritional properties. The development of low-gluten wheat using this technology has provided new opportunities for individuals with celiac disease. Another significant advancement is in disease resistance, where CRISPR–Cas has been used to knock out susceptibility genes, strengthening plant defenses against bacterial blight in rice, citrus canker in citrus crops, and powdery mildew in wheat and tomato. The system has also been harnessed to engineer resistance against plant DNA and RNA viruses. Additionally, herbicide-resistant crops have been developed by modifying specific genetic sequences, reducing dependence on chemical weed control [2].

Beyond improving crops, CRISPR–Cas has streamlined breeding processes by accelerating domestication and hybrid seed production. Through haploid induction, editing of genes like MATRILINEAL has facilitated the production of haploid plants, significantly reducing the time needed to develop stable genetic lines. The modification of male sterility genes such as Ms1 in wheat has enabled the efficient production of hybrid seeds, which exhibit higher yield and resilience. Scientists have also induced apomixis through precise gene editing, allowing plants to reproduce asexually while maintaining the advantages of hybrid vigor [3].

In addition to direct genome modifications, CRISPR–Cas is expanding its role in gene regulation, multiplexed editing, and directed evolution. Modified CRISPR variants like dCas9 allow for precise activation or repression of genes without altering DNA sequences, making it possible to fine-tune gene expression. Multiplexed CRISPR systems enable the simultaneous targeting of multiple genes, increasing the efficiency of genetic modifications. Directed evolution strategies using CRISPR–Cas facilitate the rapid adaptation of plant traits to environmental stressors, contributing to sustainable agricultural practices [4].

Despite its transformative potential, several challenges remain, including the need to improve editing efficiency, address regulatory concerns, and ensure consumer acceptance. Future research aims to optimize CRISPR–Cas for broader applications in diverse crop species and agricultural settings. Nonetheless, CRISPR–Cas stands as a revolutionary tool for sustainable agriculture, offering precise and efficient solutions to global food security challenges [3].

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CRITERIA FOR THE EFFECTIVENESS OF ENTERPRISE MANAGEMENT

У статті досліджено критерії ефективності управління підприємством, зокрема виробничу, трудову, організаційну, фінансову та ринкову складові. Розглянуто методи оцінки ефективності менеджменту та їхній вплив на досягнення стратегічних цілей підприємства.

Ключові слова: *ефективність, менеджмент, підприємство, трудові ресурси, фінансові показники, маркетинг.*

The article studies criteria of efficiency in enterprise management, in particular, production, labour, organisational, financial and market components. Methods of assessment of management efficiency and their impact on achievement of strategic goals of an enterprise are considered.

Keywords: *efficiency, management, enterprise, labour resources, financial indicators, marketing.*

Management effectiveness is a multifaceted concept that covers a wide range of aspects of management activities aimed at achieving the organisation's ultimate goals under conditions of optimal use of available resources and adaptation to the external environment. The definition of management efficiency as the level of effectiveness of management activities is based on criteria and indicators that reflect the qualitative and quantitative characteristics of the management process, as well as the degree of achievement of the set objectives.

Management efficiency criteria perform the function of assessing the quality of management processes and must meet several requirements. They should fully reflect the results of economic activity, determine the level of achievement of goals, and be measurable. In the economic literature, the efficiency of management activities is traditionally viewed through the prism of the maximum excess of results over resource costs. This is based on the generally accepted principle of rational use of material, financial and labour resources.

The key criteria for the effectiveness of enterprise management include profitability, product quality, production defect rate, production process capacity, technological efficiency, rhythmicity and continuity of the production cycle. In addition, indicators of human resources potential, such as employee qualifications, staff turnover, labour productivity and the quality of management decisions, are also of significant importance. Financial criteria include the level of profitability,