FEATURES OF IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE IN MACHINE-BUILDING PRODUCTION

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Abstract: The paper shows that technology and manufacturing are the sectors with the greatest potential for transformation through artificial intelligence. The use of artificial intelligence to process projects can dramatically increase the number and significantly improve the quality of production through digital analysis of market demand from the environment. The information system can act as a formalized tool for methodological support of the continuous process of improving the properties of the network production system. Artificial intelligence in modern companies can increase productivity and reduce production losses by more accurately forecasting the necessary parameters of production. The most general critical challenges of transformation of the information and communication nature of management of modern production systems are revealed. Digital duplicates of equipment and processes allow to make decisions taking into account all operating factors on the basis of fuzzy parameters. It is established that to create digital duplicates it is necessary to combine such technologies as system modeling based on wave physical processes and machine learning. Innovative activity at different levels leads to a sharp increase in the intensification and speed of interaction between its participants, as well as to the creation of relevant at a certain time for consumers products and services of the required quality and quantity, exceeding customer expectations through the use of artificial intelligence. However, the role of artificial intelligence systems in innovation in a plurality of subjects with heterogeneous systems for determining the purpose and motives of behavior, inaccuracy and dynamism of their goals and objectives is insufficiently studied. The development and widespread use of artificial intelligence in production processes, changes the usual idea of human functions. Changing the nature of work in production systems using artificial intelligence will affect all employees of all skill levels. This in turn will have profound implications for the structure of the workplace and the organization of work. Therefore, the paper provides a list of tasks for the introduction of artificial intelligence in modern engineering. Now cyber-physical systems provide such intellectual spheres of production as autonomous works, augmented reality, augmented production, vertical and horizontal integration, implementation of principles of intersectoral integration of artificial intelligence systems in various scientific fields, from natural and exact sciences to humanities. Given the available intellectual potential, in the near future Ukraine may become a regional leader in these areas, providing comprehensive and high-tech engineering services.

Keywords: artificial intelligence, mechanical engineering, digital production, cyber-physical systems, production automation, innovation.

INTRODUCTION.

Technology and manufacturing are the sectors with the greatest potential for AI transformation. Establishing links between project modules in innovative production systems is possible on the basis of artificial intelligence for algorithmic digital information processing technologies, which can significantly increase the number of generated projects and, consequently, increase employment without additional efforts of living intelligence. The use of different types of neural generative algorithms can take into account the individual characteristics of the performers to perform specific modules of individual projects without intersecting interests and conflicts of resources [1,2,3].

The use of artificial intelligence to process project data can dramatically increase the number and significantly improve the quality of potential projects by automatically comparing project parameters, human properties and digital analysis of market demand for projects from the external environment.

Due to the use of genetic mechanisms of object formation (generative design) a significant increase in strength, stability, and at the same time a significant reduction in the resource intensity of production of such a product. In the absence of machine design methods based on the use of artificial intelligence, the creation of such products would be difficult, and most likely impossible.

It is important to launch a mechanism for continuous generation of projects using the capabilities of artificial intelligence to find new better solutions in the digital environment. The information system can act as a formalized tool for methodological support of the system of generation, testing and decision-making, providing a continuous process of improving the properties of the network production system, its participants and network products [4,5].

BASIC PART.

Creation of systems for collecting and analyzing ideas and proposals for the development of the production system, as well as decision-making on the implementation of innovative projects. Management of innovation in modern production systems is based on the use of a significant amount of data. Modern companies build their strategies of innovative development on the operation of big data, which is formed in the process of functioning of the production system and in the process of its interaction with the external environment. They create systems that collect and analyze ideas and proposals for the development of the production system, as well as make decisions in the implementation of innovative projects based on artificial intelligence resources.

Artificial intelligence in modern companies has become one of the most effective means of labor, which can increase productivity and reduce production losses by more accurately forecasting the necessary parameters of production.

Artificial intelligence as a factor in the effectiveness of the company's innovation today largely determines the direction of development of scientific and applied research in large corporations.

Artificial intelligence is becoming a key element of production systems, which allows you to build intelligent innovation management systems, as well as to develop intelligent systems to promote innovative products.

Among the most important efficiency factors:

1) mental activity of people who carry out creative search, as a rule, to meet the personal need to find new solutions, and not for commercialization;

2) the use of collective intelligence resources in the field of generation and implementation of innovations, including through the collection and analysis of big data;

3) professional orientation of the subjects of innovation, who have leadership qualities, ready to decisively change production systems in order to qualitatively change the parameters of production;

4) new models of innovation management in network production systems aimed at the development of network participants' skills of active communication, including in a cross-cultural environment;

5) a favorable social climate for the development of innovation both within the network production system and offline;

6) active development of technologies based on the use of artificial intelligence in network production systems;

7) creating conditions for the development of human capital of network production systems based on lifelong learning;

8) the development of emotional intelligence of the network society; the desire of participants in innovation to beauty and aesthetics in creating new products and technologies.

The most general critical challenges of transformation of the infocommunication nature of management of modern production systems are revealed:

1) active use of smart grids and control systems;

2) the formation of a new technological structure in the global system of economic relations;

3) creation of new methods and technologies of organization of economic systems; development and widespread use of artificial intelligence;

4) digitalization of production, which leads to the blurring of boundaries between Bio, Social & digital reality.

The key competence of managers in the network production system is the ability to organize the mass creativity of interested, neutral and disinterested people, purposeful mental activity which forms the intellect of society..

Creation of innovative digital production models. New (innovative) digital technologies (artificial intelligence, the Internet of Things, big data, robots, etc.) undermine traditional approaches to the automation of production and business. Being at the forefront of this wave of digital innovation is important for business. This is the key to the competitiveness of the digital economy. The development of production systems is aimed at replacing human intelligence with machine control tools based on the use of digital management tools and active involvement in the network management structure of artificial intelligence capabilities [7].

Setting up and constantly restructuring the production system are complex and time-consuming processes. The integrated engineering platform supports the production of engineers in this process and significantly reduces production. The engineering platform: from the 3D product model to the final production concept.

Digital duplicates of equipment and processes (reference models). Thus, industrial production and operation generate a large number of variables, so it becomes clear the huge need for an intelligent system capable of making decisions taking into account all these factors and on the basis of fuzzy parameters. Technologies such as systems modeling based on physical processes and machine learning should be combined to create digital duplicates.

Combinatorial processes optimize production planning and workflow in the steel and aluminum industries. The advantage of this procedure is to eliminate competing goals in terms of comprehensive strategies tailored to the specifications of a particular enterprise (For example, maximum use of production capacity while meeting delivery deadlines).

Ensuring the innovative nature of mechanical engineering development. Innovative activity at different levels leads to a sharp increase in the intensification and speed of interaction between its participants, as well as to the creation of relevant at a certain time for consumers products and services of the required quality and quantity, exceeding customer expectations by using artificial intelligence.

This opens new horizons for innovative development of products, technologies, models of production organization, models of operation and consumption. There is great potential for their use in mechanical engineering, such as in "smart industries". These include the rapid development of technologies such as smart grids and control systems, the formation of new technological systems, additive production technologies using the potential of artificial intelligence. Today, technological advances in automation abound in areas related to physical equipment and robotics to artificial intelligence and software. The role of artificial intelligence systems in innovation in a plurality of subjects with heterogeneous systems for determining the purpose and motives of behavior, inaccuracy and dynamism of their goals and objectives is insufficiently studied.

The factors of efficiency of innovative activity at different stages of its organization in production systems in the digital economy include the following [8]:

- a high level of mental activity of people engaged in creative search, usually to meet the personal need to find new solutions, rather than for commercialization;

- active involvement of the collective mind in the field of generation and implementation of innovations, including through the collection and analysis of big data;

- accelerating the scale of changes in the production activities of enterprises through setivization of production processes, the formation of a system of training and manifestation of innovators from among the subjects in the network with leadership qualities, ready to decisively change production systems to qualitatively change production parameters, resulting in professional resentment individuals as a factor of innovative activity of the company;

- the use of open flexible models of innovation management in network production systems aimed at developing the participants of the network skills of active communication, including in a cross-cultural environment;

- development of the non-profit sector, which creates a socially favorable climate for the development of innovation both within the network production system and offline;

- rapid development of technologies based on the use of artificial intelligence in network production systems; application of health-preserving technologies in the system of labor organization and creation of conditions for development of human capital of network production systems on the basis of lifelong learning;

- formation of participants in the network of emotions associated with certain innovations, and management of these emotions; the desire of participants in innovation in the network to beauty and aesthetics in creating new products and technologies.

AI functions in new production systems. Any modern enterprise produces more and more data, and most of them have different criteria for storage and filtering. A person can no longer cope - moreover, there are moments that can not predict even an experienced specialist, and it is critical errors in the "bottlenecks" are the most expensive.

Modern businesses focus on an integrated approach. The use of statistical methods in production and at the stage of operation is a dead end branch of development. The symbiosis of machine learning algorithms and numerical simulation is a completely conditioned solution. Yes, there are risks, but they can be offset by strong industry expertise and best-in-class technology. The system only makes recommendations - the decision is still left to the person [9,10,11].

The main functions of production systems, in particular - machine-building, are aimed at solving the following tasks:

- forecasting of critical malfunctions, prevention of sudden failure of the equipment, maintenance of a condition, forecasting of a resource of the equipment. Work in hard-to-reach places, in harmful chemical production, work in conditions of permafrost or high radiation.

-diagnostics of equipment during operation. This requires the analysis of a large amount of data to obtain information from systematically collected information. But the industry often lacks the information received from real objects, so the database needs to be supplemented with the results of field and virtual experiments, using engineering analysis based on numerical simulations, conducting regular calibration to improve the quality of the forecast.

-optimization of operating modes of equipment and technological processes From the correctly selected modes of operation of the product depends on the reduction of unscheduled downtime and increase the service life of equipment and, as a consequence, improve product quality and reduce costs of the enterprise as a whole. The operator can be assisted by a system that selects the most optimal scenarios of technological processes and predicts deviations in the operation of equipment based on statistical models and engineering analysis.

-maintenance: predictive maintenance and repair. The transition to maintenance allows to increase the service life of the equipment and its maintenance period, as well as to detect defects due to the data supplied in real time. Information on the current state of components and units and the forecast of the residual resource gives the chance to form recommendations on service and repair of the equipment, to provide timely delivery of spare parts.

-defect recognition: computer vision. Machine vision as a set of technologies that allows computers not just to process images as an array of data, but to perceive and interpret them in a human-like way.

-continuous production For example, in the smelting of steel it is necessary to accumulate history to predict the initial characteristics of the current conditions of smelting. Or with the help of machine learning to determine the initial composition of the alloy and the melting parameters to achieve a given quality. This will reduce the cost of raw materials, optimize the composition of the elements, predict the quality of the original product, optimally manage the smelting process. It should be understood that there can be no two identical steel melts.

-task of machine learning - to analyze a huge number of parameters to optimize the composition and number of input elements and operating parameters to obtain quality in accordance with the technical requirements using neural networks.

-flexible energy management to increase energy efficiency Machine learning technologies can reduce the operating time of equipment in high-intensity mode, reduce excess inventory, timely predict equipment wear and residual life, reduce waste, and reduce energy consumption by taking into account the state of the environment.

-predicting equipment failures and its preventive maintenance, optimizing supply planning, production processes and financial decisions.

Development of network nature of production. The emergence of network production systems is associated with a qualitative change in production and economic relations based on the transformation of ideas that production is a set and concentration of production capacity of the company and its staff located in certain areas, in the idea that the site and effective functioning can be an information space on the Internet, which is able to connect separate and independent entities that have objects and / or means of labor owned or otherwise, and also have the necessary competencies to perform specific production tasks on a temporary basis. basis.

A characteristic feature of modern network production systems is the formation of customer expectations through the extensive use of artificial intelligence in terms of properties and functionality of products, models of product consumption.

Network production systems, as a rule, have a significant margin to increase the intensity of the flow of applications, which is provided by the widespread use of information technology, as well as the capabilities of artificial intelligence.

A feature of the network production system is openness and relatively high flexibility, which are provided mainly through the use of digital technologies for the organization of production processes in the main, auxiliary and service industries. This property allows the network production system in the mode of semi-automatic control to create relevant at a certain time for consumers products and services of the required quality and in the required quantity, exceeding customer expectations, through the use of artificial intelligence.

Access to new segments involves the transformation of a set of production systems into a network production system through the introduction of innovations based on the use of digital technologies such as artificial intelligence, intelligent transport systems, Big Data, photonics, crystal systems, Internet of Things, cloud technology, telematics, design digital factories, network-centric system, etc.

The development and widespread use of artificial intelligence in production processes, changes the usual idea of human functions. Refusal to concentrate "jobs" in office buildings or production shops leads to the fact that intellectual and material production will move into the living space of houses and apartments of workers. Decentralization will also affect electricity generation, the generation and redistribution of which will also be controlled by Artificial Intelligence.

Changing the nature of work and skill levels of workers in terms of artificial intelligence. Changing the nature of work in production systems using artificial intelligence will affect all employees of all skill levels. There will be less routine and repetitive work based on

rule-based activities, as this can be automated for many professions and industries. This, in turn, will mean that many employees may need to acquire new skills. The workplace will become permanent more the place of interaction of people and technology productive. The bulk of most human work will involve working with artificial intelligence, robotics, and other technologies. Automation will affect more than the various workflows: processes and procedures are also likely to need to be adapted. This in turn will have profound implications for the workplace structure and organization. For the technicians themselves, automation can change the workplace and their roles.

The analysis shows that all employees have the potential at all skill levels, which is at least partially influenced by automation based on currently demonstrated technologies.

There are factors that indicate that this time is different. There is an inflection point between the first machine age, based on the automation of physical tasks through mechanization, and the second machine age, based on the automation of cognitive tasks using digital technologies.

Many factors affect the pace and scale of automation implementation, such as engineering to solve specific problems, especially non-technical management of organizational change, the dynamics of regulation and acceptance around the implementation of technology.

Automation should not destroy jobs as a result of the latest technological advances, including robotics, artificial intelligence (AI) and machine learning. Automation now has the potential to change everyone's daily work.

CONCLUSIONS.

Intelligent manufacturing systems, which are based on the full use of embedded computer models, have led to the emergence of cyber-physical systems (CFS) capable of combining the real and virtual worlds. KFS now provides such intellectual spheres of production as autonomous works, augmented reality, expanded production, vertical and horizontal integration,

Given the available intellectual potential, in the near future Ukraine may become a regional leader in these areas, providing comprehensive and high-tech engineering services, primarily in the following areas:

-programming in the field of industrial high technologies / creation of new software products, including new technologies of Industry 4.0;

-design (electrical, mechanical, electronic, technological, construction, etc.);

-industrial automation, computerization and intellectualization (including commissioning of industrial sites);

-development and production of complex, small-scale or unique products.

For the domestic market, Industry 4.0, filled with artificial intelligence solutions, should be a catalyst for the growth of industry as well as the defense industry. At the same time, a huge challenge is the involvement of IT companies, science and universities in the digital transformation of Ukrainian industry and energy. Against the background of labor shortages, this may also mean an increase in demand for automation.

Implementation of the principles of intersectoral integration of artificial intelligence systems in various scientific fields, from natural and exact sciences, to the humanities.

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