DEVELOPMENT OF ARTIFICIAL INTELLIGENCE AS A FACTOR OF EDUCATIONAL STRUCTURE TRANSFORMATION IN THE CONTEXT OF THE ENERGY TRANSITION

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Abstract: This article examines the impact of artificial intelligence development on the transformation of the educational workforce training structure in the context of the global energy transition. The study analyzes the interrelationships between the growth of computational capacity, increasing energy consumption of digital infrastructure, and changing labor market demands. Particular attention is paid to the influence of AI regionalization on the expansion of data centers and the emergence of new requirements for specialist training systems. It is argued that the widespread adoption of artificial intelligence increases demand not only for information technology professionals but also for energy engineers, digital infrastructure operators, and specialists in energy system management.

Keywords: artificial intelligence, energy transition, data center, digital infrastructure, workforce training, educational structure, labor market.

Introduction

Artificial intelligence is one of the most rapidly developing technologies of the twenty-first century. In recent years, its application has expanded across virtually all spheres of social and economic activity, including industry, transportation, finance, healthcare, public administration, and education. One of the most significant outcomes of AI development has been the emergence of large language models and intelligent systems capable of performing a broad range of tasks that were previously considered exclusively human capabilities.

In public perception, artificial intelligence is often viewed primarily as a software-based technology existing in a virtual environment. However, the operation of modern intelligent systems is impossible without a complex physical infrastructure that includes server hardware, data centers, cooling systems, telecommunication networks, and energy facilities.

As AI models become increasingly sophisticated, their computational requirements continue to grow. This trend leads to the continuous expansion of data storage and processing infrastructure, as well as increasing electricity consumption. Consequently, the development of artificial intelligence is beginning to exert a direct influence on the energy sector and on the structure of workforce education and training.

Simultaneously, processes of regionalization and technological sovereignization of digital infrastructure are becoming increasingly visible worldwide. Governments seek to locate critical computing resources within their own territories in order to maintain control over data and technological assets. This tendency is accompanied by the construction of new data centers and the formation of national digital ecosystems.

These developments create new challenges for educational systems. There is a growing need to train specialists capable of maintaining and operating the complex infrastructure that supports artificial intelligence technologies. Under these conditions, educational structures are gradually transforming, and priorities in workforce development policies are changing accordingly.

The Energy Dimension of Artificial Intelligence Development

The development of artificial intelligence is closely associated with the increasing volume of computational operations. Modern language models are trained on enormous datasets and require thousands of specialized processors operating simultaneously for extended periods. Even after the training phase has been completed, these models continue to consume substantial computational resources during operation.

Every user request submitted to an intelligent system initiates a sequence of computational processes executed on remote servers. As the number of users utilizing such services increases, the workload on computational infrastructure grows correspondingly, resulting in higher electricity consumption.

A distinctive feature of modern data centers is not only the high energy demand of computing equipment but also the necessity of maintaining optimal operating temperatures. A significant portion of total electricity consumption is devoted to cooling systems, ventilation, and uninterrupted power supply mechanisms.

As artificial intelligence adoption continues to expand, further growth in demand for energy resources can be expected. Consequently, energy efficiency is becoming one of the key determinants of digital economy development.

Under these circumstances, artificial intelligence is no longer merely an information technology. It is increasingly becoming an essential component of modern energy infrastructure. Addressing the challenges associated with ensuring reliable and sustainable energy supplies for digital facilities is acquiring strategic importance for both governments and regions.

Regionalization of Artificial Intelligence and Data Center Development

Alongside the growing demand for computational resources, a trend toward the regionalization of digital infrastructure is becoming increasingly evident worldwide. Concerns related to data protection, information security, and technological independence are encouraging governments to establish domestic computing capacities and develop national data processing centers.

Whereas, during the early stages of digitalization, a significant share of computational operations was concentrated within a limited number of global facilities, the current stage is characterized by the gradual geographical distribution of infrastructure across various regions of the world. An increasing number of countries now view the construction of data centers as an integral component of their national technological development strategies.

The construction of such facilities requires substantial investments and the involvement of specialists from multiple professional fields. A modern data center represents a highly complex engineering facility that integrates energy systems, telecommunication infrastructure, cooling technologies, physical and cybersecurity mechanisms, and high-performance computing equipment.

In essence, the development of artificial intelligence is contributing to the emergence of a new sector of the economy associated with the operation and maintenance of digital infrastructure. The more actively governments adopt AI technologies, the greater the demand becomes for professionals capable of ensuring the reliable functioning of these facilities.

This process is particularly evident in countries implementing digital transformation programs and striving to strengthen their technological sovereignty. For such states, the development of national AI infrastructure represents not only a technological challenge but also a workforce development challenge directly connected with the activities of educational institutions.

Transformation of the Labor Market Under the Influence of AI Infrastructure Development

The growing scale of artificial intelligence utilization inevitably leads to significant changes in labor market structures. Public discussions of this issue often focus on job automation and the increasing demand for specialists in programming, data analytics, and machine learning. However, such an approach reflects only part of the ongoing transformation.

Behind every intelligent system lies a sophisticated engineering infrastructure that requires continuous maintenance, modernization, and expansion. As the number of data centers increases, so does the demand for specialists responsible for ensuring their uninterrupted operation. This demand extends beyond information technology professionals to include engineers from various disciplines.

Energy specialists are becoming particularly important. Modern data centers are major consumers of electricity and require exceptionally reliable power supplies. Even short-term power interruptions can result in substantial financial losses and disruptions to digital services.

As a consequence, the importance of professionals specializing in electrical power engineering, power supply systems, automated energy management, and electrical load distribution continues to increase. It can reasonably be expected that the further expansion of artificial intelligence technologies will be accompanied by sustained growth in demand for such professions.

Equally important are specialists in cooling systems and climate-control technologies. The performance of modern computing facilities depends directly on maintaining optimal temperature conditions. As server capacities increase, engineering solutions associated with cooling digital infrastructure become increasingly sophisticated.

Therefore, the development of artificial intelligence is contributing to the emergence of a new category of professionals operating at the intersection of information technology, energy systems, and engineering disciplines.

The Paradox of Engineering Education in the Age of Artificial Intelligence

One of the most interesting consequences of the spread of artificial intelligence may be the renewed interest in engineering education. Over the past several decades, many countries have experienced a steady increase in student enrollment in fields related to information technology, finance, management, and the digital economy.

At the same time, numerous engineering disciplines have gradually lost popularity among younger generations. However, the development of AI infrastructure has the potential to reverse this trend.

The paradox lies in the fact that a technology widely perceived as digital and virtual requires an increasing number of specialists working with physical infrastructure. Servers must be designed, manufactured, installed, connected to power grids, cooled, and maintained. Data centers require backup power systems, engineering communications, and sophisticated security infrastructure.

In practice, every new data center generates employment opportunities not only for programmers and data analysts but also for power engineers, electrical engineers, industrial automation specialists, equipment operation engineers, and infrastructure maintenance professionals.

As a result, a gradual shift in labor market demand toward interdisciplinary specialists capable of working at the intersection of digital technologies and engineering systems can be expected.

New Directions in Workforce Training

Changes in the economic structure will inevitably influence educational systems. The traditional separation between information technology and engineering disciplines may prove insufficient for meeting the demands of the next-generation digital economy.

In the coming years, universities may face the necessity of developing new academic programs specifically designed to prepare specialists responsible for supporting artificial intelligence infrastructure.

Promising areas of specialization may include:

- Data Center Engineering;
- Energy Supply Systems for Digital Infrastructure;
- Intelligent Energy Systems;
- Operation and Maintenance of Artificial Intelligence Computing Facilities;
- Digital Platform Infrastructure Management;
- Automated Data Center Cooling Systems;
- Cybersecurity of Critical Digital Infrastructure;
- Energy Efficiency Management of Computing Systems.

The adoption of an interdisciplinary approach to education will become increasingly important. Future professionals will require expertise not only in information technologies but also in energy systems, automation, and the management of complex technical infrastructures.

Under these conditions, the content of traditional educational programs will also change. Even energy engineering specialists will need to acquire knowledge of digital platforms and artificial intelligence technologies. Similarly, graduates of information technology programs will require an understanding of the principles governing energy and engineering infrastructure.

Impact on Educational Policy

The growing demand for new categories of specialists will require adjustments to educational policy at the national level. Governments will need to consider the interrelationship between artificial intelligence development, the energy transition, and workforce preparation.

This issue is particularly relevant for countries implementing digital transformation programs and establishing their own national AI ecosystems. The development of digital infrastructure without the parallel preparation of qualified specialists may result in workforce shortages and constrain the future growth of the sector.

Consequently, universities are increasingly viewed not merely as educational institutions but also as integral components of national technological infrastructure. The effectiveness of workforce preparation will directly influence a country's ability to develop its digital economy and sustain the operation of artificial intelligence facilities.

Furthermore, educational policy will need to become more flexible and responsive to rapidly changing technological requirements. Traditional educational models based on narrowly specialized training may gradually be replaced by interdisciplinary approaches that combine competencies in information technology, engineering, energy systems, automation, and management.

The successful implementation of such policies will require close cooperation among governments, universities, research institutions, and industry representatives.

This collaboration will facilitate the development of educational programs aligned with labor market demands and the strategic priorities of national technological development.

Conclusion

The development of artificial intelligence exerts a multifaceted influence on the economy, the energy sector, and educational systems. The expansion of computational capacities and the regionalization of digital infrastructure are accompanied by the construction of new data centers and increasing energy consumption within the digital sector.

These processes generate new requirements for workforce preparation. Alongside specialists in programming and data analytics, there is a growing demand for energy engineers, infrastructure operations specialists, cooling system experts, and professionals responsible for managing complex technical facilities.

Thus, the advancement of artificial intelligence contributes not to the decline of engineering education but rather to its qualitative transformation. In the context of the energy transition, the integration of digital and engineering competencies may become the foundation for workforce preparation in the economy of the future.

It can be assumed that in the coming decades educational systems will increasingly focus on preparing a new generation of professionals capable of supporting both intelligent algorithms and the physical infrastructure that underpins modern artificial intelligence technologies. Such specialists will play a crucial role in ensuring the sustainable development of digital economies, maintaining critical technological infrastructure, and strengthening national competitiveness in an increasingly technology-driven world.

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