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The effectiveness of applying a cluster approach to the higher education system

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Abstract

This article analyzes the importance of implementing a cluster approach in the higher education system and its impact on economic efficiency. The author defines the cluster approach as a model based on cooperation between educational institutions, industry, and research centers. It is noted that educational clusters are partnerships that unite schools, universities, government agencies, and businesses. This system serves not only to adapt curricula to industry requirements but also to improve the quality of education, commercialize scientific research, and increase economic efficiency. It is noted that the integration of education and production serves to provide students with practical knowledge, improve the quality of personnel training, and expand employment opportunities. Through this approach, educational institutions can enter international assessment and accreditation systems and achieve high rankings. Moreover, the article emphasizes that successful implementation of the cluster approach in the higher education system will significantly boost the country's overall economic and innovative potential.

Keywords: higher education system, cluster approach, economic efficiency, modernization of education, online learning platforms, digital educational resources, startups and incubation centers.

1. Introduction

"Today, the modernization of the education system, like all spheres of our life, remains one of the most pressing tasks".[1] The cluster system is a model that ensures mutually beneficial cooperation between companies, universities, and research centers located in close geographical proximity, with the aim of increasing economic growth and competitiveness. In this system, participants create a mutually beneficial situation by developing interaction, generating innovations, and exchanging resources. This system, first proposed in the 1990s by economist Michael Porter, has had a positive impact on the economic development of many countries.

In modern educational paradigms, the effectiveness of the cluster approach is primarily determined by the ability to design the educational process in accordance with labor market needs. In this process, the step-by-step alignment of labor market requirements with the representativeness of information processing in the educational process is understood as the selection of professional information reflecting the needs of production

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and employers, its adaptation to the educational content, and its integration into the educational process in the form of representative educational materials representing real professional situations. In determining the effectiveness of such an approach, the structural assessment of the compatibility of the invariance and discreteness of educational qualimetry with integral indicators of competence levels allows for a comprehensive analysis of educational results, an objective assessment of competence levels, and the scientific determination of the effectiveness of the cluster educational model. This coordination mechanism is implemented in three stages: at the first stage, the competencies demanded by the labor market and manufacturing enterprises are analyzed; at the second stage, the identified requirements are transformed into representative educational information through subject content, practical assignments, projects, and cases; and at the third stage, the level of competence formation is assessed based on qualimetric criteria, and the educational content is improved according to the results. As a result, a close connection between the content of education and the needs of the labor market is ensured. Therefore, the formation of pedagogical conditions within the cluster approach requires ensuring the representativeness of educational information processing, the gradual improvement of competency-oriented educational content, and the harmonization of educational results with the qualimetric assessment system. As a result, the process of developing the professional competence of future engineering specialists is organized based on the mutual integration of labor market requirements, educational content, and assessment mechanisms. [2]

The cluster approach is a system aimed at innovative and professional development that ensures an organic connection between an organization, educational institution, and manufacturing enterprises in a specific field or direction. Based on the introduction of a cluster approach, close and stable integration between education, science and production is ensured, professional training of specialists is adapted to the requirements of the labor market, and favorable pedagogical conditions are created for deepening and strengthening practical skills aimed at real production conditions. When evaluating the results of such integration, an important methodological basis is the structural assessment of the consistency of the invariance and discreteness of educational qualimetry with the integral indicators of competence levels, which provides an objective diagnosis of the development of professional competence.

Educational clusters, uniting various stakeholders such as schools, universities, government institutions, non-profit organizations, and businesses, are aimed at solving common problems and developing cooperation, as well as stimulating innovation and knowledge exchange. This is considered an effective way to improve the education system.

2. Methods

Before discussing the role of the cluster approach in improving economic efficiency and competitiveness in the higher education system, let's briefly review the history of the cluster concept development in education, which has evolved over time in response to various educational needs and challenges:

initial collaborative efforts. The roots of educational clusters can be traced back to the early collaborative efforts between schools and teachers. In the past, schools often formed partnerships or networks aimed at sharing resources, expertise, and best practices to enhance learning outcomes;

regional educational initiatives. By the late 20th century, regional cooperation in education had gained increasing importance. Many regions and countries began implementing initiatives to cluster schools or educational institutions based on geographical proximity. This facilitated improved coordination, resource sharing, and the development of regional educational strategies;

specialized clusters. As education became more specialized, clusters started forming around specific disciplines or fields. For example, educational clusters in Science, Technology, Engineering, and Mathematics (STEM) emerged to foster collaboration and innovation in these areas;

collaboration between industry and academia. With the development of the knowledge economy, educational clusters began to form around partnerships between industry and academia. These clusters aim to bridge the gap between education and labor market needs by adapting curricula to industry requirements, organizing internships, and fostering cooperation between educational institutions and businesses.

technology-based clusters. In recent years, technological advancements have influenced educational clusters. The integration of education and technology has led to the formation of clusters focused on educational technologies (EdTech) and digital learning. These clusters specialize in utilizing technology to enhance teaching and learning experiences. [6]

The role of the cluster approach in enhancing economic efficiency and competitiveness of the higher education system is reflected in the research of many Eastern and Western scholars. In the works of M.E. Porter, the cluster approach is considered a factor that strengthens economic competition. How clusters contribute to economic development is also examined in this article as one of the main theoretical sources [5]. The research of C. Johnson and K. Scholes explores methods of utilizing the cluster system in corporate strategy, effective resource management through the integration of education and industry, and the implementation of innovations in modern education systems. Among domestic scientists, B. Albekov, in his scientific research [3], serves as a local source on digital cluster systems in Uzbekistan. In this book, he described methods of using cluster technologies, developing digital infrastructure, and implementing modern teaching methods [4].

Let's consider the following methods that contribute to increasing economic efficiency and competitiveness when applying the cluster approach in the higher education system.

The development of collaboration between universities and industrial enterprises through the integration of education and industry will enable the adaptation of educational programs to meet enterprise requirements, the implementation of scientific achievements in practice by combining research and innovation activities in clusters, the expansion of students' opportunities for practical training, and the preparation of personnel that meet employer demands.

By fostering mutual competition in specialist training, we will support healthy competition among educational clusters in personnel preparation, introduce competitive mechanisms for staff selection and evaluation, and implement assessment and accreditation systems at national and international levels to enhance the quality of education.

By introducing financing mechanisms for clusters, we will develop public-private partnerships to attract state and private investments for funding each cluster's innovative projects, provide grants and subsidies to educational clusters for obtaining independent economic resources, and support socially significant educational projects.

Methods for commercializing scientific research and innovation include offering universities' scientific developments to enterprises and organizations on a commercial basis, supporting startup projects in innovation clusters and establishing incubation centers, as well as implementing patenting and generating income through the practical application of innovative developments.

The method of implementing and developing digital educational resources allows for expanding the possibilities of interactive and distance learning using digital technologies in the educational process, developing online platforms for students and teachers,

digitizing educational resources, creating online educational programs for each cluster, and facilitating information exchange through these platforms.

Methods of sharing resources within the cluster create opportunities for exchanging scientific laboratories, libraries, and educational materials between different higher education institutions, jointly utilizing available resources to reduce unnecessary expenses in educational and research activities, and increasing economic efficiency within the cluster through joint projects and activities.

The aforementioned methods can significantly increase economic efficiency and competitiveness when the cluster approach is successfully applied in higher education.

3. Results and discussion

The application of the cluster approach in the higher education system yields the following results in increasing economic efficiency and competitiveness.

Improvement in personnel quality and expansion of employment opportunities are achieved by adapting educational programs to the needs of industrial enterprises through strengthening the integration of education and industry, providing students with up-to-date knowledge and skills. This, in turn, increases the competitiveness of personnel and improves their employment prospects. Training specialists who meet the requirements of enterprises reduces the shortage of personnel in the labor market. [7].

International recognition of education quality and creation of a positive image: healthy competition between educational clusters, as well as the implementation of international accreditation and assessment systems, contribute to the international recognition of educational institutions and the formation of their positive image. This allows local higher education institutions to occupy high positions in world rankings. Additionally, high-quality education also helps attract foreign students.

The growth of innovations and scientific achievements, along with the commercialization of research and innovative developments within the cluster, contribute to the creation of breakthroughs in the field of science and technology. This allows universities to generate income from scientific developments and patents. As a result, higher education institutions are financially strengthened and gain the opportunity to implement even more scientific projects and research.

Strengthening cooperation between the state and the private sector: The partnership between the state and the private sector is developing through cluster financing mechanisms. Investments attracted to finance innovative projects contribute to the development of personnel training and research activities. This, in turn, has a significant positive impact on the states economy.

In the context of modern pedagogical paradigms according to the teachings of I.F. Gerbart, three directions of the cluster approach are highlighted (see Fig. 1):

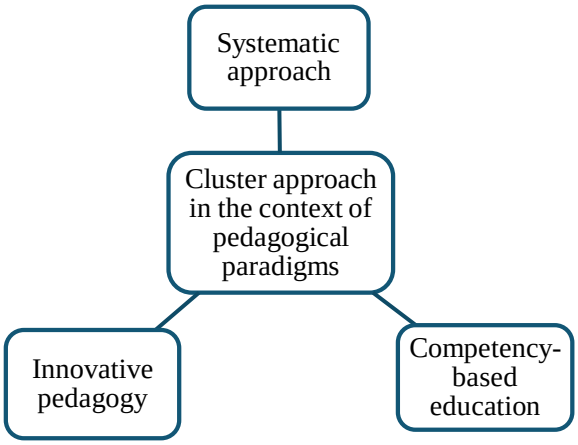


Figure 1. Three directions of the cluster approach in the context of modern pedagogical paradigms according to the teachings of I.F. Gerbart.

The systems approach views the educational process as a robust and harmoniously functioning mechanism.

Within the framework of the competency-based learning model, each cluster designs the learning process around a pre-defined and clearly structured set of skills.

Within the framework of the concept of innovative pedagogy, the integration of digital and interactive technologies within a cluster group serves to bring the substantive, procedural, and result-oriented components of the educational process to a qualitatively new level.

The development of digital education and the modernization of the educational process ensure the participation of students and teachers in learning through distance and interactive approaches by widely implementing digital educational resources. This not only enhances the quality of education but also makes the learning process more convenient and effective. Online platforms and digital resources increase cost-efficiency by reducing training expenses and expanding educational opportunities. [8].

Reducing expenditures on education and research allows various higher education institutions to share resources such as scientific laboratories, libraries, and educational materials by exchanging them within a cluster. This contributes to cost reduction and efficient use of available resources. Such approaches improve the economic efficiency of institutions and allow for the allocation of financial resources to other pressing needs.

4. Conclusions

The application of a cluster approach in the higher education system not only enhances economic efficiency and competitiveness but also makes a significant contribution to improving the quality of human resources, commercializing scientific research, and fostering innovation. Through this approach, higher education institutions gain the opportunity to possess internationally recognized, high-quality educational and research infrastructure, which in turn has a substantial impact on the development of the economy and society. Thus, the cluster approach serves as a crucial factor in boosting the country's competitiveness and diversifying its economy.

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