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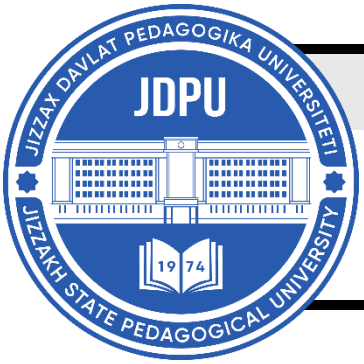

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INNOVATIVE DEVELOPMENT OF THE EDUCATIONAL CLUSTER THROUGH STARTUPS, INCUBATORS, AND SCIENTIFIC RESEARCH PROJECTS

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ABOUT ARTICLE

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Abstract: This article analyzes the role and importance of the education cluster in innovative development through startups, incubators and research projects. Education clusters, through mutual cooperation and knowledge exchange, help to develop new ideas and technologies by combining education and innovation. The article examines the structure, activities of education clusters and their role in the innovation ecosystem. It also provides information on the projects and programs implemented through startups and incubators, as well as how research activities affect education clusters.

Introduction

The globalization of the world economy and the transition to a knowledge-based economy mean that the competitiveness of countries largely depends on their innovative potential. In this context, educational institutions, especially universities, play a crucial role not only as centers for training skilled personnel but also as generators of new ideas, technologies, and innovative business projects. Therefore, a number of laws and decrees have been adopted in the Republic of Uzbekistan, specifically aimed at increasing the effectiveness of reforms in the higher education system, ensuring the financial stability of state higher education institutions, strengthening their material and technical base, resolving issues of financial independence, expanding the opportunities for attracting funds into scientific research activities, and developing a competitive environment between higher education institutions. As a result, several higher education institutions have been granted financial independence. [1.b-61].

One of the effective mechanisms ensuring the close cooperation of education, science, and entrepreneurship is the cluster approach. An educational cluster is a geographically close, interrelated group of universities, research institutes, companies, government organizations, and other infrastructure elements, which work together to create innovative products and services and enhance competitiveness. The innovative development of such clusters largely depends on their ability to foster a startup culture, establish incubators to support young entrepreneurs, and effectively implement the results of scientific research into practice. "In today's rapidly changing world, countries whose economic development is based on innovation, where production is closely linked to science and education, and where the results of scientific research can be turned into competitive products in the shortest time, will succeed." [4.b-60-62].

Literature Review*

One of the founders of cluster theory, M. Porter, defines clusters as an important factor for increasing competitiveness, emphasizing their role in fostering innovations [Porter, 1998].

According to Porter, clusters accelerate the exchange of knowledge and ideas and create opportunities to utilize specialized suppliers and skilled labor. To explain innovative systems based on cooperation between universities, industries, and governments, Etzkowitz and Leydesdorff proposed the "Triple Helix" model [Etzkowitz & Leydesdorff, 2000]. This model was later expanded into the "Quadruple Helix" by adding the role of society. Educational clusters are a practical manifestation of these models, where universities hold a central position.

The development of startup ecosystems based on universities has been studied in numerous research works. For example, Shane demonstrated the economic significance of spin-off companies (startups) formed based on technologies developed in universities. The role of business incubators in supporting startups and the factors contributing to their success have also become a separate area of research [3.b-127-135]. "The analysis of definitions and approaches put forward by researchers to clarify the concept of standard of living shows that in the development of innovative clusters, social and economic goods, rather than material wealth, play a crucial role." [6.b-127-134].

In Uzbekistan, a number of regulatory and legal documents have been adopted, and research is being conducted on the issues of innovative development, modernization of the higher education system, and the practical application of scientific achievements. However, the comprehensive study of mechanisms for innovative development of educational clusters through startups, incubators, and ITLs remains an urgent issue.

Within educational clusters, startups play a significant role in transforming innovative potential into practical outcomes. Several factors drive the emergence and development of startups within clusters.

Firstly, intellectual capital consists of university professors, young scientists, students, and graduates, and serves as a source of new ideas and technological solutions. Members of this group create the fundamental basis for startups through innovative thinking and research.

Secondly, entrepreneurial education and culture are formed in universities through the teaching of subjects such as entrepreneurship basics, innovative management, and project management. Startup competitions and idea fairs help develop the entrepreneurial spirit among students.

Thirdly, the results of scientific research, such as prototypes, patents, and know-how created in university laboratories, can serve as crucial foundations for new technological startups. In this process, spin-off companies also play an important role. Additionally, opportunities to utilize resources, such as laboratories, equipment, libraries, and other infrastructure elements available within the cluster, help the development of young startup teams. Networking is also crucial. Cluster events such as conferences, seminars, and roundtable discussions provide startup teams with opportunities to meet potential investors, partners, and mentors. University spin-offs are new companies established based on intellectual property created by university staff or students. Their development requires clear policies and support mechanisms developed by the university.

Scientific Research Projects and Their Importance

Scientific research projects (SRPs) are an essential part of scientific activity aimed at generating new knowledge, deepening existing knowledge, and solving practical problems. They are implemented in various fields, including natural sciences, social sciences, medicine, engineering, and other areas. SRPs play a crucial role in the development of innovations, ensuring technological progress, and improving societal welfare.

The main directions of scientific research within innovative educational clusters are as follows:

- Development of Theoretical Foundations of Education: This direction focuses on studying the psychological, pedagogical, and sociological aspects of the educational process, creating the foundation for new educational concepts and methodologies. For example, theoretical foundations for the application of artificial intelligence in education, effective methods of distance learning, and principles of inclusive education are explored.

- Creation of New Educational Technologies and Tools: This direction aims to make the educational process more engaging and effective by using modern tools such as interactive whiteboards, virtual reality technologies, mobile applications, online platforms, and other contemporary educational technologies.

- Improvement of Educational Methods: This direction focuses on increasing the effectiveness of traditional teaching methods, developing new teaching methods (such as project-based learning, problem-based learning, and collaborative learning), and implementing them into practice.

- Updating the Educational Content: This direction is aimed at improving curricula and teaching materials in light of the latest achievements in science and technology. For example, projects in the field of STEAM education (science, technology, engineering, art, and mathematics) and programs aimed at improving digital literacy are developed.

- Improvement of Educational Management Systems: This direction focuses on optimizing the activities of educational institutions, improving decision-making in management, and creating innovative management systems that enable more effective use of resources.

Problems and Opportunities in the Development of Education Clusters in Uzbekistan

Currently, there are sufficient resources, economic conditions, and a safe environment for entrepreneurship. For example, in our country, the granting of economic freedoms to entrepreneurs in recent years, the openness of the market (i.e., the absence of artificial barriers to the movement of goods, investments, data, labor force, and raw materials), the existence of market infrastructure, the establishment of strong legislation and legal guarantees protecting entrepreneurs, and the provision of benefits by the state all contribute to a positive environment. [7.b-107.]

The young entrepreneurs (graduates) of educational institutions should make effective use of these opportunities. The analysis of the innovative development of educational clusters through startups, incubators, and scientific-research projects (SRPs) shows that while there is

considerable growth potential in this area, several systemic problems remain. In particular, cooperation between universities and industry has not developed sufficiently, the commercialization mechanisms of SRPs are inefficient, and the startup ecosystem and incubation structures are not adequately supported. In general, educational clusters serve as an important tool for the development of startups, but to use them effectively, the problems outlined above must be addressed. The transition to an innovative economy through the development of educational clusters in Uzbekistan is an urgent task. The efficiency of educational clusters depends on their specialization, the integration of stakeholders, and funding opportunities. Currently, several problems are observed in the activities of educational clusters in Uzbekistan, including: insufficient cooperation between universities and industry, weak commercialization mechanisms of SRPs, underdeveloped startup ecosystems, and limited funding opportunities. To overcome these problems and develop educational clusters, it is advisable to implement a comprehensive set of measures.

Firstly, it is necessary to develop a clear specialization and development strategy for each potential educational cluster, create a coordinating structure for the cluster's activities, and ensure the participation of all stakeholders (universities, businesses, government). Secondly, universities should activate industrial relations departments, involve representatives from industrial enterprises in the educational process, implement mechanisms to increase the volume of contractual research, and hold joint events. Thirdly, it is important to establish offices for the transfer of professional technologies (TTO) at universities, develop intellectual property management policies, simplify the processes of patenting and licensing, and implement methodologies for evaluating scientific developments. Moreover, entrepreneurship education should be strengthened with a focus on practical skills, the number of startup competitions and acceleration programs should be increased, and the network of specialized business incubators and technoparks should be expanded. It is also essential to develop criteria for evaluating the performance of incubators. Additionally, improving venture capital legislation, supporting "angel" investors, expanding grant programs for financing startup projects, and developing

crowdfunding platforms are all advisable. In conclusion, by implementing the above measures in a comprehensive manner, it is possible to accelerate the innovative development of educational clusters in Uzbekistan through startups, incubators, and SRPs, forming a competitive national economy, and increasing the production of high-tech products.

Educational clusters are a key tool in generating innovations in the modern knowledge economy and enhancing the competitiveness of the country. To fully realize their innovative potential, it is necessary to ensure the organic interconnection between startups, business incubators, and scientific-research projects (SRPs) and to take advantage of their synergistic effect. While scientific research is the source of new ideas and technologies, startups are a dynamic way to bring them to market, and incubators provide the necessary support infrastructure for young entrepreneurs during this process. The coordinated functioning of these three mechanisms will transform the educational cluster into a true innovation ecosystem.

Incubators and accelerators in the education sector play a crucial role in implementing innovative ideas and modernizing the educational system. They help develop curricula, technologies, and teaching methodologies. Education incubators provide opportunities for teachers and students to test new ideas, experiment, and develop innovative solutions. Accelerators offer educational startups the chance for rapid growth and adaptation to market demands, which contributes to improving the quality of education. Estonia, Singapore, and the USA showcase successful experiences in developing educational innovations. Estonia is a leader in the implementation of digital education and innovative technologies. Their education incubators provide opportunities for teachers and students to test new technologies. Singapore is implementing strategies to modernize its education system and increase global competitiveness through education accelerators. The USA has numerous educational startups and incubators that play a significant role in implementing innovative ideas and developing new solutions in the education sector.

The prospects for developing educational incubators and accelerators in Uzbekistan are vast. Strengthening collaboration between the public and private sectors is essential for modernizing the education system and implementing innovative ideas. Educational incubators in Uzbekistan can provide opportunities for teachers and students to test new ideas, experiment, and develop innovative solutions. Additionally, studying international experiences and adapting them to local conditions is crucial for advancing innovations in education. Developing an incubator system in Uzbekistan will be an important step in improving education quality and equipping the younger generation with modern knowledge. Global practices show that successful innovative clusters encompass the entire range of industrial, scientific-technical, and social infrastructure. Achieving success in innovative development can be accomplished by collecting a significant mass of innovations at the country and global levels, which includes creating networks of relationships between education, science, practice, and production. [4.b-60-62]

In conclusion, based on the above analyses, it should be emphasized that educational clusters are emerging as a strategic innovation infrastructure element in the modern knowledge economy. They not only serve to systematize scientific-research activities and accelerate the generation of new knowledge but also ensure the practical implementation of innovative products and services through collaboration with startups and business incubators. This, in turn, plays an important role in enhancing the competitiveness of the country, transitioning to a high-value-added economy, and supporting a sustainable development strategy. The startups within educational clusters provide opportunities for rapid integration of innovative ideas into economic circulation, while business incubators offer the necessary organizational-technical, advisory, and financial support. Furthermore, scientific-research institutions strengthen the intellectual foundation of these processes through fundamental and applied research. The integral integration of these three components generates a synergistic effect in the innovation ecosystem, meaning the overall result achieved from their interaction will be significantly higher than the sum of the individual contributions. Additionally, the

successful functioning of educational clusters is directly dependent on strategic planning, effective management systems, diversified funding mechanisms, and a modern regulatory-legal framework. Strengthening collaboration between the public and private sectors, improving the investment climate, and developing innovation infrastructure will ensure the stability of clusters. Thus, educational clusters will emerge as centers that not only promote innovations but also systematically implement them and stimulate economic development in the modern economy.

In conclusion, educational clusters are an essential tool in generating innovations and increasing the competitiveness of the country in the modern knowledge economy.

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