THE ROLE OF THE INSTITUTE OF PHYSICS AND TECHNOLOGY IN THE DEVELOPMENT OF SCIENCE IN UZBEKISTAN

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Abstract: This article explores the role and significance of the Institute of Physics and Technology within the Academy of Sciences in Uzbekistan in promoting scientific progress. Using an analytical and historical approach, we examine the scientific activities of the institute from the years of independence until 2010. We present the achievements and practical outcomes of the institute's work in the context of Uzbekistan's scientific development.

Keywords: Academy of Sciences, Institute of Physics and Technology, fundamental and applied research, physics.

Introduction.

After Uzbekistan gained independence, the government started to pay great attention to radical reforms in science and education. Academic institutions, including the Institute of Physics and Technology, began to take on new tasks and prioritize scientific research that meets modern requirements. The institute has done extensive research in energy, materials science, nuclear physics, nanotechnology, and modern programming, and its work has been recognized both within the country and internationally.

Several resolutions and decrees passed by the government have supported science, giving the institute the opportunity to purchase modern laboratory equipment, strengthen international cooperation, train young scientists, and implement innovative projects. [1, p. 42-45]

The Main Part.

By the 1990s, Uzbekistan began to feel the need for a new phase in its scientific development. The issues of training qualified scientists and establishing effective collaboration between academic institutions and universities were particularly significant. Through systematic and scientific approaches, it became necessary to develop fundamental sciences and thoroughly prepare young people on the basis of modern scientific knowledge.

In this context, the year 1990 marked a significant turning point for science in Uzbekistan. A collaboration agreement was signed between the Scientific Production Association "Physics and the Sun" of the Academy of Sciences of the Uzbek Soviet Socialist Republic (UzSSR) and the Tashkent

State Pedagogical Institute, which later became the National Pedagogical University of Uzbekistan. This agreement established scientific and technical cooperation between the two institutions. [2, p. 198] This collaboration included two important aspects: first, the application of advanced scientific ideas to the higher education system; and second, the formation of a community of young scientists through the deepening of fundamental and applied research within the university environment.

Based on this agreement, on April 16, 1990, a new scientific department was established under the "Physics and Electronics" department of Tashkent State Pedagogical University. This department specializes in the fields of semiconductor and dielectric physics, which aims to increase the scientific potential of students through both theoretical knowledge and modern laboratory experiments.

The newly formed scientific unit provides opportunities for practical solutions in the educational process, combining the expertise of the physics-technical institute with higher education. This has led to an expansion of activities in the scientific and educational fields.

Thus, this cooperation, which started in the 1990s, has played an important role in the development of scientific infrastructure, innovation, and technological advancement in recent years since independence. It has become a part of history not only as a vision for integrating scientific institutions and higher education, but also as a significant step towards ensuring an inseparable link between science and education in Uzbekistan.

At the same time, practical cooperation between universities and research institutes in Uzbekistan has become more widespread in the scientific field. In particular, branches of special scientific and educational centers have been established on the basis of physical and technical institutes through scientific and educational partnerships with relevant departments of Tashkent State University (National University of Uzbekistan) and Tashkent Pedagogical Institute (National Pedagogical University of Uzbekistan). These partnerships focus on important and promising areas such as high energy physics, physics of semiconductors and dielectric materials, and solid state physics.

The activities of these centers not only accelerate fundamental and practical scientific research, but they also improve the system of training highly qualified scientific and pedagogical personnel. In this scientific environment, students and graduate students can conduct research based on real laboratory experiments and learn modern physical methods. The theoretical and practical training for young specialists has increased significantly, especially due to the provision of in-depth knowledge in specific areas of physics.

The establishment of scientific and educational centers has created the

foundation for close cooperation between higher education institutions and research centers in Physics in Uzbekistan. This has led to increased effectiveness of cross-industry scientific projects, creation of innovative developments, and formation of a strong intellectual base for international collaboration.

On the eve of and after independence, special attention was paid to integrating various fields of science in Uzbekistan, particularly in the health system. The Institute of Physics and Technology mobilized its scientific potential to serve practical purposes, such as protecting public health, modernizing medical technology, and developing the national healthcare system.

For example, on June 15, 1990, the government of the republic made important decisions regarding reforming the healthcare sector and providing modern medical equipment to medical institutions. These decisions tasked scientific and technical organizations with developing innovative solutions tailored to the needs of healthcare. As a result, the Institute of Physics and Technology - which was part of the Scientific-Production Association "Physics-Sun" affiliated with the Academy of Sciences of the Uzbek Soviet Socialist Republic - carried out several significant scientific developments. [2, p. 199]

As one of the most significant achievements, we can demonstrate the creation of a drying and sterilization technique based on infrared radiation. This technological innovation has led to the development of a prototype modern sterilizer, which is used especially in the production of medicines, medical devices, and other items that require sterilization.

This apparatus, in contrast to traditional thermal sterilization methods, provides high levels of cleanliness in a short period of time and has proven to be highly effective in practice.

In addition, the Scientific-Production Association "Physics-Sun" has expanded its activities through cooperation with other scientific and technical institutions. Specifically, cooperation with the computer design system "Algorithm' has led to the conduct of clinical trials in order to prepare a number of products for mass production. These trials have involved testing the efficacy of innovative medical devices and the successful completion of three major research and development projects.

Based on the results of these tests, plans have been drawn up to develop a variety of new types of practical medical equipment and consumer goods. These plans aim to modernize healthcare systems, produce locally manufactured technologies that can replace imported products, and improve the quality of health services.

During the years of independence, the Institute of Physics and Technology placed a strong emphasis on in-depth research into fundamental physical processes, making it one of their top priorities. During this time, important research was carried out by scientific teams within the institute in areas such as material physics, quantum mechanics, high-energy physics and device physics.

This research had a direct impact not only on theoretical physics development but also on practical techniques and the development of modern devices. As a result, in 1992, a group of researchers from the institute received a state prize for their work in silicon material science. [3, pp. 80-86] This team, including notable physical scientists such as academician M.S. Saidov and R.A. Muminov, played a significant role in laying the foundation for semiconductor device technology using silicon.

Thus, the fundamental and applied scientific activities of the Physical and Technical Institute played a significant role in the years following independence in harmonizing science and technology and forming new generations of devices and scientific fields. These achievements were particularly significant in enhancing Uzbekistan's scientific capacity, ensuring its technological autonomy, and strengthening its standing in the international scientific community.

Fundamental research and technological developments conducted by the Institute of Physics and Technology have yielded results that have not only been published in scientific articles and laboratory experiments, but have also been directly applied to industry and practical applications. By 1993, it became necessary to better direct the technological potential generated in the scientific community and to systematize work on new materials. To meet this need, several advanced laboratories were established within the Institute of Physical and Technological Sciences, including an Institute for Materials Science based on the experimental facilities of a large solar furnace. [4, pp. 87–99]

The new institute launched activities aimed at strengthening the collaboration between science and industry. Its primary areas of focus included modern materials physics, high-temperature testing, development of solar-powered materials, production of ceramic products, and technological applications. Within a short period of time, the Institute of Materials Science rose to the status of a modern research center and established a prominent position in the scientific landscape of Uzbekistan.

Commercialized structures, such as the joint venture “QURISHGELIOSERVIS” and LLC “Ceramics-Sun” began operating under the Institute's umbrella. These enterprises specialize in developing and producing innovative technologies based on the effective use of solar energy, drawing on the scientific developments of the Institute. Specifically, they

produce high-efficiency solar collectors and hot water supply systems that meet international standards. In 2003, these manufacturers produced products worth a total of 75 crore, which was a successful first step in commercializing scientific research. [5, pp. 40-41]

The Institute of Material Science has also made a serious effort to bring its activities to the international level. Specifically, a scientific journal called "Heliotechnics", aimed at an international audience, was published, where the results of research on solar energy, materials physics, and advanced technologies are regularly published. This has become an important tool for maintaining continuous information exchange not only with the national scientific community, but also with regional and global scientists.

In addition, the institute has made significant strides towards the development of a modern digital infrastructure. A scientific and educational network called UzSciNet has been established, as part of a United Nations project to expand internet access throughout the country and provide digital information services to academic institutions, universities, and professional colleges. This initiative has played a significant role in shaping the scientific and information space.

Meanwhile, the experimental production department of the institute continues to expand its operations. Complex parts, prefabricated components, molds, and other technical equipment are manufactured here under special orders. Additionally, liquid nitrogen delivery services have been established for industrial and scientific organizations through a liquid gas station.

The scope of international scientific and technical cooperation of the Institute of Material Science has expanded. In particular, Stirling heat engines of various capacities have been developed on the basis of international projects and exported to countries such as India, England, Russia, and China. Additionally, hydropower engines have been developed, and the first batch has been successfully delivered to India.

Another significant event that demonstrates the increased scientific potential of the institute is the appointment of Academician M., who was appointed in 2007. Another important event was the award of State Prize of the Republic of Uzbekistan to S. Saidov, I. G. Atabayev and A. S. Saidov for their research in semiconductor physics in 2019. This work laid the foundation for the study of electronic properties of semiconductors, energy gaps and their use in practical devices. [4, pp. 87-99]

Thus, the Institute of Materials Science, formed from the Institute of Physics and Technology, has become a successful scientific center that demonstrates the inextricable link between science, technology, and industry. It is an essential part of the country's innovative development process and has

made significant contributions to scientific progress in Uzbekistan through fundamental research, technological advancement, and international collaboration.

During the period from 2006 to 2010, the activities of the Academy of Sciences of Uzbekistan, including the Institute of Physics and Technology, were marked by an increase in the quality of research and its international recognition. This was also reflected in the application of research findings to the real economy through innovative projects. During this period, scientific research results, especially in fundamental sciences such as mathematics, astronomy, physics, chemistry, biology, ecology, and archeology, started to be published widely in international scientific journals. During this period, the results of research in various fields, especially in fundamental sciences such as mathematics, astronomy, physics, chemistry, biology, ecology, archeology, and Oriental studies, began to be widely published in international scientific journals. [6, pp. 213-214]

The fact that every third paper or thesis published by researchers affiliated with the Academy of Sciences is published in leading foreign journals indicates that not only the scientific quality is improving, but also the position of researchers in Uzbekistan within the scientific community. During this time, academic institutions have obtained certificates for 181 Uzbek patents for inventions, 89 software products, and trademarks, as well as other intellectual property rights. The increase in the number of applications for patents from 33 in 2006 to 57 in 2010 demonstrates a consistent increase in innovation activity within the country.

During this period, several significant events took place within the context of international scientific and technological cooperation. In 2010, a license agreement for industrial production was signed with ENVIROMATION INC, based in the United States. As a result of this agreement, a 5 kW Stirling heat engine production facility was established in the US, developed by the Physics and Technology Faculty of Uzbekistan, using copyright certificates and patented technologies. This event demonstrated not only the international recognition of Uzbek technology, but also the country's export-oriented scientific potential.

Conclusion.

In summary, during the years of independence, the Institute of Physics and Technology in Uzbekistan has played a significant role in science and education. The institute’s fundamental and applied research has contributed greatly to the country's technological progress, particularly in areas such as nuclear physics, energy, materials science, and nanotechnology. These achievements have earned the institute state awards and recognition.

Through cooperation with other higher education institutions, the institute has nurtured a community of young scientists. In addition, the institute has been actively involved in international projects, contributing to the development of technologies in semiconductor, solar, and infrared sterilization. The number of scientific publications and patents has increased, leading to the institute's recognition in the global scientific community.

Furthermore, the preservation of the institute's scientific heritage through museification is essential for preserving its history and passing it down to future generations. Museums play an important role in promoting scientific culture among young people and preserving scientific heritage. They help to raise awareness about science and encourage the development of scientific thinking. At the same time, museums also serve as a means of protecting scientific wealth through the process of museumification. [7, pp. 1624-1628]

Solar and infrared sterilization technologies have been implemented in museums, which helps to preserve valuable scientific artifacts and prevent them from being damaged. As the number of scientific articles and patents published by the Institute has increased, it has become more well-known in the global scientific community.

The museification of scientific heritage is crucial for preserving the history of the Institute and ensuring that future generations can learn from its achievements. Museums engage young people in scientific activities and promote a culture of innovation and creativity. This is especially important in today’s rapidly changing world, where the need for scientific knowledge and innovation is greater than ever. [8, 9]

By combining science with the economy, the Institute has been able to create a successful model for future scientific institutions. Its future plans include becoming a leader in implementing innovative solutions and technologies. Therefore, it is essential to continue to museify and present its scientific heritage to the public in order to maintain its legacy and inspire future generations of scientists.

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