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History and Development of The Organizational Activities of The Physics and Technology Institute

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Abstract: The article examines the key stages of formation and development of the organizational activities of the Physics and Technology Institute. It analyzes the historical prerequisites for the institute's establishment, its role in the country's scientific and technological progress, changes in management structures, methods of organizing scientific work, and cooperation with other scientific institutions. Special attention is given to current trends and challenges in the context of the digital transformation of science.

Keywords: Physics and Technology Institute, scientific organization, history of science, organizational structure, scientific management, academic environment.

Introduction: The Physics and Technology Institute is one of the leading scientific institutions concentrating on fundamental and applied research in physics and related technical sciences. Its history of formation, development, and transformation is closely tied to the modernization of science, the industrialization of the country, and changes in scientific and educational policy throughout the 20th and 21st centuries.

The Institute was established on November 4, 1943, based on the Physics and Technology Laboratory during the Great Patriotic War, in response to the urgent need to develop national scientific potential amid a shortage of qualified personnel and scientific infrastructure in the Soviet republics [1, p. 4; 2]. The initiative to establish the Institute came from a group of prominent physicists, among whom was S.V. Starodubtsev, one of the first scientific leaders. From 1943 to 1945, the Institute was headed by Associate Professor S.S. Vasiliev, Head of the Department of Experimental Physics at the Central Asian State University (CASU) [3, p. 9; 4].

The formation of the Institute took place under centralized scientific management, yet from its early years, it managed to gain scientific authority both within the Uzbek SSR and beyond.

METHOD

Stages of Institutional Development. In the 1950s–1970s, the Institute actively developed, creating new scientific directions and laboratories. Major research institutions were established on its basis: the Institute of Nuclear Physics (1956), the Institute of Electronics (1967), the "Physics-Sun" Scientific Production Association (1986), and the Institute of Materials Science (1993) [1, p. 4].

The initiative to establish the Institute of Nuclear Physics came from young scientists S.A. Azimov and U.O. Oripov. With the support of the government, the Academy of Sciences of Uzbekistan (President Kh.M. Abdullayev), and leading USSR scientists (I.V. Kurchatov, Yu.B. Khariton), a decision was made in 1956 to open the first scientific center in Central Asia with a nuclear reactor and specialized equipment [5, p. 8].

Key scientific schools under the leadership of U.A. Arifov, S.A. Azimov, and S.B. Starodubtsev played a critical role in the formation of the institute. These scholars contributed significantly to the development of the Institute of Nuclear Physics and its infrastructure, continuing their work even under challenging conditions. Their collaboration laid the foundation for the advancement of nuclear physics in Uzbekistan. In 1956, S.A. Azimov became Deputy Director of the Institute, and in 1962, he was appointed Director.

The Institute of Electronics named after U.A. Arifov was established in 1967 based on the scientific departments of the Physics and Technology Institute. Its founder and first director was Academician U.A. Arifov, a renowned physicist in electronics. [6] Its main research areas included physical electronics, semiconductor technology, and the development of electronic devices.

In 2012, it was reorganized into the Institute of Ion-Plasma and Laser Technologies named after U.A. Arifov of the Academy of Sciences of Uzbekistan. According to Presidential Decree No. PP-2524 dated May 2, 2016, it was dissolved [7]. However, by Presidential Decree No. PP-2789 dated February 17, 2017, and Cabinet Resolution No. 292 dated May 18, 2017, the institute was re-established within the Academy of Sciences of Uzbekistan [8, 9].

The "Physics-Sun" Scientific Production Association was formed in 1986 under the Academy of Sciences of the Uzbek SSR. Its creation was a logical continuation of major research in solar energy, high-temperature physics, and materials science initiated at the Physics and Technology Institute named after S.A. Azimov. It became the first scientific association in Central Asia to integrate resources and expertise for full-scale solar energy research. Its developments are applied in metallurgy, mechanical engineering, aerospace, and next-generation energy systems.

The Association collaborates with leading research centers in the CIS, Europe, and Asia and participates in international projects supported by UNESCO, IAEA, and others. Dissertation councils and researcher training programs actively function within the association.

The Institute of Materials Science was founded in 1993 as a research institution of the Academy of Sciences of the Republic of Uzbekistan. It emerged from the "Physics-Sun" Association to meet the need for in-depth studies of high-temperature materials and the development of new structural and functional materials for science, industry, energy, and aerospace [1, p. 12]. From its inception, the institute attracted researchers in high-temperature materials science. Its unique experimental base, including the Big Solar Furnace (BSF) in Parkent, quickly earned it leading status.

The first director, Doctor of Physical and Mathematical Sciences U.I. Meliev (1993–2005), played a key role in forming the scientific school of solar materials science in Uzbekistan. Under his leadership, the research infrastructure and scientific staff of the institute were established and continue to develop.

RESULTS AND DISCUSSIONS

In the 1990s and 2000s, the Physics and Technology Institute named after S.A. Azimov underwent a difficult transformation and adaptation period. After the collapse of the USSR and Uzbekistan's independence in 1991, the institute faced multiple challenges. These years marked a time of profound changes, a reassessment of priorities, and efforts to survive under new socio-economic realities.

A key consequence of the systemic crisis was a sharp reduction in state funding for science, causing major difficulties in maintaining research infrastructure. Additional pressure came from the loss of scientific and technological ties with union institutes that once formed a unified research network.

There was a mass exodus of qualified personnel, especially young scientists and specialists, which negatively affected the reproduction of scientific potential. The Institute had to urgently shift from primarily fundamental research to applied and commercially relevant science, adapting to market conditions and international requirements.

To meet the challenges of transforming the scientific and technical sphere and increasing the effectiveness of research, the Institute undertook targeted measures for sustainable development, including:

- Increasing participation in international research grants (INTAS, CRDF,

ISTC, IAEA), enabling global scientific integration and access to advanced resources;

- Establishing research laboratories and small enterprises to commercialize

scientific developments and strengthen ties between science and industry;

- Focusing on applied fields such as solar energy technologies, laser and plasma

technologies, and radiation material processing;

- Participating in national programs to improve energy efficiency, develop

renewable energy sources, and protect the environment;

- Preserving scientific schools and training young specialists through

postgraduate and doctoral programs, ensuring scientific continuity.

The results achieved highlight the effectiveness of these measures:

- The Institute preserved its core scientific potential and infrastructure during the challenging transition period;

- It laid the foundation for new scientific areas aligned with Uzbekistan's national development priorities;
- A new generation of scientists and engineers began forming, capable of contributing to international research agendas.

In the 21st century, the Physics and Technology Institute named after S.A. Azimov underwent a strategic shift toward applied research, digitalization of scientific activity, and strengthening international cooperation.

Current focus areas include:

High-Energy and Nuclear Physics: Theoretical and experimental research on nuclear reactions, radiation safety, particle physics (in cooperation with JINR, IAEA, etc.);

Semiconductor Physics and Nanotechnology: Development of nanomaterials, quantum dots, and sensor structures for optoelectronics and diagnostics;

Solar Energy and Renewables: Study of hybrid systems, thermoconcentrators, photovoltaic modules, and batteries for green energy programs;

Materials Science: Analysis of mechanical, thermal, and radiation properties of new composites and superconductors, using ion-plasma and laser processing methods.

The Institute participates in projects and grants from:

IAEA – radiation safety initiatives;

ISTC, CRDF, INTAS – international scientific exchange programs;

UNESCO – training of young professionals;

JINR (Dubna) – fundamental particle physics research.

Digital science infrastructure includes:

- Digital simulation labs (COMSOL, ANSYS, GEANT4);
- Electronic archives of publications and experiment databases;
- Online platforms for remote learning and scientific seminars;
- Automated systems for internal reporting and accounting. [10].

The Institute emphasizes the sustainable development of its scientific schools:

- Postgraduate and doctoral programs in core specializations;
- International summer schools and seminars;
- Academic mobility mechanisms (research internships abroad);
- Engagement of young professionals in project work and scientific groups [11, 12].

CONCLUSION

The current stage of development of the Physics and Technology Institute named after S.A. Azimov is characterized by strategic reorientation toward priority scientific fields, integration into the international scientific community, digital transformation, and the active training of a new generation of researchers. The Institute has maintained its role as a national center of excellence in physics, energy, and materials science.

The history of the Institute reflects the evolution of scientific thought and research infrastructure in Uzbekistan over more than eighty years. From its foundation during the hardships of World War II to its current status as a global research platform, the Institute has undergone major institutional and intellectual transformations.

The Institute has played a key role in establishing leading scientific centers such as the Institute of Nuclear Physics, Institute of Electronics, “Physics-Sun” NPO, and the Institute of Materials Science. It has been instrumental in developing key areas like nuclear physics, solar energy, solid-state physics, nanotechnology, and materials science. Despite the post-Soviet crisis, it preserved scientific continuity, adapted to new economic and political conditions, and continued training highly qualified scientific personnel.

Today, the Physics and Technology Institute stands as one of the flagships of scientific and technological progress in Uzbekistan, contributing significantly to solving both national and international scientific challenges.

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