Problems And Solutions In Training Engineering Personnel

Abdurakhmanov Abdurashid Atakhanovich

Candidate of Technical Sciences, Professor of the Department of Occupational Safety
Andijan State Technical Institute
abduraxmanovabdurashid25@gmail.com

ABSTRACT

This article analyzes the main problems arising in the process of training engineering personnel in Uzbekistan and proposes practical recommendations for their solution. Within the framework of cooperation between researchers, educational institutions, and industrial enterprises, the quality of education and the factors influencing it are examined. The issues of improving educational effectiveness through modernization of the education system, updating methodological resources, and implementing modern technologies are considered.

Keywords: engineering, education system, innovation, personnel training, technical education, dual education.

Introduction

The development of industry, the digitalization of the economy, and the acceleration of modernization processes in Uzbekistan require the formation of a new generation of highly qualified engineering personnel. Today, engineers are a key resource in implementing innovations, ensuring technological independence, and increasing the country's competitiveness in the global market. Despite active reforms in the education sector and the expansion of technical fields, the engineering competencies of graduates still do not fully meet the requirements of the modern economy.

The relevance of this topic is determined by the need to analyze existing problems in Uzbekistan's engineering education system and to search for effective solutions aimed at improving the quality of professional training.

2. Research Methods

The following research methods were used in this study:

Analysis of regulatory documents, including:
National programs for the development of higher education;
The "Digital Uzbekistan – 2030" strategy;
Regulatory documents of the Ministry of Higher Education, Science, and Innovation.

Content analysis of scientific literature and international reports, including publications by UNESCO and the World Bank, as well as materials on engineering education reforms in developed countries (South Korea, Germany, Japan).

Comparative analysis, comparing the engineering training system in Uzbekistan with international models such as CDIO, STEM, and dual education.

Expert assessments, summarizing the opinions of professors from technical universities, representatives of the industrial sector, and employers from IT companies.

3. Research Results

3.1. Identified Key Problems

Mismatch between curricula and labor market requirements

In many technical universities, curricula remain predominantly theoretical and insufficiently adapted to new technologies (IoT, industrial robotics, production automation). Industrial enterprises emphasize that graduates lack practical engineering skills and experience in working with modern equipment and software systems.

Limited material and technical infrastructure

Although some universities are undergoing modernization, many laboratories are equipped with outdated equipment. This reduces the level of students' practical training and limits opportunities for implementing innovative projects.

Low level of integration between education and industry

Enterprises are insufficiently involved in curriculum development. Student internships are often formal in nature. Unlike the dual education model in Germany and other countries, university–industry cooperation in Uzbekistan remains insufficiently effective.

Shortage of qualified engineering faculty

Competition with the private sector leads to a "brain drain" from universities. Young specialists rarely choose academic careers. The professional development system for teachers does not always encourage the adoption of modern technologies and international teaching methodologies.

Limited access to international experience and exchange

Joint educational programs, internships, and student and faculty exchange initiatives in engineering fields are not sufficient to form global engineering thinking.

3.2. Existing Potential and Opportunities

Despite the identified problems, large-scale reforms are being implemented in Uzbekistan, including:

Opening branches of leading foreign technical universities;

Establishing technoparks, IT parks, and innovation laboratories;

Developing pilot educational programs;

Government support for STEM fields;

Formation of a national qualifications framework.

These processes create a solid foundation for improving engineering education.

4. Discussion

4.1. Proposed Solutions for Improving the Quality of Engineering Training

Modernization of curricula in line with international standards

A transition to a competency-based approach grounded in the CDIO (Conceive–Design–Implement–Operate) model is required, with a focus on project-based learning and practical application of engineering knowledge.

Development of dual education and strengthening university–industry cooperation

Universities and enterprises should jointly establish laboratories, research centers, and training facilities. Industrial internships should involve students in real projects, with personal responsibility assigned to enterprise management.

Implementation of digital technologies in the educational process

Extensive use of simulators, CAD/CAM/CAE engineering systems, virtual laboratories, and robotics kits will bring education closer to real industrial conditions.

Professional development of faculty at foreign industrial enterprises and universities

Regular internships for teachers at enterprises, training in new technologies, and participation in international engineering programs are essential. This requires grants, professional courses, and incentive-based compensation mechanisms.

Expansion of international cooperation

Establishing joint faculties and master's programs with foreign universities will facilitate the transfer of best practices, modernization of educational methodologies, and development of research activities.

Development of innovation infrastructure

Technoparks, FabLabs, and startup incubators should become platforms for engineering practice and preparation for real-sector activities.

5. Conclusion

Uzbekistan's modern economy requires a new generation of engineering personnel—knowledgeable, technologically competent, and innovation-oriented specialists. The analysis shows that the main problems in engineering training are outdated curricula, insufficient practical training, weak ties with industry, and limited modern infrastructure.

At the same time, all prerequisites for a fundamental renewal of engineering education exist in the country, including government reforms, expanded international cooperation, digitalization, and the formation of an innovation ecosystem.

The implementation of the proposed solutions will improve the quality of engineering training, strengthen human capital, and ensure Uzbekistan's long-term sustainable technological development.

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