Digital Industry Talent and Higher Education Digitalization in Central Asia

Research Report

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Preface

In recent years, the profound digital transformation taking place worldwide has not only changed people's attitudes toward information processing, storage, and transmission technologies, but also reshaped their views on the economy, social relations, and education systems. Today, it is difficult to imagine an educational institution without computer technologies and information and communication technologies (ICT). Digital transformation helps improve the quality of education, transform teaching content as well as the methods and approaches of instructional activities, and enables more objective assessment of the mastery of knowledge and skills in rapidly evolving digital learning environments, thereby enhancing student learning outcomes. In higher education, digital technologies have enabled new models for organizing and delivering teaching activities that were not possible with traditional technologies, thus playing a key role in the systemic transformation of higher education.

Since 1990s, Central Asian countries have been committed to strengthening their industrial, economic, and financial infrastructure, as well as developing education. As these countries advance modernization, their education systems have continued to move toward internationalization. This is reflected in the increasing opportunities for exchanges among faculty, students, and researchers, the growing number of scientific and educational cooperation projects, and the sharing of relevant experience in ICT-enabled education.

Under the overall coordination and support of the UNESCO International Centre for Higher Education Innovation (Shenzhen, China) (ICHEI), expert teams from China and the Central Asian countries—Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan—jointly produced the analytical report Digital Transformation of Higher Education in Central Asian Countries. The report provides an important reference for a comprehensive and objective understanding of the current status, trends, challenges, as well as related reforms and initiatives in the digital transformation of higher education in Central Asian countries, along with the demand for digital industry talent in the region.

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Foreword

In the early 1990s, following the dissolution of the Soviet Union, the geopolitical landscape of Eurasia underwent structural changes. The five newly independent Central Asian countries—Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, and Turkmenistan—emerged from historical obscurity onto the international stage and became truly independent sovereign states. Situated in the hinterland and junction of the Eurasian continent, these countries constitute a key geopolitical hub. They have long served as a major transportation artery of the ancient Silk Road and today represent key nodes and core regions of the Belt and Road Initiative, and their geostrategic position has historically been of great importance. It must be acknowledged, however, that in the aftermath of the Soviet Union's dissolution, the resurgence of nationalism and the assertion of individual national interests have stalled regional integration in Central Asia. Coupled with conflicts that have occurred from time to time, the region's geopolitical landscape has, since the end of the Cold War, continued to exhibit a fragmented pattern of development.

The geoeconomic environment of Central Asian countries also warrants attention. Following the dissolution of the Soviet Union, Central Asian countries embarked on a transition from a planned economy to a system oriented toward Western free-market principles. During this difficult transformation from planning to market, their GDP levels only gradually returned to Soviet-era levels by the early 21st century. Since then, the economies of the five Central Asian countries have achieved new development, entering a new stage of recovery-driven growth. It is worth noting that, due to differences in resource endowments, development bases, and development models, there are substantial disparities in economic development levels among these countries. Taking 2020 as an example, Kazakhstan's per capita GDP reached USD 10,964, ranking among the top 50 worldwide, while that of Kyrgyzstan was only USD 1,098. With the advent of the Industry 4.0 era, driven by the digital industrial technology revolution, all Central Asian countries have attached great importance to the application of intelligent technologies and have actively engaged in industrial digital transformation. However, constrained by limitations in funding, technology, and talent, the development of digital industries in these countries still exhibits notable shortcomings and faces numerous challenges.

Chapter 1
Digital Development of Industries and Talent Demand in Central Asian Countries

1.1 Digital Development of Industries in Central Asian Countries

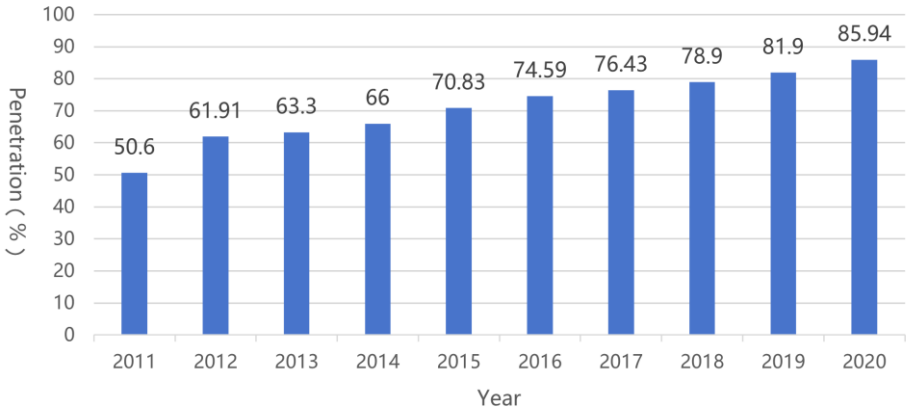
Advancing toward digital industries is an irresistible trend of the times that Central Asian countries cannot avoid. The advent of the Industry 4.0 era, based on informatization and intelligent technologies, has injected strong momentum into the digital economy and has become an unstoppable force in global economic development. Central Asian countries, situated within the broader context of globalization, cannot remain outside this trend. Digital technologies and the digital economy in Central Asian countries started relatively late and remain at a relatively low level of development; however, their "revolutionary" nature has attracted great attention from governments, which have incorporated digital transformation into their national key development strategies. In recent years, Central Asian countries have successively introduced digital development strategies in the form of legislation, thereby promoting and applying digital technologies across multiple sectors in the five Central Asian countries. As a result, the digital economy in these countries has entered a phase of rapid growth.

● Kazakhstan

Kazakhstan is the earliest among the five Central Asian countries to implement a digitalization strategy and the fastest-developing in this regard. As early as 2004, the first President, Nursultan Nazarbayev, put forward the concept of e-government, and in 2006, Kazakhstan adopted an e-government system. Since 2010, digital services—including e-procurement, e-payment, e-commerce registration, and electronic healthcare—have been successively launched. In December 2017, the government adopted the *State Program "Digital Kazakhstan"*, which planned to implement initiatives during 2018–2022 across five key areas: economic digitalization, transition to a digital government, implementation of the Digital Silk Road, human capital development, and the creation of an innovation ecosystem.

In March 2020, in the context of the COVID-19 pandemic, the Government of Kazakhstan reviewed its digital strategy plan and called for updates and adjustments to digitalization across various sectors, including e-government and distance education. In October 2020, Kazakhstan again formulated a new revised version of the *State Program "Digital Kazakhstan"*, increasing the number of priority areas in its digitalization strategy from five to ten. The updated program focuses on improving the functioning of government institutions, enhancing healthcare and education systems, developing financial

technologies, building smart cities, and strengthening information and communication infrastructure.



Internet Penetration in Kazakhstan, 2011–2020 (Source: Statista)

Thanks to strong government attention and increasing investment in implementing the national digital strategy, Kazakhstan's digital capabilities and infrastructure have been significantly enhanced. Its internet services have maintained rapid and substantial growth momentum (as shown in the figure below), making it a regional leader in the application of digital technologies. According to the International Telecommunication Union (ITU), Kazakhstan ranked 52nd among 176 countries in the ICT Development Index in 2017, and by the end of 2019, its internet penetration rate had reached approximately 80%.

To keep pace with global trends and further harness the potential of digital technologies to develop the digital economy, Kazakhstan has actively utilized domestic resources while also prioritizing international cooperation with digitally advanced countries, including the US, European nations, China, Singapore, and South Korea, as well as international organizations. On December 28, 2020, the United Nations Development Programme (UNDP) and Kazakhstan's Ministry of Digital Development, Innovation, and Aerospace Industry signed a Memorandum of Understanding (MoU) to collaborate in digitalization, public services, and innovation. The agreement aims to support Kazakhstan in attracting leading international digital experts, allocate USD 200,000 to accelerate the country's digital transformation, and provide digital skills training for 1,000 civil servants needed for remote work. Such international cooperation and exchanges are pivotal for further advancing Kazakhstan's digital development and industrial digital transformation.

● Kyrgyzstan

Kyrgyzstan is, to some extent, the most open country in Central Asia. As early as March 2002, it issued its first national strategy on digital development. In December 2018, Kyrgyzstan adopted the *Concept of Digital Transformation of Kyrgyzstan 2019–2023*, which prioritized agriculture, light industry, tourism, and the creative economy as key sectors. The concept also outlined three priority areas: first, the digital transformation of business production, including the development of digital infrastructure and platforms in key economic sectors; second, building on the digital economy strategies of partner countries

and supporting international initiatives related to regional digital infrastructure development; and third, reducing barriers to digital technology development and deployment. In October 2021, Kyrgyzstan approved the National *Development Program of the Kyrgyz Republic 2026* as its economic development plan for the next five years. The program emphasizes further advancement of national digital development and sets specific targets, such as bringing the country's e-government into the top 60 globally.

As the above analysis indicates, Kyrgyzstan's relatively open and liberal social environment, coupled with its early adoption of a national digital development strategy, has allowed it to remain at the forefront of digitalization in Central Asia. Although small in size, the country boasts an exceptionally high internet penetration rate, ranking second globally, resulting in very active digital activity. Although Kyrgyzstan's IT industry has developed rapidly, the scale of its digital economy remains limited, contributing less than 0.4% to national GDP by 2020. Constrained by limited national resources, Kyrgyzstan has placed greater emphasis on leveraging its reputation as a "democratic island" in Central Asia to attract foreign support, strengthen international cooperation, and promote the development of its digital industries and services. Key partners in Kyrgyzstan's digital cooperation include international organizations such as the United Nations, the World Bank, and the European Union, as well as countries like South Korea. In 2021, the United Nations Development Programme (UNDP) assessed its digital progress and helped develop its digital strategy. Additionally, in March 2018, the World Bank launched the Digital Central Asia–South Asia (CASA) Project, allocating USD 50 million to support Kyrgyzstan's digital transformation.

● Tajikistan

The development of digital technologies in Tajikistan has been relatively slow in Central Asia. In January 2019, the government formally proposed the introduction of the digital economy in its strategic plan *On the Results of the Socio-Economic Development of the Republic Tajikistan in 2018 and the Challenges for 2019*. In December of the same year, President Emomali Rahmon officially approved the *Concept of the Digital Economy of Tajikistan*, which outlines a three-phase approach to digital transformation: 2020–2025, 2026–2030, and 2031–2040. The plan is to be implemented within the framework of the Digital Central Asia–South Asia (Digital CASA) project. The first phase focuses on training highly qualified personnel for digital projects; the second emphasizes the development of domestic digital infrastructure; and the third aims to launch digital initiatives in key sectors of the national economy and social sectors.

Compared with other Central Asian countries, Tajikistan not only introduced its national digital development strategy relatively late, but also suffers from comparatively weak telecommunications infrastructure supporting its digital economy. In particular, its internet penetration remains lower than that of other countries in the region, with services that are slow and costly, thereby significantly constraining industrial digital transformation and the growth of the digital economy. With a population of approximately 9.6 million, Tajikistan had about 3.18 million internet users as of 2020, including mobile users, meaning that only 26%

of the population had access to the internet. The underdeveloped information and communication infrastructure has also resulted in a relatively low level of e-commerce, which further limits the digital economy's development. As one of the region's economically disadvantaged countries, Tajikistan allocates only limited resources to national digital development. Although smaller than regional powers such as Uzbekistan and Kazakhstan, Tajikistan has maintained only modest international cooperation in digitalization. Apart from limited collaboration under the World Bank's Digital CASA framework, Tajikistan has primarily pursued technical cooperation with Russian telecommunications operators.

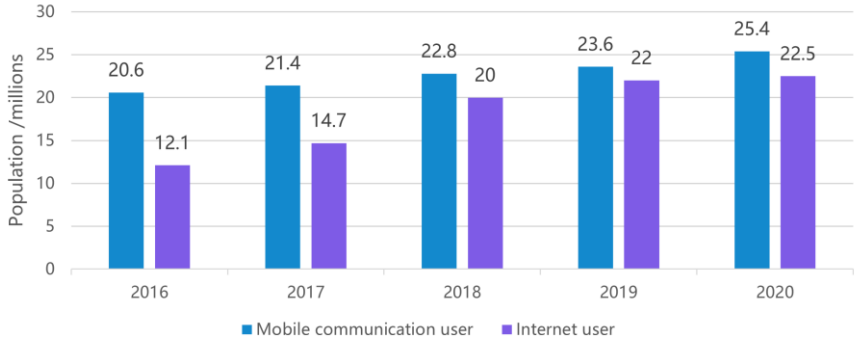
● Turkmenistan

The application of digital technologies in Turkmenistan is similarly underdeveloped as in Tajikistan. To promote business and investment, introduce modern governance practices, and create new employment opportunities, the President of Turkmenistan signed a decree on December 1, 2018, approving the *Concept for the Development of the Digital Economy of Turkmenistan for 2019–2025*. The concept is to be implemented in three phases. The first phase (2019) focuses on establishing an interministerial commission to formulate a national roadmap for digital economic development, improving legislation and related policy support, and assessing the feasibility of digitalization across all sectors. The second phase (2020–2023) emphasizes expanding and upgrading digital communication systems, developing one-stop digital service portals, and introducing digital reporting. The third phase (2024–2025) aims to implement digitalization projects across sectors of the national economy and integrate them into the international digital economy system.

Due to its closed national system, Turkmenistan's digitalization process and digital economy development lag behind Tajikistan, placing it at the lowest level in the region. As of 2020, the country had 1,223,591 internet users, accounting for 21.25% of the population. As in Tajikistan, internet penetration in Turkmenistan remains low, and digital literacy among its population is also limited. Despite these challenges, Turkmenistan places considerable importance on developing advanced digital technologies. To implement the "Digital Turkmenistan" national program and bridge the digital divide, it secured USD 273 million from the Islamic Development Bank in 2017 to develop internet infrastructure and electronic systems. In addition, Turkmenistan has strengthened its cooperation with the European Union and countries such as South Korea in the field of digitalization. In July 2021, during the EU–Central Asia High-Level Political and Security Dialogue held in Tashkent, the Turkmen delegation proposed establishing a European Center for Information and Digital Technologies in Turkmenistan together with EU diplomatic missions.

● Uzbekistan

Following the assumption of office by President Shavkat Mirziyoyev in 2016 and the adoption of a reform-oriented, liberalizing policy agenda, Uzbekistan's national image and its economic and social landscape have gradually shifted from relative closure to greater openness. In this context, the country's digitalization process has made significant progress, with notable improvements in telecommunications infrastructure and a steadily expanding digital economy. In July 2018, the government issued a presidential decree On Measures to Develop the Digital Economy in the Republic of Uzbekistan, which, for the first time, introduced the implementation of innovative technologies and applications. In October 2020, President Mirziyoyev signed the decree On Approval of the Strategy "Digital Uzbekistan-2030" and Measures for Its Effective Implementation, further clarifying the strategic plan for developing the digital economy and establishing priorities and concrete measures for the country's digital transformation. The Strategy "Digital Uzbekistan–2030" stipulates that more than 280 projects were to be digitalized between 2021 and 2022, with the aim of facilitating the transition to digitalization. It defines two implementation pathways—regional digitalization and sectoral digitalization—covering priority areas such as digital infrastructure development, e-government, the national digital technology market, IT education, and advanced skills training. The strategy also calls for the introduction of more than 400 information systems, electronic services, and other software products across various sectors of regional socio-economic development. In addition, it plans to provide basic programming training to 587,000 individuals, including 500,000 young people under the "One Million Programmers" initiative. Further details on the development and dynamics of information and communication technologies in Uzbekistan since President Mirziyoyev took office can be found in the table below.



Growth in Mobile Communication and Internet Users in Uzbekistan, 2016–2020
(Units: million; Source: Мининфоком)

Notably, although Uzbekistan's digital technologies and digital economy have developed rapidly in recent years, a considerable gap remains relative to developed countries. At present, the digital economy accounts for only about 2.2% of GDP. To address weaknesses in digital infrastructure and the shortage of digital skills, the Uzbek government has consistently prioritized international cooperation to enhance its level of digitalization, with South Korea as one of its key strategic partners. Uzbekistan began strengthening cooperation with South Korea in the field of e-government as early as 2013. In 2020, the two countries launched the second phase of cooperation through the signing of a memorandum of understanding between Uzbekistan's Ministry for Development of

Information Technologies and Communications and South Korea's Ministry of the Interior and Safety. According to the agreement, the two countries established expert groups to carry out cooperation in three main areas within e-government and the digital economy: first, the development of artificial intelligence technologies in Uzbekistan; second, improving Uzbekistan's position in the United Nations e-government development rankings; and third, enhancing the role and status of digital technology training centers established in the country.

1.2 Demand for Digital Talent in Central Asian Countries

Digital technologies and the digital economy are key drivers of a modern economic system. Due to weak historical foundations, a late start in the adoption of digital technologies, and limited capacity for talent cultivation, Central Asian countries face a widespread shortage of digital talent. As a result, demand for such talent is particularly urgent and strong. This is clearly reflected in national digital development strategies across the region, all of which emphasize the need to vigorously develop digital talent. Since 2020, the COVID-19 pandemic has brought about profound changes in business models worldwide, further intensifying the demand for digital talent in Central Asia. According to reports, 90% of companies in the region are experiencing a shortage of IT specialists due to the pandemic and identify the difficulty of finding suitable talent as a major challenge in implementing digitalization projects. Consequently, 59% of companies have decided to accelerate their digital transformation initiatives.

In terms of the specific conditions of the five Central Asian countries, Kazakhstan outperforms the other four in the utilization of digital technologies. In the state program "Digital Kazakhstan", the fourth development area focuses on human capital, emphasizing that, in the digital age, essential competencies include critical thinking, self-organization, and creativity. The digitalization of the education process, the expansion of distance learning, and the introduction of new university majors provide conditions for developing these competencies. Due to the IT sector's annual growth rate of 10–20%, although 83 of Kazakhstan's 116 universities train professionals in information and communication technologies, this remains insufficient to meet demand. In response, the government has increased investment in ICT education, aiming to supply at least 25,000 specialists to the labor market annually starting from 2020. In Uzbekistan, the post-Karimov era has been marked by increased economic liberalization and rapid growth in information technologies, which has driven significant changes in demand for digital talent. More than 120 higher education institutions have introduced digital training modules and established incubation centers, while new vertical training systems have been developed under ICT education development programs. In 2020, Uzbekistan launched the "One Million Programmers" initiative, offering free programming training, with over 130,000 participants having received such training. In addition, more than 100 IT training centers have been established nationwide, with plans to open a further 200 centers in 2021; currently, over 85,000 trainees are enrolled in these centers. Kyrgyzstan has incorporated digital development as a key

component of its national development strategy through 2040, making the cultivation of and demand for digital talent a central focus of its higher education system. Many universities in Kyrgyzstan have established innovation laboratories and technology parks in collaboration with enterprises to explore and study issues related to accelerating digital transformation and societal digitalization. To meet demand for digital talent, many higher education institutions have also established IT training centers for professions such as programmers. Nevertheless, the supply of digital talent in Kyrgyzstan remains insufficient to meet societal needs. The situations in Tajikistan and Turkmenistan are broadly similar to those of other countries in the region. However, due to their relatively closed and less developed conditions, both countries face more acute shortages of digital talent. Accordingly, their national digital strategies place strong emphasis on the cultivation of digital professionals.

1.3 Opportunities and Challenges of Industrial Digital Transformation in Central Asian Countries

The digital industries of Central Asian countries is currently at a critical stage of development and transition. As reflected in the national digital development strategies introduced since 2018, the digitalization process in all five countries remains, to some extent, at an early stage. This means that the digital transformation of industries in Central Asia faces both development opportunities and numerous challenges.

Opportunities:

First, precisely because of their relatively late start, Central Asian countries have greater room for growth in digital technologies and the digital economy, which has attracted significant interest and attention from external actors and is conducive to unlocking their digital potential;

Second, the inflow of a large number of Russian IT specialists into Central Asia following the Russia–Ukraine war has, to some extent, helped to ease the shortage of digital talent in the region. In addition, the return of many Central Asian labor migrants—some of whom have acquired new skills—has further contributed to the development of digital industries in these countries.

Finally, under the Belt and Road Initiative, China has actively promoted the joint building of the Digital Silk Road with Central Asian countries, contributing to enhanced digital development in the region.

Challenges:

First, the foundations for the digital transformation of industries remain weak. The survival and development of this transformation fundamentally depend on well-established ICT infrastructure. Underdeveloped basic telecommunications infrastructure constitutes the most significant bottleneck limiting the digital transformation of industries in Central Asian countries. ICT development indicators across the region generally fall below

the global average. With the exception of relatively higher 3G and 4G coverage rates, most other indicators lag behind the levels observed in Commonwealth of Independent States (CIS) countries. The level of ICT access and application among enterprises in the five countries remains limited. Compared with developed countries, enterprise-level internet penetration is relatively low, and only a small number of firms are capable of leveraging ICT in a sophisticated manner. In addition to substantial disparities among countries in the region, significant digital divides also exist within individual countries, particularly between urban and rural areas, making it unlikely that these gaps can be bridged in the short term.

Second, funding, technology, and talent remain core factors constraining the digital transformation of industries in Central Asian countries. Among the five countries, only Kazakhstan faces relatively fewer difficulties in investing in digital technologies and related sectors, while the other four face difficulties, with Kyrgyzstan and Tajikistan facing the most severe constraints. Insufficient funding not only hampers the upgrading and modernization of ICT infrastructure but also affects the cultivation of relevant technical talent. According to the Global Information Technology Report 2015 by the World Economic Forum, Tajikistan ranked 117th out of 143 countries. A key reason for this low ranking lies in the country's underdeveloped IT education system. In Kyrgyzstan, the challenges in cultivating digital talent stem from a shortage of qualified instructors in digital fields within higher education institutions and the lack of targeted targeted talent development programs; only a limited number of private universities offer advanced digital technology courses, while most public universities lack access to up-to-date digital technologies, software, and technical equipment, which severely constrains their capacity to train talent. Moreover, due to the lack of competitive compensation, Kyrgyzstan not only struggles to attract foreign experts but also experiences a substantial outflow of highly skilled domestic digital talent.

Third, geopolitics and geo-economics are also important factors that cannot be ignored in influencing the digital transformation of Central Asian countries. Central Asia is located at the geopolitical axis of the Eurasian continent and serves as a stage for the competition among major external powers. At present, the impact of the Russia–Ukraine war on the Central Asian economies has been significant for finance, industrial chains, and the service sector, while its effect on the real economy remains limited. The outbreak of the war caused a large number of labor migrants to return from Russia to their home countries, resulting in a sharp decline in remittance income for Uzbekistan, Kyrgyzstan, and Tajikistan, which has substantially harmed national economic development and clearly hindered investment in digital development. In addition, the Russia–Ukraine war has greatly impaired trade between Central Asian countries and Russia. Russia is Kazakhstan's largest trading partner, and as of August 2021, nearly 78,000 Russian companies operated in Kazakhstan. The deep economic integration between Russia and Kazakhstan means that Western sanctions on Russia would have serious repercussions for Kazakhstan's economic development. On March 16, 2022, President Tokayev noted in his state-of-the-nation address a series of concerning economic consequences caused by the

Russia–Ukraine war, including soaring food prices and currency fluctuations. Against this backdrop, Kazakhstan's national fiscal investment in the digital industry is inevitably affected, and the development of the sector faces significant risks. Moreover, prior to the Russia–Ukraine war, Russia had invested in and collaborated on many digital development projects in Central Asian countries. The war, along with the severe Western sanctions on Russia, has put these projects at risk of being suspended or even canceled, creating constraints in technology and financing and introducing considerable uncertainties and challenges for the digital development process in the region.

Chapter 2
Overview of Higher Education Digital Transformation in Central Asia Countries

Over more than 30 years of post-independence transition and the deep adjustment and development of industrial structures, Central Asian countries have increasingly recognized that high-quality talent aligned with market needs is a critical support for revitalizing the high-quality development of the national economy. The key to cultivating such talent lies in education, particularly higher education. Consequently, higher education is widely regarded across the region as a priority sector for socio-economic development. Each country has sought to establish its own education system based on its specific development characteristics and capacities. The social, educational, and cultural sectors require substantial financial investment, the economic benefits of which often take time to materialize. As a result, a country's educational infrastructure is closely linked to its economic potential. All Central Asian countries clearly recognize that the education system, or knowledge capital, is the most important resource directly involved in shaping the digital economy. In recent years, government legislation and presidential decrees have focused on improving the quality of higher education. The number of higher education institutions across the region has grown significantly. Central Asia now has more than 400 universities: Uzbekistan 170, Kazakhstan 125, Kyrgyzstan 64, Tajikistan 27, and Turkmenistan 24. By 2022, the total number of higher education students in the region had reached 1.6 million. The COVID-19 pandemic has influenced the digital transformation process of higher education in all Central Asian countries, highlighting the advantages of remote learning:

- Educational resources can be accessed at suitable times and locations;
- Leading foreign scholars and lecturers can be invited to participate in teaching;
- Hosting and attending international and national conferences, seminars, and workshops online can reduce travel costs and broaden participation;
- Teachers can be encouraged to develop additional online courses;
- New and innovative teaching methods and tools can be developed;
- Universities and government ministries can be encouraged to strengthen support in funding, technical equipment, and broadband telecommunications, in order to deliver high-quality multimedia resources for distance learning.

2.1 Reform Measures for Higher Education Digital Transformation in Central Asian Countries

Central Asian countries have established legal frameworks for developing higher education through advanced technologies, drawing on national programs for governance and economic digitalization (such as "Digital Uzbekistan," "Digital Kazakhstan," and "Digital Kyrgyzstan").

The primary purpose of these concepts and plans is to create the conditions necessary for future digital economy transformation. As a fundamental driver of development in other sectors, higher education digitalization supported by advanced information technologies has attracted significant attention. In recent years, digital learning technologies have made

significant progress. For all Central Asian countries, the process of higher education digital transformation was significantly affected during the COVID-19 pandemic period. At the same time, emphasis has been placed on the advantages of remote learning, including encouraging teachers to offer new online courses and developing innovative teaching methods and tools. However, although remote education has undergone active adjustment and governance, it still faces certain challenges compared with traditional face-to-face teaching, where teachers and students participate in the classroom in person.

To address constraints in funding, technology, and talent, the five Central Asian countries have continued to strengthen international cooperation. In the early 2000s, all Central Asian countries joined the Electronic Information for Libraries (EIFL), which made it possible to access databases from leading global publishers such as Springer Nature, EBSCO Information Services, and ProQuest. As an important external actor in the region, the European Union (EU) has long maintained a high level of cooperation with Central Asian countries in the political and educational fields. Participation of Central Asian universities in EU programs such as TEMPUS and ERASMUS+ has greatly accelerated the integration of information technologies into higher education. Many of these projects require active use of the MOODLE platform in MOOCs to access learning materials remotely. At the same time, the development of a large number of electronic teaching materials has significantly enhanced the effectiveness of the application of information technology in teaching, particularly in remote education. On November 12, 2021, the EU Delegation to Kazakhstan held a forum titled “30 years of EU-Kazakhstan cooperation in education: opportunities and challenges for future EdTech”. The forum reviewed the EU’s digital education cooperation in Kazakhstan, while conducting in-depth exchanges and discussions on further strengthening cooperation in digital education transformation. In 2021, several EU countries jointly launched a bilateral Twinning project with Kyrgyzstan titled “Support to the Digitalisation Agenda in Kyrgyzstan”, marking the first bilateral cooperation project between EU member states and Central Asian countries conducted on an equal footing. Due to historical ties with the region, South Korea has maintained active cooperation with Central Asian countries, including in the field of digital technologies. As early as October 2017, Turkmen President Gurbanguly Berdimuhamedow approved at a Cabinet meeting cooperation with South Korea’s Ministry of Science and ICT to establish an Information Access Center in Turkmenistan. The center aims to provide a basis for technological innovation in Turkmenistan’s digital education system, the improvement of digital education services, and the development of modern electronic education. In November 2019, the Kyrgyz Ambassador to South Korea held talks with the Director of South Korea’s Ministry of the Interior’s E-Government Bureau on e-government and digital cooperation. Both sides proposed establishing an IT Academy in Kyrgyzstan to train IT specialists to enhance the country’s capabilities in public service digitalization, cybersecurity, and other areas.

2.2 Challenges to Higher Education Digital Transformation in Central Asian Countries

Although higher education in the five Central Asian countries made significant progress during the Soviet period, overall quality and standards remained relatively low, which in turn affected talent development. At present, higher education in Central Asia is still in the process of internal reform and internationalization, facing numerous problems and challenges:

- Difficulty in overcoming the legacy of the Soviet education system. Higher education development models in Central Asian countries are currently diverse, with Russian, European, and American systems coexisting. In terms of academic programs, degrees, diplomas, teaching systems, and even educational management practices, most countries still follow certain Soviet-era traditions. At the same time, all Central Asian countries regard aligning higher education with international standards as a major strategic decision to enhance national higher education. The European "Bologna Process" and the U.S. "Fulbright Program" have been implemented across the region. However, the level of internationalization of higher education in Central Asian countries remains limited. Although countries such as the United States, Turkey, South Korea, and some European countries have established universities in the region, both the number of institutions and the resources invested are limited, and their management models still largely follow their home-country systems.

- Economic underdevelopment is a fundamental factor affecting higher education and talent development in Central Asia. Since the collapse of the Soviet Union, economic difficulties have severely constrained investment in higher education, resulting in serious shortcomings in infrastructure, teaching resources, research conditions, academic corruption, and faculty attitudes and interest toward research—all of which have negatively affected the quality of talent development in the region's higher education institutions.

- The application of information technology in higher education remains insufficient, and there is still a shortage of highly qualified teachers in this field. Consequently, it is necessary to offer courses to improve teachers' professional skills.

- Some information technology training programs are outdated and need timely updates to meet modern development requirements and consolidate advances in science and ICT. Lifelong learning through digital methods and tools has not yet become a standard means of acquiring knowledge.

- Student migration is also a critical challenge for higher education in Central Asia. The gap between the region's higher education and that of Western countries, including Russia, leads most high school graduates to seek higher education abroad. According to statistics, in 2016, four of the top six source countries for full-time international students in Russia were Central Asian states—Kazakhstan, Turkmenistan, Uzbekistan, and Tajikistan—with a combined total of 72,195 students, accounting for 36% of all full-time international students

in Russia. The majority of these graduates rarely return home, resulting in a significant brain drain. In addition, the lack of interaction between universities and enterprises in Central Asia results in a large portion of trained talents being disconnected from labor market needs. Moreover, most students choose to study humanities and social sciences, while relatively few enroll in natural sciences and engineering programs, which seriously affects the region's supply of high-tech talent and the development of an innovation-driven economy.

- Digital transformation in the education systems of the five Central Asian countries remains slow. Although universities have rapidly installed computer equipment, a digital divide persists. Not all institutions are equipped with high-speed internet, high-quality computers, or specialized teaching devices. This is particularly relevant for smart classrooms, electronic whiteboards, and other modern intelligent classroom devices.

- Central Asian countries share common roots, with similar cultures and languages, and there is strong demand for scientific and educational resources. However, there is currently no active and effective information exchange, no higher education partner portals, and no integrated scientific and educational resources to support the development of information infrastructure in the region.

- Most higher education institutions in Central Asia have access to electronic resources provided by leading publishers and aggregators, including EBSCO Information Services, Springer Nature, Elsevier, and Clarivate Analytics. As members of the international library alliance EIFL, and with the support of their respective Ministries of Higher Education, Science, and Innovation, these countries have subscribed to these valuable resources. Private and elite universities can subscribe to foreign databases at their own expense. However, statistics show that some universities rarely use these valuable resources for teaching and research purposes. Therefore, there is a significant need for training courses in the use of analytical databases, electronic resources from world-leading publishers, multimedia resources, and simulation systems.

2.3 Conclusion

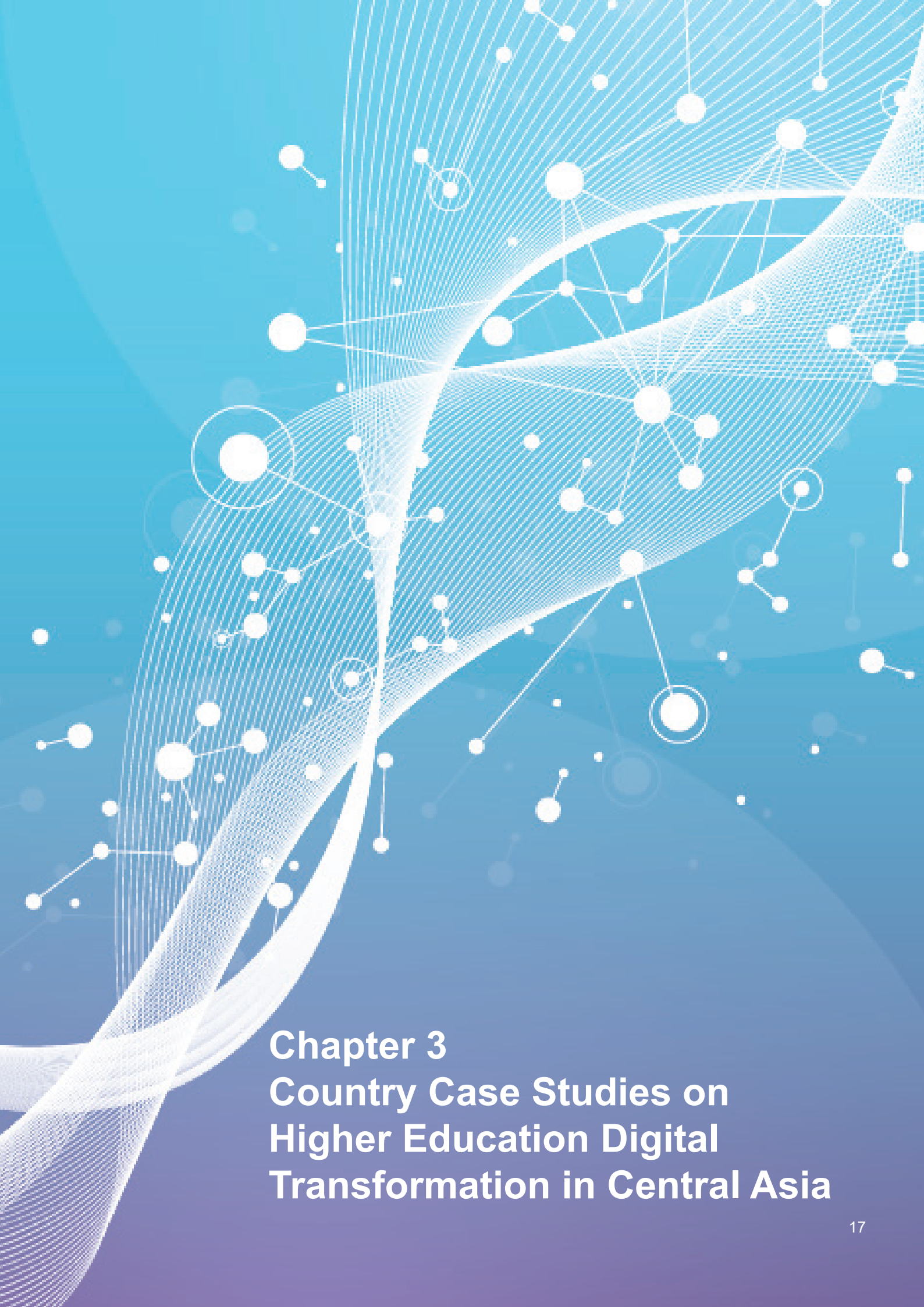
Overall, Central Asian countries regard the development of the digital economy as a strategic priority, with the digital transformation of higher education playing a central role in this process. The leaders of these countries recognize that this is not simply a matter of following global trends, but arises from significant practical needs.

The issues outlined above cannot be addressed in isolation, as they are interrelated, and can only be resolved through a systematic approach:

- Develop multiple forms of education: traditional, remote, and hybrid, as well as university management systems based on modern information technology;

- Develop and implement advanced training programs, using multimedia resources and methods to access domestic and international knowledge databases;

- Produce high-quality electronic teaching materials, which must be certified by authoritative centers and recognized by experts;
- Integration processes and global mobility play a positive role in the digital transformation of higher education. This also concerns integration within domestic universities, as well as close cooperation regionally and with universities in other developed countries. Learning from advanced international experience is of critical importance for guiding higher education and society toward a new stage of development. By building advanced infrastructure and promoting broad and active information exchange among universities, Central Asia can significantly enhance the efficiency of its higher education system and its research potential.



Chapter 3
Country Case Studies on Higher Education Digital Transformation in Central Asia

The digital transformation of higher education in the five Central Asian countries exhibits many similarities, yet differences remain among them.

3.1 Kazakhstan

Digital Reform and Prospects for Higher Education

On December 12, 2017, the Government of Kazakhstan issued Government Decree No. 827, the State Program “Digital Kazakhstan”, initiating the systematic and comprehensive development of a digital ecosystem. The program aims to accelerate Kazakhstan’s economic development, improve the quality of life for the people, and create favorable conditions for the future digital transformation of the economy. The State Program “Digital Kazakhstan” outlines five key directions to accelerate digitalization. Among them, the fourth direction, “Development of Human Capital ”, sets specific targets for the digital transformation of education and the enhancement of citizens’ digital literacy.

Five Key Directions of “Digital Kazakhstan”

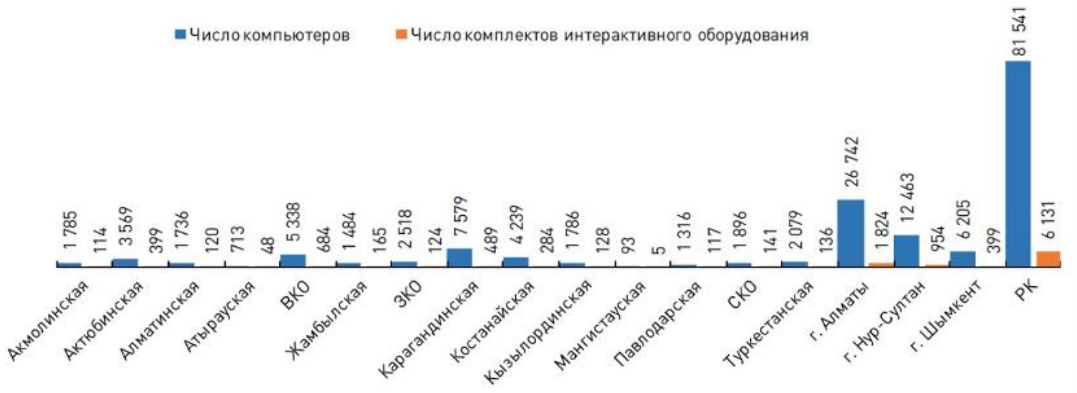
The digital transformation of education is a key prerequisite for building the country’s digital ecosystem, as it determines both the number of graduates with basic IT application skills and the digital literacy of Kazakhstan’s citizens.

Accordingly, equipping educational institutions with digital infrastructure and advancing the digitalization of education is a core objective of the State Programme of Education and Science Development of the Republic of Kazakhstan for 2020–2025 (hereinafter referred to as “the Programme”). To achieve these objectives, the Programme outlines the following initiatives:

- Establish an integrated certification system for formal and non-formal learning outcomes;
- Integrate universities into the “Kazakhstan Open University” platform;
- Further develop digital educational resources and offer Massive Open Online Courses (MOOCs);
- Build digital platforms for the creation, discussion, and review of textbooks, and monitor their online delivery to educational institutions (including complete digitization of textbooks, uploading them to open education platforms, and expanding the number of electronic textbooks);

- Organize annual regional and national competitions with domestic and international companies, leveraging digital skills (e.g., hackathons) to develop IT solutions across industries, and create platforms that can replace traditional job fairs while serving as talent discovery platforms for vocational education students;
- Develop online resources, update research information systems and software licenses, adhere to GLP and GSP international standards certification, and and enhance experts' digital literacy and skills (accredited training);
- Establish an automated system to manage educational processes in vocational education institutions, covering the full student lifecycle from university admission to graduation;
- Transition Kazakhstani universities to knowledge management and digital services aiming to establish a digital education ecosystem;
- Create an interactive online map of educational institutions, providing the public with information about the institutions, resource availability, performance analysis results, unallocated degree places, and online diploma certification, etc.

In 2020, the total number of computers used for educational purposes at Kazakhstani universities increased by 3,318 units compared with 2019 [2020: 81,541 units (see figure below); 2019: 78,223 units], of which 76,350 were connected to the Internet.



Development of Digital Infrastructure in Kazakhstani Universities in 2020

Furthermore, the need for remote learning is likely the main reason for the sharp increase in Internet-connected computers in 2020 (as shown in the figure below).

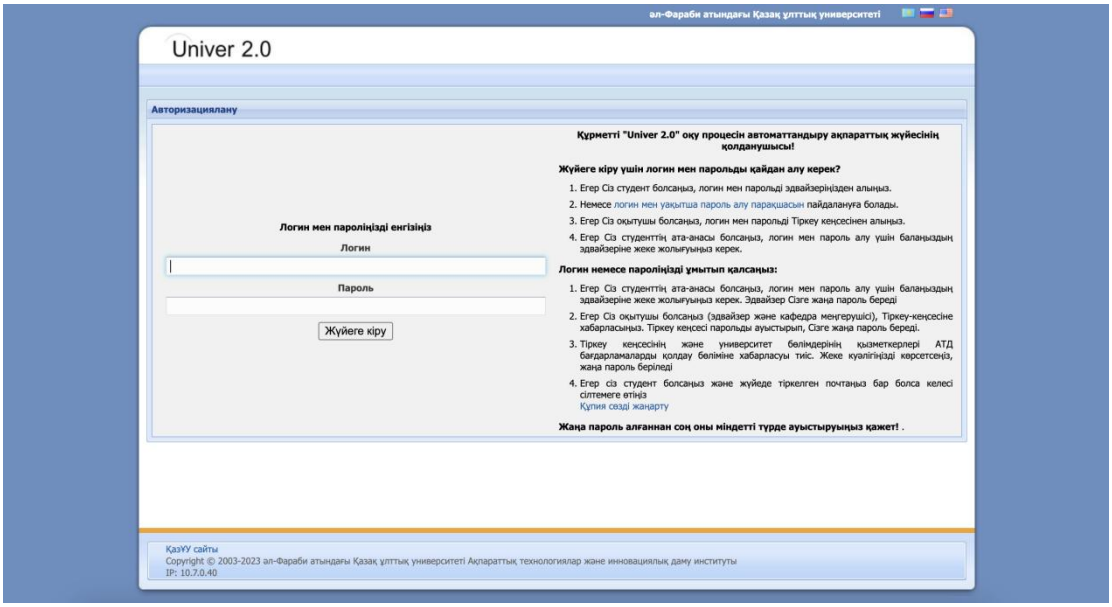
Number of Internet-Connected Computers in Kazakhstani Universities (2016–2020, units)

Although digital information resources had previously received limited attention (despite their slow and gradual development), their importance and quantity increased severalfold due to the large-scale transition to remote learning.

Digital Development Projects in Higher Education

The COVID-19 pandemic prompted three university-based studios to continuously produce video lectures. The number of video-based lectures increased from 700 to 2,000, and the number of learners grew from 400 to 14,000. Except for language courses, all foundational courses have been uploaded to the MOOC platform. According to data from the Bologna Process and the Academic Mobility Center, 33 universities offered 1,430 MOOCs during the pandemic. All universities employing MOOCs have set up multimedia classrooms, with key experts, installation staff, camera operators, programmers, engineers, and other specialists present. Currently, 78 courses on the platform https://mooc.enu.kz/ have successfully passed the internal MOOC review.

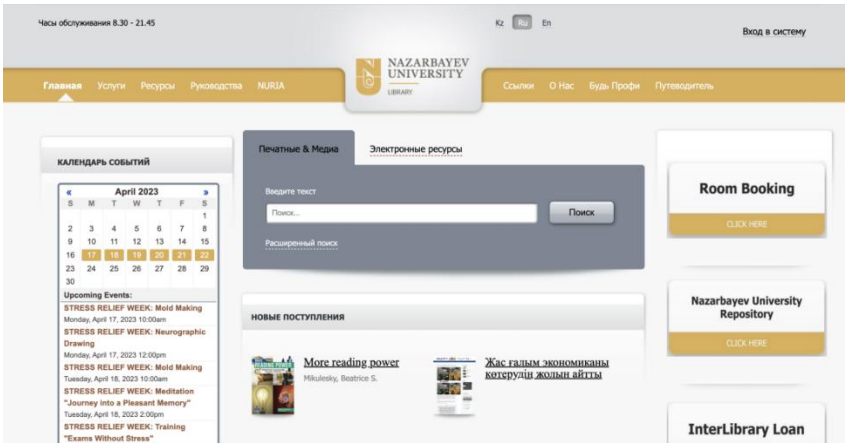
Kazakhstani universities conduct online teaching and professional exchanges primarily through widely used software such as Skype, Zoom, and Google Hangouts, as well as remote learning platforms like Platonus, Moodle, and Univer. These platforms provide access to course schedules, assignments, grades, and other materials. Al-Farabi Kazakh National University has developed its own platform, Univer 2.0, which is integrated with Moodle and facilitates course creation, lecture delivery, assignment distribution, and progress tracking. At the Kazakh University of Humanities and Law, the entire teaching process, including course planning and assessment, is displayed on the Canvas platform. This platform can also integrate with other digital tools, such as Zoom, and utilizes AI, sensors, and cameras to monitor students during examinations.



Univer 2.0 Official Website

Role of the Library

Libraries play a vital role in the development of digital campuses at universities. For example, the Nazarbayev University (NU) Library provides extensive information resources, including educational databases and open-access materials that meet the information needs of university faculty, students, and researchers. In addition, benefiting from partnerships with the University of Wisconsin–Madison, Duke University, the University of Pittsburgh, and the U.S. Library of Congress, the NU Library provides electronic document delivery services. The NU Library portal includes sections such as “Transition to Online Learning”, which includes links to information, tools, resources, and training for remote learning, and “Supporting Online Teaching”, offering information, online textbooks, courses, and educational platforms for teaching and learning. The library has also produced and uploaded videos on its official portal introducing its services and resources to new students and faculty. Furthermore, it has developed subject-specific guides (LibGuides) tailored to the disciplines taught at NU.



Nazarbayev University Library Official Website

The transition to a digital library enables production meetings, training sessions, and other professional activities to be conducted on platforms such as ZOOM and Google Meet. It also supports collaborative discussions with IT specialists via the JIRA platform on the development and modifications of the Integrated Library Automation System (ILAS), as well as oversight of its implementation.

Major Events	New Resource Updates	Electronic File Delivery
Virtual Reference, Virtual Consultation, Virtual Training	Library Collection Update Notification Service	Subject Guides (Library Resources)
Virtual Library Tour	Frequently Asked Questions (FAQ)	Personal Center
Online Catalog	Unified Search Service	Book Purchase Request
Database or E-Journal Title Search(A-to-Z)	Virtual (Video) Orientation Session	Create Group Collaborative Learning
EZProxy Access Authorization	Virtual Library Tips	Virtual Library Tips

Virtual Information and Consultation Services at Nazarbayev University Library

The library maintains the Nazarbayev University Institutional Repository on the DSpace platform, which comprises articles and published works authored by university faculty, students, and researchers. The content is indexed by Google search engine. Specialized training and consultation have been implemented to cultivate students' digital literacy.

Challenges

Despite numerous effective exploratory initiatives in the digital transformation of higher education, many technical, personnel, and organizational issues persist:

- The use of the Platonus system has surged across multiple Kazakhstani universities. Simultaneous access by a large number of users, combined with delayed updates to technical solutions, has led to system overloads and malfunctions.
- The effectiveness of remote education remains low. Persistent issues include inadequate computer hardware, limited network coverage in remote areas, insufficient enforcement of academic integrity standards, low digital literacy among faculty and staff, and students' insufficient basic skills for remote learning.
- Research remains one of the primary activities of universities, yet existing research infrastructure no longer complies with modern development requirements. Kazakhstan lacks a unified national scientific database. The integrated development of educational information technology infrastructure, digital teaching resources, and large-scale open online course (MOOC) platforms remains an urgent task.

During the process of remote learning, teachers and students also identified the following shortcomings:

- Decline in academic performance – according to the results of the spring exams for the 2020–2021 academic year after remote learning under quarantine, actual exam performance in class dropped from 91% to 85%;
- Low access to digital infrastructure – 17% of students did not have a personal laptop or a computer equipped with a webcam and microphone at home; many households had only one computer for three or more children;
- Blurred boundaries between work and rest – teachers' workload increased: they were required not only to deliver lectures and seminars but also to check students' assignments; lesson preparation time increased; in certain subjects requiring students to perform hands-on practical work (such as laboratory experiments), the methods used proved ineffective;
- Inability to ensure students complete assignments independently;
- Lack of personal communication.

Conclusion

The digital revolution is sweeping across all aspects of human life, making it imperative for Kazakhstan to establish digitalization as a national policy and incorporate it into its development plans. The adoption of the State Program “Digital Kazakhstan” marks the beginning of a comprehensive introduction of digital technologies, with priority given to their integration across all levels of the education sector. The government and leadership of Kazakhstan recognize that digitalization can help build a new society with dynamic human capital development. These profound changes across sectors are driven by technological innovation.

As noted in the National Report on the State and Development of the Education System of the Republic of. Kazakhstan (as of 2020), the COVID-19 pandemic served as a catalyst for the digital transformation of higher education, compelling universities to accelerate the development and application of remote learning and digital technologies. Digital infrastructure—centered on the Internet, computer equipment, and software—provides a critical guarantee for citizens’ right to education.

Whether considering an individual educational institution or the education system as a whole, the formation of the digital space is primarily focused on two directions:

- Establish a digital space by creating a repository of normative documents and an inclusive virtual information environment, leveraging digital information resources, digital information platforms, applications, digital teaching models (remote, online, and blended), and virtual information services.
- Instill science, technology, and cultural-education concepts to practitioners in cultural and educational institutions—including students, teachers, researchers, administrators, and librarians—with critical thinking and digital literacy (or digital competence) as the most essential components. Digital competence refers to the knowledge, skills, and capacities needed to live, work, learn, and thrive in an increasingly digital world.

3.2 Kyrgyzstan

Digital Reform and Prospects for Higher Education

In the Resolution the Concept of Digital Transformation “Digital Kyrgyzstan” 2019-2023, Kyrgyzstan outlines key priorities for development in the coming years and is committed to comprehensively advancing national digital transformation. As the President of Kyrgyzstan noted, “digital transformation will open broad prospects for the country, helping to create new employment opportunities and expand access to quality healthcare and educational resources”. The Concept aims to develop approaches—based on the principles of media and information literacy—to promote the advancement of e-learning and digital education management systems across institutional, regional, and national levels. It also seeks to ensure citizens’ access to comprehensive, inclusive, and high-quality

education, safeguard social equity across regions, advance the personalized development of lifelong learning, and make effective use of financial and human resources.

Concept of Digital Transformation for Kyrgyzstan (2019–2023)

The Government of Kyrgyzstan has stated that it will advance 33 digital projects as priority areas for national development, including maximizing the provision of broadband Internet access for social facilities, thereby providing rural areas far from city centers with reliable and affordable network connectivity and data transmission infrastructure.

In addition, the Resolution emphasizes that the education sector is a key domain in the country's digital transformation. In the context of a modern, globalized, and information-driven society, education faces serious challenges and significant difficulties, all of which will profoundly affect the development of students' competencies. Kyrgyzstan also recognizes that the education system is one of the key guarantees for achieving sustainable national development, and that it must ensure high-quality development of education aligned with the requirements of the times.

The Kyrgyz Republic declared 2019 as the Year of Regional Development and Digitalization of the Country, and subsequently proclaimed 2020 as the Year of the Regional Development, Digitalization and Child Support. These initiatives have set clear tasks for education system reform, namely to fully integrate the cultivation of students' ICT literacy into the education process. The following are the priority tasks of education system reform:

- Establish and develop a regulatory framework to support the development of digital learning across all levels and types of education;
- Establish and develop information technology–based education management systems at both national and institutional levels;
- Build methodological and organizational foundations for developing, implementing, and improving digital learning systems across all levels and types of education, within the context of information literacy;

- Develop and expand digital learning infrastructure at national and institutional levels;
- Establish and develop systems for digital skills training, retraining, and professional development for teaching and administrative staff;
- Adapt digital learning to address issues related to inclusive education;
- Enhance the investment appeal of digital learning and related areas.

To implement these plans, the Ministry of Education and Science of the Kyrgyz Republic has set out priority tasks. A primary task is to define the long-term goals for the digitalization of education in the Kyrgyz Republic, including the establishment and implementation of an Education Management Information System (EMIS). To this end, Kyrgyzstan has established databases for the issuance of diplomas, certificates, and licenses. To implement the "Digital Kyrgyzstan 2019–2023" digital transformation concept, universities are actively introducing automated and intelligent learning systems. Processes such as testing, university admissions, and the acquisition of all required certificates and documents have been automated under the "single window" project. Online university admissions in Kyrgyzstan allow secondary school graduates to submit applications electronically, while also enabling the collection, registration, and storage of national testing (university entrance examination) certificates, as well as the automated compilation and assignment of lists of recommended secondary school graduates. At the same time, digital technologies are being widely applied in the education sector, fostering a new generation of practice-oriented professionals to support cross-sector integration across the market (such as "Digital Agriculture," "Digital Economy," and "Digital Public Administration").

The Education Development Program of the Kyrgyz Republic for 2021–2040 sets out solutions to three major tasks and specifies priorities for the digitalization of education: (1) ensuring equitable access; (2) prioritizing quality; and (3) strengthening effective financing and governance.

Digital Development Projects in Higher Education

Domestic and international databases have made significant contributions to the development of digital education. Kyrgyzstan is a member of the International Federation of Library Associations and Institutions (IFLA) and enjoys preferential access to resources such as EBSCO Information Services, Springer, and East View. International educational platforms, including Coursera, Pluralsight, Udacity, edX, Khan Academy, and Codecademy, are also widely used. Leading universities develop their own electronic libraries, databases, and scientific and educational information platforms for higher education. These resources originate from the country's leading library systems, including KRAD, Rarebooks, and the Electronic Digital Library. Within the framework of the international "Tempus" project, the KIRLIBNET network was established to integrate electronic resources from university libraries.

Kyrgyzstan hosts major international and national conferences, academic seminars, and roundtable discussions each year to discuss the application of modern information technologies in education. Among them, the most representative are a series of thematic activities organized by the Kyrgyz-German Institute of Applied Informatics (KGIPI). KGIPI is a university specializing in research in information science and technology. Its mission is to draw on the experience of German higher education institutions and, through the implementation of innovative information technology training programs, expand the development of IT education in Kyrgyzstan. The institute also holds major annual conferences focusing on the development of information and communication technologies, as well as the digital transformation of related fields—particularly in higher education—thereby enhancing participants' understanding of IT-enabled educational innovation. For example, the 2020 conference on "Digital Transformation of Education":

- Promote the concept of digitalization in education and, in line with international market requirements, raise the level of training to a new stage;
- Exchange experiences and discuss key issues in the digital transformation of society, the transformation of education system management in the digital era, and formulate effective strategies for high-quality technological transformation.
- 2021 — Digital Competencies in the Context of "Future Professions" :
- Adjust curricula to align with the digital economy;
- Future digital competencies and professions;
- Use and further develop educational platforms in professional settings to cultivate digital and IT competencies within the educational environment.
- 2022 — "Innovation in IT Education" Conference:
- Integrate IT into educational innovation on the basis of drawing on foreign experience;
- Build online learning software platforms;
- Conduct technological foresight on IT education.

The annual international conference "Libraries and the Democratization of Society" is one of the most important events organized by libraries across Central Asia. It has been held for 20 consecutive years and has attracted widespread attention from representatives in the fields of information technology, education, and the library sector across Central Asia and worldwide.

"Libraries and the Democratization of Society" International Library Conference

Challenges

An analysis of digital development reveals a number of issues, the resolution of which would contribute to the advancement of education as well as broader socio-economic development.

For example, according to the global ICT Development Index, Kyrgyzstan ranked 109th in 2017 out of 176 countries, placing last among CIS countries. Internet penetration in Kyrgyzstan was 34.5%, compared to 65.1% in the CIS, while household Internet penetration stood at 21.4%, compared to 62.1% in the CIS. The Education Development Strategy of the Kyrgyz Republic for 2021–2040 points out that a number of urgent issues remain in higher vocational and graduate education:

- The training of specialists for an "export-oriented," resource-intensive economy with outdated specializations;
- Outdated teaching methods and limited responsiveness among teachers to innovation negatively affect education quality and fail to meet labor market requirements and societal needs;
- Universities lack a solid material and technical foundation and lag behind the pace of modern technological development.

To advance the digital transformation of education, the "Digital Kyrgyzstan" digital transformation concept document identifies several obstacles that require particular attention:

- Limited network access in some educational institutions and underdeveloped IT infrastructure hinder the use of information technologies in teaching and learning;

- A lack of knowledge and skills in the application of digital technologies among teaching staff and administrators significantly weakens students' ability to use digital technologies for learning;
- A shortage of digital learning resources that are aligned with local curricula and freely accessible, and low utilization of computer-based teaching equipment in educational institutions;
- Insufficient support for the Kyrgyz language in digital content limits citizens' access to remote courses delivered in Kyrgyz.

Conclusion

An analysis of the current state of digital transformation in higher education indicates that the active promotion of the application of new-generation information technologies in the teaching process, and ensuring access to knowledge and information resources in higher education management systems, are strategic priorities for Kyrgyzstan and its universities. To this end, the country has formulated national plans and invested substantial financial resources. At the same time, several tasks still require particular attention from government authorities and university leadership:

- Provide training to enhance teachers' digital competencies and in the development of electronic textbooks;
- Ensure access to electronic educational resources made openly available by publishers worldwide, and integrate automated management systems across all levels of the education sector;
- Strengthen the material and technical foundation of universities and skills training institutions, including providing technical support through information and communication systems for classroom teaching and next-generation electronic educational resources.
- Overall, Kyrgyzstan has already created favorable conditions for the large-scale implementation of digitalization projects in higher education.

3.3 Tajikistan

Digital Reform and Prospects for Higher Education

Information and communication technologies are increasingly permeating all sectors of Tajikistan's economy and social life, including the education sector, thereby creating new opportunities to accelerate educational development. The National Development Strategy of the Republic of Tajikistan for the Period Up To 2030 ("NDS 2030") emphasizes that without embedding innovation across all sectors and stages of socio-economic development, the country cannot achieve sustainable development. The driving forces of this growth model must be human capital and its key components—education and science—which constitute the fundamental basis for enhancing national security capacity

and the competitiveness of the national economy. The core principles of this policy area are to comprehensively address human capital development, improve quality of life, and create the necessary preconditions for the development of a knowledge-based economy. On this basis, Tajikistan has defined development priorities, calling for a shift toward innovation-driven growth and highlighting the urgency of advancing the digitalization of education.

The education sector was one of the earliest socio-economic fields in Tajikistan to undergo computerization, reflecting the state's recognition of its priority status in socio-economic development. In this context, the NDS 2030, adopted by the Parliament at the end of 2016, states that human capital is a critical factor in production and economic development, and that its quality is closely linked to the development of all sectors.

The NDS 2030 reflects the main directions for digital transformation in the education and science sectors:

- Advance the information-based development of education and knowledge management; promote computer literacy; and develop and implement computer science education standards across all levels and types of educational institutions;
- Develop human resources in the field of ICT; provide multi-level vocational education in the ICT field, while taking into account labor market needs;
- Reform the regulatory and legal framework to ensure institutional safeguards in the context of the transition to new educational structures;
- Apply distance learning technologies; fully introduce open education systems; establish new knowledge bases and develop specialized electronic libraries based on integrated e-learning systems; organize virtual conferences; and conduct scientific research.

In the digital transformation of higher education, the most critical task is to improve the quality and efficiency of developing highly qualified talent with competitive strengths. In this regard, the application of ICT can serve as a strategic implementation mechanism with significant potential not only to optimize the learning process and ensure learning outcomes, but also to expand access to education and improve management efficiency. In terms of unlocking talent potential, the National Strategy of Education Development of the Republic of Tajikistan till 2020 stipulates that school teachers can use the Internet to access electronic teaching resources and materials, thereby supporting sustainable professional development. The strategy further notes that the application of ICT and distance education teaching methods in skills training programs has increased. On September 28, 2017, the Government of the Republic of Tajikistan approved the Fourth national plan under the State Program for the Introduction of Information and Communication Technologies in Educational Institutions of the Republic of Tajikistan for 2018–2022. The primary objective of this plan is to improve the standards and quality of education in line with international

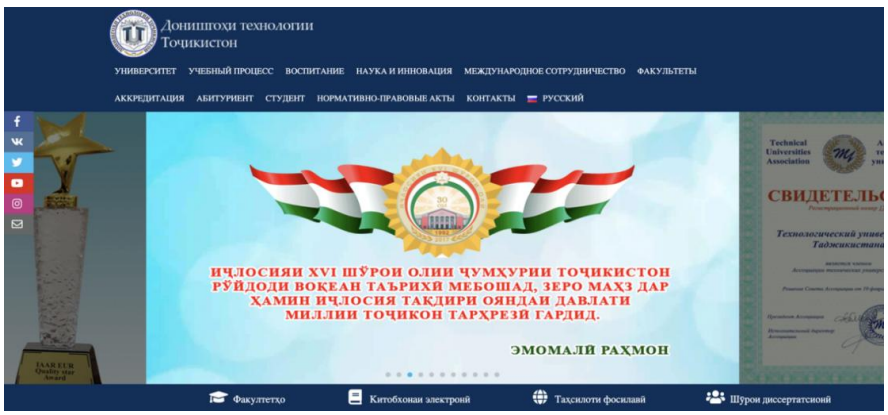
benchmarks, and to develop the modern material and technical base of educational institutions.

State Program for the Introduction of Information and Communication Technologies in Educational Institutions of the Republic of Tajikistan for 2018–2022

Digital Development Projects in Higher Education

Technological University of Tajikistan is a leader in the digital transformation of higher education and has long been engaged in scientific research, as well as development and application-oriented research in this field. The university hosts a Center for Computer and Educational Technologies, whose primary responsibilities include designing and developing automated computer programs for digital education transformation, conducting workshops on new curricula through ICT-based approaches, and organizing short-term standardized professional training.

The university's digital platform is structured into the following independent modules, which are integrated into the tut.tj subdomain within the university's local network, while operating as independent modules:



www.tut.tj

www.tut.tj – This is the university's online information portal, containing statistical information on its organizational units, their established activities, published official documents, as well as information on personnel and achievements.

www.lms.tut.tj – (Learning Management System) This system is used exclusively within the university's internal network and is a local system. It is designed to manage the educational process and to provide dedicated modules for processing and generating results in accordance with the requirements and regulations governing the educational process.

www.ls.tut.tj – This system is used exclusively within the university's internal network and is a local system. Its purpose is to provide secure, authorized access to students' personal accounts. After the examination administrator activates the examination process in accordance with the examination schedule, students log in to the system within a specified time to take the exam. The system is capable of conducting tests and grading simultaneously and presents the final results upon completion of the designated time period.

www.unidoc.tut.tj – This system is used exclusively within the university's internal network and is a local system. Its purpose is to ensure communication between organizational units, monitor the implementation of orders and instructions issued by ministries and other government bodies, ensure communication with other organizations and partners, and monitor the dynamics of implementation processes.

www.acadmobility.tut.tj– This portal is designed as an interactive, dynamic website aimed at promoting academic interaction between students of the university and learners from other domestic and international educational institutions, thereby creating opportunities for scholarly exchange. The portal includes dedicated modules for two-way academic interaction and is capable of processing and outputting required information in accordance with requirements. The system can also provide specified reports to users at designated times.

www.fosilavi.tut.tj– This portal manages and controls the learning process of remote and off-campus education through an interactive model. It includes modules such as personal learning spaces, chat rooms, timetables, academic calendars, electronic libraries, tests, gradebooks, attendance records, video lectures, and training courses supported by methodological materials. The system is built on the popular Moodle platform and was initially designed for educational use.

www.cisco.tut.tj – Online courses of the Cisco Networking Academy at Technological University of Tajikistan.

www.service.tut.tj – This system is a local interactive system composed of three main modules:

- "Requests" module – This module is currently in active use at the Computer Technology and Learning Center;

- “Regular Tasks” module – This module allows administrative and management staff in the center and departments to assign tasks to their subordinates and monitor their implementation in real time;
- “Work Attendance” module – This module was created to monitor employee attendance.

With financial support from the EU Erasmus+ Program, the Computer and Educational Technology Center is actively advancing the implementation of the ELBA project (establishment of a research center in Central Asia and the introduction of courses in intelligent big data analytics). Within the framework of this project, online courses on “Machine Learning,” “Deep Learning,” and “Data Management and Visualization” have been planned. In addition, a dedicated laboratory for the intelligent processing of large volumes of data has been established during the implementation of the project in higher education institutions.

HiEdTec Project (Modernizing Higher Education in Central Asia through New Technologies) places greater emphasis on the application of information technology in teaching a) hosts two open educational resource platforms: “Open Lectures” (http://www.rtsu.tj/ru/learners/otkrytye-lektsii.php), which are freely accessible to all students of the university; “E-Books” (http://www.rtsu.tj/ru/learners/distantsionnoe-obuchenie.php) , which are available to distance learners.

Tajik Technical University (Khujand Branch) actively applies innovative technologies and information and communication technologies in education via the platform http://www.fosilavi.tj. The portal http://lms.tajmedun.tj (supported by Tajik State Medical University) hosts 421 online courses. The educational website of the Examination Center of Tajik State University of Commerce (http://moodle.tguk.tj) includes 190 online courses and 12,619 online examinations. Notably, access to certain electronic educational resources within university e-libraries has distinct local (institutional) characteristics. In 2008, Technological University of Tajikistan established an electronic library (http://elibrary.tut.tj), which is accessible to both faculty and students. Since 2016, the distance learning portal (http://fosilavi.tut.tj) has been in operation at the university. The electronic library (http://elibrary.tut.tj) contains approximately 480,000 volumes, while the distance learning system (http://fosilavi.tut.tj) holds 324 GB of digital resources.

The library of Tajik National University holds one million volumes, including theses and other publications, and provides readers with abundant electronic resources. The electronic library of Tajik Agrarian University contains nearly 9,000 volumes and more than 5,000 online lectures delivered in the Tajik language, all of which can be accessed through the university library’s computer system. Educational resources from universities across Tajikistan are gradually being made freely available on the Internet, becoming open educational resources.

Challenges

Although relevant laws, regulations, and strategic documents have laid a foundation for open educational resources in Tajikistan, regardless of how information is obtained, they cannot fully coordinate the relationships among participants in the education informatization domain. They do not standardize mechanisms governing the exercise of rights by enterprises and citizens, nor do they conform to international practices in the provision of public services to citizens, the development of information resources, and organizational management. In addition, the planning, approval, financing, and supervision of informatization initiatives lack unified regulations, and the fundamental principles of information provision—completeness, timeliness, and reliability—have not been brought under unified supervision.

Conclusion

Currently, the digital transformation of higher education in Tajikistan focuses on three areas: first, the building and development of digital infrastructure for education, namely, the building and development of the digital space; second, the formation and development of digital educational resources and related services, including the digital evaluation of talent development for future needs; and third, the development and application of new models of educational organizational management.

The main components of Tajikistan's higher education digital development strategy include:

- In improving the laws and regulations related to the digitalization of higher education in Tajikistan, it is also necessary to comply with relevant provisions and requirements of international law;
- Digital technology serves as the foundation for the digital development of higher education institutions;
- Digital teaching refers to maximizing the potential of digital technologies to advance the digital transformation of the teaching workforce in higher education institutions;
- Digital learning refers to maximizing the potential of digital technologies in the learning process to enhance the digital literacy and skills of talent;
- Digital scientific research refers to the digitalization of research activities involving all faculty members as well as undergraduate, master's and doctoral students;
- The digital campus underpins the building and development of digital infrastructure;
- Stakeholders in digital transformation refer to universities that, by strengthening communication and seeking cooperation opportunities, maximize benefits through partnerships with other institutions.

3.4 Turkmenistan

Digital Reform and Prospects for Higher Education

Drawing on leading innovations in digital information technology both domestically and internationally, reforming the national education system in phases is one of the priorities of Turkmenistan's state policy. In 2017, Turkmenistan adopted the Concept for the Development of the Digital Education System in Turkmenistan, along with its implementation plan. The primary objective of the Concept is to fundamentally improve the operations of educational institutions, provide high-quality digital information for all levels of education, promote the widespread use of digital resources to improve the educational standards of educational institutions and support the advancement of quality to world standards.

Image source: turkmenistan.gov.tm

The digital transformation of higher education is both a process of the digitalization of information and a process in which teaching organization and management in universities, as well as across the entire higher education system, are optimized. The Concept for the Development of the Digital Economy of Turkmenistan (2019–2025) aims to further promote the development of education and science and accelerate the diversification of the national economy. In this process, the digitalization of education, particularly higher education, plays a significant role. The Concept also aims to build a national education system aligned with the innovation levels of the world's leading scientific and educational centers.

A data center is a data infrastructure that integrates three core elements: data storage and processing, network equipment and server systems, and network connectivity. The implementation of data center construction projects will provide local governments and sectoral authorities with opportunities to deliver services. Currently, Turkmenistan has provided the necessary infrastructure to support the digital transformation of the economy and the digital development of education. Universities in Turkmenistan have developed

digital education portals based on web-based applications. These portals provide many materials for students' self-directed learning, including audio, video, and text materials, as well as academic conference publications.

Higher education institutions in Turkmenistan make use of digital education technologies not only to offer distance learning courses and hold video conferences, but also to offer introductory courses on the application of digital and multimedia technologies in teaching and learning. Short-term specialized computer-related training has effectively enhanced teachers' digital literacy. For example, Magtymguly Turkmen State University offers advanced training courses for university faculty and secondary school subject teachers. Most teaching staff are proficient in office software applications and multimedia production software, and they also exchange experience in ICT. Since the 2020–2021 academic year, a specialized course in the field of the digital economy has been introduced for students.

Planning and Projects for the Digital Development of Higher Education

Magtymguly Turkmen State University has long been committed to improving its teaching plans and programs in accordance with national concepts and plans, including the Concept for the Development of the Digital Education System of Turkmenistan, the Concept for the Development of the Digital Economy of Turkmenistan for 2019–2025, the Concept for Improving Foreign Language Teaching in Turkmenistan, and the Concept on Improving the Teaching of Natural and Exact Sciences in Turkmenistan, all approved by resolutions of the President of Turkmenistan. Based on network technology, the university's Moodle teaching platform provides software for academic assessment as well as information resources for managing electronic teaching materials and classroom video recordings. These contribute to the automation of the teaching process and improve the efficiency of learning and the training of future professionals. Connecting universities to high-speed internet creates significant opportunities for the digitalization of education, the organization of distance learning, holding teleconferences, and the delivery of video courses.

In accordance with the Concept for the Development of the Digital Education System of Turkmenistan, experts, faculty, and students at the Yagshigeldi Kakayev International University of Oil and Gas have established an internal network, developed network software, and, building on this, created a digital education portal. All higher education institutions in Turkmenistan have established similar portals, with opportunities to share educational resources.

A joint project implemented by the Academy of Civil Service under the President of Turkmenistan, the United Nations Development Programme (UNDP), the European Union, and the Academy of Public Administration under the President of the Republic of Belarus is one of the most effective initiatives. Within the framework of this program, a Master's program in Digital Management was launched, with the aim of training more high-level

professionals for government agencies in the fields of management, law, and information and communication technologies for state organs.

Image source: DAI official website

Pursuant to a decree signed by the Head of State of Turkmenistan, an Innovation Information Center under the Ministry of Education was established, and the Concept for Improving the Teaching of Natural and Exact Sciences in Turkmenistan was formulated. This Concept specifies the application of digital technologies and ICT-based teaching methods, for example, the introduction of advanced pedagogical approaches and instructional technologies in educational activities. At present, educational institutions at all levels across Turkmenistan are equipped with computers, multimedia facilities, laboratories, and language lab facilities, and full internet coverage has been achieved. All first-grade students in Turkmenistan are provided with netbooks (learning devices distributed on behalf of the President). To actively support innovation-driven transformation, a series of specialized courses has also been introduced, including programs aimed at developing university teachers' digital competencies in building and using the Moodle platform, thereby expanding access to electronic educational resources via digital means.

Challenges

To integrate digital technologies into all aspects of the national economy, society, and culture, it is necessary to strengthen the material and technical foundations of all institutions and organizations. The comprehensive improvement of soft capacities requires enhancing the professional expertise of personnel engaged in digital technology development and those with advanced vocational skills. Measures are also needed to enhance the digital literacy of the entire population, enabling people to gradually adapt to the digital era.

Restricted access to foreign library resources is another issue that warrants special attention. Although the necessary information can be obtained via the internet, Turkmenistan has yet to become part of regional and even global library networks; these library platforms are essential for the retrieval and utilization of information resources. Access to global resources remains limited, and foreign language proficiency remains insufficient.

Advanced technologies require the training of highly qualified personnel; however, the country continues to face a shortage of high-level IT professionals. Funding is primarily directed toward the establishment of IT centers in Ashgabat and the provinces. Against the backdrop of the wave of large-scale national reforms and the concept of economic digitalization, it is necessary to strengthen the integration of industry, education, and research. To this end, new degree programs should be introduced in universities in Turkmenistan, and teaching methods in key fields such as engineering and technology should be improved.

Conclusion

The President of Turkmenistan has approved a program for the development of the digital education system, aimed at improving the efficiency of talent cultivation, creating a digital educational environment, ensuring sufficient access to electronic teaching resources, mobilizing the intellectual potential of all sectors of society, and improving teaching methods for professional practice in accordance with international standards. Although certain challenges remain—particularly in skills development and training in ICT, access to global information resources, and the development of technical infrastructure—overall, Turkmenistan has made significant progress in the digital transformation of higher education and in the application of advanced technologies in this field.

3.5 Uzbekistan

Digital Reform and Prospects for Higher Education

In recent years, the development of the digital economy has attracted considerable attention as a key mechanism for Uzbekistan's advancement toward developed-country status. Various sectors are actively taking steps to introduce modern information and communication technologies (ICT), with primary focus on public administration, education, healthcare, and agriculture. Over 220 major projects are underway nationwide to enhance the e-government system, further develop domestic software products and the information technology market, and establish information technology parks in various regions. As an effective mechanism for cultivating qualified personnel, the digital transformation of higher education also merits careful attention.

The Digital Uzbekistan 2030 Strategy sets out the main tasks for the development of education, particularly higher education. To this end, Uzbekistan is establishing new universities and IT parks, implementing skills upgrading and retraining programs, and attracting highly qualified foreign professionals. In the past five years alone, more than 60 universities have been established, with information technology and its applications across various fields forming the core content of academic programs.


НОВЫЙ
УЗБЕКИСТАН
СПЕЦИАЛЬНЫЙ ВЫПУСК, ПОСВЯЩЕННЫЙ 30-ЛЕТИЮ НЕЗАВИСИМОСТИ РЕСПУБЛИКИ УЗБЕКИСТАН
ЭКОНОМИКА
Узбекистан 2.0:
на пути к развитому
цифровому обществу
Современным Узбекистаном взят курс на обновление и качественные преобразования. И во многом, как отмечает руководство страны, успех этой деятельности зависит от масштаба цифровых реформ.
Задачи по развитию мобильной связи на ближайшие два года
Телекоммуникационный фундамент
Нормативно-правовой фундамент
26

A special issue of the Russian journal Budget, titled New Uzbekistan, highlights the achievements of the Uzbek government in the field of digitalization

In 2011, with the support of Huawei Technologies Co., Ltd. (China) and JSC Uzbektelecom, a major higher education investment project was completed, which established the National Distance Education System of Uzbekistan. This undoubtedly marked one of the most significant steps in accelerating the digital transformation of higher education in the country. As a result of this project, 84 higher education institutions gained access to the national distance education system, with connection speeds reaching 1 Gbps. Universities across Uzbekistan have also been equipped with multimedia classrooms. At the same time, the system has helped address several key tasks, including digital transformation, conducting teaching activities, and data exchange:

- Organize various activities remotely using audio and video conferencing methods, and recording these sessions for further educational or research use;
- Conduct comprehensive teleconferences at the national level with foreign universities and educational institutions;
- Upload information resources developed by higher education institutions, online projects (websites, portals, social networks), and virtual laboratories, and opening channels for faculty and students to access these resources;
- Deliver remote training programs for professional skills development, as well as training courses for institutional administrative personnel.

To establish a unified computer information network system, bringing together all higher education institutions in Uzbekistan, the country adopted the Resolution on Establishing a Distance Education Center under the Ministry of Higher and Secondary Specialized Education of the Republic of Uzbekistan. The center is intended to establish a unified organizational framework to ensure the provision of electronic educational resources and library information services, including open educational resources, and to support the educational information systems of secondary specialized and higher education institutions.

The main tasks of the center are:

- Administer the national “Electronic Education” network;
- Implement projects in higher and secondary specialized education institutions that organize teaching and research using ICT, including distance learning and videoconferencing methods;
- Provide higher and secondary specialized education institutions with access services to the ICT-enabled educational resources of the national “Electronic Education” network;
- Establish unified requirements for electronic methodological and other educational resources created within higher and secondary specialized education institutions and included in the national “Electronic Education” network.
- Conduct specialized skills training courses for teachers in secondary and higher vocational education to enhance their ability to apply information and communication technologies and open educational resources in the teaching process.
- In 2016, Uzbekistan issued the National Youth Policy, which emphasized the necessity of compiling and widely introducing a new generation of educational materials, as well as providing higher education institutions with modern educational resources, teaching aids, as well as to provide higher education institutions with modern educational resources, teaching methods, and scientific literature. This includes regularly updating the funding of information and resource centers to acquire and translate the latest foreign publications.

Digital Development Projects in Higher Education

On April 11, 2017, the World Bank and the Government of Uzbekistan signed a USD 42.2 million loan agreement to support the modernization reform project of the Uzbek higher education system. This project aims to enhance the governance capacity and level of higher education, align it with labor market demands, and improve university operating conditions. Although the project’s direct goal is to advance the digitalization of higher education, it also includes tasks such as developing university information management systems, promoting distance education, and improving teaching conditions in universities. With the support of the World Bank, an integrated electronic information system—the Higher Education Management Information System (HEMIS)—was established. The system includes databases of students from public, private, and international universities in Uzbekistan, tracking student attendance and academic performance. It also covers databases of teaching staff, electronic resources, academic courses, educational content, and mechanisms for monitoring and managing educational tasks and their assessment. Further development of HEMIS will provide functionalities for creating and accessing educational resources online, monitoring and ensuring task completion, and administering knowledge assessments.

Universities in Uzbekistan participate in international education programs such as the TEMPUS and ERASMUS+ projects, which have significantly accelerated the integration of

information technology into higher education. Research on the European Union's experience with higher education digital transformation has greatly promoted the practical application of distance education systems. Many projects actively use the MOODLE platform in MOOCs to provide remote access to learning resources. At the same time, hundreds or even thousands of electronic teaching materials have been developed.

Since 2001, Uzbekistan has been a member of the Electronic Information for Libraries (EIFL, www.eifl.net) consortium, allowing Uzbek universities to access valuable databases from leading international publishers such as Springer Nature, EBSCO Information Services, and ProQuest at affordable prices. One of the consortium's initiatives is the Open Access (OA) project. Thanks to this project, as a full EIFL member, Uzbekistan can freely access numerous journals and databases from major academic publishers, including Oxford University Press, EBSCO Publishing, SAGE, Taylor & Francis Journals, ASTM International, and Cambridge University Press. The right to use open resources provides a unique opportunity for EIFL member libraries in Uzbekistan—which include 83 university and research institution libraries—to create their own electronic educational resources in areas where knowledge is limited. Moreover, under the Open Access project, university faculty, PhD students, and researchers can participate in webinars on utilizing open access resources, publishing scholarly articles in open access journals, and building personal knowledge repositories. The ZiyoNet public education information network, implemented under the initiative of the Uzbek government, is among the most representative projects. It facilitates the integration of education and distance learning methods and provides broad information and communication services to students and young people throughout Uzbekistan.

ZiyoNet

The main objectives of the “ZiyoNet” Public Education Information Network are as follows:

- Develop and build national information resources for young people to enhance patriotic education, strengthen their love for the homeland, and cultivate noble moral qualities grounded in an understanding of Uzbekistan’s rich history, national traditions, and spiritual values. Foster harmonious personalities with a positive life attitude;
- Ensure, in line with Uzbekistan’s national interests, broad access to information that supports intellectual and spiritual growth among youth, including content on socio-political and economic matters, analytical insights, spiritual enlightenment, and educational sciences;
- Promote healthy lifestyles among young people and encourage participation in various sports;
- Facilitate the integration of distance learning methods into the education system, providing Uzbek youth with comprehensive ICT services.

Higher Education Digital Transformation Conferences

Uzbekistan has hosted numerous conferences related to higher education development. The country’s most important annual event is the international forum “Access To Scientific Information And Publication Activity”, held annually since 2017. The forum primarily discusses the digital transformation of higher education and how to use modern information technologies to improve the efficiency of information services in educational research. The conference “Perspectives of Higher Education Development in Uzbekistan” conference serves as the annual review meeting for Higher Education Reform Experts (HEREs). Its purpose is to enhance the effectiveness of innovative approaches in higher education by enabling university faculty, students, and researchers to gain insights from the best practices of EU countries and Uzbekistan, and to summarize the HEREs’ work over the past year.

The significance of these events cannot be overstated. They not only provide faculty, doctoral candidates, and undergraduates with critical knowledge of digital technologies and advanced teaching methods, but also serve as a key guide for adopting global best practices to advance the digital transformation and strategic development of higher education.

Education Centers and IT Industry Parks

Tashkent University of Information Technologies (TUIT) is a leading institution for training professionals in digital technologies and is actively pursuing several major initiatives, notably including the digital transformation of higher education. For example, under the Memorandum of Understanding between the governments of Uzbekistan and Japan (2019), TUIT established an Educational Converged Media Center. The purpose of this center is to develop digital education through fully integrating education with practical

work and active university involvement, and to establish a talent pool of highly skilled specialists in television technology, thereby expanding employment opportunities.

The main tasks of the center are:

- Integrate advanced higher education standards into the educational process based on international experience; apply the latest technologies within the education system; and develop students' theoretical knowledge and practical skills;
- Actively promote real-time interaction between educational and production activities; conduct skill-enhancement and short-term specialized courses in media production;
- Conduct educational activities to enhance media literacy among administrative staff and faculty in Uzbekistan's higher and secondary specialized educational institutions;
- Provide selective training for faculty, staff, and students of universities, their branches, and secondary vocational institutions, and offer opportunities for in-depth study of media and television production technologies;
- Offer various forms of distance education;
- Develop interactive media resources and video courses.

Additionally, the university has established a Teacher Development Center, which offers specialized IT courses for higher education faculty teaching subjects related to the application of information technology. Notably, these courses cover multimedia production, developing instructional guides and materials, and innovative methods for organizing and conducting teaching activities with advanced technologies.

Over the past five years, Uzbekistan has developed close collaborations with numerous countries worldwide, jointly developing digital technologies and establishing new joint ventures, higher education institutions, and training centers. Notably, the Software and Information Technology Industry Park (IT-Park) was established in 2019 to foster globally competitive software development and establish an ICT outsourcing cluster in Uzbekistan. This project was initiated following the Uzbek President's visit to India in 2018, after which both countries agreed to expand IT sector cooperation. The IT-Park also houses the IT Industry Academy, providing training in digital technologies. One of its main initiatives, the "One Million Programmers" project, offers programming courses and develops information systems across various sectors, including education (https://it-park.uz). Numerous similar IT parks have been set up in regional centers throughout Uzbekistan. For instance, in 2020, an IT park was established in the Khorezm region, known for producing top-tier programmers. The Uzbek government also plans to establish IT park branches in Bukhara, Namangan, Samarkand, and Gulistan.

Challenges

The main challenges faced by Uzbek higher education institutions and the government in the digital development of higher education are as follows:

- Universities and newly established IT development centers still lack sufficient highly qualified personnel. The IT sector undergoes changes every year, and even minor changes require leveraging global experience, acquiring foreign language skills, and accessing valuable information resources from international publishers;
- Although Uzbek universities have gained access in recent years to foreign electronic resources such as EBSCO, Elsevier, and Springer, there are still challenges in effective utilization. Statistics show that only 30% of universities actively use databases from global publishers and content aggregators. Furthermore, there is a lack of training programs that simultaneously target university faculty, doctoral candidates, and undergraduates;
- To date, no effective material incentive mechanisms have been established to support the development of high-quality online courses on platforms such as MOOCs, Zoom, or Camtasia. In most cases, course development, presentation, instructional planning, and monitoring of student assignment completion rely heavily on the initiative and creativity of individual instructors. Although the Higher Education Management Information System (HEMIS) continues to expand robustly, challenges remain in its practical use and in mastering its software and program-related technical skills.

Conclusion

As the analysis shows, Uzbekistan has made significant progress in the digital transformation of higher education:

- To improve university rankings, fostering healthy competition is essential. At the same time, the application of next-generation information and communication technologies is crucial for domestic university performance evaluations and for achieving better outcomes in internationalization assessments;
- Large-scale IT industrial park projects have accelerated the adoption of advanced technologies in education. In addition, the establishment of Uzbekistan’s independent software ecosystem and its adaptation to the local operational environment have been prioritized;
- The implementation of higher education information provision initiatives—such as joining the Electronic Information for Libraries (EIFL) network, subscribing to resources from global publishers (Springer, EBSCO, etc.), and developing the “ZiyoNet” public education information network—has continuously enhanced the efficiency of knowledge acquisition and accelerated Uzbek universities’ integration into the global information space.

As noted, there are still issues that need to be addressed at both the institutional level and within universities themselves. These issues include bureaucratic procedures, the development of high-quality personnel, faculty training in the field of ICT, the effective use of global electronic information resources, the effective use of global electronic information

resources, the cultivation of awareness of copyright protection, and the efficient implementation of teaching processes. As the analysis shows, not all universities are yet fully prepared for comprehensive digital transformation. The transition to remote education, along with the staffing of faculty and leadership, will take time, as these individuals bear the responsibility of driving the deep integration of advanced technologies with higher education. Nonetheless, strategic planning by national authorities at all levels—through initiatives such as the strategy “Digital Uzbekistan”, which prioritizes both economic and educational digitalization—has been established, and these issues are expected to be gradually resolved.

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