

EFFECTS OF ARTİFİCİAL İNTELLİGENCE APPLİCATIONS ON SOCİO-ECONOMIC DEVELOPMENT: THE CASE OF UZBEKİSTAN

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Abstract

Artificial intelligence has become one of the most important agenda items in the development of modern societies and digital transformation processes. The leading position of artificial intelligence among today's technologies and the advantages it provides to societies are undeniable. AI has become so deeply integrated into every aspect of our lives that it is reshaping the world by creating profound impacts in both the public and private sectors. In this context, AI-based competition among countries is rapidly increasing, and many nations are implementing AI-supported projects and applications. Uzbekistan, one of the countries effectively utilizing artificial intelligence in both the public and private sectors, has undertaken comprehensive reforms in all areas, particularly following the election of Shavkat Mirziyoyev as President in 2016. This reform process has paved the way for significant progress in the field of technology. In order to keep pace with global AI developments and integrate into innovations in this field, Uzbekistan is implementing AI-based applications and strategies across both public and private sectors. In this regard, the "Digital Uzbekistan 2030 Strategy," prepared in 2021, serves as a roadmap highlighting the country's goals in the field of artificial intelligence. The strategy aims to enhance Uzbekistan's capacity for domestic technology production and to ensure the widespread and effective use of these technologies across the economy. The Digital Uzbekistan 2030 Strategy focuses on priority areas such as strengthening digital infrastructure, expanding e-government applications, building a digital economy, developing the national digital technology market, and ensuring accessible education for all.

Keyword: Artificial Intelligence, Uzbekistan, Socio-Economic Development

1. Introduction

In recent years, Uzbekistan has become one of the countries attracting attention by focusing on technological investments and digital transformation. By transforming artificial intelligence into a national-level strategy, the country has set critical goals such as strengthening the digital economy and gaining a competitive advantage in the international arena. Uzbekistan's National Artificial Intelligence Strategy aims to accelerate the development of AI technologies, cultivate a qualified workforce, and integrate these technologies into economic development. The country's efforts within the digitalization process are based on foundations that date back many years. Since the 2000s, Uzbekistan has prioritized the development of information and communication technologies and has implemented strategic documents such as the "2013–2020 National Program for the Development and Integration of Information and Communication Systems." In addition, the "2017–2021 Action Strategy on Five Priority Areas of Development" and the "2022–2026 New Uzbekistan Development Strategy" have ensured the continuity of this vision. A significant step in the field of artificial intelligence was taken with the "Digital Uzbekistan 2030 Strategy," published on February 17, 2021. This strategy emphasizes the importance of AI technologies while identifying key focus areas such as strengthening digital infrastructure, expanding e-governance applications, developing the digital economy, advancing the national digital technology market, and promoting comprehensive education and training processes. This study examines Uzbekistan's national artificial intelligence strategy in detail.

2. Artificial Intelligence and Digital Transformation in Uzbekistan

In general, artificial intelligence is defined both as a subfield of computer science and as a modern communication technology; therefore, it has become a subject of research across various fields and disciplines (Kavut, 2022a: 80). Artificial intelligence (AI) is considered a branch of computer science that focuses on intelligent behaviors such as perception, learning, acting in complex situations, and communication, while also representing a new form of communication technology. In addition, it encompasses efforts to develop computers and robots capable of mimicking human-like cognitive processes, such as establishing causal relationships and self-verification (Kavut, 2022b: 69). AI also emerges as a communication technology that enables the development of machines and robots capable of exhibiting human-like behaviors (Kavut, 2022c: 76).

Uzbekistan's national artificial intelligence strategy aims to promote the rapid adoption of digital technologies across the country. In this context, the policies and investment programs developed seek to expand the use and prevalence of AI applications. One of the most important initial

steps of the strategy is the establishment of an infrastructure suitable for the development of AI technologies (Khakimov, 2022). Accordingly, priority is given to encouraging the expansion of broadband internet, establishing data centers, and developing high-capacity computing systems. The need for large-scale data and strong IT infrastructure for the efficient operation of AI algorithms has driven Uzbekistan to make significant investments in this field (Uzdaily, 2022). The country's strategy envisions the application of AI technologies across many sectors, including urban management, healthcare, education, and agriculture. In particular, within the scope of smart city projects, the active use of AI in critical areas such as transportation, energy management, and public safety is among the top priorities. Another fundamental element of the strategy is accelerating the digitalization of public services (GlobalCIO, 2023). In this regard, Uzbekistan aims to provide citizens with the ability to interact with public institutions quickly and conveniently through online platforms via e-government solutions. Among the country's long-term plans is the full digitalization of all public services by 2030. This initiative aims to reduce bureaucracy, increase transparency, and prevent corruption (Demircioğlu, 2024).

3. The Effects of Artificial Intelligence on Uzbekistan's Economy

One of the primary objectives of the artificial intelligence strategy is to support national economic growth. In Uzbekistan, the application of AI technologies across various sectors such as manufacturing, services, and agriculture is expected to accelerate the economic development process by increasing efficiency (Erdoğan, 2024:402). These technologies play a key role in the country's industrial transformation. Particularly in the industrial sector, the widespread use of robotics and automation systems has the potential to optimize production processes while reducing costs (Avazov, 2024). In agriculture, AI-based data analysis not only increases productivity but also enables more efficient management of water resources (Shermukhamedov et al., 2024: 1077–1079). Moreover, the widespread adoption of AI is expected to create new job opportunities in Uzbekistan. Opportunities in fields such as data science, machine learning, and algorithm development will provide innovative career paths, especially for the younger workforce (Khakimov, 2022).

In line with its AI strategy, Uzbekistan aims to establish a local AI ecosystem and foster a culture of entrepreneurship. In this context, supporting technology-oriented startups, implementing AI projects, and encouraging young entrepreneurs will strengthen the country's technological innovation infrastructure (Shermukhamedov et. al., 2024: 1077–1079). Providing financial support to local initiatives and enabling them to expand into global markets are among the key elements of the strategy. Through investments in innovative projects, Uzbekistan seeks to increase the global visibility of its entrepreneurs and encourage them to develop AI-based solutions. The Digital

Uzbekistan 2030 Strategy also aims to support the country's digital economy and create an innovation-driven entrepreneurial ecosystem (Global CIO, 2023). In line with this strategy, various programs are planned to support technology startups and promote new business models. Innovation centers will provide both financial and technical support to young entrepreneurs, accelerating the development of AI projects. This wave of digitalization is considered a transformative step with the potential to reshape Uzbekistan's economic structure. The establishment of technology and innovation centers across the country aims to create an ideal environment where digital entrepreneurs can turn their ideas into reality. In particular, financing programs and tax incentives designed for small and medium-sized enterprises (SMEs) operating in the digital sector aim to support their growth. Additionally, investments in financial technologies will promote the expansion of digital payment systems and create a suitable infrastructure for fintech startups. (OECD, 2023). This comprehensive approach represents a significant step toward shaping Uzbekistan's digital future.

4. Social Impacts of Artificial Intelligence in Uzbekistan

It is possible to state that artificial intelligence has significant effects on education, employment, and social inequality in Uzbekistan. Under the leadership of Shavkat Mirziyoyev, the country has been hosting a series of important initiatives aimed at accelerating the development of AI and increasing youth participation in this field. At an international AI forum, the President proposed declaring November as “Youth Artificial Intelligence Month,” suggesting the organization of various competitions, workshops, and projects for students, young scientists, and programmers throughout this period. In addition, an AI entrepreneurship competition targeting primary and secondary school students is being planned. Schools that achieve success in the competition will receive special funding for the establishment of modern AI laboratories. This initiative aims to foster technological thinking from an early age. Another major initiative introduced at the forum is the “5 Million AI Leaders” project, which seeks to encourage young people's interest in science and technology while supporting talented individuals (Zarqarayeva, 2025).

Uzbekistan has made notable progress in AI education and research. The number of higher education institutions offering AI courses has increased significantly—from just four a few years ago to sixteen today. Doctoral programs in artificial intelligence are also becoming more widespread. However, there remains a significant skills gap that hinders the large-scale implementation of AI technologies in both the public and private sectors. As of 2023, Uzbekistan ranks 70th out of 134 countries in terms of AI research output, placing it at a mid-level position globally. To strengthen its AI ecosystem, Uzbekistan needs to enhance collaboration between industry, academia, and research institutions, as well as improve funding and infrastructure for research. Expanding AI education on a broader scale is also crucial for increasing innovation capacity and competitiveness (UNDP, 2025).

By 2030, it is planned that 4.75 million students, 150,000 teachers, and 100,000 public officials will benefit from specialized AI training programs. As part of major technological cooperation efforts, Uzbekistan aims to collaborate with NVIDIA to establish a supercomputing cluster focused on artificial intelligence. Furthermore, a National Technology Transfer Office is planned to be established in Silicon Valley, and AI projects are expected to be gradually implemented within the “Future Center.” These initiatives are anticipated to make significant contributions to building a digital economy based on modern technologies and fostering a knowledge-based society in Uzbekistan (Zarqarayeva, 2025).

It is also possible to argue that artificial intelligence applications have significant effects on employment. The impact of AI on employment can be evaluated from two perspectives. First, the replacement of manual labor through automation may increase unemployment, pushing individuals to seek new job opportunities. On the other hand, despite the transformative nature of technology, people tend to shift toward different areas of employment to meet the demand for new products and services, thereby paving the way for the emergence of new sectors and professions. As technological innovations reshape the balance between supply and demand, the labor market must adapt to these changes. In this respect, the impact of AI on employment has both positive and negative dimensions, and it is expected to transform the labor market on a broad scale (Tekin and Demirel, 2024).

Artificial intelligence has become a powerful and transformative force in today’s digital age, revolutionizing industries, increasing efficiency, and creating new opportunities across various sectors. However, the rapid advancement and widespread adoption of AI technologies have also raised legitimate concerns about their potential to deepen inequalities. The relationship between AI and inequality brings critical issues to the forefront, particularly regarding access to resources, opportunities, and the balance of power within society. While AI has the potential to stimulate economic growth, create new employment opportunities, and provide significant advantages to businesses, it can also improve quality of life through innovations in healthcare, education, finance, and other sectors, as well as help address complex social challenges (Autor et al., 2023). Nevertheless, these positive effects are not distributed equally across society. AI applications carry the risk of exacerbating existing inequalities, and concerns in this regard are steadily increasing. One of the most debated aspects of AI is its potential negative impact on employment. As the automation of routine tasks and the transformation of skill requirements reshape working practices, labor markets may face increasing risks of unemployment and polarization. This situation is particularly concerning for low-skilled workers, who may struggle to adapt to the evolving demands of the digital economy. Consequently, income inequality may widen, undermining social justice. Moreover, the concentration of wealth and influence generated by artificial intelligence in the hands of a limited number of large

technology companies raises serious concerns regarding fairness, accountability, and democratic governance. These challenges make it necessary to reassess social balances and decision-making processes in the age of artificial intelligence (Kong et al., 2023).

5. Challenges in the Development and Implementation of Artificial Intelligence in Uzbekistan

The challenges encountered in the development and implementation of artificial intelligence in Uzbekistan can be categorized as infrastructure deficiencies, a lack of qualified human resources, and regulatory and ethical issues. One of the most significant obstacles to AI development efforts in the country is the inadequacy of advanced computing infrastructure. Although there has been a noticeable increase in data center capacity in recent years, Uzbekistan still lacks the supercomputing capabilities required for advanced AI training and research. To address this gap, strategic investments are being implemented, such as partnerships with companies like Data Volt to establish green technology-focused AI data centers. In addition, government initiatives to establish supercomputing laboratories at various universities aim to mitigate these shortcomings. However, limitations in data accessibility persist. While open data initiatives have expanded in recent years, many datasets remain insufficient, and existing data sources often lack the analytical tools necessary to unlock their full potential. To improve this situation, the Ministry of Digital Technologies has initiated efforts to develop a data lake for collecting large volumes of raw data and plans to implement 100 priority AI models (UNDP, 2025).

A recent analytical report published by the Microsoft Economy Institute reveals that Uzbekistan possesses significant yet underutilized potential in the field of artificial intelligence. According to the findings, the country is still at an early stage in integrating AI technologies. The current state of digital and energy infrastructure stands out as a major barrier, while the adoption rate of AI technologies in Uzbekistan is reported to be only 5.7%, indicating limited widespread use. The report highlights that Uzbekistan is not yet among the countries where AI is actively utilized across key sectors such as the economy, education system, and public administration. It also outlines priority areas necessary to unlock the country's potential. First, expanding data transmission infrastructure and increasing computational capacity are recommended. Second, the development of language models adapted to Uzbek and other local languages is emphasized. Third, the importance of systematically improving digital literacy among the population is underlined. Finally, creating a supportive environment for startups working on AI technologies is identified as essential to fostering innovation. According to analysts, the consistent implementation of these strategic steps will not only enhance efficiency in public administration but also stimulate the growth of innovative sectors. This process is expected to

strengthen Uzbekistan’s regional competitiveness and help the country achieve a more prominent position in Central Asia. (Tovmurodov, 2025).

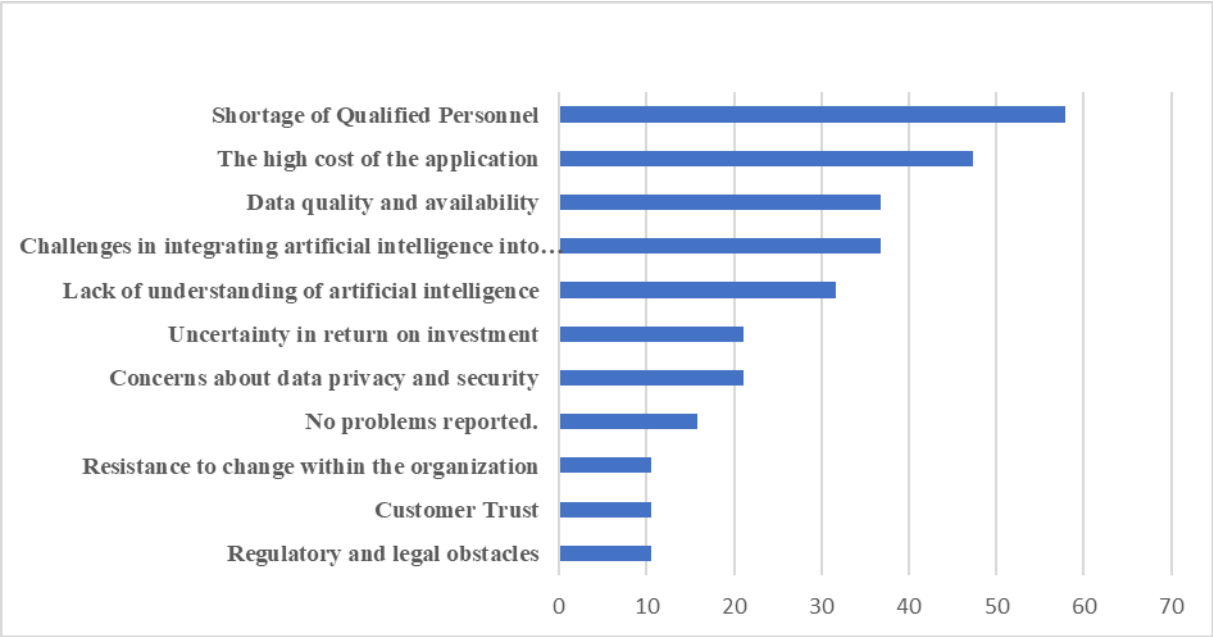


Figure 1. Key Challenges Faced By Businesses in Adopting Artificial Intelligence in Uzbekistan

Source: UNDP. (2025), Digital Economy of Uzbekistan: The State of Digital Entrepreneurship and Artificial Intelligence. Ministry of Economy and Finance of the Republic of Uzbekistan, (Page. 75)

<https://www.undp.org/uzbekistan/publications/digital-economy-uzbekistan-state-digital-entrepreneurship-and-artificial-intelligence> (Access Date: 21.03.2026)

According to survey results evaluating the challenges of AI adoption, 57.9% of businesses identified the need for a qualified workforce as the most significant issue, emphasizing the necessity for AI specialists and specialized training. Meanwhile, 47.4% of respondents highlighted the high cost of implementation as one of the main barriers to adopting AI applications. Additionally, 36.8% of participants identified data quality and accessibility as a major problem, demonstrating how critical reliable and accessible data is for effective AI implementation. Similarly, 36.8% pointed to difficulties in integrating AI with existing systems, indicating that technical and financial challenges remain significant obstacles for many businesses. On the other hand, only 21.1% of respondents cited return on investment (ROI) as a concern, suggesting that the majority of businesses believe in the long-term benefits of artificial intelligence. However, an equal proportion (21.1%) expressed concerns regarding data privacy and security, which is still a considerable issue. Regulatory barriers, resistance to change, and issues related to customer trust were mentioned by only 10.5% of participants. Overall, these findings indicate that the most significant barrier to AI development and implementation is the

shortage of qualified personnel. Despite a growing willingness among businesses to adopt AI, they continue to face major challenges related to skilled human resources, data readiness, technical infrastructure integration, and financial sustainability. Addressing these issues through expanded AI education, workforce development, and financial incentives could play a crucial role in accelerating AI adoption and ensuring its broader diffusion (UNDP, 2025).

In the context of ethical issues related to artificial intelligence in Uzbekistan, many businesses believe that additional regulations are necessary to manage these challenges more effectively. In this regard, companies in Uzbekistan were also asked about the support and resources they require to successfully adopt AI technologies.

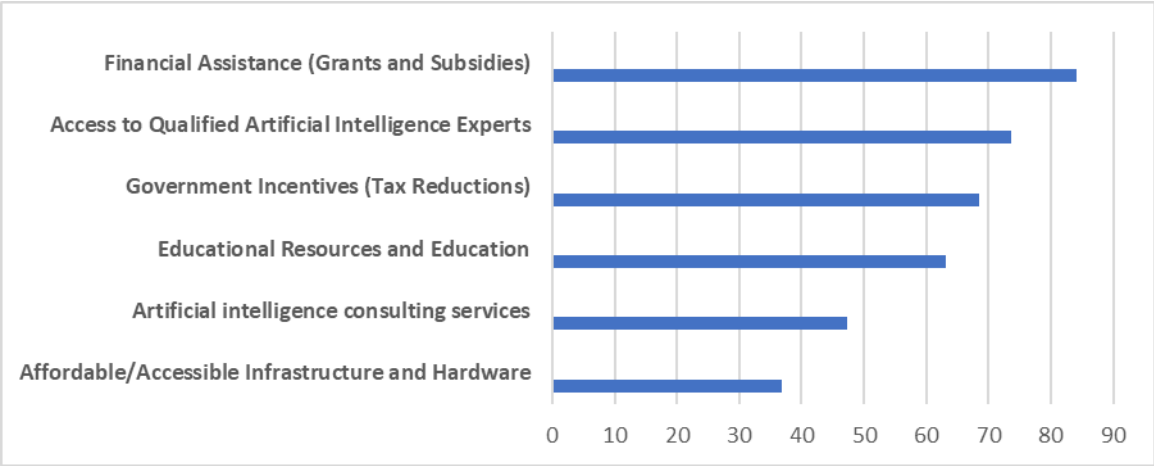


Figure 2. Essential Support Resources for Artificial Intelligence Adoption (%)

Source: UNDP. (2025), Digital Economy of Uzbekistan: The State of Digital Entrepreneurship and Artificial Intelligence. Ministry of Economy and Finance of the Republic of Uzbekistan, (Page 78) <https://www.undp.org/uzbekistan/publications/digital-economy-uzbekistan-state-digital-entrepreneurship-and-artificial-intelligence> (Access Date: 21.03.2026)

A large majority of participating businesses (84.2%) identified financial support as the most critical factor for the adoption of artificial intelligence. This was followed by 73.7% of respondents emphasizing the need for access to qualified AI specialists within the workforce. At the same time, 68.4% of businesses believe that government incentives make a highly significant contribution to the development of AI. Additionally, a considerable portion of respondents (63.2%) stated that educational resources and training would play an important role in advancing AI development. Furthermore, 47.4% of surveyed businesses reported an increasing demand for AI-related consultancy services, highlighting the importance of expert guidance. Affordable and accessible infrastructure and hardware were mentioned by 36.8% of respondents; although this factor is less prominent compared to others, it still remains a significant barrier for some businesses. These findings clearly demonstrate that, in order for businesses to fully benefit from AI solutions, a combination of financial support,

access to qualified professionals, and expert guidance is required. It is emphasized that government policies providing funding, educational programs, and professional consultancy can play a critical role in accelerating AI adoption and fostering innovation. When perceptions regarding AI regulations are evaluated, a significant portion of participants expressed the need for additional regulations in the field of artificial intelligence, indicating a demand for clear policies and a well-defined regulatory framework. However, the fact that an equally large group remains undecided suggests a lack of sufficient knowledge or the presence of uncertainty regarding current regulations (UNDP, 2025). In Uzbekistan, the principles of AI ethics include fundamental elements such as fairness, transparency, prevention of discrimination, accountability, and the protection of human rights. In addition, mechanisms aimed at preventing or reducing algorithmic bias, as well as promoting inclusivity and diversity, are also encompassed within these principles.

6. Future Perspective

Uzbekistan aims primarily to establish AI laboratories within universities and research institutions. However, the country remains limited in terms of integration due to the absence of a comprehensive mechanism connecting research with industry, academia, and society. Efforts to commercialize research outcomes are also quite restricted. Unlike Germany's approach, which integrates research findings into industry through public-private partnerships, Uzbekistan has not fully leveraged such collaborations. Furthermore, the strategic role of the country's official research body, the Institute of Digital Technologies and Artificial Intelligence, has not been clearly defined. Although the institute has the potential to enhance cooperation across sectors, it is crucial for it to strengthen its influence as a multi-stakeholder platform and to develop innovation capacity in key areas. In conclusion, Uzbekistan continues to advance with determined steps in line with its forward-looking vision under the "Digital Uzbekistan 2030 Strategy," established in 2021 (UNDP, 2025).

Conclusion and Recommendations

This study evaluates the socio-economic impacts of artificial intelligence (AI) applications within the context of Uzbekistan. The research findings indicate that AI technologies create significant and multifaceted effects in areas such as productivity growth, public service efficiency, industrial transformation, and the digital economy. In recent years, Uzbekistan's increasing emphasis on digitalization policies has facilitated the wider adoption of AI-based applications, particularly in strategic sectors like agriculture, finance, healthcare, and public administration. These developments have accelerated economic growth while also driving substantial structural changes in the labor market. Demand for skilled labor is rising, whereas low-skilled workers face employment risks due to automation. This situation generates both new opportunities and potential risks concerning income distribution and social inequality. The use of AI in public administration holds the potential to enhance

transparency and accountability by promoting data-driven decision-making processes. However, successfully sustaining such applications faces several challenges. Issues such as data security, ethical concerns, and inadequate digital infrastructure emerge as key factors that limit the sustainable and inclusive implementation of AI technologies. In conclusion, while AI applications play a pivotal role in Uzbekistan's socio-economic development, realizing their full potential depends on establishing appropriate policy frameworks, strengthening institutional capacities, and increasing investments in human capital. Strategic initiatives in AI education, workforce development, infrastructure enhancement, and ethical governance are essential to ensure that AI contributes effectively to inclusive and sustainable growth.

For artificial intelligence (AI) to develop robustly in Uzbekistan, increasing investments in education focused on the AI field is of critical importance. To meet the demands of the AI era, the education system should place greater emphasis on digital skills, data analytics, and algorithmic thinking competencies. Simultaneously, stronger collaborations between universities and industry should be fostered to cultivate a qualified workforce. In addition, digital infrastructure development for AI must be prioritized. Effective implementation of AI applications requires nationwide access to high-speed internet, advanced data center infrastructure, and cloud computing systems. Closing the digital divide, particularly in rural areas, should be a top priority. Ethical and legal frameworks for AI development also require attention. Comprehensive legislation must be developed to address data privacy, algorithmic fairness, and ethical standards. Such regulations should protect individual rights while providing a foundation that encourages innovation. Furthermore, enhancing collaboration between the public and private sectors is essential. Strengthening partnerships among government institutions, private companies, and academic organizations will reinforce the AI ecosystem. Increased support for entrepreneurship will also contribute significantly to the development of domestic technological solutions. Finally, investment in the data economy is crucial for AI applications. National strategies should be developed and implemented to support data production, storage, and processing. Adoption of open data policies can further strengthen the innovation ecosystem, facilitating the growth of a data-driven economy aligned with AI development.

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