Adv Mobile Learn Educ Res, 2025, 5(1): 1262-1271
DOI: 10.25082/AMLER.2025.01.003

REVIEW

Adapting to a rapidly evolving world: Insights from AI initiatives in Azerbaijan

Tunar Mammadov[1] **Maral Jamalova**[2*]

[1] Physics-Mathematics and Computer Science oriented High School, Baku AZ1073 , Azerbaijan
[2] Department of Economic and Technological Sciences, Azerbaijan State University of Economics, Baku, AZ 1001, Azerbaijan

Correspondence to: Maral Jamalova, Department of Economic and Technological Sciences, Azerbaijan State University of Economics, Baku, AZ 1001, Azerbaijan; Email: maral_jamalova@unec.edu.az

Received: September 19, 2024;
Accepted: January 2, 2025;
Published: January 6, 2025.

Citation: Mammadov, T., & Jamalova, M. (2025). Adapting to a rapidly evolving world: Insights from AI initiatives in Azerbaijan. *Advances in Mobile Learning Educational Research*, 5(1), 1262-1271. https://doi.org/10.25082/AMLER.2025.01.003

Abstract: This study investigates the evolution and impact of Artificial Intelligence (AI) in Azerbaijan, focusing on its integration into various sectors through state-led digital initiatives. It examines Artificial Intelligence (AI) developments in Azerbaijan from 2019 to 2023, focusing on its integration across government, technology, and infrastructure through the AI Readiness Index. As Azerbaijan adopts AI to boost economic growth and enhance public services, significant progress is evident in digital initiatives and broader e-governance efforts. The study highlights the potential of AI to transform Azerbaijan's socioeconomic landscape and establish it as a regional hub for digital innovation, while also considering the ongoing challenges and future opportunities for enhancing its digital ecosystem.

Keywords: artificial intelligence, Azerbaijan, situational approach

1 Introduction

The fast development of Information Communication Technologies (ICT) has greatly changed how the world works, transforming the way people communicate, find information, and do business ("ICTs in Developing Countries: Research, Practices and Policy Implications," 2016). Artificial intelligence (AI) has become a crucial part of this digital era, helping improve decision-making and making processes more efficient in various sectors. AI can analyze vast amounts of data quickly, enabling the delivery of tailored educational content that meets individual students' needs and optimizes learning outcomes (Lampropoulos, 2023). Around the world, countries are investing more in ICT and AI to strengthen their economies, improve public services, and enhance the quality of life for their citizens (Jankin et al., 2018). Situated at the crossroads of Europe and Asia, Azerbaijan is also participating in this global technological transformation.

Digital approaches and Artificial Intelligence (AI) continue to enhance the exercise and enjoyment of political, civil, economic, and social rights (such as freedom of speech, peaceful assembly, freedom of movement, the right to health, education, *etc.*). In this regard, several countries have embarked on state e-governance' transformation strategies' where significant resources are allocated to e-government (*e.g.*, digitalizing public service delivery), enhancing biometric systems (*e.g.*, electronic identification systems, facial recognition technology in courts or police investigations, AI-driven predictive policing systems), and also extending both the infrastructure and physical reach of the web throughout their countries (Iuga & Socol, 2024). Unfortunately, the inequality of this dimension still exists between nations, within regions, and between urban and rural populations (Yamashita et al., 2021).

In the recent past, the Azerbaijani people's attitude toward technology has experienced a noticeable change. Following attaining independence in the early 1990s, the country set out to update its infrastructure and incorporate ICT into some industries. The foundation for a digital transformation has been established by initiatives like the State Agency for Public Service and Social Innovations and the development concept "Azerbaijan 2020: Look into the Future" (UNDP, 2023). After the Second Karabakh War, the government launched many initiatives to support digital education (Azerbaijan 2030: National Priorities for Socio-Economic Development, 2021), smart city projects (Strategic Road Map of the Perspective of the National Economy of the Republic of Azerbaijan, 2016), and e-government services (such as "mygov" digital platform.) throughout the years, paving the way for artificial intelligence to become a major force in the country's technological environment (Strategic Roadmap for the Development of Telecommunications and Information Technologies in the Republic of Azerbaijan, 2016).

Azerbaijan has actively embraced digital transformation, deploying over 430 innovative digital services such as ASAN Imza, digital payments via ASAN Pay, ASAN Certificate Services Center, Open DataPortal, Interactive Monitoring Panel, and the Automated Tax Information System. These initiatives are part of the nation's strategic effort to centralize public services through a "one-stop" system, enhancing efficiency and accessibility. This approach aligns with Azerbaijan's broader commitment to integrating artificial intelligence into public administration, leveraging AI to streamline processes and improve service delivery.

The purpose of this research is to explore the development of ICT and AI in Azerbaijan, focusing on their application across major sectors and evaluating their potential to drive future growth. By examining current initiatives, opportunities, and constraints, this study aims to provide valuable insights into how Azerbaijan can leverage these technologies to enhance its socioeconomic landscape and position itself as a regional leader in digital transformation. Additionally, the research highlights key activities undertaken by the Azerbaijani government in advancing AI development. The main research questions are framed as follows:

(1) What is the current state of AI-related activities and policies in Azerbaijan?

(2) What are the primary government efforts aimed at fostering the extensive development of AI?

(3) What initiatives have been implemented to utilize AI as an effective and beneficial tool?

2 Literature review: AI-related principles and indices

In 2019, the member countries of the Organization for Economic Cooperation and Development (OECD) agreed on a set of guidelines called the OECD Principles on Artificial Intelligence (Recommendation of the Council on Artificial Intelligence, 2019). These guidelines commit the nations to support the ethical, secure, and positive use of AI technologies. The principles outlined by this international group define responsible AI through five main areas: 1) Promoting inclusive growth, sustainable development, and well-being, 2) Focusing on human-centered values and fairness, 3) Ensuring transparency and explainability in AI systems, 4) Achieving robustness, safety, and security in AI applications, and 5) Upholding accountability in the deployment of AI technologies. These guidelines aim to direct countries to develop AI technologies that are beneficial and equitable for society at large.

Since 2017, Oxford Insights has been evaluating governments' AI preparedness, publishing an annual Government AI Readiness Index. The 2020 report, produced with the International Development Research Centre, includes a special focus on responsible AI use by governments, covering 34 countries. Interestingly, the report highlights a contradiction: countries that score high on AI readiness do not always perform well on responsible AI use. (see Figure 1)

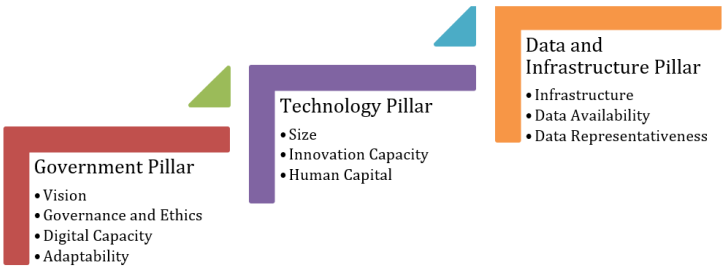

Figure 1 Pillars and dimensions of the AI Readiness Index

The AI Readiness Index is a multifaceted tool designed to evaluate how prepared different sectors, including government, technology, and infrastructure, are to adopt and leverage artificial intelligence technologies. It assesses aspects such as governance and ethics, digital capacity, and adaptability to determine a government's capability to integrate AI. In the technology sector, it measures infrastructure, innovation capacity, and human capital to gauge the readiness for AI-driven innovation. Additionally, the index considers data and infrastructure pillars, evaluating the availability and representativeness of data critical for AI applications (Stirling, 2024). This comprehensive index helps policymakers, businesses, and researchers understand the current landscape and foster AI development in their jurisdictions. The main pillars of the AI Readiness Index are individually illustrated above.

2.1 AI Readiness Index: Government Pillar

The Government Pillar of the AI Readiness Index provides a comprehensive evaluation of how prepared governments are to integrate and leverage artificial intelligence technologies

(Stirling, 2024). This pillar encompasses several key dimensions, including Vision, Governance and Ethics, Digital Capacity, and Adaptability, each assessing different aspects of government readiness from strategic planning to operational implementation. Through these dimensions, the index examines a government's capability to support AI development, ensure ethical deployment, manage digital infrastructure, and adapt to technological advancements, ultimately shaping a nation's AI landscape for future growth and innovation.

2.1.1 Vision dimension of Government Pillar

The "Vision" dimension of the Government Pillar within the AI Readiness Index is centered on discerning whether the government has a clear and actionable vision for supporting the development and implementation of AI technologies. This dimension critically evaluates the presence and effectiveness of a national AI strategy, which serves as the main variable in assessing a government's commitment to AI integration. The existence of such a strategy indicates proactive governmental planning and resource allocation aimed at fostering AI innovation, building infrastructures, and ensuring ethical governance of AI applications. This dimension also explores how this strategic vision aligns with broader economic and technological goals, examining its comprehensiveness, feasibility, and the mechanisms in place for achieving set milestones. Through this in-depth analysis, the Vision dimension provides insights into how prepared a government is to lead and support the transformative impacts of AI on society and the economy (Liengpunsakul, 2021).

2.1.2 Governance and ethics dimension of the Government Pillar

The "Governance and Ethics" dimension of the Government Pillar within the AI Readiness Index examines whether appropriate regulatory and ethical frameworks are established to deploy AI technologies in a manner that fosters trust and legitimacy. This assessment includes a detailed look at several key indicators, such as the presence and effectiveness of data protection and privacy legislation, which assesses how well personal and sensitive information is safeguarded in the age of AI (Schiff, 2022). Additionally, it considers the robustness of cybersecurity measures, crucial for protecting systems and networks from digital threats associated with AI technologies. Another crucial indicator is the existence of a national ethics framework, which is evaluated on a binary basis (Yes/No) to determine if ethical guidelines specifically tailored to AI are in place. Lastly, the adaptability of legal frameworks to digital business models is scrutinized to see how well laws can accommodate and regulate the innovative and often disruptive business practices brought about by AI advancements. By thoroughly examining these components, the Governance and Ethics dimension sheds light on a government's capacity to provide a stable, secure, and ethically sound landscape for AI integration, which is vital for fostering innovation while maintaining public trust and legal compliance.

2.1.3 Digital capacity dimension of the Government Pillar

The "Digital Capacity" dimension of the Government Pillar within the AI Readiness Index meticulously assesses the existing digital infrastructure and capabilities within government bodies. This dimension evaluates critical indicators that reflect the government's technological sophistication and readiness to integrate AI systems. Key indicators include the extent of government procurement of advanced technology, which gauges the investment in and adoption of cutting-edge tools necessary for modern governance (Dinh Thanh et al., 2020). Additionally, it examines the use of Information and Communication Technology (ICT) and its correlation with government efficiency, indicating how effectively technology is integrated into daily operations to enhance productivity and service delivery. Another vital aspect is the scope and quality of online services provided by the government, which assesses the availability and user-friendliness of digital platforms for public interactions, thus facilitating access to government services.

2.1.4 Adaptability dimension of the Government Pillar

The "Adaptability" dimension of the Government Pillar in the AI Readiness Index is designed to evaluate the government's capacity to change, adapt, and innovate in response to emerging technologies and shifting circumstances. This evaluation specifically includes indicators such as the effectiveness of government operations, which measures how efficiently and successfully governmental bodies implement policies and adapt to new technologies to meet their objectives. Another critical indicator is the government's responsiveness to change. This assesses the speed and extent to which the government can shift its strategies, policies, and operations in reaction to new technological trends and societal needs. It looks at how quickly a government can integrate innovations into public services and adapt its regulatory frameworks to accommodate new business models and technologies.

2.2 AI Readiness Index: Technology Pillar

The Technology Pillar of The AI Readiness Index serves as a critical measure for assessing a country's infrastructure and capabilities to adopt and integrate artificial intelligence technologies. This index evaluates various components such as the availability of advanced hardware, the development and accessibility of AI software solutions, and the robustness of data and information systems. By analyzing these elements, the index provides insights into how prepared a nation is to leverage AI for economic and social advancement, highlighting both strengths and areas for improvement. This evaluation is essential for policymakers, businesses, and researchers aiming to understand the technological landscape and foster AI-driven innovation within their jurisdictions.

2.2.1 Size dimension of the Technology Pillar

The size of the technology sector is a foundational element of the AI Readiness Index, emphasizing its critical role in determining a nation's capacity to adopt and implement AI technologies effectively. The "Size" dimension within the index is multifaceted, assessing several key indicators that reflect the breadth and economic potency of the technology landscape. These indicators include the number of technology unicorns, which showcases the innovation and entrepreneurial success within the sector. Additionally, the market value of public technology companies provides insight into the sector's financial stability and growth potential. Moreover, the index evaluates the value of trade in ICT services and goods per capita, indicators that highlight the international competitiveness and integration of a country's technology sector in the global market. Lastly, computer software spending is examined, reflecting both public and private investment levels in critical software infrastructure and development. Together, these metrics offer a comprehensive view of the technology sector's size and its readiness to support and advance AI-driven initiatives, providing a crucial benchmark for policymakers and industry leaders aiming to enhance their AI capabilities.

2.2.2 Innovation Capacity dimension of the Technology Pillar

Within the Technology Pillar of the AI Readiness Index, the "Innovation Capacity" dimension critically evaluates whether the technology sector is equipped with the essential conditions to drive innovation. This assessment includes an analysis of several key factors, such as the presence of an entrepreneurial culture that encourages creative problem-solving and risk-taking, the ease of doing business which encompasses regulatory procedures and market accessibility, the level of research and development (R&D) spending which reflects commitment to innovation, and the extent of company investments in emerging technologies. Together, these elements provide a comprehensive view of the sector's ability to support and advance the development of AI technologies, thus playing a pivotal role in a nation's technological progress and competitive edge in the global arena.

2.2.3 Human Capital dimension of the Technology Pillar

The "Human Capital" dimension of the Technology Pillar in the AI Readiness Index is pivotal in assessing whether the population possesses the necessary skills to support and advance the technology sector (Uren & Edwards, 2023). This metric delves into various aspects of workforce competence and readiness, focusing on the availability of advanced technical education, the prevalence of STEM (Science, Technology, Engineering, and Mathematics) skills among the populace, and the capacity for ongoing professional development in cutting-edge technologies. Some tools have become increasingly accessible to students, significantly contributing to the democratization of AI and its applications in education. The rapid pace of technological advancements has further accelerated these changes, making tools like ChatGPT more readily available and impactful. In the context of advancing educational methodologies through technology, the deployment of such tools stands out as a particularly notable development, enhancing the learning experience, fostering engagement, and supporting personalized and adaptive learning at an unprecedented speed (Sarwari & Mohd Adnan, 2024).

It also examines the density of AI researchers and the level of engagement in international technology networks, which are critical for fostering innovation and maintaining a competitive edge in the global technology landscape. By evaluating these elements, the Human Capital metric provides insights into the readiness of the workforce to meet the demands of an increasingly AI-driven world, offering a clear picture of a country's potential to sustain and grow its technology sector. This assessment is essential for guiding investments in education and training programs, thus ensuring that the human resources align with future technological advancements and market needs.

2.3 AI Readiness Index: Data and Infrastructure Pillar

The Data and Infrastructure Pillar of the AI Readiness Index evaluates a country's technological and data ecosystem to determine its capacity to support AI technologies effectively. This pillar is divided into three key dimensions: Infrastructure, which assesses the quality of telecommunications, 5G networks, internet bandwidth, and the integration of advanced technologies necessary for AI; Data Availability, which examines the accessibility and robustness of datasets, including open government data and statistical capacity, to ensure sufficient resources for training AI models; and Data Representativeness, which focuses on whether available data reflects the entire population, addressing gaps in digital access across gender, socioeconomic groups, and geographic areas. Together, these dimensions provide a comprehensive view of a country's readiness to foster equitable and efficient AI adoption through strong technological foundations and inclusive data practices.

2.3.1 Infrastructure dimension of the Data and Infrastructure Pillar

The "Infrastructure" dimension of the Data and Infrastructure Pillar in the AI Readiness Index is dedicated to assessing whether a country possesses the necessary technological infrastructure to support AI technologies effectively (Neumann et al., 2024). This evaluation includes key indicators that measure the depth and breadth of the infrastructure in place. One of these indicators is the telecommunications infrastructure, which assesses the overall quality, coverage, and capacity of networks critical for seamless communication and data exchange. Another significant indicator is the 5G infrastructure, which is crucial for enabling ultra-fast and reliable internet service, supporting everything from AI-powered mobile applications to complex, real-time data analytics. Internet bandwidth is also scrutinized to determine the available data transmission speeds and their consistency across different regions, which are vital for the high demands of AI computations and cloud-based AI services. Lastly, the availability of the latest technologies is evaluated to gauge how accessible and integrated cutting-edge AI and information technology tools are within the country. This includes the uptake of advanced hardware and software that are foundational to developing and running AI applications. By systematically analyzing these indicators, the "Infrastructure" dimension highlights a country's current capability and potential gaps in supporting robust AI initiatives, thereby informing strategies for infrastructure enhancement and technological upgrades.

2.3.2 Infrastructure dimension of the Data and Infrastructure Pillar

The "Data Availability" dimension of the Data and Infrastructure Pillar in the AI Readiness Index plays a vital role in determining whether a country has sufficient accessible and usable data to effectively train AI models. Key indicators within this dimension include open government data, which assesses the availability of public datasets crucial for AI development, and statistical capacity, which reflects the nation's ability to collect, analyze, and disseminate reliable data. Additionally, the number of mobile-cellular telephone subscriptions provides insight into the volume of communication data generated, while the proportion of internet users indicates the digital engagement of the population and the potential to generate data for AI applications. Together, these indicators provide a comprehensive view of a country's data landscape and its readiness to support AI through a robust data ecosystem.

2.3.3 Data Representativeness dimension of the Data and Infrastructure Pillar

The "Data Representativeness" dimension of the Data and Infrastructure Pillar in the AI Readiness Index evaluates whether the available data accurately reflects the entire population, ensuring inclusivity in AI development. Key indicators include the gender gap in internet usage, which examines disparities in digital access between men and women, and the socioeconomic gap in internet usage, which assesses how internet accessibility varies across different income groups, helping determine if data captures diverse segments of society. The dimension also considers how well data availability and usage encompass different geographic regions, particularly urban versus rural areas, to ensure balanced representation. By addressing these gaps, the "Data Representativeness" dimension highlights the extent to which a country's data ecosystem can support equitable AI solutions that are reflective of and beneficial to its entire population.

2.3.4 The current state of AI in Azerbaijan

Digital technologies and artificial intelligence are enhancing the implementation of various rights worldwide, such as freedom of expression and the right to education. Many countries are advancing their e-government services by investing in the digitalization of public sectors, including biometric IDs and AI-based systems in judicial processes. They are also improving

Internet accessibility materially and physically. However, significant disparities still exist between countries and regions, and between urban and rural areas.

In the South Caucasus, efforts to align artificial intelligence systems, data management, and data protection with international and regional standards are progressing, despite facing various challenges and risks. This alignment aims to stimulate innovation and enhance infrastructure while supporting key policy goals, including a dynamic and inclusive society, environmental sustainability, and technological advancements. Although Azerbaijan has not officially announced a national AI strategy, its participation in the Council of Europe's Special Committee on Artificial Intelligence and its initiation of projects like the "Artificial Intelligence Lab" platform underscore its commitment to these objectives (UNDP, 2023). (see Figure 2)

Figure 2 AI-related activities in Azerbaijan (Source: authors' own editing)

According to data from Oxford Insights (2020), Azerbaijan's National AI Strategy (2020-2025) played a central role in guiding these advancements. Based on the Artificial Intelligence Index report from Stanford University (Maslej et al., 2023; 2024) Azerbaijan released "Yearly AI National Strategies" in 2023. However, it was not possible to find this information on any government website. The same report indicated that no other relevant information about Azerbaijan. Azerbaijan's progress in AI readiness has been steady and significant over the past few years, reflecting the country's growing commitment to integrating artificial intelligence into its public services and governance. From 2019 to 2023, Azerbaijan made notable advancements in its rankings, strategic initiatives, and sectoral development.

(1) 2019

In 2019, Azerbaijan ranked 64th out of 194 countries, with a score of 5.244 (Oxford Insights, 2019). This year showed the start of the country's concentrated efforts to enhance its AI readiness, particularly through improvements in data infrastructure and governance capabilities. It's important to mention that the way the AI readiness index was calculated changed after 2019, so it is hard to directly compare it with the following years.

(2) 2020

By 2020, Azerbaijan had made remarkable progress, moving up to 3rd place in the South and Central Asia region and achieving a global score of 46.44 (Oxford Insights, 2020). Globally, the country ranked 65^{th} out of 172 countries. This leap was driven largely by the introduction of the National AI Strategy for 2020-2025. The strategy outlined Azerbaijan's plan to integrate AI into governance and public services, emphasizing the importance of fostering human capital, improving data availability, and building the necessary technical infrastructure to support AI applications. This strategic shift demonstrated Azerbaijan's ambition to leverage AI for governance and technological advancement.

In the same year, the Court Services and Smart Infrastructure Project (World Bank, 2020) was approved by the World Bank, aiming to adopt new technologies, including artificial intelligence, to enhance policy decisions and court services. These innovations are designed to provide 24/7 access to justice, automate the random assignment of cases to judges, improve e-governance and efficiency, introduce an electronic adjudication system, and establish a fast-track process for uncontested small civil claims.

(3) 2021

In 2021, Azerbaijan's ranking adjusted slightly to 67th globally, with a score of 48.26 (Oxford Insights, 2021). In the same year, Azerbaijan maintained its position as a regional leader, ranking fourth in the region. Although the country experienced a minor decline in ranking, it made notable improvements in its government sector, particularly in enhancing its digital governance capacities. The year saw a continued focus on integrating AI into public service

delivery. However, challenges remained in developing the technology sector and building the infrastructure necessary to support AI innovation at a broader scale.

Coordination Center of the Fourth Industrial Revolution (4SIM)

Established under the Ministry of Economy by Presidential Decree on January 6, 2021, in the Republic of Azerbaijan, the center facilitates collaboration across government levels and with both national and international stakeholders in the realm of the Fourth Industrial Revolution. Given the strong focus on technology-related coordination and cooperation, the work of the Analysis and Coordination Center of the Fourth Industrial Revolution (4SIM) aligns with national initiatives on artificial intelligence as part of the broader digital economy strategy. It also manages the analysis and coordination of challenges, initiatives, strategies, and projects related to the digital economy. Furthermore, the center coordinates the analysis and implementation of technological initiatives of the Fourth Industrial Revolution, promotes partnerships between the public sector, private sector, and academic communities, and serves as a platform for discussions and cooperation in these areas (Charter of the Center for Analysis and Coordination of the Fourth Industrial Revolution, 2021).

The Azerbaijan Artificial Intelligence Lab

The Azerbaijan Artificial Intelligence Lab, established in 2021 under the Ministry of Digital Development and Transport, is dedicated to advancing artificial intelligence and managing national AI activities effectively (AI Lab, 2024). This lab has built an innovative infrastructure designed to develop skills and train professionals for an AI-driven future. Its main goal is to enhance research and development in AI, provide technical skills training, and host specialized seminars to nurture talent. The AI Lab collaborates with industry partners, innovative companies, and academic institutions to maximize the potential of AI. Furthermore, it organizes and participates in various activities, including training, boot camps, webinars, conferences, and targeted workshops, aiming to broaden and maximize AI capabilities over the long term. The platform is committed to strengthening partnerships between industry and academia for research and development, as well as talent cultivation, to build AI-centric and future-ready skills.

(4) 2022

By 2022, Azerbaijan retained its regional leadership position, ranking 74th globally (Oxford Insights, 2022). The country made further progress in improving its data infrastructure, focusing on expanding data availability and enhancing digital capacity. Nonetheless, there were still gaps in fostering a dynamic innovation ecosystem. Azerbaijan needed to strengthen support for AI startups and further develop its technical infrastructure to stimulate greater AI-driven advancements.

Azerbaijan's Fourth Industrial Revolution Analysis and Coordination Center (4SIM) entered into a cooperation agreement with the 4SIM Kazakhstan Center in October 2022. This agreement aims to facilitate the exchange of expertise in the digital economy and Fourth Industrial Revolution technologies, including Artificial Intelligence and the Internet of Things. Additionally, it covers the conduct of joint research, the organization of events focused on digital solutions within various industries, and the implementation of collaborative projects in emerging technology areas. This partnership is designed to enhance the technological capabilities of both nations through shared knowledge and resources (UNDP, 2023).

(5) 2023

In 2023, Azerbaijan maintained a consistent performance, continuing its efforts to enhance AI readiness with a focus on human capital, digital infrastructure, and public-private collaboration. The country ranked 73rd out of 193 countries in 2023 (Oxford Insights, 2023). While Azerbaijan has made progress in these areas, challenges persist in scaling up its technology sector and fully harnessing AI's potential. The country's continued development in human capital and infrastructure remains critical to ensuring it maximizes the benefits of AI technologies. Recognizing the significance of emerging artificial intelligence-based solutions and their potential to drive development across various sectors, a memorandum of understanding was signed between the Central Bank and the Ministry of Digital Development and Transport on November 7, 2023 (https://www.cbar.az/, 2023).

Based on 2023 data, in the 2024 report, Azerbaijan ranks 78th overall in the global AI index published by Tortoise Media (Tortoise Media, 2024), with specific scores in key indicators that differ slightly from those calculated by Oxford Insights. The country ranks 68th for Talent, 65th for Infrastructure, 51st for Operating Environment, 78th for Research, 80th for Development, 72nd for Government Strategy, and 81st for Commercial, where lower numbers indicate a better position. These rankings highlight Azerbaijan's strengths in talent and infrastructure while

emphasizing areas for improvement in development and commercial sector.

3 The AI Readiness Index results for Azerbaijan

The AI Readiness Index for Azerbaijan provides an annual assessment of the country's preparedness in adopting and implementing artificial intelligence, analyzed through a total score and three key pillars: Government, Technology Sector, and Data & Infrastructure (see Figure 3). Over the years 2021 to 2023, the total score fluctuated, starting at 48.26 in 2021, dipping to 45.55 in 2022, and slightly recovering to 48.15 in 2023, reflecting variability in overall AI readiness.

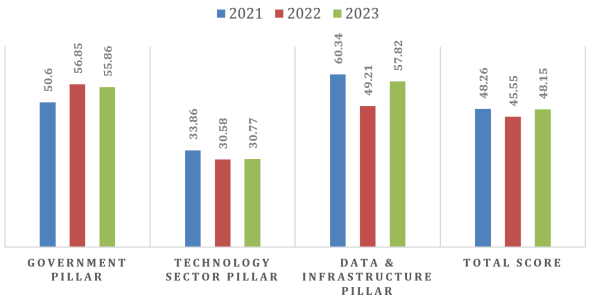

Figure 3 AI Readiness Index results for Azerbaijan (Source: authors' own editing)

The Government Pillar demonstrated consistent growth, peaking at 56.85 in 2022 before a minor decline to 55.86 in 2023, showcasing the government's active role in promoting AI initiatives. The Technology Sector Pillar faced persistent challenges, with scores declining from 33.86 in 2021 to 30.58 in 2022 and only a slight improvement to 30.77 in 2023, indicating a critical need for further investment and development. Meanwhile, the Data & Infrastructure Pillar exhibited variability, starting strong at 60.34 in 2021, dropping significantly to 49.21 in 2022, and rebounding to 57.82 in 2023, signaling inconsistent progress in building sustainable AI infrastructure. These trends highlight the importance of focused efforts to strengthen the technology sector and infrastructure while capitalizing on the government's supportive role to enhance Azerbaijan's AI readiness.

4 Conclusion

Azerbaijan's journey in embracing Artificial Intelligence epitomizes a strategic commitment to digital transformation, highlighting the nation's forward-looking approach to integrating technology within its social and economic frameworks. As evidenced by the AI Readiness Index, the country has made substantial strides in leveraging AI to enhance public services and governance. Despite some challenges in technological infrastructure and sector-specific developments, the proactive measures taken towards developing digital governance and fostering human capital illustrate Azerbaijan's potential to emerge as a leader in AI-driven innovation within the region. Moving forward, it is crucial for policymakers, industry leaders, and educational institutions to continue their collaborative efforts in addressing the remaining gaps, thereby ensuring that AI not only supports sustainable development but also inclusively benefits all segments of Azerbaijani society. This ongoing commitment will be pivotal in shaping Azerbaijan's future as a resilient and dynamic digital economy.

Moreover, as Azerbaijan continues to navigate the complexities of a rapidly evolving digital landscape, the integration of AI presents an opportunity to redefine the nation's economic and social paradigms. The development of a national AI strategy could catalyze further advancements, positioning Azerbaijan not only as a participant but as a pioneer in the global AI arena. The potential for AI to drive significant improvements in sectors such as healthcare, education, and public administration is immense. By harnessing these technologies, Azerbaijan can achieve a transformative impact that extends beyond economic growth, fostering a society that is more informed, connected, and empowered. The continued focus on ethical AI deployment and the expansion of AI literacy among its populace will be essential in maximizing these benefits and securing a sustainable and equitable technological future for all Azerbaijanis.

Conflicts of interest

The authors declare that they have no conflict of interest.

References

AI Lab. (2024). Azerbaijan Artificial Intelligence LabNo Title. https://ailab.az

Azerbaijan 2030: National Priorities for socio-economic development, (2021). https://president.az/az/articles/view/50474

Charter of the Center for Analysis and Coordination of the Fourth Industrial Revolution, (2021). https://4sim.gov.az/en/page/haqqimzda/nizamname

Dey, B., Sorour, K., & Filieri, R. (Eds.). (2016). ICTs in Developing Countries. Palgrave Macmillan UK. https://doi.org/10.1057/9781137469502

Dinh Thanh, S., Hart, N., & Canh, N. P. (2020). Public spending, public governance and economic growth at the Vietnamese provincial level: A disaggregate analysis. Economic Systems, 44(4), 100780. https://doi.org/10.1016/j.ecosys.2020.100780

Iuga, I. C., & Socol, A. (2024). Government Artificial Intelligence Readiness and Brain Drain: Influencing Factors and Spatial Effects in the European Union Member States. Journal of Business Economics and Management, 25(2), 268–296. https://doi.org/10.3846/jbem.2024.21136

Lampropoulos, G. (2023). Recommender systems in education: A literature review and bibliometric analysis. Advances in Mobile Learning Educational Research, 3(2), 829–850. https://doi.org/10.25082/amler.2023.02.011

Liengpunsakul, S. (2021). Artificial Intelligence and Sustainable Development in China. The Chinese Economy, 54(4), 235–248. https://doi.org/10.1080/10971475.2020.1857062

Maslej, N., Fattorini, L., Brynjolfsson, E., Etchemendy, J., Ligett, K., Lyons, T., Manyika, J., Ngo, H., Niebles, J. C., & Parli, V. (2023). The AI index 2023 annual report. AI Index Steering Committee, Institute for Human-Centered AI, Stanford University, Stanford, CA.

Measuring the AI content of government-funded R&D projects. (2021). In OECD Science, Technology and Industry Working Papers. Organisation for Economic Co-Operation and Development (OECD). https://doi.org/10.1787/7b43b038-en

Mikhaylov, S. J., Esteve, M., & Campion, A. (2018). Artificial intelligence for the public sector: opportunities and challenges of cross-sector collaboration. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 376(2128), 20170357. https://doi.org/10.1098/rsta.2017.0357

Neumann, O., Guirguis, K., & Steiner, R. (2022). Exploring artificial intelligence adoption in public organizations: a comparative case study. Public Management Review, 26(1), 114–141. https://doi.org/10.1080/14719037.2022.2048685

Oxford Insights. (2019). Government AI readiness index 2019. https://oxfordinsights.com

Oxford Insights. (2020). Government AI Readiness Index 2020. https://oxfordinsights.com

Oxford Insights. (2021). Government AI Readiness Index 2021. https://oxfordinsights.com

Oxford Insights. (2022). Government AI Readiness Index 2022. https://oxfordinsights.com

Oxford Insights. (2023). Government AI Readiness Index 2023. https://oxfordinsights.com

Press-relizler. (2023). A Memorandum of Understanding has been signed between the Central Bank of the Republic of Azerbaijan and the Ministry of Digital Development and Transport. Central Bank of the Republic of Azerbaijan. https://www.cbar.az

Recommendation of the Council on Artificial Intelligence, (2019). https://legalinstruments.oecd.org

Sarwari, A. Q., & Mohd Adnan, H. (2024). The effectiveness of artificial intelligence (AI) on daily educational activities of undergraduates in a modern and diversified university environment. Advances in Mobile Learning Educational Research, 4(1), 927–930. https://doi.org/10.25082/amler.2024.01.004

Schiff, D. (2021). Education for AI, not AI for Education: The Role of Education and Ethics in National AI Policy Strategies. International Journal of Artificial Intelligence in Education, 32(3), 527–563. https://doi.org/10.1007/s40593-021-00270-2

Stirling, R. (2024). Evaluating national AI readiness with the Government AI Readiness Index. https://www.unesco.org

Strategic Road Map of the perspective of the national economy of the Republic of Azerbaijan. 2016: 947. https://static.president.az

Strategic Roadmap for the development of telecommunications and information technologies in the Republic of Azerbaijan. 2016: 65. https://azertag.az

Tortoise Media. (2024). The Global AI Index 2024. https://www.tortoisemedia.com/intelligence/global-ai

UNDP. (2023). Geleceye Aparan Yol: Azerbaycanda Süni Intellekt, Melumatların Mühafizesi ve Yeni Texnologiyalara Baxış (The Road to the Future: An Overview of Artificial Intelligence, Data Protection and New Technologies in Azerbaijan). https://www.undp.org

Uren, V., & Edwards, J. S. (2023). Technology readiness and the organizational journey towards AI adoption: An empirical study. International Journal of Information Management, 68, 102588. https://doi.org/10.1016/j.ijinfomgt.2022.102588

World Bank. (2020). Azerbaijan Judicial Services and Smart Infrastructure Project-Additional Financing. https://www.worldbank.org