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HUMAN DEVELOPMENT MANAGEMENT IN THE AI ERA AS A TOOL FOR ACHIEVING SUSTAINABLE DEVELOPMENT IN THE REPUBLIC OF AZERBAIJAN

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Abstract. In this article we analyse human development management as an instrument for sustainable development policy of the Republic of Azerbaijan under the conditions of rapid digital AI development. We focus on three connected domains of education, digital infrastructure and cybersecurity, and post-conflict regional development and assess how public policy in each is responding to structural pressures of technological change (UNDP, 2025; OECD, 2023). Based on data from the Human Development Report 2025, ITU Global Cybersecurity Index 2024 and Global Peace Index 2025, the study places Azerbaijan in a comparative framework that includes post-Soviet states Russia, Kazakhstan, Georgia, Armenia and Uzbekistan and regional partners Türkiye and Iran (World Bank, 2024; ITU, 2024; IEP, 2025). This framework is the basis for Azerbaijan's genuine progress and structural constraints that continue to limit its development trajectory. The analysis is based on Academician Urkhan Alakbarov's (2019) concept of inclusive development management and on the prior work of the author on connecting human capital investment to sustainability outcomes (Mehdiyev, 2022) and the article asserts that Azerbaijan's further progress in the AI era depends on three interrelated conditions: stronger institutional coordination across policy sectors; the development of national AI governance mechanisms; and sustained long-term investment in human capital.

Key words: human development, sustainable development, Republic of Azerbaijan, artificial intelligence (AI), digital infrastructure, cybersecurity, institutional coordination, post-conflict development.

Introduction. The 2030 Agenda for Sustainable Development is in order to reframe people not as passive recipients of development outcomes but as active agents (United Nations, 2015). This conceptual shift draws upon Amartya Sen's capability approach to human development which is the substantive expansion of human freedom rather than the accumulation of material resources (Sen, 1999). The Human Development Report 2025 expands the concept of this framework to the form of artificial intelligence, and argues that AI is not just a technological instrument but a structural factor that shapes the conditions under which human capabilities are formed and exercised (UNDP, 2025).

For Azerbaijan, these theoretical positions have concrete empirical meaning as the country is moving through structural economic transition – diversifying away from hydrocarbon revenues, building digital public infrastructure and integrating previously affected territories into national development planning (IMF, 2023; World Bank, 2024); in this context, human capital quality is a central determinant of long-term resilience.

The article studies this problem from the perspective of human development management – the goal of which is to build up public policy in different sectors with the aim of human development in a sustainable and equitable manner. Its analysis is based on three empirical domains: education, digital infrastructure and cybersecurity; and post-conflict regional development. Azerbaijan has the position in each with respect to a comparative group of countries (Kazakhstan, Russia, Georgia and Armenia) and regional partners (Türkiye, Iran). This comparative framing is methodologically conscious: it makes it possible to identify structural patterns that are invisible in a purely national context.

Educational cooperation is a key part of this regional picture. Azerbaijan is now a more and more popular place for international students (modern.az, 2026; UNESCO, 2022), and such an impact not only contributes to the exchange of academic students but also to the regional integration processes that are directly related to human capital dynamics.

The theoretical foundation of the study is based on two complementary bodies of work. The first is Academician Urkhan Alakbarov's inclusive development management concept which is based on active institutional coordination as a pre-condition for sustainable and equitable growth (Alakbarov, 2017; 2019). The second is the author's previous work which indicates that human capital is an active driver of economic transformation only if it is embedded in stable institutional conditions with sustained public investment (Mehdiyev, 2022). Taken together, these frameworks support the study to migrate from broad theoretical discussion to an assessment of concrete policy conditions in the AI era.

Materials and Methods. The methodological framework combines four complementary approaches that enable a multidimensional study of human development in the context of AI diffusion. The first is a systems approach, which considers human development as a process that is shaped by the interrelation of economic, social, institutional and technological factors (UNDP, 2025; OECD, 2023; Alakbarov, 2017a). This perspective is especially relevant to the cross-sectoral nature of AI's effects, as a change in one domain – such as labour market disruption – will be reflected in feedback in education, digital access and institutional capacity in another. The study draws on national strategic document "Azerbaijan 2030: National Priorities for Socio-Economic Development and voluntary national reviews on the SDGs. The third is a comparative method that places Azerbaijan in a group of structurally close countries, post-Soviet states (Kazakhstan, Russia, Georgia, Armenia, Uzbekistan) and regional partners (Türkiye, Iran). The selection is based on shared historical legacies, geographic proximity, and overlapping development challenges (World Bank, 2024; UNESCO, 2022; ITU, 2024). The fourth is statistical analysis of key human development indicators: HDI, GNI per capita, educational achievement, broadband speed, internet penetration and cybersecurity score. Data is collected from World Bank, UNESCO, ITU, Ookla and Institute for Economics and Peace (World Bank, 2024; UNESCO, 2022; ITU, 2024; Ookla, 2025; IEP, 2025).

The analysis is based on descriptive statistics and contextual interpretation of institutional and policy differences. This combination allows for a more nuanced assessment than either quantitative ranking or qualitative narrative alone would allow for.

Theoretical Foundations of Human Development Management in the AI Era. Classical human capital theory, which was related to Gary Becker and Theodore Schultz, framed investment in education and health mainly based on their returns to the person and the nation's economic output. The World Bank and World Economic Forum, then, have developed this theory and have placed human capital as a strategic national asset and a competitive resource for the nation, where knowledge-intensive economies thrive (World Bank, 2024).

The Human Development Report 2025 is a further step into this idea. Instead of the accumulation of human capital, it focuses on the expansion of human capabilities – the substantive freedoms available to people to live lives they have reason to value (UNDP, 2025). In this framework, AI is not so much a technical tool as a structural force that can change the scope of human capabilities at scale. In contrast to previous generations of digital technology, AI systems are able to approximate some cognitive and creative functions, but not just automate physical or routine tasks (UNDP, 2025, Chapter 1; OECD, 2023).

This distinction is both a risk and an opportunity. As neuroscientist Terrence Sejnowski has said, large language models are not people, as their mode of processing is totally different from human cognition (UNDP, 2025, Spotlight 1.1). The risks are over-reliance on automated decision-making, amplification of already existing inequalities, and reproduction of algorithmic biases. The opportunities are enhanced productivity, expanded access to knowledge, and new forms of human-AI comple-

mentarity – but only where appropriate institutional and governance conditions exist (UNDP, 2025; OECD, 2023; European Commission, 2023).

In the national context, Academician Urkhan Alakbarov's inclusive development management view offers an analytically distinct framework. Its central argument is that the primary function of contemporary public administration is not routine service delivery but full development of state capacity and citizen well-being through proactive institutional design (Alakbarov, 2017b; 2019). Applied to Azerbaijan, Alakbarov shows that progress in these areas is dependent on innovative governance technologies, the digitalization of the public sector, and the development of a developmental state capable of steering long-term trajectories of inclusive growth.

Building on this foundation, the author's own research has shown that human capital has become a driver of economic transformation not automatically, but only when supported by systemic institutional conditions, stable investment frameworks, and coherent cross-sectoral policy (Mehdiyev, 2022).

These three theoretical layers – Sen's capability framework as the normative foundation, AI as the new structural context of development, and the Alakbarov approach as the nationally grounded analytical perspective – form the integrated framework of this study. They enable an assessment that moves beyond aggregate indicators toward the conditions that determine whether technological change expands or constrains human development in Azerbaijan.

Education as a Strategic Factor in the Era of New Technologies. The Human Development Report 2025 makes the case that is easy to agree with in principle but difficult to act on in practice: education systems must prioritize not access alone, but the quality of learning outcomes and the development of critical, creative, and interpersonal capabilities (UNDP, 2025). In the context of AI, this argument has a particular implication -- technology should be a complement to pedagogical depth, not replace it. Personalized learning platforms and digital educational resources can improve access and quality, but only where they reinforce and do not displace the core skill development (UNDP, 2025; UNESCO, 2022; OECD, 2023).

Table 1

Education indicators in comparative perspective

Country	Tertiary enrolment, gross % (UNESCO UIS, 2022–2023)	Public expenditure on education, % of GDP (World Bank, 2023)
Türkiye	127.6	4.3
Russia	n/a	4.7
Iran	67.2	3.9
Kazakhstan	60.7	4.1
Armenia	61.2	2.4
Georgia	78.9	3.8
Azerbaijan	41.0	3.7
Uzbekistan	45.8	5.1

Source: compiled by the author based on UNESCO UIS/TheGlobalEconomy.com (2022–2023)

Data are based on the most recent and available data for each country in the UNESCO comparative dataset (2022 or 2023). STEM share data are not consistently available across all countries in the comparison group and have been excluded to ensure methodological consistency. Azerbaijan's education system has undergone substantive reform, with increasing investment in the modernization of curricula, the development of digital infrastructure, and the growth of higher education capacity (UNESCO, 2022; Ministry of Science and Education, 2023).

Education is a core priority of the national development agenda and it was 3.7% of GDP in 2023 (World Bank, 2024) with higher education spending up to 4.5% of GDP. Currently, the tertiary enrolment rate is around 41% of the age group in Azerbaijan which is at the lower middle of the regional comparison group. Uzbekistan has witnessed a drastic rise in the tertiary enrolment rate over the last years (45.8% in 2023), indicating a further expansion of higher education in recent years and that Azerbaijan is now behind its Central Asian peers on this indicator (UNESCO UIS / TheGlobalEconomy.com, 2022-2023).

Türkiye's high gross enrolment ratio of over 127% reflects both the size of its higher education expansion and the large number of international students that it has attracted and is therefore not comparable on a like-for-like basis. The more important regional metric to measure the progress of Azerbaijan's development is the expansion of STEM and ICT oriented courses that are increasingly important for AI-based economic competitiveness. In this regard Azerbaijan's national priorities for Azerbaijan 2030 specifically include digital and technological education and this is an essential part of the strategy in order to achieve further progress (Azerbaijan 2030, 2021; UNDP, 2025).

Digital Infrastructure, Cybersecurity, and Security as Competitive Advantages. The education data presented above indicate that Azerbaijan still has some ground to cover when compared with other national leaders. But a more comprehensive picture of the country's development trajectory involves the areas of real and measurable benefits, which are directly related to how it absorbs and manages AI diffusion: digital infrastructure, cybersecurity and security stability in the countries of the world. These strengths are documented in established international sources and are not reflected as well by aggregate indices like the HDI.

As for digital connectivity, Azerbaijan has been the fastest-growing country in the region in fixed broadband speed. According to the Speedtest Global Index – the most widely used global rating of internet speed published monthly by Ookla – Azerbaijan's average fixed broadband speed was 84 Mbps in 2025, far above each country in the comparison group: Turkey (60 Mbps), Kazakhstan (82 Mbps), Armenia (72 Mbps), Georgia (43 Mbps) and Iran (19 Mbps) (Ookla, 2025). This is something new as Azerbaijan was ranked 116th on the list in 2016 and only 33 Mbps in 2016.

The turnaround is the result of ongoing investment in the online Azerbaijan program that reached full broadband coverage by end-2024 and made fibre-optic coverage available in rural areas and liberated territories in Karabakh as well (ITU, 2025). Internet penetration has reached 89% of the population – the highest in either the South Caucasus or Central Asia. As the ITU Regional Director (ITU, 2025) said in his report regarding Azerbaijan, the cost for a standard broadband subscription is only 1.3% of gross national income per capita, well below the 2% international standard.

Table 2

Fixed broadband internet speed in comparative perspective (Mbps, median, 2025)

Country	Fixed broadband speed (Mbps)	Internet penetration (%)
Azerbaijan	84	89
Kazakhstan	82	91
Armenia	72	79
Türkiye	60	85
Russia	82	88
Georgia	43	78
Uzbekistan	67	79
Iran	19	69

Source: compiled by the author based on Ookla / Speedtest Global Index (2025); ITU ICT Development Index (2025)

This is important for human development in a real-world sense. High-speed, affordable internet is the infrastructure through which AI-enabled services in education, healthcare, and public administration actually reach people. A country having built this infrastructure nationally – in the suburbs, not in the city – is better positioned to ensure that AI diffusion leads to inclusive development rather than further urban-rural divides (UNDP, 2025; ITU, 2025). Security is a second area of strength. For the ITU Global Cybersecurity Index 2024, which is the most rigorous global assessment of national cybersecurity frameworks, Azerbaijan ranked at the "Advanced" level with 93.76 out of 100, significantly above the global average of 65.7 (ITU, 2024). Azerbaijan achieved the highest score on two of the five assessment pillars (Legal Measures and International Cooperation).

This is particularly critical in the AI era: as decision-making at the sector level is now heavily dependent on digital systems, the integrity and resilience of those systems is the basis of responsible AI governance. A country that has a strong legal and collaborative approach to cybersecurity will be better positioned to extend protection to AI-specific risks (algorithmic manipulation, data breaches and adversarial attacks on digital public services) than one that has a weaker institutional base (ITU, 2024; OECD, 2023).

Table 3

Cybersecurity and peace indicators in comparative perspective

Country	GCI 2024, score / tier (ITU)	GPI 2025, rank / 163 (IEP)
Türkiye	100 / T1 Role-Modelling	146
Kazakhstan	94.04 / T2 Advancing	56
Azerbaijan	**93.76 / T2 Advancing**	**95 (↑18 positions)**
Armenia	T3 Establishing	58
Georgia	T3 Establishing	109
Uzbekistan	T3 Establishing	67
Russia	T2 Advancing	163 (last)
Iran	T3 Establishing	142

Source: compiled by the author based on ITU Global Cybersecurity Index 2024; IEP Global Peace Index 2025. GCI scores: exact figures available for Türkiye (100), Kazakhstan (94.04), and Azerbaijan (93.76); tier classification used for remaining countries. GPI ranks out of 163 countries assessed

The third dimension relates to physical security and stability, a basic component to human development that is often overlooked as it is only tangible when value is lost. The Global Peace Index 2025, conducted by the Institute for Economics and Peace and based on 23 indicators on societal safety, ongoing conflict and militarisation, showed Azerbaijan as the best performing country in all 163 nations, with an improvement from 113 to 95 (IEP, 2025).

The main reason was the decline of conflict-related deaths (both internal and external) that followed the end of active war in the Nagorno-Karabakh region. Russia was the lowest performer in the same index in comparison as well as Armenia and Georgia, but the majority of countries in the comparison group showed deterioration. A secure environment reduces the allocation of public wealth to military expenditure, enables investment plans to be made in the longer term, and allows the institutional continuity of human capital to develop over time (IEP, 2025; UNDP, 2025). Combined, these three indicators – regional broadband speed, advanced cybersecurity score, and world's largest improvement in peacefulness – demonstrate the structural conditions that make Azerbaijan a better place to support AI-enabled human development than its HDI ranking reflects. They do not solve the education gaps but it is clear that the country has established the foundation on which it can continue to progress (Alakbarov, 2019; Mehdiyev, 2022).

The development of AI is not linked to technology alone but the quality of the institutional systems that allow for AI to be deployed. The Human Development Report 2025 is very much about this: cooperation between multiple sectors is critical for AI to be beneficial for human development rather than hostile (UNDP, 2025). Alakbarov's inclusive development management framework provides a theoretical basis for this assertion: strategic planning, public administration reform and social policy must be consistent with long-term development goals if institutional efforts are to achieve coherent results (Alakbarov, 2017b; 2019).

There is international evidence to back up this view. Countries with a focus on specific coordination mechanisms – national digital councils, SDG implementation platforms and inter-ministerial working groups – have better growth and development outcomes (World Bank, 2024; OECD, 2023). Azerbaijan has made significant progress in this direction. As such, participation in SDG monitoring and the development of national strategic frameworks centered on human capital development, digitalization, and institutional reform are real policy commitments (UNDP, 2023; Azerbaijan 2030, 2021).

There are still many opportunities in institutional coordination. The sectoral boundaries between education, healthcare, labour market policy and digital development are not yet properly bridged, which makes policy responses to AI-related challenges difficult to coordinate. Making these connections stronger is especially crucial given the cross-sectoral impact of AI on human development.

Human Development Management and Regional Dimension. The involvement of human development as a focus for rehabilitation of the Karabakh region is a concrete demonstration of Azerbaijan's commitment to inclusive development. Not only is the rebuilding of schools, medical facilities, employment services and digital infrastructure in liberated territories a matter of physical reconstruction, but also the institutionalization of the development principles as outlined by Alakbarov and Mehdiyev and their impact on the policy formulation (Alakbarov 2019; Mehdiyev, 2022). Three key issues matter very much. Educational and medical institutions with digital and AI-enabled technology can accelerate human capital development in the region as long as physical infrastructure is coupled with sufficient human resources and quality of programming. Second, the restoration of communication and broadband access can close the digital divide and make distance learning and telemedicine viable from the ground up and are as much a function of connectivity (UNDP, 2025; ITU, 2023; 2025). Third, the involvement of local communities and returnees in planning and managing reconstruction projects builds institutional trust and long-term social resilience that external investment can't provide for (UNDP, 2023).

At the regional level, the rise in the education and science cooperation level of Azerbaijan (academic exchanges, joint research projects and cooperation with regional partners like Türkiye, Iran and post-Soviet countries) has created new pathways and links for sharing of global best practice and the development of common ethical norms for AI use in education and healthcare as well as social protection (UNDP, 2025; OECD, 2023).

The need to improve intersectoral coordination. As we have seen above, Azerbaijan is unable to respond to the development of AI in an efficient and equitable way due to lack of cohesive cross-sectoral mechanisms. Four areas of institutional development are particularly important. To the best of our knowledge, the establishment of a national coordination platform to link AI and the Sustainable Development Goals would help in developing policy coherence with a common institutional space that would enable government bodies, academia, the private sector, and civil society to work together on AI strategic planning and risk management (OECD, 2023; UNDP, 2021).

Moreover, developing better monitoring systems to include digital skills acquisition, AI usage, and access to technology would more accurately reflect development progress in the digital age, and not just HDI (UNDP, 2025; ITU, 2023). Third, it is essential to strengthen the link between strategic planning and public budgeting in order to make sure that investments in digital technologies are linked to long-term human development objectives rather than short-term efficiency gains (World Bank, 2024;

IMF, 2023). Lastly, stronger institutional cooperation between universities, research institutes, and the private sector would facilitate innovation and better align education and future human development in the AI-based economy (UNESCO, 2022; OECD, 2023).

Conclusion. This article has looked at human development management as a policy tool for sustainable development in Azerbaijan in light of the situation that AI has brought. The comparison of three domains (education, digital infrastructure and cybersecurity, and post-conflict regional development) is quite clear in this regard: Azerbaijan has achieved some of its best and exceptional results by regional standards but has to contend with structural restraints that AI diffusion is likely to expose and exacerbate. In education, the gap in tertiary enrolment compared to regional leaders (especially Türkiye and Kazakhstan) indicates that the human capital base for an AI-capable economy is not fully established.

In digital infrastructure and cybersecurity, Azerbaijan is in a more genuine position of leadership in the region: the country has the highest fixed broadband speed among its peers, an advanced status in the ITU Global Cybersecurity Index, and the world's greatest single-year improvement in the Global Peace Index in 2025. In post-conflict regional development, the rehabilitation of liberated territories is a major institutional challenge and a test of Azerbaijan's ability to apply inclusive development principles in practice.

The theory created by Alakbarov is very pertinent to the analysis of these patterns, with the same basic argument that human capital becomes a development accelerator if it is embedded in a stable institutional environment and if the investment is well-coordinated in a long-term way (Alakbarov, 2019).

The difficulty for Azerbaijan is not lack of strategic ambition but the institutional coherence necessary to translate that ambition into a consistent, fair, and sustainable development performance across sectors. AI's role in Azerbaijan's development should be seen not as a substitute for institutional reform but as a force that elevates the institutional challenge to all. When coordination is on the up and when investment is high, AI will be able to add value to the human capabilities that are available to improve service delivery and accelerate the expansion of the economy. The solution to this is good governance and cross-sectoral coordination, and the kind of commitment that is fundamental to the development of the human potential that is the basis of any lasting development.

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