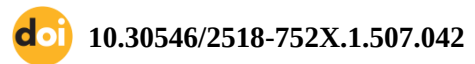


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DIGITALISATION AND DIGITAL LITERACY OF HIGHER EDUCATION INSTITUTIONS IN AZERBAIJAN: GLOBAL AND LOCAL TRENDS

Keywords: Digital transformation; digitalisation; digital literacy; higher education; Azerbaijan

Açar sözlər: Rəqəmsal transformasiya; rəqəmsallaşdırma; rəqəmsal savadlılıq; ali təhsil; Azərbaycan

Ключевые слова: Цифровая трансформация; цифровизация; цифровая грамотность; высшее образование; Азербайджан

1 Introduction

The rapid advancement of digital technologies has dramatically transformed how people communicate, access information, and operate businesses worldwide [17]. COVID-19 has demonstrated that digitalisation and technological advancements are essential to an increasingly globalised world [21]. Within Higher Education Institutions (HEIs), there is broad agreement that technology constitutes a critical part of the 21st-century university [4] and the cornerstone of the globalisation process within HEIs [22]. In light of the COVID-19 pandemic, digital transformation has emerged as the foremost priority in HEIs [21], [7]. Scholars in the field maintain that digital transformation is a defining characteristic of modern higher education [20], and this digital evolution has gained significant traction in HEIs over the past decade [26]. Bibliometric evidence shows a dramatic rise in peer-reviewed studies on HEI digital transformation during the first two years of the COVID-19 pandemic, signalling a sector-wide acceleration [24].

Moreover, advancements in Artificial Intelligence (AI) have made it a necessary part of this digital era, increasing the need to establish a digital infrastructure within HEIs [14]. Consequently, HEIs worldwide cannot distance themselves from digital transformation, as it remains essential for higher education [34]. A recent bibliometric review by Zhao & Zhou (2024) covering 8,521 papers published between 1968 and 2023 demonstrates that research on higher-education digitalisation has expanded exponentially, especially in the past decade. Yet, little is known about how lower-middle-income post-Soviet systems, such as Azerbaijan, are translating high-level digital strategies into campus-level

practice. This paper, therefore, asks: What progress have Azerbaijani HEIs made toward digital maturity, and what gaps remain relative to global benchmarks?

Azerbaijan is also participating in this global technological transformation as a developing country in the Eurasian region. Several initiatives and strategies have been set to pave the way for the digital transformation of HEIs [12]. For instance, the State Agency for Public Service and Social Innovations and the “Azerbaijan 2020: Look into the Future” development concept have laid the groundwork for digital transformation [33]. The subsequent socio-economic development strategy of Azerbaijan highlights the cultivation of innovative and digital skills in higher education as a national priority, signalling high-level political commitment to digitalisation [2].

The purpose of this paper is to discuss the development and incorporation of digitalisation within HEIs in Azerbaijan and compare the global and local trends in the field. By exploring current international and regional initiatives, opportunities, and challenges, this study aims to shed light on valuable insights into how HEIs in Azerbaijan can leverage the technologies to enhance their digital transformation.

2 Literature review: Digitalisation and Digital Transformation in HEIs

Digital transformation has been conceptualised in the literature through multiple lenses. Scholars frame digital transformation as the strategic use of technologies to improve performance, redesign workflows, and create new organisational value [36]. This notion is predominantly associated with the strategic orientation and business practices of organisations and enterprises. Digitalisation in education refers to integrating digital technologies into all aspects of teaching, learning, and administration [31]. At the operational level, it involves deploying e-textbooks, electronic diaries, and e-mail-based communication to replace paper-heavy routines, making it dependent on digital tools [10]. Studies indicate that while digital infrastructure in developing countries has improved, effective implementation requires alignment of technology, pedagogy, and policy [16].

HEIs hold a pivotal position in the development of human capital on a global scale. It is crucial for these institutions not only to adapt to technological advancements but also to take a proactive role in driving them. Subsequently, scholars have conceptualised the digital transformation of higher education as an ongoing process [26], [36], in particular, described digital transformation as a process through which organisations respond to evolving conditions by leveraging digital technologies to generate value, enhance outputs, or increase the overall value of their offerings. While many universities are enhancing their technological frameworks, there remains a pressing need for further progress, particularly in the realms of research and digital innovation. According to Gümüšoğlu (2017), the core domains of digital transformation in HE includes education, administration, research, and societal engagement. A deliberate and strategic focus on each of these areas can foster a more adaptive and resilient educational environment.

A growing body of research highlights the critical influence of institutional governance and management in advancing digital transformation during the globalisation era [12,13,23] universities form partnerships with industry, they play a key role in facilitating and supporting student mobility, delivering online education, and tracking academic progress. For instance, in sustainable management within

higher education, Spanish scholars [1] have emphasised that digital transformation entails a comprehensive integration of digital technologies across all institutional dimensions. This transformation necessitates substantial changes in technological infrastructure, organisational culture, and university operational processes [23]. Other researchers highlight digital transformation in universities as a form of organisational evolution. For instance, Hinings, Gegenhuber, and Greenwood [11] assert that “digital transformation is, without doubt, institutional change,” while Deja, Rak, and Bell (2021) describe it as a process of organisational transformation.

Grosbeck et al. (2020) stress the importance of clearly defined objectives concerning digital infrastructure, the cultivation of digital literacy among both faculty and students, and the seamless integration of technology into teaching practices. This includes formulating strategic plans, building external collaborations, fostering innovation, and ensuring institutions remain aligned with the dynamic expectations of students and the workforce (Pashayeva, 2024).

In the post-Soviet context, countries like Azerbaijan face unique institutional and cultural challenges that influence the pace and scale of digital adoption (Ismayilov & Khalilova, 2021). The digital divide, particularly between urban and rural areas, and the lack of trained faculty remain key barriers to achieving full digital maturity in HEIs [37].

Notable progress has been made in this area within Azerbaijani universities, particularly the HEIs that host international students. The urgency brought on by the COVID-19 pandemic has further accelerated these developments. These efforts reflect a continuous and structured approach to modernising administrative operations and harnessing digital technologies to enhance efficiency and accessibility.

2.1 Global Trends and Practices of Digitalisation in HEIs

The existing literature indicates that advancements in digital infrastructure and emerging technologies are prompting HEIs to expand their online course offerings, necessitating the development of educators’ digital skills and competencies. According to the research carried out by Prabowo and Bandur (2021), quantitatively, 42 per cent of the 125 Scopus papers surveyed employ purely quantitative methods, and nearly half were published during 2020-2021, underscoring the field’s rapid expansion. This can extend the global accessibility of HE. Digital learning tools are increasingly being customised to accommodate various learning and teaching styles, contributing to improved academic performance.

Digitalisation streamlines the distribution and access of learning resources, framing digital research in HE as an interdisciplinary space that bridges technology, pedagogy, administration, leadership, and ethics [40]. Together, these advances are modernising the sector while expanding accessibility and raising standards.

Recent survey data from Muscanell and Gay (2025) show that HEIs are shifting decisively from purely face-to-face instruction to hybrid and fully online models, forcing curriculum teams and teacher-education programmes to rethink assessment, engagement, and learner support. A growing body of systematic reviews [15] confirms that building advanced digital competences, from multimedia course design to data-informed pedagogy and fluent online communication, has become a strategic imperative for both staff and students. A key institutional priority is the cultivation of digital competencies among both educators and students. Supporting this transition

requires significant investment in digital infrastructure, including high-speed internet and virtual laboratories [40]. Additionally, ensuring equitable access to digital learning resources remains critical, particularly in light of the diverse needs and backgrounds of the student population [32].

The growing transformation and shift toward digital learning necessitate a fundamental overhaul of national education policies. Hence, governments must develop standardised regulations that uphold both the quality, cybersecurity and fairness of digital transformation. This highlights the need for strong legal frameworks to protect the personal information of students and educators and to ensure the security of educational data. In the following section, faced challenges and presented opportunities of digitalisation are discussed in more detail.

2.2 Global Trends and Practices of Digitalisation in Azerbaijan HEIs

Significant progress has been made in Azerbaijan toward the digitalisation of education, including the development of new ICT infrastructure and the integration and modernisation of advanced technologies. For instance, several HEIs in Azerbaijan connected to the Azerbaijan Education Network now have access to GEANT – the world’s largest international academic and research network. This connection enables these institutions to tap into GEANT’s extensive research capabilities, facilitating collaborative academic/scientific activities and joint research projects.

Over time, set measures have helped shape the country’s technological landscape [27]. As noted in Pashayeva [24]., the Strategic Roadmap (2016) included points such as:

1. The first direction focused on enhancing the educational content and improving curricula across all levels of education.
2. The second direction aimed to train professionals to meet contemporary standards, modernise human resources in education and create an inclusive training methodology for individuals with special needs.
3. The third direction focused on establishing a management mechanism in education that is transparent, responsible, and successful.
4. The fourth strategic direction aimed to develop an educational infrastructure that meets current standards and supports lifelong learning. This direction also includes crucial aspects such as establishing a suitable framework for implementing information and communication technology-driven learning methods and remote education.
5. The fifth objective focused on establishing a financially viable framework for funding the education system in the country, aligning it with the benchmarks set by the world’s top education systems. This involved utilising diverse resources to enhance the financing mechanism of education, implementing per capita funding and providing assistance for the provision of paid educational services.

The strategic plans of HEIs show notable emphasis on embedding IT skills across all levels of the education system, from primary to higher education [23]. This integration was identified as a crucial curriculum element starting in 2025, aligning with international educational standards [27]. According to the Strategic Roadmap (section 3.1.4), the initiative aims to enhance HEIs by combining education, research, and innovation.

Furthermore, Suleymanov's (2019; 2020) research outlines the most recent trends observed in HEIs in Azerbaijan amidst the globalisation process. The author identifies thirteen key trends, and one of those trends is related to the significance of adopting information and communication technologies (ICT). It was noted that the incorporation of ICT into higher education and administrative processes has rapidly expanded, mainly due to challenges presented by the COVID-19 pandemic.

One of the key areas within the innovative educational initiatives aimed at modernising the education system in Azerbaijan is the digitalisation of official educational documents. In this context, a significant step was taken on February 5, when the President of the Republic of Azerbaijan, Ilham Aliyev, signed a Decree to implement the amendments to the Law of the Republic of Azerbaijan "On Education," originally passed on December 18, 2020. This legislative action underscores the government's commitment to advancing the digital transformation of the education sector.

The "Virtual School" platform, introduced in Azerbaijan during the 2020–2021 academic year in response to the COVID-19 pandemic, proved effective in gathering extensive data on the educational activities of students. Notably, two rounds of national assessments conducted via the platform during this period enabled the establishment of a comprehensive database containing students' exam results [10].

The implementation of this innovative approach enhances Azerbaijan's position in international rankings and strengthens its reputation. However, those initiatives come with challenges as well as opportunities that the higher education sector must face.

2.1.1 Opportunities of the digitisation transformation of education in Azerbaijan

The digitalisation of education in Azerbaijan and the growing effectiveness of digital technologies have manifested in several keyways:

- Digital tools have streamlined administrative and organisational processes within educational institutions.
- The integration of technology has enhanced the overall learning experience, making education more accessible and convenient.
- Digital transformation provides an opportunity to be part of the global knowledge.
- The digital learning ecosystem enables to continuous refinement and improvement of teaching and learning processes.

2.1.2 Challenges of the digitisation process in education

As previously discussed, the digitalisation of HE in Azerbaijan has yielded notable achievements. However, several challenges persist. These issues include:

- Individuals lacking prior experience with internet usage and digital tools often struggle to adapt to online learning environments. Some are unaware of the educational benefits digitalisation offers, while others, despite recognising its potential, are unable to navigate applications without external assistance.
- A segment of the population lacks access to the necessary devices, such as computers or tablets, and high-speed internet, which are essential for effective participation in online education.

Given the rapid evolution of the knowledge economy, the commercialisation of knowledge, the rise of AI, and the emergence of new professions, some of which are replacing outdated roles, education must increasingly adopt a research-driven, forward-looking approach. As a result, educational institutions are expected to embrace greater responsibility and accountability. However, tangible indicators of research commercialisation remain limited. For instance, Azerbaijan filed only 171 patent applications in 2018, far below Belarus (513) and Georgia (274), highlighting the early stage of university-driven innovation [2].

As a result, like other nations worldwide, Azerbaijan has been significantly influenced by global trends in digital technology. Yet a misalignment between university outputs and labour-market needs persists: in 2019, more than 16,000 degree-holding youths were unemployed, evidence of a skills gap that hampers Azerbaijan's knowledge-economy ambitions [2]. Cross-sector benchmarks indicate that higher education ranks lowest on digital-readiness indices, chiefly because hierarchical governance and change-resistant academic cultures dampen agile leadership [24]. Scholars further underscore persistent digital divides: low- and lower-middle-income countries still struggle with infrastructure, devices and learning-platform access, hampering the transition to fully online models [39].

Furthermore, research suggests that in today's information society, scientific knowledge is evolving rapidly. Effectively managing the growing volume of data and harnessing it as a foundational scientific and educational resource requires a deeper engagement with disciplines such as informatics and its subfields. The fields such as Bibliometrics and Elmetrics significantly contribute to the advancement of science and the development of HEIs, particularly (Hajiyeva et al, 2023).

3 Requirements for the development

To ensure sustainable and effective digital transformation across HEIs in Azerbaijan, several key requirements must be fulfilled. These requirements span across policy, infrastructure, staff development, institutional governance, and technological innovation:

Regulatory Frameworks: Develop comprehensive regulations addressing digital learning standards, cybersecurity, data privacy, and online credential verification.

Digital Infrastructure Expansion: Ensure high-speed internet connectivity across all regions, particularly in underserved rural areas, to bridge the digital divide. Invest in virtual laboratories and integrate AI-driven tools to support advanced learning and research. Zhao and Zhou's (2024) findings reinforce the urgency of device-loan schemes and rural broadband initiatives to close these gaps.

Capacity Building and Digital Literacy: Design and implement nationwide professional development programs to build educators' digital competencies, including instructional design, online communication, and content creation. To establish a digital education system, there must be an ongoing focus on enhancing the technological competencies of academic staff. However, existing structural challenges within Azerbaijan's higher education system limit universities' ability to respond swiftly to evolving labour market needs, thereby impeding the development of a knowledge-driven society [35].

Strategic Institutional Planning: Each HEI should develop a dedicated digitalisation roadmap with clear goals, timelines, and measurable outcomes.

Benchmarking studies classify universities into ‘digital masters,’ ‘evolving planners,’ ‘growing implementers,’ and ‘starters’ based on the intersection of leadership strength and digital capability, implying that capacity-building interventions must be cluster-specific [24].

Research and Innovation Ecosystem: Foster interdisciplinary research that combines education, technology, and data science. Strengthen cooperation with global HEIs and networks to access shared digital resources and collaborative research opportunities. Current policy already envisages ‘innovation clusters’ within multidisciplinary universities; operationalising these clusters would anchor the education-research-innovation continuum and raise patenting as well as industry collaboration.

Sustainable Funding and International Collaboration: Secure diverse financing mechanisms to underwrite digital initiatives, including public-private-partnership (PPP) models and targeted grants for non-state innovation centres. Without such funding streams, digital uptake in Azerbaijani HEIs is likely to stall [2].

By addressing these foundational requirements, Azerbaijan can build a resilient and forward-looking higher education system capable of leveraging digital technologies to improve quality, access, and global competitiveness.

4 Conclusions

The digitalisation of HEIs in Azerbaijan reflects both a national imperative and a global trend, shaped by technological advancements. This paper has examined the complex and multidimensional nature of digital transformation in Azerbaijani HEIs through the lens of global and local developments, highlighting both opportunities and persistent challenges.

Globally, digital transformation in higher education has catalysed new pedagogical models, enhanced administrative efficiency, and fostered inclusive access to knowledge. In Azerbaijan, substantial strides have been made in aligning national education strategies with international digitalisation benchmarks. Recent legislative amendments and strategic documents, such as the “Strategic Roadmap” and “Azerbaijan 2030,” underscore the institutionalisation of digital initiatives in education governance.

Despite these advances, several systemic challenges remain. The digital divide between urban and rural areas, limited access to necessary technological tools, lack of policy regulations and frameworks (e.g. data protection, cybersecurity), and gaps in digital literacy among both faculty and students hinder the equitable implementation of digital transformation. Addressing these challenges requires a coordinated approach encompassing policy reform, infrastructural investment, human capital development, and institutional capacity building.

Ultimately, the success of digitalisation in Azerbaijan’s higher education sector depends on a holistic and inclusive strategy that bridges technological, pedagogical, and administrative domains. By embracing digital transformation as both an educational and societal objective, Azerbaijan has the potential to emerge as a regional leader in higher education innovation, thereby contributing to the global knowledge economy and fostering a resilient, future-ready academic ecosystem.

Despite its breadth, this review is limited by (i) reliance on publicly available Azerbaijani sources, which may overlook grey literature; (ii) the absence

of primary stakeholder interviews, leaving some findings unvalidated; and (iii) a rapidly evolving policy landscape that could render certain data obsolete. Future studies should employ mixed-methods designs, including surveys and semi-structured interviews with faculty, students, and policymakers, to triangulate evidence and track digital transition and maturity over time.

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Xülasə

AZƏRBAYCANDA ALİ TƏHSİL MÜƏSSİSƏLƏRİNİN RƏQƏMSALLAŞMASI VƏ RƏQƏMSAL SAVADLILIĞI: QLOBAL VƏ YERLİ TENDENSİYALAR

Bu məqalədə Azərbaycanda ali təhsilin global və yerli tendensiyalar çərçivəsində rəqəmsallaşdırılması geniş kontekstdə araşdırılır. Azərbaycan ali təhsil müəssisələrində rəqəmsallaşma və rəqəmsal savadlılığın artırılması üçün qəbul edilə bilən rəqəmsal transformasiyanın hərəkətverici qüvvələrini, əsas çağırışları və ən yaxşı təcrübələrindən bəhs edilir. Tədqiqatın məqsədi global və regional aspektdən siyasətləri, texnoloji irəliləyişləri və nümunə araşdırmaları təhlil edərək Azərbaycanda ali təhsildə daha effektiv və davamlı rəqəmsal ekosistem üçün tövsiyələr verməkdir.

**Хаяла Пашаева
Севда Иманова**

Резюме
ЦИФРОВИЗАЦИЯ И ЦИФРОВАЯ ГРАМОТНОСТЬ
В ВЫСШИХ УЧЕБНЫХ ЗАВЕДЕНИЯХ АЗЕРБАЙДЖАНА:
ГЛОБАЛЬНЫЕ И ЛОКАЛЬНЫЕ ТЕНДЕНЦИИ

В данной работе рассматривается цифровизация высшего образования в Азербайджане в контексте глобальных и локальных тенденций. Анализируются движущие силы цифровой трансформации, основные вызовы и лучшие практики, которые могут быть использованы для содействия цифровизации и повышения цифровой грамотности в высших учебных заведениях Азербайджана. Цель исследования – выработка рекомендаций по созданию более эффективной и устойчивой цифровой экосистемы в сфере высшего образования Азербайджана на основе анализа политики, технологических достижений и тематических исследований в глобальном и региональном контексте.