

AI-Based Quality Management Mechanisms in Higher Education: Digital Transformation, Challenges, and Development Prospects

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Abstract

The modern higher education system is in the process of active digital transformation, where the development of quality management and quality assurance mechanisms based on Artificial Intelligence (AI) is gaining particular importance. In the context of technological progress and rapid changes in the educational environment, universities are increasingly moving to data-based and innovative management models, which contribute to the effectiveness of teaching, assessment, monitoring and institutional development. The COVID-19 pandemic has further accelerated this process and sharply demonstrated the importance of digital platforms, Learning Analytics and automated quality mechanisms in higher education.

The aim of the paper is to analyze the impact of digital transformation, modern quality assurance approaches, key challenges and development prospects in higher education. The study is based on the Desk Research method and combines the analysis of international scientific literature, ESG standards, ENQA, UNESCO, OECD and Council of Europe documents. Special attention is paid to internal quality assurance mechanisms, data-driven governance, integration of the PDCA cycle and the use of digital technologies.

The results of the study showed that AI-based quality management systems significantly increase the organizational effectiveness of universities, the accuracy of decision-making and the ability to continuously improve quality. Artificial intelligence is used to analyze student progress, develop personalized learning, automate assessment and identify academic risks. In addition, challenges such as data confidentiality, algorithmic bias, academic integrity and the need for effective AI Governance frameworks were identified.

The paper concludes that quality assurance in higher education institutions should be viewed as a multidimensional, integrated and continuous development process that combines systemic approaches, practical mechanisms, innovative technologies and people-centered management. Quality management systems based on artificial intelligence are not only a technological innovation, but also an important mechanism for the strategic development of universities, their competitiveness and effective integration into the international educational space.

Keywords: artificial intelligence, quality management, higher education, digital transformation, quality assurance

Introduction

The world's higher education system is undergoing a significant transformation in the context of globalization, technological progress and rapid changes in the labor market. Universities are no longer considered only as a space for knowledge transfer; they have gradually turned into centers of innovation, research and digital governance. In this process, special importance is attached to the quality of education, which determines not only institutional efficiency, but also the international competitiveness and sustainable development of universities. That is why quality assurance and quality management have become one of the main strategic directions of modern higher education institutions.

The reforms implemented in the European higher education area have significantly changed the traditional understanding of quality assurance. Quality management today is no longer limited to the function of assessment and control, it is associated with continuous improvement, institutional development and the formation of a quality culture. According to the European Association for Quality Assurance in Higher Education (2015)¹, quality assurance is based on student-centered learning, transparency, institutional autonomy, and the active involvement of stakeholders. Consequently, quality management in modern universities is becoming a more systematic and data-driven process.

In the era of digital transformation, artificial intelligence (AI) has gained a special role in the field of education. The development of AI, Learning Analytics, Predictive Analytics, and Big Data technologies has provided universities with entirely new opportunities. These technologies enable higher education institutions to analyze student progress, the effectiveness of the learning process, and institutional outcomes in real time. Wayne Holmes, Johan Boren Persson, Ioanna Chounta, Barbara Wasson, and Vania Dimitrova (2022) ²note that artificial intelligence in education is not merely a technological innovation but also an important tool for teaching and quality management.

The COVID-19 pandemic further accelerated the process of digitalization in higher education and clearly highlighted the importance of technology-oriented and data-driven management³. Universities were forced to rapidly transition to online and hybrid learning, which fundamentally changed the organization of the educational process, communication methods, and assessment practices. These developments increased the relevance of Learning Management Systems (LMS), electronic assessment systems, and AI-based analytical mechanisms. At the same time, challenges such as data confidentiality, technological inequality, academic integrity, and the ethical use of AI became increasingly evident.

Modern quality management systems are based on the principle of continuous improvement, one of the foundations of which is the PDCA (Plan-Do-Check-Act) cycle. This model allows universities to consider educational and administrative processes as a constantly evolving system, based on data analysis and timely

¹ Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG) (Brussels: ENQA, 2015),

² Zawacki-Richter, O., Marín, V., Bond, M., & Gouverneur, F., "Systematic Review of Research on Artificial Intelligence Applications in Higher Education," International Journal of Educational Technology in Higher Education 16, no. 39 (2019):

³ OECD, Digital Education Outlook 2021: Pushing the Frontiers with Artificial Intelligence, Blockchain and Robots (Paris: OECD Publishing, 2021), 17.

response to assessment results. Quality assurance in universities has gradually turned into a systematic and evidence-based process, where special importance is attached to internal quality mechanisms, feedback and integration of digital tools. In today's educational environment, artificial intelligence is actively used to predict student progress, develop personalized learning, automate assessment and identify academic risks. These approaches significantly increase the effectiveness and organizational flexibility of quality management processes. However, the integration of AI is also associated with a number of challenges, including data security, algorithmic bias, and academic ethics.

The relevance of this study is due to the fact that traditional quality management models in the higher education system are gradually being replaced by systems based on artificial intelligence and data-based governance principles. Accordingly, the study of AI-based quality management mechanisms, their capabilities, and development prospects is of particular importance.

The aim of the paper is to analyze AI-based quality management mechanisms, the impact of digital transformation, modern quality assurance systems, and key challenges in higher education. The study is based on the Desk Research method and includes an analysis of international scientific literature, ESG standards, ENQA, UNESCO, OECD, and Council of Europe documents.

Main Body

Modern approaches to quality assurance in higher education are increasingly based on data analysis, digital governance and technological integration. In contrast to traditional quality control models, modern universities are focused on continuous development, institutional flexibility and evidence-based decisions. In this process, special importance is attached to the use of artificial intelligence, which has had a significant impact on the transformation of both academic and administrative processes.

In the contemporary educational environment, artificial intelligence is used not only as a tool for technological support but also as an important component of quality management systems. Through AI, universities are able to analyze student engagement, learning outcomes, assessment effectiveness, and institutional data in real time, which significantly improves the decision-making process. Wayne Holmes, Johan Boren Persson, Ioanna Chounta, Barbara Wasson, and Vania Dimitrova (2022) note that AI in education is an important mechanism that makes teaching and quality management processes more effective and data-driven⁴.

In modern universities, artificial intelligence is particularly used in internal quality assurance mechanisms, which include:

- Monitoring of the teaching and learning process;
- Program self-evaluation;
- Analysis of student feedback;
- Evaluation of academic staff;

⁴ Holmes, W., Persson, J., Chounta, I.-A., Wasson, B., & Dimitrova, V., Artificial Intelligence and Education: A Critical View through the Lens of Human Rights, Democracy and the Rule of Law (Strasbourg: Council of Europe Publishing, 2022), 25

- Assessment of learning outcomes;
- Quality control of e-learning systems;
- Protection of academic integrity;
- Student support services;
- Data-driven institutional governance.

Learning Analytics systems allow universities to assess student activity, attendance, learning engagement, and academic progress in detail. The analysis of this data is used to identify students' academic risks in a timely manner and plan individual support mechanisms. Predictive analytics is particularly effective in the process of early detection of academic lag and the risk of dropping out. This approach makes quality management a more preventive and predictable process.

Artificial intelligence also contributes to the improvement of institutional efficiency by supporting evidence-based decision-making and strategic planning. Universities are increasingly integrating AI-powered analytical systems into their internal quality assurance frameworks in order to strengthen institutional responsiveness, improve educational outcomes, and ensure continuous quality enhancement. Through real-time monitoring and automated data analysis, higher education institutions can respond more effectively to academic challenges and institutional needs.

In addition, AI technologies play an important role in enhancing academic integrity and the quality of online education. Automated plagiarism detection systems, intelligent assessment tools, and digital monitoring mechanisms help universities maintain transparency, fairness, and ethical standards in academic processes. As online and hybrid learning environments continue to expand, AI-supported quality control systems have become essential components of modern higher education governance.⁵

AI also plays a significant role in the processes of program self-evaluation and monitoring. In modern universities, artificial intelligence systems are used to analyze the effectiveness of academic programs, assess quality indicators, automatically process student feedback, and prepare institutional reports. This approach significantly reduces administrative workload and increases the ability to make data-driven decisions.⁶

Particular importance is attached to the evaluation of the quality of e-learning. The development of electronic/distance and hybrid learning has created new challenges for universities related to monitoring the educational process, student engagement, and the reliability of assessment. AI-based systems evaluate student activity during online lectures, the intensity of learning platform usage, the quality of assignment completion, and the level of achievement of learning outcomes. These mechanisms contribute to the improvement of the quality of distance learning and the more effective management of the educational process.

⁵ Valdiviezo Sir, P., Arévalo Reátegui, R., Guevara, M., Revilla, D., & Valqui, J., "Artificial Intelligence and Predictive Analytics in Higher Education Quality Management," *International Journal of Educational Technology in Higher Education* 22, no. 3 (2025)

⁶ Carmo, M., Lacerda, D., Klingenberg, C., & Piran, F., "Digital Transformation and Quality Assurance Mechanisms in Higher Education Institutions," *Quality Assurance in Education* 33, no. 2 (2025)

Artificial intelligence is also actively used in the protection of academic integrity. Modern universities widely utilize plagiarism detection systems, text analysis tools, and electronic exam monitoring mechanisms⁷. These technologies ensure the reliability of the assessment process, the protection of academic ethics, and the prevention of academic misconduct.

AI is also being used in universities for student support services. Chatbots, virtual assistants, and AI-based advisory systems provide students with information about the learning process, administrative procedures, and academic support. These systems help to simplify communication and increase student engagement. In addition to internal quality assurance mechanisms, external quality assurance systems also play an important role, including:

- Authorization;
- Accreditation;
- External expertise;
- Institutional evaluation;
- International rankings;
- Monitoring of quality indicators;
- Assessment of compliance with international standards.

Under modern conditions, AI is actively used in authorization and accreditation processes. Artificial intelligence systems support the analysis of self-evaluation reports, the assessment of quality indicators, and the comparative processing of data. These mechanisms significantly increase the efficiency of the evaluation process and reduce dependence on administrative resources.

In the process of external evaluation, particular importance is attached to international rankings and institutional analytics. AI is used to analyze universities' academic outcomes, research productivity, student employment indicators, and international cooperation. These data enable universities to plan strategic development more effectively and increase international competitiveness.

Modern quality management systems are based on the principle of continuous improvement, one of the foundations of which is the PDCA (Plan-Do-Check-Act) model. This approach allows universities to consider educational and administrative processes as continuously developing systems based on evaluation, monitoring, and timely responses to achieved results. At the same time, the ADDIE model is actively used in the planning process of online and hybrid learning, which includes the stages of analysis, design, development, implementation, and evaluation.

Within the framework of the research, it was revealed that modern universities are gradually transitioning to the Smart Quality Assurance Ecosystem model, which combines artificial intelligence, data-driven governance, predictive analytics, and internal and external quality assurance mechanisms. This approach transforms quality management into a more flexible, integrated, and development-oriented process.

⁷ UNESCO, Generative AI and the Future of Higher Education (Paris: UNESCO Publishing, 2023)

Despite the significant opportunities, the integration of AI is associated with a number of challenges. One of the main concerns is data privacy and information security. AI systems rely on the processing of large amounts of data, which increases the risk of misuse of personal information. The Council of Europe (2022) emphasizes that the use of AI in education is directly related to issues of human rights, freedoms and the protection of personal data.

Another important challenge is algorithmic bias. AI systems depend on the data they are trained on, therefore, incorrect or biased data may affect the objectivity of decisions. The European Commission (2021) notes that trustworthy AI must be based on transparency, fairness and human oversight.

In addition, technological inequalities, a lack of digital competences and the absence of effective AI Governance policies remain significant challenges. Accordingly, it is important for universities to establish systems that balance technological development with academic values and ethical standards.

Thus, quality management mechanisms based on artificial intelligence in modern higher education create the basis for data-based and predictive governance. Modern universities are gradually moving to the Smart University model, which is based on artificial intelligence, Learning Analytics and integrated quality management systems. This model allows universities to ensure continuous quality improvement, institutional efficiency and effective integration with the international educational space.

Conclusion

The modern higher education system is undergoing an active process of digital transformation, which significantly changes the governance, academic, and quality assurance systems of universities. The research demonstrated that AI-based quality management mechanisms are no longer merely technological innovations for modern universities; rather, they are gradually becoming important tools for institutional development, strategic governance, and quality improvement.

The analysis of international literature, ESG standards, documents of ENQA, UNESCO, OECD, and contemporary academic practices conducted within the framework of this paper confirmed that traditional quality management models are gradually being replaced by data-driven and more predictive systems. The integration of Learning Analytics, Predictive Analytics, Big Data, and AI Governance enables universities to evaluate in real time the effectiveness of the educational process, students' academic progress, institutional outcomes, and quality indicators.

The research also revealed that artificial intelligence plays a significant role in both internal and external quality assurance mechanisms. AI is actively used in monitoring the educational process, program self-evaluation, analysis of student feedback, control of academic integrity, authorization and accreditation processes, assessment of institutional effectiveness, and strategic decision-making. These mechanisms significantly increase the accuracy, flexibility, and efficiency of quality management processes.

One of the important findings of the paper is the concept of the Smart Quality Assurance Ecosystem, according to which quality assurance should be considered as an integrated digital ecosystem that combines artificial intelligence, data-driven governance, predictive analytics, and internal and external quality

assurance mechanisms. This approach transforms quality management into a more preventive and development-oriented process.

At the same time, the study identified significant challenges related to data privacy, algorithmic bias, academic ethics, technological inequality, and the need for effective AI Governance policies. Accordingly, it is of particular importance for modern universities to establish governance frameworks that balance technological development with ethical and academic standards.

Based on the results of the study, it can be said that the modern higher education system is gradually moving towards the Smart University model, where quality management is based on artificial intelligence, digital ecosystems, and data-driven solutions. This transformation allows universities to ensure continuous quality improvement, international competitiveness, and institutional development.

Thus, artificial intelligence-based quality management mechanisms represent one of the important directions in the development of modern higher education, which significantly determines the functioning model of future universities, quality culture, and integration with the international educational space.

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