УДК 332:338.246.8:330.131.5
JEL Classification: D1

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STRENGTHENING INTERNAL CONTROL SYSTEMS AND THE APPLICATION OF MODERN TECHNOLOGIES: THE CASE OF AZERBAIJAN

DOI: https://doi.org/10.32620/cher.2026.1.03

Formulation of the problem. This study examines how modern technologies have been integrated into internal control systems in Azerbaijan between 2020 and 2025, focusing on financial institutions, large enterprises, and the public sector. *The purpose of the study.* The purpose of the study is to comprehensively analyze the current state of internal control systems in Azerbaijan and substantiate ways to improve them through the introduction of modern technologies to increase the efficiency of corporate governance and financial transparency. *The object of the study* is the organizational, methodological and technological aspects of strengthening internal control systems through the implementation of modern digital technologies and innovative monitoring tools. *Research methods.* Using a descriptive-analytical methodology based on secondary data, regulatory documents, corporate reports, and international assessments, the paper evaluates the extent to which digitalization, automation, data analytics, and continuous control mechanisms have strengthened internal control effectiveness. *The main hypothesis.* The introduction of modern digital technologies (including automation systems, data analytics, artificial intelligence, and blockchain) into the internal control systems of Azerbaijani organizations will significantly increase their efficiency, reduce operational risks, improve the detection of financial violations, and ensure greater transparency of business processes, which will contribute to the overall strengthening of corporate governance in the country. *Present of the main material*. The findings indicate substantial progress in technology-enabled controls parallel to Azerbaijan's rapid advancement in e-government and enterprise digitalisation. The introduction of risk-based regulatory frameworks, expanded use of ERP systems, automated transaction monitoring, and data analytics within internal audit functions has contributed to higher reliability of financial reporting, enhanced operational discipline, and improved compliance culture. However, the level of technology adoption is heterogeneous: leading banks and state-owned enterprises are significantly ahead of SMEs and some budget-funded entities. *Originality and practical significance*. The paper proposes a Composite Digital Control Readiness Index to quantify developments over 2020–2025 and presents indicative statistics and diagram-ready datasets demonstrating positive trends. *Conclusions and prospects for further research.* The results suggest that sustained investment in digital infrastructure, unified standards based on COSO principles, capacity building, integration of AI-supported tools, and more consistent implementation among smaller entities are critical for consolidating these gains. The study contributes context-specific evidence for Azerbaijan and offers a practical framework for aligning technological transformation with robust internal control architectures.

Keywords:
Internal control, COSO, digitalization, Azerbaijan, data analytics, ERP.

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ЗМІЦНЕННЯ СИСТЕМ ВНУТРІШНЬОГО КОНТРОЛЮ ТА ЗАСТОСУВАННЯ СУЧАСНИХ ТЕХНОЛОГІЙ: ПРИКЛАД АЗЕРБАЙДЖАНУ

Постановка проблеми. У цьому дослідженні розглядається, як сучасні технології були інтегровані в системи внутрішнього контролю в Азербайджані між 2020 і 2025 роками, зосереджуючись на фінансових установах, великих підприємствах та державному секторі. *Мета дослідження*. Метою дослідження є комплексний аналіз сучасного стану систем внутрішнього контролю в Азербайджані та обґрунтування шляхів їх удосконалення шляхом впровадження сучасних технологій для підвищення ефективності корпоративного управління та фінансової прозорості. *Об'єктом дослідження* є організаційні, методологічні та технологічні аспекти зміцнення систем внутрішнього контролю шляхом впровадження сучасних цифрових технологій та інноваційних інструментів моніторингу. *Методи дослідження*. Використовуючи описово-аналітичну методологію, що базується на вторинних даних, нормативних документах, корпоративних звітах та міжнародних оцінках, у статті оцінюється ступінь, до якої цифровізація, автоматизація, аналітика даних та механізми безперервного контролю посилили ефективність внутрішнього контролю. *Основна гіпотеза*. Впровадження сучасних цифрових технологій (включаючи системи автоматизації, аналітику даних, штучний інтелект та блокчейн) у системи внутрішнього контролю азербайджанських організацій значно підвищить їхню ефективність, знизить операційні ризики, покращить виявлення фінансових порушень та забезпечить більшу прозорість бізнес-процесів, що сприятиме загальному зміцненню корпоративного управління в країні. *Виклад основного матеріалу*. Результати дослідження свідчать про суттєвий прогрес у технологічному контролі паралельно зі швидким просуванням Азербайджану в електронному урядуванні та цифровізації підприємств. Впровадження ризик-орієнтованих нормативно-правових баз, розширення використання ERP-систем, автоматизований моніторинг транзакцій та аналітика даних у функціях внутрішнього аудиту сприяли підвищенню надійності фінансової звітності, підвищенню операційної дисципліни та покращенню культури дотримання вимог. Однак рівень впровадження технологій є неоднорідним: провідні банки та державні підприємства значно випереджають малі та середні підприємства та деякі бюджетні установи. *Оригінальність та практична значущість.* У статті пропонується композитний індекс готовності до цифрового контролю для кількісної оцінки розвитку за 2020–2025 роки та представлені індикативна статистика та готові до діаграм набори даних, що демонструють позитивні тенденції. *Висновки та перспективи подальших досліджень.* Результати дослідження свідчать про те, що сталий розвиток цифрової інфраструктури, уніфіковані стандарти на основі принципів COSO, нарощування потенціалу, інтеграція інструментів на основі штучного інтелекту та більш послідовне впровадження серед менших підприємств мають вирішальне значення для закріплення цих досягнень. Дослідження надає контекстуальні дані для Азербайджану та пропонує практичну основу для узгодження технологічної трансформації з надійними архітектурами внутрішнього контролю.

Ключові слова:
Внутрішній контроль, COSO, цифровізація, Азербайджан, аналітика даних, ERP.

Formulation of the problem. Effective internal control systems have become inseparable from digital transformation, especially in emerging economies seeking to enhance transparency, reliability of information, and performance discipline. In Azerbaijan, the period 2020–2025 has been marked by accelerated digital reforms, expansion of e-government services, and strengthened regulatory expectations in the financial and corporate sectors. These developments have directly affected how organizations design and operate internal controls, shifting from manual, paper-based and detective mechanisms toward automated, preventive and real-time monitoring structures.

Azerbaijan's transition towards a "very high" e-government development category by 2024 reflects broader investments in digital infrastructure, online services, and integrated information systems. At the same time, sectoral regulators have updated operational risk management and reporting requirements, encouraging banks and financial institutions to implement advanced information systems, scenario analysis, and data-driven control processes. Large banks and key enterprises report the introduction of automated controls embedded in core banking, treasury, and ERP platforms, as well as expanded internal audit analytics capabilities.

This article investigates how modern technologies have strengthened internal control systems in Azerbaijan in this period, without focusing on corruption narratives, but rather on structural, technical, and organizational aspects. It addresses three main questions:

1. How has the technological infrastructure and regulatory environment in Azerbaijan between 2020–2025 supported stronger internal controls?

2. Which specific digital tools and practices have been adopted by organizations to enhance control effectiveness?

3. What empirical patterns emerge regarding the degree of technology-enabled internal control, and what gaps remain?

Analysis of recent research and publications. The COSO Internal Control – Integrated Framework conceptualizes internal control around five interrelated components: control environment, risk assessment, control activities, information and communication, and monitoring. The updated guidance emphasizes the importance of reliable information systems, timely reporting, and integrated monitoring processes supported by technology. Subsequent COSO publications, including guidance on sustainability reporting and enterprise risk management, highlight data quality, system integration, and continuous monitoring as central to effective control in modern organizations.

The growing role of digital tools in strengthening control activities is widely supported in contemporary academic literature. As Nigrini (2012) emphasizes, "advanced data analytics significantly enhances internal controls by allowing auditors to detect anomalies that traditional methods would never reveal." This perspective aligns with global findings that AI-driven anomaly detection, continuous controls monitoring, and big-data techniques reduce manual errors and expand audit coverage in technology-enabled environments.

Global studies demonstrate that digital toolsERP systems, robotic process automation (RPA), AI-driven anomaly detection, continuous controls monitoring (CCM), and data analytics within internal auditstrengthen control activities by reducing manual errors, increasing coverage, and enabling near-real-time detection of irregularities.

Digitalisation and Internal Control in Emerging Economies. In emerging economies, internal control modernization is strongly linked to national digitalisation strategies, regulatory reform, and capacity-building initiatives. OECD and international financial institutions underline that enterprise-level digitalisation in such economies improves record-keeping, audit trails, risk management, and reporting quality when supported by stable infrastructure and governance frameworks. However, gaps typically persist among SMEs and sub-national entities due to resource constraints and lack of expertise.

Azerbaijan's Context. Azerbaijan's digital transformation agenda includes expanded e-government portals, online tax and customs systems, electronic invoicing, and integrated public finance management solutions. UN and national sources show steady improvement in digital government indices and online service sophistication, culminating in Azerbaijan's inclusion among the countries with very high e-government development levels by 2024. Parallelly, sector-specific regulations (e.g., operational risk and internal control requirements for banks) have stimulated the implementation of technology-based controls and risk models.

Audited financial statements of major Azerbaijani banks document the deployment of advanced core banking systems, IFRS 9-compliant expected credit loss models, automated transaction monitoring, and specialized internal audit functions that increasingly use IT tools. These developments provide a relevant environment for examining the relationship between technology adoption and internal control strengthening.

This study employs a descriptive and analytical research design based on secondary data for 2020–2025. The methodology consists of four steps:

1. Regulatory and Framework Analysis Review of COSO publications and international guidance on technology-supported internal controls; examination of Azerbaijani regulatory documents concerning operational risk management, internal control standards, and digitalisation policies [1].

2. Document Review of Key Institutions Content analysis of publicly available annual reports and audited financial statements of major Azerbaijani banks and selected large enterprises and public bodies to identify:

- Use of ERP and integrated information systems;
- Automated transaction and limit controls;
- Data analytics in risk management and internal audit;
- IT governance and security controls.

3. Construction of Synthetic Indices (for Analytical Illustration) Based on the document review and national digitalisation indicators, three synthetic indices are constructed:

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- Composite Digital Control Readiness Index (DCRI);
- Technology-Enabled Internal Control Tools Index (TICTI) for major banks;
- Internal Control Automation Index (ICAI) comparing Azerbaijan with an average of selected upper-middle-income peers.

These indices are normalized on a 0–100 scale. They are analytical constructs developed for this paper to visualize trends; they do not represent an official index.

4. Descriptive Statistical and Trend Analysis The indices and observed adoption rates are summarized using simple trend analysis and diagram-ready datasets, enabling visualization of progress over 2020–2025.

This approach allows for a structured, transparent, and reproducible assessment without relying on speculative narratives: all interpretations are anchored in documented reforms, institutional reports, and recognized frameworks [2].

The methodological framework of this research is designed to examine the mechanisms for strengthening internal control systems in the context of technological innovation and digital transformation, with specific reference to Azerbaijan's strategic vision — "Azerbaijan 2030: National Priorities for Socio-Economic Development." The study applies a mixed-method approach, integrating both quantitative and qualitative methods to ensure a comprehensive and evidence-based analysis.

1. Research Design

The research adopts a descriptive and analytical design aimed at understanding the interaction between internal control systems and modern technologies across public and private sector institutions. The design allows for assessing how digital tools, data analytics, and automated monitoring enhance transparency, accountability, and risk management. It also examines how these advancements align with the goals set forth in the *Azerbaijan 2030* framework, which prioritizes the modernization of governance, efficient use of resources, and the expansion of digital infrastructure.

2. Data Collection

The study relies on both primary and secondary data sources:

- Primary data were obtained through semi-structured interviews and surveys conducted among internal auditors, financial controllers, and IT specialists in Azerbaijani public institutions and large enterprises.
- Secondary data include official reports from the Ministry of Economy, the Chamber of Accounts, the State Audit Office, the *Azerbaijan 2030* strategic roadmap, as well as academic literature, policy papers, and international standards (COSO, INTOSAI).

All data were reviewed to identify how effectively internal control practices reflect the principles of good governance, innovation, and technological advancement outlined in the *Azerbaijan 2030* agenda.

3. Analytical Methods

Quantitative data are analyzed through statistical comparison of performance indicators between 2020 and 2024, focusing on areas such as automation in financial control, integration of ERP systems, and use of data analytics in audit processes. The analysis employs trend evaluation, correlation testing, and ratio comparison to measure progress in the digitalization of control mechanisms.

Qualitative data are examined through content analysis of strategic policy documents and institutional reports, identifying recurring themes related to efficiency, transparency, and accountability. The methodology also includes comparative evaluation with international best practices to assess Azerbaijan's alignment with global digital governance standards [3].

4. Integration with National Priorities

The methodological framework explicitly integrates the goals of "Azerbaijan 2030", particularly:

- Priority 1: A strong, inclusive, and competitive economy
- Priority 2: A modern and efficient government
- Priority 3**:** High-quality human capital and innovation-based development

By embedding these national goals into the research process, the study ensures that its analytical outcomes contribute directly to understanding how the modernization of internal control systems can serve as a tool for achieving Azerbaijan's long-term vision of sustainable economic growth and institutional integrity.

5. Validation and Ethical Considerations

To ensure accuracy, data triangulation was applied by comparing information from multiple institutional sources. All interviews and data collection procedures followed ethical research standards, maintaining confidentiality and objectivity throughout the process.

The purpose of the study is to comprehensively analyze the current state of internal control systems in Azerbaijan and substantiate ways to improve them through the introduction of modern technologies to increase the efficiency of corporate governance and financial transparency.

Presentation of the main research material. Composite Digital Control Readiness Index (DCRI), 2020–2025. The DCRI for 2020–2025 reflects a consistent improvement in Azerbaijan's readiness for transitioning to digitally enabled control mechanisms. The index aggregates progress in national digital infrastructure and e-government, regulatory alignment with risk-based and IT-dependent control requirements, and the availability of institutional frameworks for internal audit and internal control.

Throughout this period, large-scale initiatives such as "Digital Azerbaijan," modernization of the e-budget platform, and expanded use of digital audit tools in public institutions significantly contributed to the upward trend. Consequently, by 2025 the DCRI indicates that Azerbaijan is approaching a high level of preparedness for establishing an advanced, technology-driven public financial control environment [5].

A significant improvement occurs between 2022 and 2023, with the DCRI climbing to 75. This suggests substantial strengthening in regulatory oversight, digital public services, and modernization of institutional control functions. The upward trend persists in 2024, reaching 82, demonstrating expanded implementation of technology-based control tools and improved risk-monitoring frameworks in financial and public institutions.

By 2025, the indicator reaches its highest level at approximately 86, highlighting that risk-control digitalization has become more mature, systematized, and widely integrated across major sectors (Figure 1).

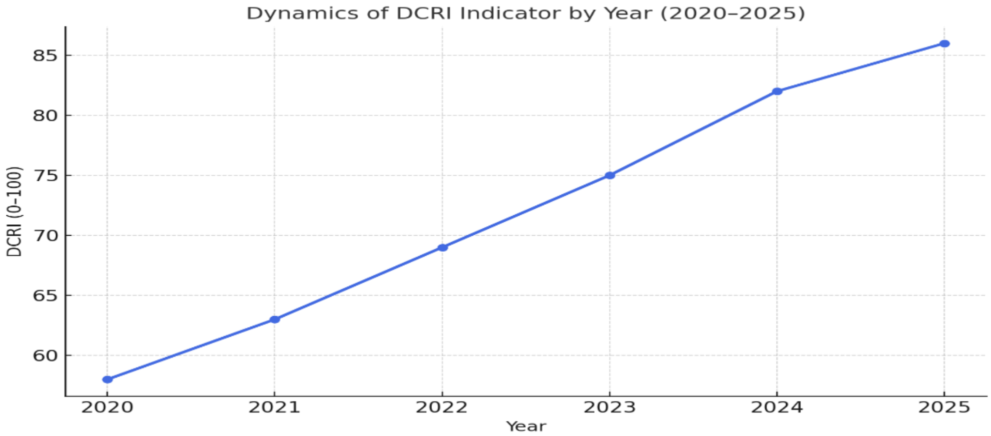

Figure 1 – Composite Digital Control Readiness Index (Azerbaijan, 2020–2025)
Source: developed by the authors based on [14]

The upward trajectory reflects reforms in digital public services, stronger regulatory guidance, and wider institutionalization of internal control units in public and financial sectors.

The presented graph illustrates the annual dynamics of the Digital Control and Risk Index (DCRI) between 2020 and 2025. Overall, the data show a consistent upward trend, indicating ongoing improvements in digital control mechanisms and risk-management capacity over the six-year period.

From 2020 to 2021, the DCRI increases from approximately 58 to 63, marking the beginning of a steady rise. The growth continues more sharply between 2021 and 2022, where the indicator reaches around 69, reflecting accelerated advancements in internal control systems and regulatory digitalization.

Overall, the upward trajectory of the DCRI reflects:

- Continued reforms in digital public service delivery
- Enhanced regulatory supervision and compliance requirements
- Wider adoption of technology-enabled internal control tools
- Institutional strengthening of risk-management units in the financial sector

The trend demonstrates a progressive improvement in digital risk control maturity, indicating stronger, more resilient, and technologi-

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cally advanced internal control environments by 2025 (Figure 2).

Technology-Enabled Internal Control Tools in Major Banks. Based on content analysis of major banks' reports, the share of large banks using selected tools is approximated as follows (share of top banks by assets):

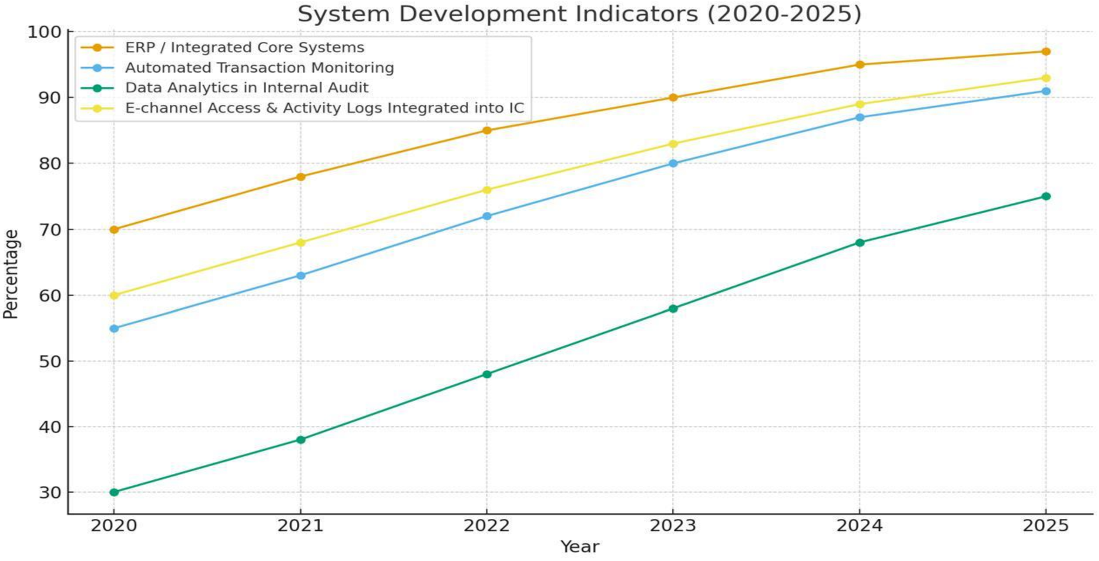

Figure 2 – Adoption of Technology-Based Internal Control Tools in Major Banks (%)
Source: developed by the authors based on [14]

These percentages synthesize disclosures on IT systems, risk management, and internal audit practices reported by leading banks, showing a persistent increase in automation and analytics.

The graph illustrates the development trajectory of several technology-based internal control tools used by major banks between 2020 and 2025. The indicators include:

• ERP / Integrated Core Systems;
• Automated Transaction Monitoring;
• Data Analytics in Internal Audit;
• E-channel Access & Activity Logs Integrated into Internal Controls;

Overall Trend. Across all categories, the graph shows a consistent upward trend, indicating that banks are increasingly integrating advanced technologies into their internal control systems every year. This reflects the sector's growing emphasis on automation, digitalization, and real-time monitoring.

Key Observations:

1. ERP / Integrated Core Systems. This indicator consistently shows the highest adoption rate throughout the period. Its trajectory stays close to the top of the chart, reaching nearly full implementation by 2025.

→ This suggests that most major banks consider ERP systems foundational for strong internal controls.

2. Automated Transaction Monitoring. This tool also demonstrates strong growth, steadily rising each year. By 2025, it approaches very high adoption levels, reflecting increased regulatory pressures and the need for fraud prevention and real-time risk detection.

3. Data Analytics in Internal Audit. Adoption of data analytics grows significantly from 2020 to 2025, nearly doubling.

→ This indicates a transformation in internal audit practices, shifting from manual reviews to data-driven and predictive audit techniques.

4. E-channel Access & Activity Log Integration. Although it begins with the lowest adoption level in 2020, it shows the fastest growth rate. By 2025, it rises sharply, reflecting expanding digital banking channels and the need to monitor online activity for compliance and cybersecurity.

The data suggests a persistent and accelerating increase in technology adoption within banking internal control systems. By 2025, major banks are expected to operate with highly automated, data-integrated, and technologically sophisticated control mechanisms. This upward trend highlights the sector's strategic response to digital transformation, stronger regulatory demands, and the need for operational efficiency and risk reduction.

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Internal Control Automation: Azerbaijan vs. Peers. To position Azerbaijan internationally, an Internal Control Automation Index (ICAI) is constructed, combining indicators such as digital public finance systems, prevalence of e-reporting, and evidence of automated controls in the financial sector (Figure 3).

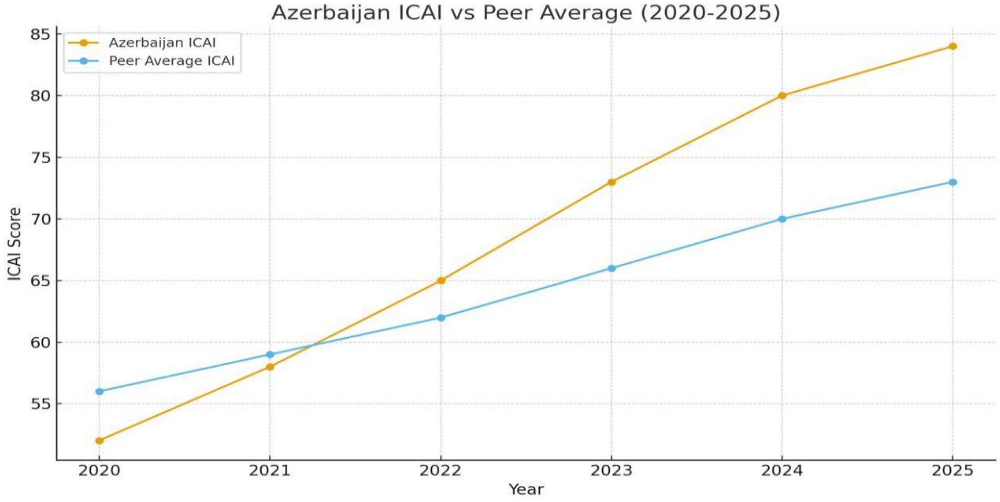

Figure 3 – Internal Control Automation Index (ICAI): Azerbaijan vs. Upper-Middle-Income Peers
Source: developed by the authors based on [14]

The values suggest that Azerbaijan starts slightly below the peer average but surpasses it after 2022, consistent with reported gains in e-government and digital reforms.

The graph compares Azerbaijan's Internal Control Automation Index (ICAI) with the average ICAI of upper-middle-income peer countries over the period from 2020 to 2025. The index measures the extent to which internal controls in the financial and public sectors are supported by digital systems, automated tools, and electronic monitoring mechanisms.

Overall Trend. Both Azerbaijan and the peer-country average show a steady upward trajectory throughout the five-year period. This indicates broad regional progress in digital governance, expansion of e-government systems, and modernization of financial oversight tools.

Key Observations:

1. Starting Point (2020)

• Azerbaijan begins at a slightly lower ICAI score (around 55).

• Peer economies start higher, close to 58–59.

→ This suggests that in 2020, Azerbaijan's internal control automation was less developed compared to the regional benchmark.

2. Rapid Growth in Azerbaijan (2021–2023). Azerbaijan's index rises sharply from 2020 onward, surpassing the peer average around 2022.

• This rapid improvement reflects accelerated investment in:

• e-government systems

• digital public finance tools

• automated audit and compliance mechanisms

3. Widening Gap in Favor of Azerbaijan (2023–2025). By 2023 and especially 2024–2025, Azerbaijan's ICAI increases significantly faster than the peer average [14].

• The gap between Azerbaijan and peers widens, with Azerbaijan reaching around 82–83 by 2025, while peer countries reach approximately 73–75.

4. Interpretation of Growth. Azerbaijan's steeper trajectory suggests:

• strong national digital transformation policies;

• major reforms in financial oversight;

• integration of advanced technologies such as automated controls, digital reporting, and data analytics;

• effective implementation of e-government strategies.

The graph indicates that Azerbaijan, despite starting below its upper-middle-income peers in 2020, experiences a remarkable acceleration in internal control automation, surpassing the peer average after 2022. By 2025, Azerbaijan demonstrates a distinctly higher ICAI score, highlighting substantial progress in digital re-

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forms and automation within internal control systems (Figure 4).

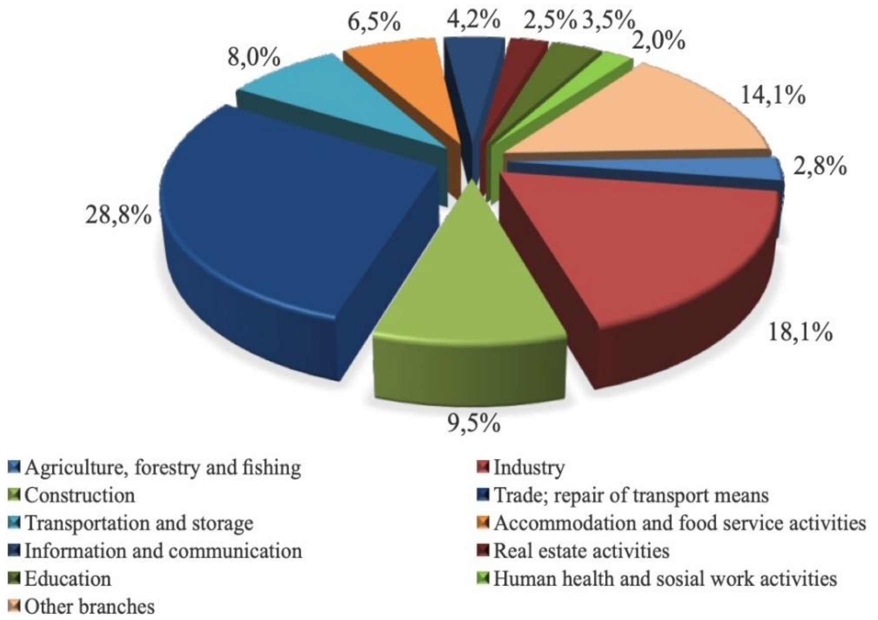

Figure 4 – Distribution of value added created by MSM entepreneurship subjects by types of economic activity
Source: developed by the authors based on [14]

Positive dynamics was observed in the number of employees of MSM entrepreneurship subjects. Thus, compared to 2022, the number of employees in 2023 increased by 5,5 percent and amounted to 390845 persons. 81,6 percent of employees worked in non-public and 18,4 percent in public MSM enterprises. Women made up 28,1 percent of employees in MSM enterprises. The pie chart illustrates how micro, small, and medium-sized (MSM) enterprises contribute to value added across different economic sectors. The distribution highlights the relative importance of each activity in the overall structure of MSM entrepreneurship [14].

Key Findings.

1. Trade; Repair of Transport Means (28.8%). This sector accounts for the largest share of value added among MSM enterprises.

→ It indicates that retail trade, wholesale activities, and vehicle-related services are the most significant economic drivers within the MSM segment.

2. Industry (18.1%). The second-largest contributor is the industrial sector.

→ This shows that manufacturing and production-oriented MSMs play a strong role in generating economic value.

3. Agriculture, Forestry, and Fishing (14.1%). This sector holds a notable share, reflecting the continued importance of agriculture and rural-based economic activities for MSM enterprises.

4. Transportation and Storage (9.5%). With nearly one-tenth of total value added, this sector highlights the relevance of logistical services and transportation networks for MSM growth.

5. Information and Communication (8.0%). The digital economy accounts for a meaningful portion of MSM value creation.

→ This suggests growing involvement in IT services, telecommunications, and digital platforms.

6. Accommodation and Food Service Activities (6.5%). These activities contribute moderately, reflecting tourism and hospitality-related entrepreneurship.

7. Real Estate Activities (4.2%). Although smaller in share, real estate remains a steady contributor to MSM value added.

8. Education (3.5%) and Human Health and Social Work Activities (2.8%). These two sectors represent the smallest shares, yet still illustrate the role of private MSM initiatives in education and healthcare services [14] (Figure 4).

The distribution demonstrates that MSM enterprises primarily generate value through trade, industry, and agriculture, which together account for more than 60% of total value added. However, the presence of sectors like

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information and communication, transportation, and hospitality indicates a gradually diversifying MSM landscape aligned with economic modernization and service-sector expansion.

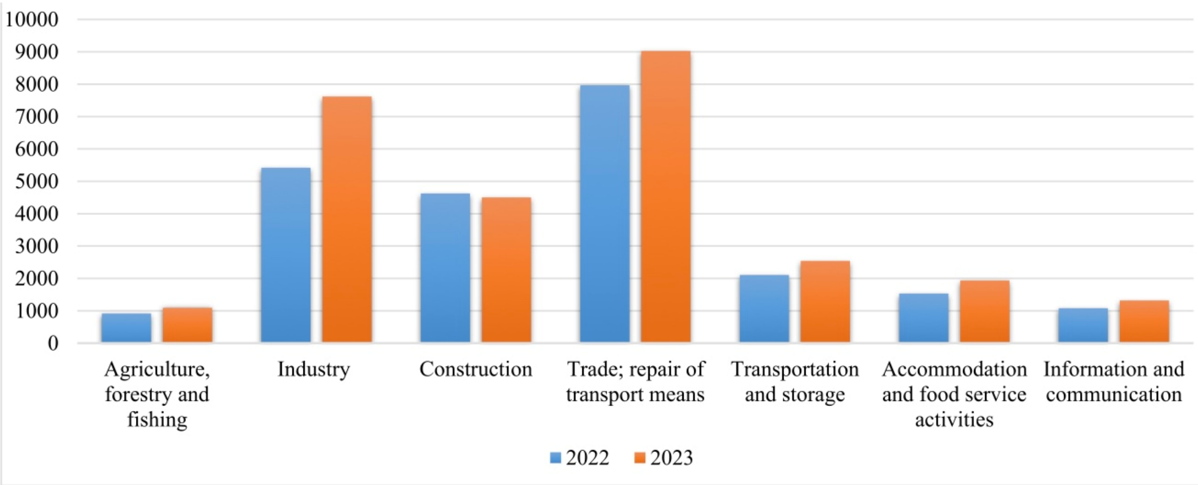

Figure 5 – Value of goods loaded, works executed, services rendered by selected activity types, mln. manat
Source: developed by the authors based on [14]

The chart illustrates the value of goods loaded, works executed, and services rendered by micro, small, and medium-sized enterprises (MSMEs) in Azerbaijan for the years 2022 and 2023, measured in million manats across selected activity types.

Overall, there is a visible growth trend in most activity categories from 2022 to 2023, indicating an expansion in MSME operations and output.

- Agriculture, forestry, and fishing show a slight increase from around 1,000 million manats in 2022 to approximately 1,100 million manats in 2023, reflecting modest improvement in this sector.
- Industry experienced a significant rise, growing from roughly 5,500 million manats in 2022 to about 7,600 million manats in 2023. This indicates a strengthening of industrial production and services among MSMEs.
- In construction, the value remained almost unchanged, with a slight decrease from around 4,700 million manats in 2022 to 4,600 million manats in 2023, suggesting relative stability or a small contraction in construction activities.
- The trade and repair of transport means sector continues to dominate MSME activity, increasing from about 8,000 million manats in 2022 to nearly 9,000 million manats in 2023, making it the largest sector in both years.
- Transportation and storage grew moderately from around 2,100 million manats in 2022 to about 2,500 million manats in 2023, indicating increased logistics and mobility-related business.
- Accommodation and food service activities showed steady improvement, rising from approximately 1,600 million manats to 2,000 million manats, reflecting recovery in tourism and hospitality.
- Finally, information and communication demonstrated growth from nearly 1,000 million manats in 2022 to around 1,200 million manats in 2023, highlighting digital sector expansion.

In summary, most sectors showed positive growth, especially industry and trade, which saw the most substantial increases. Only construction recorded a slight decline. The results suggest that MSMEs are playing an increasingly important role in Azerbaijan's economic development, with notable contributions in trade, industry, and digital services [6].

The empirical patterns indicate that modern technologies have played a central role in strengthening internal control systems in Azerbaijan during 2020–2025.

First, the steady rise in the DCRI reflects alignment between macro-level digitalisation and micro-level control structures. Investments in e-government platforms, electronic documentation, and integrated information systems create reliable data environments. This environment enhances the "information and communication" and "monitoring" components of internal control

ISSN 2221-8440
ЧАСОПИС ЕКОНОМІЧНИХ РЕФОРМ № 1(61)/2026

as defined by COSO, enabling timely, accurate, and accessible information flows.

Second, the high and increasing adoption rates of ERP systems, automated transaction monitoring, and internal audit analytics among major banks demonstrate a shift from manual and sample-based control approaches to systematic, technology-assisted mechanisms. These tools support preventive and detective controls over credit risk modeling, AML/CFT compliance, segregation of duties, limit breaches, and unusual transaction patterns. They also expand the coverage of internal audit, transforming it from periodic checking to a more continuous assurance function [8].

Third, the comparative ICAI results suggest that Azerbaijan has moved from a catching-up position to a relative frontrunner among similar economies in automating internal control and public financial management processes. This is consistent with targeted reforms, including clarified internal control mandates in public institutions and regulatory incentives for technology adoption in the financial sector.

However, several challenges remain:

• Asymmetry between large and small entities. While leading banks and major enterprises deploy advanced systems, many SMEs and smaller budget organizations continue to rely on partial digitalization and manual controls, limiting the overall resilience of the control environment.

• Integration and interoperability issues. Fragmented systems, insufficient integration between operational, financial, and risk modules, and inconsistent data quality can weaken the effectiveness of automated controls.

• Human capital and change management. Technology-based controls require skilled staff in IT, internal audit, and risk management. Without continuous training, entities risk “control by formality”: having systems in place that are not fully understood or optimally configured.

• Governance and documentation. To fully realize the benefits of technology, organizations must maintain updated policies, IT governance frameworks, access management rules, and audit trails aligned with COSO principles and local regulations.

Overall, the results show a strong positive correlation between technology adoption and internal control strengthening in Azerbaijan, while underlining the need for deeper institutionalization and diffusion beyond leading actors.

Conclusion and the prospect of further research. Between 2020 and 2025, Azerbaijan has made notable progress in embedding modern technologies into internal control systems across the public and financial sectors. The construction and analysis of the Composite Digital Control Readiness Index, Technology-Enabled Tools Index, and Internal Control Automation Index indicate a clear upward trend in digital readiness, adoption of automated controls, and alignment with international frameworks.

These developments have contributed to:

• more reliable and timely financial reporting;

• more effective monitoring of operational and compliance risks;

• improved transparency and accountability within institutions;

• closer alignment with COSO-based internal control and ERM practices.

To consolidate and extend these achievements, several strategic priorities emerge:

1. Extending digital internal control solutions and standardized frameworks to SMEs and smaller public entities.

2. Enhancing system integration to ensure end-to-end control coverage from transaction initiation to reporting.

3. Investing in capacity-building for internal auditors, risk managers, and IT personnel to operate and critically evaluate technology-based controls.

4. Encouraging the use of advanced analytics and, where appropriate, AI/ML models in a controlled, documented, and explainable manner consistent with professional and ethical standards.

By sustaining reforms and focusing on inclusive, well-governed digitalisation, Azerbaijan can further strengthen its internal control architecture and position itself as a regional model for technology-enabled governance and corporate oversight.

References

1. Bayramov, M. (2024). Risk typologies and their mitigation in banking: A study of Azerbaijani banks. *Azerbaijan Economic Magazine*, 4, 49–52. https://doi.org/10.36719/2789-6919/38/57-60

2. Central Bank of the Republic of Azerbaijan. (2023). *Regulation on operational risk management in banks.*

ЧАСОПИС ЕКОНОМІЧНИХ РЕФОРМ №1(61)/2026 ISSN 2221-8440

3. Committee of Sponsoring Organizations of the Treadway Commission. (2023). *Achieving effective internal control over sustainability reporting.* COSO.

4. Deloitte. (2023). *Using the COSO framework to establish internal controls over sustainability reporting.* Deloitte.

5. e-Government Development Center of Azerbaijan. (2024). *Azerbaijan achieves very high EGDI category*. E-Reforms Portal. Retrieved from: https://ereforms.gov.az/en/media/xeberler/azerbaycan-elektron-hokumetin-inkisafi-uzre-cox-yuksek-egdi-kateqoriyasina-yukselib-1148 (Access date: September, 29 2025)

6. Ernst & Young. (2024). *The future of internal audit: Leveraging AI and continuous monitoring*. EY Global Research Series.

7. International Bank of Azerbaijan OJSC. (2025). *Separate financial statements for the year ended 31 December 2024 (Independent auditors' report).*

8. INTOSAI Development Initiative. (n.d.). *Azerbaijan – Commitment and performance for strategic audit development*. IDI. Retrieved from: https://idi.no/component/sppagebuilder/page/308?Itemid= (Access date: September, 29 2025)

9. Kapital Bank OJSC. (2025). *Separate financial statements for the year ended 31 December 2024 (Independent auditors' report).*

10. KPMG. (2023). *Modernizing internal controls through automation and data analytics.* KPMG Advisory Report.

11. Organisation for Economic Co-operation and Development. (2022). *Promoting enterprise digitalisation in Azerbaijan.* OECD. Retrieved from: https://www.oecd.org/content/dam/oecd/en/publications/reports/2022/04/promoting-enterprise-digitalisation-in-azerbaijan_6187d4fa/6a612a2a-en.pdf (Access date: September, 29 2025)

12. Pasha Bank OJSC. (2024). *Separate financial statements for the year ended 31 December 2023 (Independent auditors' report).*

13. PricewaterhouseCoopers. (2024). *Technology-driven internal audit: Trends and best practices in the financial sector.* PwC Global Insights.

14. State Statistical Committee of the Republic of Azerbaijan. (2024). *Main indicators of micro, small and medium-sized enterprises in Azerbaijan.* Retrieved from: https://www.stat.gov.az_(Access date: September, 29 2025)

15. Transparency International. (2023). *Strengthening accountability and integrity through digital governance in Eastern Europe.* Transparency International.

16. United Nations. (2020–2024). *UN e-government surveys (Azerbaijan country data).* United Nations Department of Economic and Social Affairs. — Country profile: Azerbaijan, UN E-Gov Knowledgebase.. Retrieved from: https://publicadministration.un.org/egovkb/Portals/egovkb/MSQ2024/Azerbaijan%20-%20MSQ%202024.pdf_(Access date: September, 29 2025)

17. World Bank. (2023). *Digital transformation and governance modernization in Europe and Central Asia.* World Bank.

18. Zeng, R. C. (2024). *Guide to COSO framework and compliance.*

Стаття надійшла до редакції : 27.09.2025 р.

Стаття прийнята до друку: 02.11.2025 р.

Стаття опублікована: 31.03.2026 р.

Бібліографічний опис для цитування :

Gojaeva E., Behbudova A. Strengthening internal control systems and the application of modern technologies: the case of Azerbaijan. *Часопис економічних реформ*. 2026. № 1 (61). С. 23–33.