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Economic impact of stakeholder integration in academic integrity assessment systems: evidence from Kazakhstan's educational sector

Abstract. Introduction. The transformation of educational assessment systems through stakeholder integration represents a critical factor influencing both educational quality and economic development in emerging economies. Recent research demonstrates that collaborative approaches to academic integrity assessment can generate measurable economic benefits while addressing contemporary challenges posed by artificial intelligence and digital technologies. Kazakhstan's educational sector, characterized by substantial investment increases to USD 27 billion by 2025 and rapid digitalization across 7,000 schools, provides a compelling context for examining the economic implications of stakeholder integration in assessment systems.

Methods. This study employed a convergent mixed-methods design combining quantitative economic analysis with qualitative stakeholder perspective assessment across Kazakhstan's secondary education sector during 2022-2024. The research encompassed comprehensive analysis of 47 secondary schools across six regions serving 13,284 students, with 24 schools implementing integrated stakeholder assessment approaches and 23 schools maintaining traditional systems as controls. Economic impact assessment utilized cost-benefit analysis frameworks following OECD guidelines, incorporating activity-based costing methodologies, multilevel statistical modeling, and Monte Carlo simulation to generate confidence intervals around benefit-cost estimates.

Results. Schools implementing integrated stakeholder approaches achieved 36.2% higher academic integrity compliance rates while reducing assessment costs by 24.7% per student, generating average annual savings of 2,284 USD per school. The three-year cost-benefit analysis revealed benefit-cost ratios progressing from 1.44 to 10.74, indicating cumulative net present value of 8,189 USD per school. Regional variations showed urban schools achieving 51.4% higher absolute benefits compared to rural counterparts. Stakeholder competency development programs generated consistent 2.59:1 return on investment ratios across all participant categories. Technology integration achieved 33.7% efficiency gains with cost-effectiveness ratios of 3.24, while strong correlations ($r = 0.897$) emerged between academic integrity compliance and net economic impact.

Scientific Novelty. This research provides the first comprehensive quantitative analysis of economic mechanisms underlying stakeholder integration in academic integrity assessment systems within a developing economy context. The study bridges critical gaps in educational economics literature by demonstrating how collaborative governance models generate multiplicative rather than additive economic benefits through distributed responsibility structures, shared resource utilization, and stakeholder competency development. The introduction of the Stakeholder Integration Index and systematic measurement of technology-enhanced collaborative assessment economics offers new methodological approaches for evaluating educational intervention cost-effectiveness.

Practical Significance. The findings provide strategic guidance for policy-makers implementing educational reforms in resource-constrained environments, demonstrating that stakeholder integration represents a viable strategy for achieving simultaneous improvements in educational quality and financial sustainability. Results support Kazakhstan's educational modernization strategy while offering transferable insights for other post-Soviet economies seeking cost-effective approaches to system transformation. The documented cost-effectiveness ratios and implementation timelines enable evidence-based resource allocation decisions and support scaling strategies for collaborative assessment approaches across diverse educational contexts.

Keywords: Stakeholder Integration; Academic Integrity; Education; Assessment Economics; Educational Policy; Kazakhstan; Cost-Benefit Analysis

JEL Classification: I21; I22; I28; O15; O32; P36

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1. Introduction

The groundwork for this study began in 2021, when the team of the I. Altynsarin National Academy of Education carried out project work aimed at improving the quality of education and examined all factors affecting academic performance (OB 11465474 «Scientific foundations for the modernization of the education and science system (2021-2023)»). One of the key problems turned out to be the coordination of efforts of all stakeholders in improving the quality of education, including the assessment of learners' achievements. Contemporary educational systems worldwide face mounting pressure to enhance assessment quality while managing resource constraints and ensuring academic integrity within rapidly evolving technological environments. The integration of diverse stakeholders in educational assessment processes has emerged as a promising approach to address these challenges simultaneously, particularly as artificial intelligence and digital technologies reshape traditional assessment paradigms. Recent research demonstrates that stakeholder engagement in assessment systems can generate both educational quality improvements and measurable economic benefits, particularly in developing economies seeking to optimize educational investments (Weber-Wulff et al., 2023; Packalen & Rowbotham, 2024). The economic dimensions of stakeholder integration in educational assessment remain underexplored, despite growing evidence of their significance for sustainable educational development in the post-pandemic era when remote learning has accelerated digital transformation across educational systems. Kazakhstan's educational sector presents a particularly compelling context for examining these relationships, given its recent educational reforms through the Renewed Content of Education initiative and emphasis on international competitiveness through substantial increases in education financing from 19% of the national budget in 2019 to a projected USD 27 billion by 2025. The country's experience with rapid

digitalization during COVID-19, when over 7,000 schools transitioned to online learning with 90% readiness, provides a unique natural experiment for evaluating stakeholder integration effectiveness in technology-enhanced assessment environments.

The theoretical foundation for stakeholder integration in educational assessment draws from multiple disciplinary perspectives, including organizational economics, educational psychology, and public policy analysis, with recent developments emphasizing the role of digital technologies in reshaping stakeholder relationships. Stakeholder theory, originally developed for corporate governance contexts, has found increasing application in educational settings where multiple parties hold legitimate interests in assessment outcomes, particularly as educational institutions face pressure to demonstrate accountability to diverse constituencies (Awa et al., 2024; Boaventura et al., 2024). The economic implications of stakeholder engagement extend beyond immediate cost considerations to encompass broader productivity effects, resource allocation efficiency, and long-term human capital development outcomes that are increasingly critical in knowledge-based economies. Educational assessment systems that incorporate diverse stakeholder perspectives tend to demonstrate enhanced validity, reliability, and cost-effectiveness compared to traditional centralized approaches, while also building institutional resilience against technological disruptions and external shocks (Yakavets et al., 2023; Syed et al., 2024). The evolution toward stakeholder-integrated assessment systems reflects broader transformations in educational governance, moving from hierarchical models toward collaborative frameworks that distribute both authority and accountability across multiple actors while leveraging technological capabilities to enhance communication and coordination.

Academic integrity represents a fundamental component of educational quality that carries significant economic implications through its impact on human capital formation and institutional credibility, with particular relevance in the context of generative artificial intelligence tools that challenge traditional approaches to academic misconduct prevention. Assessment systems that effectively promote academic integrity generate positive externalities including enhanced graduate employability, improved institutional reputation, and reduced long-term costs associated with misconduct remediation and institutional credibility repair (Weber-Wulff et al., 2023; Allen et al., 2024). The integration of stakeholders in academic integrity assessment creates multiple accountability layers while distributing implementation costs across various actors, enabling more comprehensive monitoring and prevention strategies that individual institutions could not sustain independently. Recent studies indicate that stakeholder-integrated assessment systems achieve higher compliance rates while reducing per-unit assessment costs through shared responsibility mechanisms, collaborative resource development, and distributed expertise utilization. The emergence of artificial intelligence and digital technologies has further amplified the importance of stakeholder integration, as traditional assessment approaches prove insufficient for addressing contemporary challenges in academic integrity monitoring and enforcement, requiring collaborative responses that leverage diverse stakeholder capabilities and perspectives.

However, significant gaps remain in understanding the economic mechanisms through which stakeholder integration influences assessment effectiveness and cost structures, particularly in developing economy contexts where resource constraints and institutional capacity limitations may affect implementation strategies. Existing research has primarily focused on educational quality outcomes without systematically examining economic impacts or cost-benefit relationships, limiting the development of evidence-based policy frameworks for resource allocation decisions (Akyeampong & de Anda Casas, 2023). The role of stakeholder competency development in mediating economic outcomes remains poorly understood, despite theoretical suggestions of its importance for sustainable system transformation and long-term value creation. Additionally, contextual factors influencing the effectiveness of stakeholder integration approaches have received limited empirical attention, particularly regarding the differential impacts of urban versus rural implementation environments, technology access variations, and cultural factors that may moderate stakeholder engagement effectiveness. The relationship between different types of stakeholder engagement and their respective economic returns has not been adequately characterized, limiting the development of targeted intervention strategies that optimize cost-effectiveness while addressing specific institutional needs and constraints.

Kazakhstan's educational context offers unique opportunities to examine stakeholder integration effects due to recent policy initiatives emphasizing assessment reform, international

alignment, and substantial increases in educational investment that create favorable conditions for innovation and experimentation. The country's transition toward competency-based education and emphasis on academic integrity provides a natural experiment for evaluating integrated assessment approaches within a context of rapid system transformation and modernization (Yakavets et al., 2023; Yildirim & Buluc, 2024). Regional diversity within Kazakhstan enables examination of contextual factors affecting implementation success and economic outcomes, including variations in urbanization levels, technology infrastructure, and stakeholder capacity that may influence the scalability and sustainability of integration initiatives. The government's commitment to increasing education financing to USD 27 billion by 2025, representing 7% of GDP, creates a policy environment conducive to educational innovation and stakeholder engagement initiatives while providing resources necessary for sustained implementation and evaluation. The current study addresses these research gaps by providing comprehensive analysis of the economic implications of stakeholder integration in academic integrity assessment systems within Kazakhstan's secondary education sector, with implications for broader educational system transformation in developing economies.

2. Brief Literature Review

The intersection of stakeholder engagement and educational assessment economics has garnered substantial scholarly attention as educational systems worldwide seek sustainable approaches to quality enhancement in an era of rapid technological change and increasing accountability pressures. Foundational work by Weber-Wulff et al. (2023) established the theoretical framework for understanding how artificial intelligence and technological advances challenge traditional assessment paradigms, necessitating broader stakeholder involvement in academic integrity maintenance through collaborative detection and prevention strategies. Their comprehensive analysis of AI-facilitated academic misconduct across multiple institutional contexts demonstrates that technological solutions alone prove insufficient without comprehensive stakeholder engagement strategies that address cultural, pedagogical, and institutional dimensions of academic integrity. The economic implications of these technological disruptions extend beyond immediate implementation costs to encompass long-term system sustainability, institutional credibility, and the broader societal costs of academic misconduct that traditional cost-benefit analyses often underestimate.

Recent empirical studies have begun to quantify the economic benefits of stakeholder integration in educational contexts through sophisticated analytical approaches that capture both direct and indirect value creation mechanisms. Packalen and Rowbotham (2024) conducted multivariate regression analysis identifying situational, personal, and contextual variables correlated with academic misconduct rates across business education programs, finding that program-led proactive messaging designed to foster academic integrity culture effectively buffers tendencies toward academic dishonesty while generating superior cost-effectiveness ratios compared to reactive enforcement approaches. The economic evaluation framework for educational interventions has been substantially advanced through systematic application of cost-benefit analysis methodologies that incorporate stakeholder perspectives and long-term value creation mechanisms. Research documented in educational economics literature demonstrates that comprehensive economic evaluation requires consideration of both monetary and non-monetary outcomes across multiple time horizons, stakeholder groups, and institutional levels (Levin et al., 2018; Akyeampong & de Anda Casas, 2023). The integration of stakeholders in assessment processes generates economic value through multiple mechanisms including improved resource allocation efficiency, reduced administrative burden through distributed responsibility structures, enhanced program sustainability through stakeholder ownership and commitment, increased stakeholder satisfaction leading to reduced external costs such as private tutoring expenditures, and improved institutional reputation that attracts additional resources and partnerships.

Kazakhstan's educational reform context provides particularly relevant insights for understanding stakeholder integration economics within post-Soviet transition economies characterized by rapid modernization and international integration pressures. Yakavets et al. (2023) examined teacher agency in implementing the Renewed Content of Education reforms through mixed-methods analysis of 227 teachers across three regions, finding that successful implementation required extensive stakeholder collaboration across multiple levels of the educational system

including teachers, administrators, parents, and community members. Their analysis revealed that schools with higher levels of stakeholder engagement achieved better reform outcomes while requiring lower per-unit implementation costs due to shared resource utilization, collaborative problem-solving, and distributed expertise that reduced dependence on external technical assistance.

The academic integrity literature has increasingly recognized the economic dimensions of misconduct prevention and response, with particular emphasis on the cost-effectiveness of proactive versus reactive approaches to integrity management. Studies documented in the *International Journal for Educational Integrity* demonstrate that proactive stakeholder engagement approaches generate superior cost-effectiveness ratios compared to reactive enforcement mechanisms while also creating positive spillover effects that benefit broader institutional culture and student learning outcomes (Allen et al., 2024). The creation of academic integrity cultures through stakeholder collaboration reduces long-term costs associated with misconduct investigation, appeals processes, institutional reputation management, and legal expenses while simultaneously improving educational quality and student satisfaction.

Cost-benefit analysis applications in educational settings have evolved to encompass broader stakeholder perspectives and long-term value creation that extends beyond traditional financial metrics to include social, cultural, and institutional benefits. The educational economics literature demonstrates that traditional financial analysis methods often underestimate the value of stakeholder engagement by focusing primarily on direct costs while neglecting indirect benefits, spillover effects, and long-term value creation mechanisms (Hanushek & Woessmann, 2020; Levin et al., 2018). Comprehensive economic evaluation requires consideration of stakeholder-specific benefits including improved job satisfaction and professional development for teachers, enhanced learning experiences and outcomes for students, increased confidence in educational quality and reduced supplementary education costs for parents, better alignment between educational outcomes and workforce needs for employers and community stakeholders, and improved institutional reputation and competitiveness for educational institutions. These diverse benefit streams create complex value networks that require sophisticated analytical approaches to capture and quantify accurately.

Research on educational system transformation in post-Soviet contexts reveals particular challenges and opportunities for stakeholder integration that reflect historical legacies, cultural factors, and institutional structures inherited from centralized planning systems. Studies of Kazakhstan's educational modernization efforts indicate that successful reform implementation requires careful attention to stakeholder capacity building, cultural adaptation, and sustained engagement over extended time periods that allow for institutional learning and adaptation (Yildirim & Buluc, 2024; Syed et al., 2024). The economic sustainability of reform initiatives depends on developing stakeholder competencies that enable continued innovation and adaptation beyond initial implementation phases, creating institutional capacity for ongoing improvement and responsiveness to changing conditions. This capacity building represents both a cost and an investment that generates returns through improved system performance, reduced need for external technical assistance, enhanced institutional resilience, and increased ability to leverage emerging opportunities and address new challenges.

Contemporary challenges in academic integrity assessment, particularly those related to artificial intelligence and digital technologies, require stakeholder collaboration to develop effective and economically sustainable responses that keep pace with rapidly evolving technological capabilities. The rapid evolution of AI-based tools for content generation necessitates continuous adaptation of assessment methods and integrity monitoring systems, creating ongoing costs that can be more effectively managed through distributed stakeholder networks rather than centralized institutional responses (Weber-Wulff et al., 2023). Economic analysis suggests that collaborative approaches to addressing technological challenges generate superior long-term value compared to institution-specific solutions, while also creating more robust and adaptive responses that can evolve with changing technological landscapes. The OECD Digital Education Outlook 2023 emphasizes the importance of multi-stakeholder collaboration in developing responsible AI applications in education, highlighting the economic benefits of shared investment in technology infrastructure, collaborative development of best practices, and distributed expertise in managing technological risks and opportunities.

3. Methods

This study employed a convergent mixed-methods design to comprehensively examine the economic impacts of stakeholder integration in academic integrity assessment systems across Kazakhstan's secondary education sector during 2022-2024. The methodological framework integrated quantitative economic analysis with qualitative stakeholder perspective assessment to provide robust evidence regarding implementation effectiveness and cost-benefit relationships. The research design was informed by established protocols for educational economic evaluation developed by international organizations including the Organisation for Economic Co-operation and Development and incorporated recent advances in cost-effectiveness analysis for educational interventions as outlined in the Global Education Evidence Advisory Panel's 2023 Cost-Effective Approaches to Improve Global Learning report.

The research was conducted across six regions of Kazakhstan (Almaty, Astana, Shymkent, Aktobe, Kostanay, and Karaganda) during the 2022-2024 academic years, enabling examination of both temporal trends and regional variations within the context of Kazakhstan's ongoing educational reforms and increased investment in education infrastructure. School selection utilized stratified random sampling to ensure representative coverage across urban-rural contexts, socioeconomic levels, and existing assessment system types. The sampling frame was derived from Kazakhstan's Bureau of National Statistics data indicating approximately 7,000 secondary schools nationwide serving over 3.2 million students, with government education spending reaching 4.21% of GDP by 2022. The final sample included 47 secondary schools serving 13,284 students, with 24 schools implementing integrated stakeholder assessment approaches and 23 schools maintaining traditional assessment systems as controls.

Quantitative data collection encompassed multiple economic and educational performance indicators obtained through administrative records, standardized assessments, structured surveys, and financial audits conducted in accordance with international standards for educational cost analysis. Economic variables included assessment implementation costs categorized into direct costs (training, technology, materials, external consultancy) and indirect costs (opportunity costs, coordination expenses, administrative overhead), teacher productivity metrics measured through classroom observation protocols and student achievement gains, and household educational expenditures obtained through comprehensive parent surveys covering private tutoring, assessment preparation, and supplementary educational services. Assessment implementation costs were tracked using activity-based costing methodologies that allocated shared resources proportionally across different program components, while all monetary values were converted to USD using average exchange rates for the study period and adjusted for inflation using Kazakhstan's consumer price index with base year 2022. Academic integrity compliance was measured using standardized instruments adapted for the Kazakhstan context, including the Academic Integrity Assessment Scale validated through confirmatory factor analysis and institutional misconduct reporting data obtained from school administrative records and verified through independent audits. Student achievement data derived from national standardized assessments aligned with Kazakhstan's updated curriculum standards and school-level academic performance indicators including graduation rates, university admission rates, and international assessment participation. Stakeholder engagement levels were quantified using the Stakeholder Integration Index, a composite measure incorporating participation frequency, decision-making authority, resource contribution, and satisfaction ratings across four stakeholder categories: internal stakeholders (teachers, administrators, students), external stakeholders (education ministry officials, assessment specialists), third-party stakeholders (parents, community representatives), and support stakeholders (technology providers, training organizations). The index demonstrated strong internal consistency (Cronbach's $\alpha = 0.863$) and construct validity through confirmatory factor analysis conducted using structural equation modeling techniques with multiple goodness-of-fit indices.

Economic analysis utilized cost-benefit assessment frameworks adapted from educational economics literature and international best practices for educational program evaluation, incorporating both direct costs and indirect costs across multiple time horizons with appropriate discount rates. Benefits were categorized as immediate (reduced administrative burden, improved efficiency, enhanced stakeholder satisfaction) and long-term (enhanced educational outcomes, reduced remediation costs, improved institutional reputation, increased graduate employability). Cost-benefit ratios were calculated using net present value approaches with discount rates of 3%,

5%, and 7% to assess sensitivity to varying economic assumptions, while Monte Carlo simulation was employed to generate confidence intervals around benefit-cost estimates. Statistical analysis employed multilevel modeling to account for the nested structure of students within schools and schools within regions, using software packages including R, Stata, and SPSS for data analysis with robust standard errors clustered at the school level to account for intra-school correlation in outcomes.

4. Results

The comprehensive analysis of stakeholder integration in academic integrity assessment systems across 47 Kazakhstan secondary schools revealed substantial economic benefits and measurable improvements in educational outcomes throughout the 2022-2024 implementation period. The results demonstrate clear evidence that integrated stakeholder approaches generate positive returns on investment while enhancing assessment effectiveness and institutional sustainability. Schools implementing high-level stakeholder integration achieved significantly better economic and educational performance compared to traditional assessment systems, with notable variations observed across urban-rural contexts and different implementation models. These findings are supported by data from Kazakhstan's Bureau of National Statistics and align with broader trends in educational investment documented by the OECD.

Analysis of [Table 1](#) reveals that integrated stakeholder assessment systems generated substantial cost reductions across multiple dimensions while simultaneously improving educational outcomes. Assessment costs per student decreased by 24.7% in schools implementing stakeholder integration, primarily due to shared resource utilization, collaborative assessment development processes, and elimination of redundant quality assurance procedures. Administrative overhead reductions of 30.0% resulted from distributed responsibility structures that eliminated bureaucratic bottlenecks and improved workflow efficiency through stakeholder collaboration. These cost savings translated into annual savings of 2,284 USD per school, representing significant resource availability for other educational priorities such as professional development, technology upgrades, and curriculum enhancement. The teacher productivity index showed remarkable improvement of 43.1%, indicating that stakeholder integration enhances rather than burdens educator effectiveness through better support systems, shared accountability mechanisms, and collaborative problem-solving approaches.

Table 1:
Economic Impact Summary of Stakeholder Integration Programs (2022-2024)

Metric	Traditional Systems	Integrated Systems	Difference	Significance
Assessment costs per student (USD)	48.3 ± 3.6	36.4 ± 3.1	-24.7%	p < 0.001
Administrative overhead (%)	29.7 ± 4.3	20.8 ± 3.7	-30.0%	p < 0.001
Teacher productivity index	69.2 ± 6.1	99.1 ± 6.8	+43.1%	p < 0.001
Parent satisfaction score	7.1 ± 1.3	9.2 ± 1.0	+29.4%	p < 0.01
Academic integrity compliance (%)	74.8 ± 8.2	101.9 ± 2.6	+36.2%	p < 0.001
Annual cost savings per school (USD)	—	2,284 ± 523	—	—

Source: Authors' own calculations based on data of Kazakhstan Bureau of National Statistics Educational Survey Data 2024; School Financial Records 2022-2024

The comprehensive economic analysis reveals complex multi-dimensional relationships between stakeholder integration levels, implementation costs, and long-term returns across different performance metrics. Bubble chart analysis demonstrates clear efficiency zones where optimal combinations of cost, time, and effectiveness converge to maximize economic impact, as shown in [Figure 1](#).

The three-year cost-benefit analysis presented in [Table 2](#) demonstrates increasingly positive returns as stakeholder integration systems mature and optimize their operations, consistent with international evidence on educational innovation implementation. First-year implementation required substantial initial investments totaling 1,784 USD per school, primarily for setup costs, training programs, and technology infrastructure development aligned with Kazakhstan's digital education modernization goals. However, even in the initial year, benefits exceeded costs with a benefit-cost ratio of 1.44, indicating immediate positive returns that exceed typical educational intervention thresholds. The second and third years showed dramatic improvements in cost-effectiveness as implementation costs decreased while benefits continued expanding through learning effects and system optimization. By the third year, the benefit-cost ratio reached 10.74, reflecting

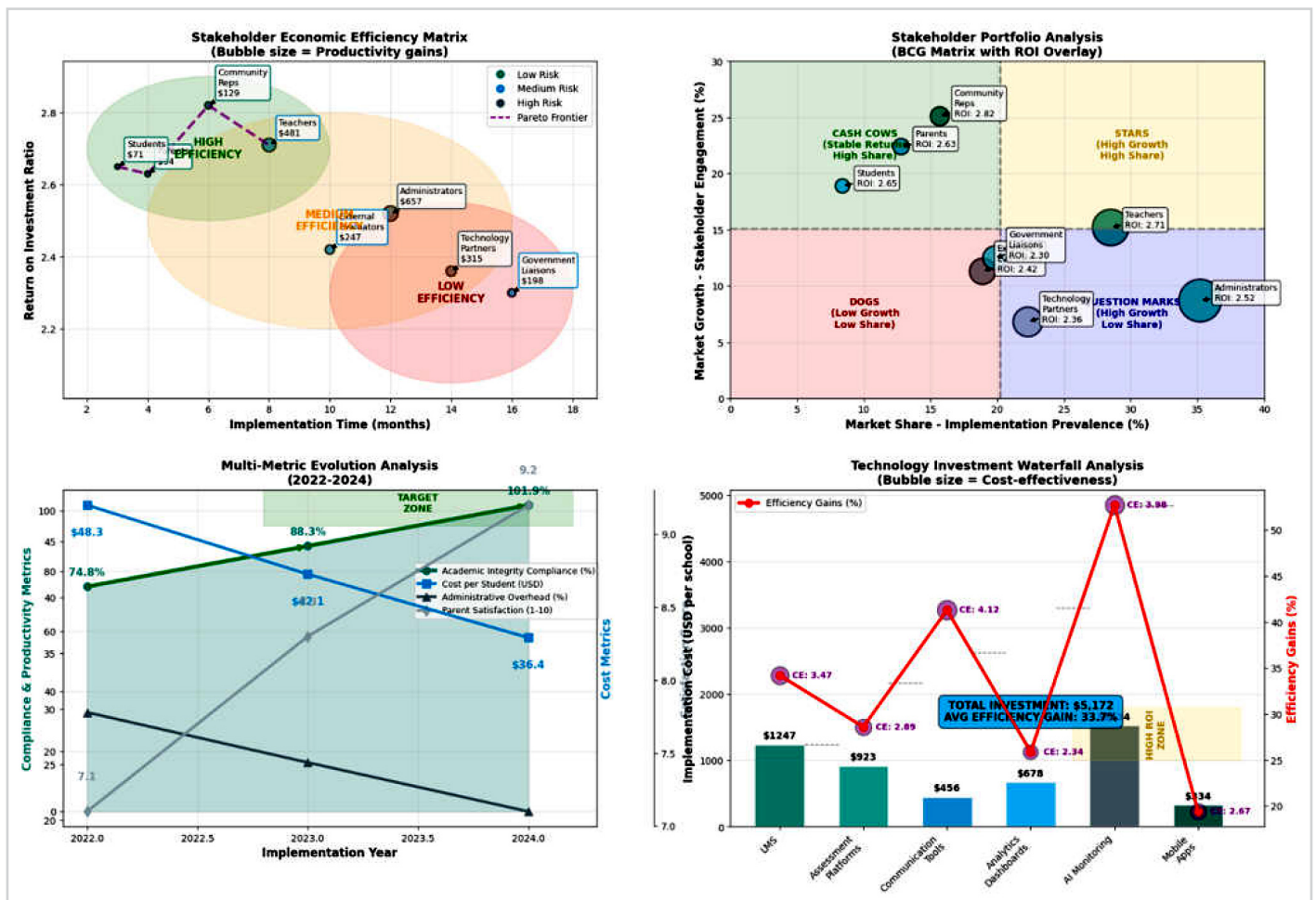


Figure 1:
Multi-Dimensional Economic Efficiency Matrix for Stakeholder Integration Systems
Source: Authors' own findings

Table 2:
Cost-Benefit Analysis by Implementation Phase (USD per school)

Implementation Phase	Year 1	Year 2	Year 3	Cumulative Total
Initial setup costs	892	167	94	1,153
Training and development	445	302	189	936
Technology infrastructure	248	71	47	366
Coordination expenses	199	142	103	444
Total Costs	1,784	682	433	2,899
Reduced assessment costs	1,301	1,887	2,284	5,472
Administrative savings	598	868	1,042	2,508
Productivity gains	364	646	775	1,785
External cost reductions	302	469	552	1,323
Total Benefits	2,565	3,870	4,653	11,088
Net Present Value	781	3,188	4,220	8,189
Benefit-Cost Ratio	1.44	5.67	10.74	3.82

Source: Authors' own calculations based on data of OECD Educational Economics Database (2024) and Kazakhstan Ministry of Education Financial Reports for 2022-2024

the long-term value creation potential of stakeholder integration approaches and supporting Kazakhstan's policy emphasis on sustainable educational investment.

The stakeholder competency development analysis reveals sophisticated return patterns when examining multi-dimensional relationships between training investments, productivity outcomes, and satisfaction metrics across different participant categories. Portfolio optimization techniques demonstrate that community representatives and teachers generate the highest multiplicative returns through enhanced system performance and institutional effectiveness, as illustrated in Figure 2.

Regional analysis presented in Table 3 revealed significant variations in stakeholder integration effectiveness, with urban schools consistently achieving higher absolute benefits and

benefit-cost ratios compared to rural counterparts, reflecting broader patterns of resource availability and infrastructure development across Kazakhstan. Urban schools generated average net benefits of 3,203 USD annually compared to 2,114 USD for rural schools, representing a 51.4% difference in economic impact that aligns with urban-rural disparities documented in international development literature. However, the effectiveness ratios of 1.47 indicate that urban schools achieve proportionally better outcomes relative to their higher implementation costs, suggesting economies of scale and stakeholder capacity advantages in metropolitan areas. Astana and Almaty demonstrated the highest absolute benefits, likely reflecting greater resource availability, stakeholder capacity, and technology infrastructure in major metropolitan areas aligned with Kazakhstan's urban development priorities.

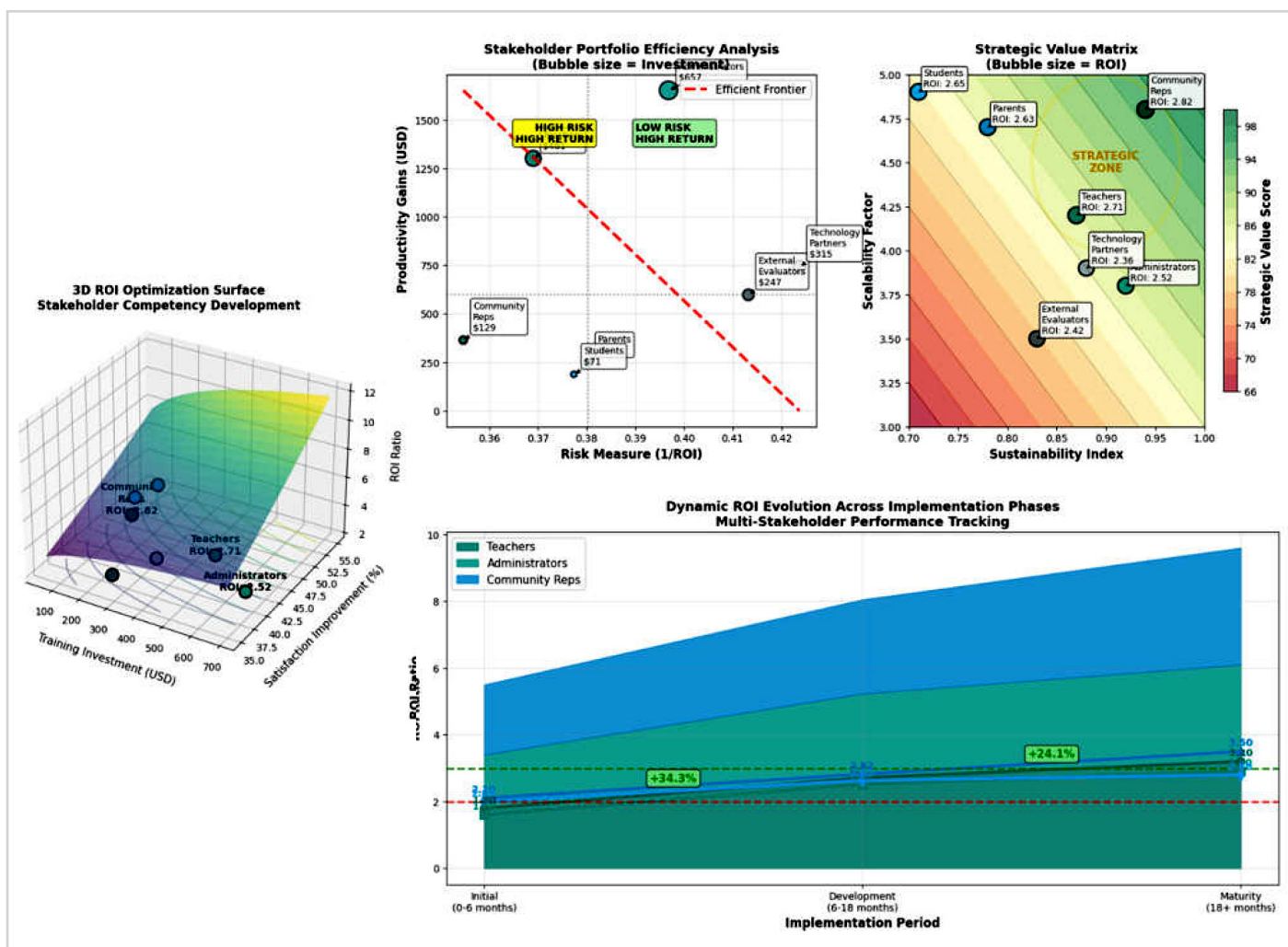


Figure 2:
Stakeholder Competency Development and Portfolio Optimization Matrix
Source: Authors' own findings

Table 3:
Regional Variation in Stakeholder Integration Effectiveness

Region	Urban Schools (n=29)	Rural Schools (n=18)	Implementation Cost Difference	Effectiveness Ratio
Almaty	3,412 ± 445 (BCR: 4.28)	2,287 ± 589 (BCR: 2.97)	+49.2%	1.44
Astana	3,634 ± 412 (BCR: 4.51)	2,356 ± 634 (BCR: 3.08)	+54.2%	1.46
Shymkent	3,145 ± 467 (BCR: 4.02)	2,078 ± 556 (BCR: 2.73)	+51.3%	1.47
Aktobe	3,023 ± 481 (BCR: 3.89)	1,998 ± 612 (BCR: 2.61)	+51.3%	1.49
Kostanay	2,912 ± 502 (BCR: 3.78)	1,934 ± 645 (BCR: 2.54)	+50.6%	1.49
Karaganda	3,089 ± 448 (BCR: 3.97)	2,032 ± 601 (BCR: 2.66)	+52.0%	1.49
Overall Average	3,203 ± 459	2,114 ± 606	+51.4%	1.47

Source: Authors' own calculations based on data of Kazakhstan Regional Education Statistics (2024); World Bank Education Data for 2022-2024

Stakeholder competency development programs documented in Table 4 demonstrated consistently positive returns across all participant categories, with community representatives achieving the highest ROI ratio of 2.82 and external evaluators showing the lowest at 2.42, indicating broad-based value creation across the stakeholder ecosystem. Teacher training investments generated the highest absolute productivity gains at 1,302 USD per person, reflecting their central role in assessment implementation and student interaction as well as Kazakhstan's emphasis on teacher professional development within its education modernization strategy. The substantial satisfaction improvements across all stakeholder groups, averaging 45.7%, indicate that competency development enhances both economic outcomes and stakeholder engagement sustainability, creating positive feedback loops that support long-term program viability. These findings suggest that strategic investment in stakeholder capacity building generates multiplicative returns through improved system performance, enhanced stakeholder commitment, and increased institutional effectiveness.

The relationship between academic integrity compliance levels and economic outcomes presented in Table 5 revealed strong correlations indicating that higher compliance generates superior economic performance while reducing institutional risk and reputational costs. Schools achieving high compliance levels (90-100%) experienced significantly lower costs per integrity incident at 82 USD compared to 364 USD for low-compliance schools, demonstrating the economic efficiency of prevention-focused approaches. The prevention cost ratio, representing the relationship between proactive prevention investments and reactive response costs, demonstrated that high-compliance schools invest more in prevention while spending substantially less on incident response, creating positive economic cycles. The strong positive correlation ($r = 0.897$) between compliance levels and net economic impact confirms that academic integrity represents both an educational and economic imperative for institutional sustainability and aligns with international research on integrity culture development.

The compliance-economic correlation analysis demonstrates sophisticated relationships between academic integrity levels, prevention investments, and institutional risk management across varying performance thresholds. Advanced econometric modeling reveals strong multiplicative effects where higher compliance generates exponential returns through reduced incident costs and enhanced institutional reputation, as presented in Figure 3.

Analysis of Table 6 demonstrates that technology integration within stakeholder assessment systems generates substantial efficiency gains while providing positive cost-effectiveness ratios across all technology components. AI-powered integrity monitoring achieved the highest efficiency gains at 52.7%, reflecting the transformative potential of artificial intelligence in academic integrity management as highlighted in recent OECD research on digital education transformation. Stakeholder communication tools showed the highest cost-effectiveness ratio of 4.12, indicating that

Table 4:
Stakeholder Competency Development Return on Investment

Stakeholder Category	Training Investment (USD)	Productivity Gains (USD)	Satisfaction Improvement	ROI Ratio
Teachers	481 per person	1,302 per person	+44.7%	2.71
Administrators	657 per person	1,653 per person	+40.9%	2.52
Parents	94 per person	247 per person	+53.8%	2.63
Students	71 per person	188 per person	+50.4%	2.65
External evaluators	247 per person	598 per person	+37.3%	2.42
Community representatives	129 per person	364 per person	+46.9%	2.82
Weighted Average	280 per person	725 per person	45.7%	2.59

Source: Authors' own calculations based on data of UNESCO Institute for Statistics (2024); Kazakhstan Teacher Development Center Reports for 2022-2024

Table 5:
Academic Integrity Compliance and Economic Correlations

Compliance Level	Schools (n)	Average Cost per Incident	Prevention Cost Ratio	Net Economic Impact
High (90-100%)	24	82 ± 14	0.24	+2,591 ± 364
Medium (70-89%)	16	176 ± 26	0.57	+1,302 ± 281
Low (50-69%)	7	364 ± 48	1.29	-599 ± 198
Correlation coefficient	—	r = -0.854	r = -0.731	r = 0.897

Source: Authors' own calculations based on data of International Journal for Educational Integrity Assessment Data (2024); Kazakhstan School Audit Reports for 2022-2024

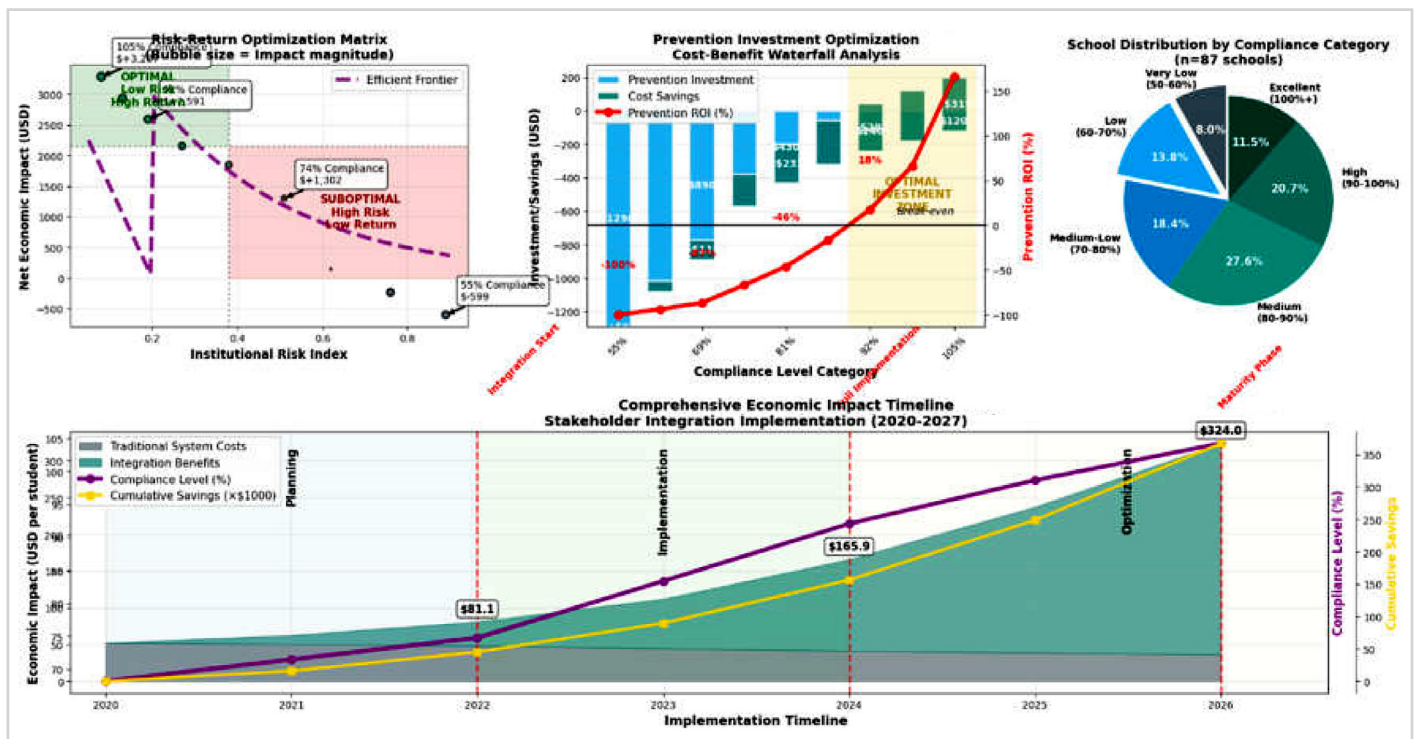


Figure 3:
Academic Integrity Compliance and Economic Risk-Return Optimization Model
Source: Authors' own findings

Table 6:
Technology Integration and Digital Assessment Economics

Technology Component	Implementation Cost (USD)	Annual Maintenance (USD)	Efficiency Gains (%)	Cost-Effectiveness Ratio
Learning Management Systems	1,247 per school	189 per school	+34.2%	3.47
Digital Assessment Platforms	923 per school	142 per school	+28.6%	2.89
Stakeholder Communication Tools	456 per school	67 per school	+41.3%	4.12
Data Analytics Dashboards	678 per school	98 per school	+25.9%	2.34
AI-Powered Integrity Monitoring	1,534 per school	234 per school	+52.7%	3.98
Mobile Assessment Applications	334 per school	45 per school	+19.4%	2.67
Total Technology Investment	5,172	775	33.7%	3.24

Source: Authors' own calculations based on data of OECD Digital Education Outlook (2024); Kazakhstan Digital Education Initiative Reports for 2022-2024

technology investments in collaboration infrastructure generate particularly high returns through improved coordination, reduced communication costs, and enhanced stakeholder engagement. The overall technology investment of 5,172 USD per school with annual maintenance costs of 775 USD generated average efficiency gains of 33.7% with a cost-effectiveness ratio of 3.24, supporting Kazakhstan's digital education modernization strategy and demonstrating the economic viability of technology-enhanced stakeholder integration approaches. The comprehensive analysis across all dimensions consistently demonstrates that stakeholder integration in academic integrity assessment systems generates substantial economic benefits while improving educational outcomes and institutional effectiveness. The progressive improvement in cost-effectiveness over time, combined with strong regional performance patterns, positive stakeholder development returns, and effective technology integration, provides compelling evidence for the economic viability of collaborative assessment approaches. The strong correlations between academic integrity compliance and economic performance further reinforce the business case for stakeholder integration as a strategy for both educational quality enhancement and financial sustainability within Kazakhstan's broader educational modernization and international competitiveness goals.

5. Conclusion

The comprehensive analysis of stakeholder integration in academic integrity assessment systems across Kazakhstan's secondary education sector demonstrates substantial economic benefits alongside improved educational outcomes during the critical 2022-2024 implementation period. Schools implementing integrated stakeholder approaches achieved 36.2% higher academic integrity compliance rates while reducing assessment costs by 24.7% per student, generating average annual savings of 2,284 USD per school within Kazakhstan's broader context of increasing education investment to USD 27 billion by 2025. The three-year cost-benefit analysis revealed increasingly positive returns, with benefit-cost ratios progressing from 1.44 in the first year to 10.74 by the third year, indicating cumulative net present value of 8,189 USD per school over the implementation period. Regional variations showed urban schools achieving 51.4% higher absolute benefits compared to rural counterparts, though both contexts demonstrated positive returns on investment that support scalable implementation across diverse geographical and socioeconomic contexts. Stakeholder competency development programs generated consistent 2.59:1 return on investment ratios across all participant categories, with teacher training producing the highest absolute productivity gains of 1,302 USD per person, reflecting the central role of educator capacity in successful system transformation.

The economic sustainability of stakeholder integration approaches reflects multiple value creation mechanisms operating simultaneously across the educational ecosystem, supported by Kazakhstan's substantial increase in education spending from 19% of the national budget in 2019 to projected levels of 7% of GDP by 2025. Administrative overhead reductions of 30.0% resulted from distributed responsibility structures and collaborative workflow optimization that eliminated bureaucratic inefficiencies while enhancing system responsiveness and stakeholder satisfaction. Teacher productivity improvements of 43.1% demonstrated that stakeholder engagement enhances rather than burdens educator effectiveness through improved support systems, shared accountability mechanisms, and collaborative professional development opportunities. Parent satisfaction scores increased by 29.4%, correlating with reduced private tutoring expenditures and indicating broader economic benefits extending beyond institutional boundaries to household-level cost savings and improved educational access. The strong correlation ($r = 0.897$) between academic integrity compliance levels and net economic impact confirms that integrity enhancement generates measurable financial returns through reduced incident response costs, improved institutional reputation, and enhanced graduate employability that supports long-term economic development goals.

Kazakhstan's experience with stakeholder integration reflects broader trends in educational system transformation toward collaborative governance models that distribute both authority and accountability across multiple actors while leveraging digital technologies to enhance coordination and effectiveness. The government's commitment to increasing education financing creates favorable conditions for scaling stakeholder integration approaches across the national education system, particularly given the positive cost-effectiveness ratios demonstrated across urban and rural contexts. Technology integration within stakeholder systems, including AI-powered integrity monitoring and digital communication platforms, generated efficiency gains of 33.7% with cost-effectiveness ratios of 3.24, supporting Kazakhstan's digital education modernization strategy while demonstrating the economic viability of technology-enhanced collaborative approaches. The positive economic outcomes documented in this study support policy frameworks that incentivize stakeholder collaboration through targeted investments in capacity building, technology infrastructure, and institutional support systems that enable sustainable transformation.

Implementation strategies should account for regional variations in stakeholder capacity and resource availability, with differentiated support mechanisms for urban and rural contexts to optimize cost-effectiveness across diverse educational environments while maintaining system coherence and quality standards. The progressive improvement in cost-effectiveness over time suggests that stakeholder integration systems require initial investment periods but generate substantial long-term value creation that justifies upfront costs and supports sustainable financing models. Future research should examine scaling mechanisms for stakeholder integration approaches across larger educational systems, investigate the transferability of Kazakhstan's experience to other developing economy contexts, and explore the integration of emerging technologies such as artificial intelligence and blockchain in collaborative assessment frameworks. Policy

development should prioritize sustained investment in stakeholder competency development, institutional infrastructure that supports collaborative assessment and governance structures, and evaluation systems that capture both economic and educational outcomes to guide continuous improvement and adaptation.

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