World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 57, April, 2026
ISSN: 2749-3628,

DIGITAL TRANSFORMATION AND INSTITUTIONAL ATTRACTIVENESS IN HIGHER EDUCATION IN UZBEKISTAN: DEVELOPMENT AND APPLICATION OF THE IRSI COMPOSITE INDEX

Berdinazarov Zafar Ulashovich, DSc. Associate professor
Higher School of Business and Entrepreneurship under the Cabinet of Ministers of the Republic of Uzbekistan
E-mail: z_berdinazarov@gsbe.uz; ORCID: 0000-0002-7194-0943
Abdurakhmonova Malika Abdujabbarovna
Higher School of Business and Entrepreneurship under the Cabinet of Ministers of the Republic of Uzbekistan
E-mail: *m.abduraxmanova@gsbe.uz;* ORCID: 0009-0004-9853-0567

Article history:

Received: 20th March 2026

Accepted: 14th April 2026

Abstract:

This study develops and applies the Integrated Rating of Smart Implementation (IRSI) index to evaluate how digital transformation relates to the attractiveness of higher education institutions in Uzbekistan. Because application-level demand data were not consistently available across institutions, attractiveness was operationalized as a multidimensional institutional outcome combining learning outcomes, learning management system (LMS) engagement, class attendance, test results, and user satisfaction. The study used a six-year institutional panel covering five leading universities from 2020 to 2025 and combined expert-based weighting, survey validation, comparative trend analysis, and exploratory forecasting. IRSI weights were estimated through the Analytic Hierarchy Process using 15 experts, then checked with consistency analysis, Cronbach's alpha, and a 1,000-iteration Monte Carlo simulation. The satisfaction sub-index was derived from a structured survey instrument covering internet quality, infrastructure, staff competence, and content quality, with additional content-validity, construct-validity, and test-retest checks. The largest weights were assigned to learning outcomes (0.354) and LMS engagement (0.245), while the overall weighting scheme showed acceptable consistency (CR = 0.067) and good reliability (alpha = 0.85). Between 2020 and 2025, all five universities recorded substantial IRSI growth, with 2025 scores ranging from 82 to 93 points. Under the realistic 2030 scenario, the two leading institutions are projected to approach 98 points, while the lowest-ranked institution is projected to reach 91.5 points. The findings suggest that digital transformation in Uzbekistan is associated with stronger educational performance, better user experience, and a more attractive higher education environment, although regional disparities remain visible.

Keywords: Digital transformation; higher education; composite index; Analytic Hierarchy Process; satisfaction; Uzbekistan; ARIMA forecasting

JEL Classification: I23; O33; C38; C53

1. INTRODUCTION

Uzbekistan's higher education system has undergone unusually rapid expansion during the reform period associated with the higher education development agenda to 2030 and the wider digital modernization agenda. Official planning documents emphasize broader participation, stronger institutional performance, and international competitiveness as strategic priorities [1]. National statistics also show sustained growth in student numbers and a rising female share in higher education, which reached 50.6% at the beginning of the 2024/2025 academic year [2].

At the same time, digital transformation has moved from a supplementary support function to a central mechanism for widening access, improving learning continuity, and strengthening the reputation and perceived attractiveness of universities. Learning management systems, remote instruction tools, and digitized student services reduce geographic and time barriers, which is particularly important in a country where regional inequality, labor-market pressure, and

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 57, April, 2026
ISSN: 2749-3628,

gendered care responsibilities still shape participation in higher education.

International evidence on digital delivery remains mixed. Some studies report that online provision can widen access for working and place-bound students [4], while others show that online delivery may lower short-run academic performance if pedagogy and support systems are weak [5]. These findings suggest that the value of digitalization is not captured well by single indicators such as internet coverage alone. A multidimensional framework is needed to assess how digital transformation is actually implemented within universities and how that implementation relates to institutional attractiveness.

The present study addresses that gap by developing the Integrated Rating of Smart Implementation (IRSI) index and applying it to five leading universities in Uzbekistan for 2020-2025. Rather than equating digitalization with hardware or connectivity only, IRSI combines outcome, engagement, participation, assessment, and satisfaction dimensions into a normalized composite measure. In this study, institutional attractiveness is treated as an indirect construct reflected in stronger academic performance, higher engagement, and a more favorable user experience.

Three research questions guide the article. First, which dimensions of digital transformation receive the greatest weight in a composite assessment model? Second, is the proposed index sufficiently reliable and valid for comparative institutional analysis? Third, how did IRSI change across selected universities from 2020 to 2025, and what trajectories are plausible through 2030 under alternative scenarios?

2. MATERIALS AND METHODS

2.1. Study design and empirical scope

The empirical design combines index construction, psychometric validation, comparative institutional analysis, and exploratory time-series forecasting. The institutional panel covers five major universities in Uzbekistan - Uzbekistan National University (UzMU), Samarkand State University (SamDU), Tashkent University of Information Technologies (TATU), Tashkent State University of Law (TDU), and Karshi State University (KarDU) - observed annually from 2020 to 2025. The unit of analysis is the institution-year, yielding 30 observations for the comparative stage.

Two data streams were used. The first consists of institution-level indicators used to calculate the IRSI composite measure. The second is a survey-based satisfaction instrument administered over a three-year period using Google Forms, Microsoft Forms, and paper questionnaires distributed through university learning systems and in face-to-face classes. The survey instrument included 20 substantive items and 5 demographic questions rated on a five-point Likert scale.

2.2. IRSI conceptualization and weighting

IRSI was designed as a weighted and normalized composite index intended to capture the maturity of digital transformation as it is manifested in educational outcomes and user experience. Five dimensions were retained after expert review: learning outcomes (LO), LMS engagement (ENG), attendance (ATT), test results (TEST), and satisfaction (SAT). The final institutional score was obtained through weighted aggregation followed by normalization to a 0-100 scale for cross-university comparability.

Dimension weights were estimated using the Analytic Hierarchy Process (AHP) [6,7]. A panel of 15 experts participated in pairwise comparisons: five professors holding doctoral degrees, five higher education methodologists, and five specialists in digital education technologies. Pairwise judgments were aggregated by geometric mean, and the resulting consensus matrix was converted into relative priorities.

Table 1. IRSI dimensions and AHP-derived weights

Dimension	Abbrev.	Meaning	Weight
Learning outcomes	LO	GPA, examinations, and practical outcomes.	0.354
LMS engagement	ENG	Frequency and quality of LMS use.	0.245
Attendance	ATT	Physical, online, and blended attendance.	0.147
Test results	TEST	Institutional and standardized assessment performance.	0.152
Satisfaction	SAT	Perceived quality of digital learning and support.	0.101

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 57, April, 2026
ISSN: 2749-3628,

2.3. Reliability and validity procedures

Several checks were used to evaluate the robustness of the index construction procedure. Internal consistency of AHP judgments was examined through the consistency ratio (CR), which compares the observed consistency index to the random index benchmark [7]. Inter-rater consistency across expert weight vectors was then summarized using Cronbach's alpha [8]. To evaluate sensitivity to sampling variability in expert judgments, the study also employed a 1,000-iteration Monte Carlo simulation that generated confidence intervals for each dimension weight.

The SAT sub-index was constructed from four components: internet quality, digital infrastructure, staff competence, and content quality. Content validity was assessed by a five-member panel (three pedagogy experts and two psychometric specialists). Agreement among judges was summarized with Cohen's kappa [9]. Construct validity was assessed through confirmatory factor analysis, and convergent and discriminant validity were evaluated using average variance extracted and the Fornell-Larcker criterion [10]. Temporal stability was examined using a test-retest design with 50 paired observations.

2.4. Comparative analysis and forecasting

After the index had been weighted and validated, IRSI scores were compared across universities and over time. The analysis focused on relative institutional position, absolute improvement from 2020 to 2025, and the changing distance between leading and lagging institutions.

To extend the analysis beyond the observed period, the study used an exploratory ARIMA(1,1,1) procedure to develop institutional forecasts for 2026-2030. Three scenarios were constructed: optimistic, realistic, and pessimistic. The scenario logic reflects alternative assumptions about the pace of infrastructure modernization, investment, cybersecurity readiness, and student satisfaction. Because each institution contributes only six annual observations, the forecasting exercise should be interpreted as indicative rather than deterministic.

3. RESULTS

3.1. Weight structure and robustness of the IRSI model

Learning outcomes emerged as the dominant IRSI dimension (0.354), followed by LMS engagement (0.245). Attendance and test results received similar intermediate weights (0.147 and 0.152), while satisfaction retained a smaller but still meaningful role (0.101). The pattern indicates that experts viewed digital transformation as most valuable when it is reflected in observable academic performance and sustained platform use rather than in infrastructure alone.

The AHP consistency ratio was 0.067, below the commonly accepted 0.10 threshold, indicating acceptable internal coherence in pairwise judgments. Cronbach's alpha for the aggregated expert weight vectors was 0.85, which suggests good reliability. Monte Carlo intervals were narrow for all five dimensions, with the widest 95% interval spanning only 0.016 points, which supports the stability of the weighting scheme under repeated perturbation.

3.2. Validity evidence for the satisfaction sub-index

The SAT sub-index showed acceptable evidence of content, construct, and temporal validity. Expert review of questionnaire content produced an average rating above 4.5 out of 5, and Cohen's kappa reached 0.78, indicating substantial agreement among reviewers. The confirmatory factor analysis supported the four-component structure of the instrument. Based on the values reported in the source material, the model fit can be summarized as acceptable to good (chi-square/df = 2.15; CFI = 0.93; TLI = 0.94; RMSEA = 0.05; SRMR = 0.04).

The test-retest exercise also indicated temporal stability. The paired difference between the two measurement rounds was not statistically significant ($p = 0.421$), while the Pearson correlation between the two administrations was 0.85 ($p < 0.001$). Together, these results support the inclusion of satisfaction as a substantive component of the IRSI framework rather than as a merely descriptive add-on.

Table 2. Summary of reliability and validity evidence

Evidence	Value	Assessment
AHP consistency	CR = 0.067	Acceptable internal coherence of pairwise judgments.
Expert reliability	alpha = 0.85	Good consistency across expert-derived weights.

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 57, April, 2026
ISSN: 2749-3628,

Evidence	Value	Assessment
Monte Carlo stability	1,000 iterations; max CI width = 0.016	Weight estimates are statistically stable.
Content validity	kappa = 0.78	Substantial reviewer agreement.
Construct validity	CFI = 0.93; TLI = 0.94; RMSEA = 0.05; SRMR = 0.04	Acceptable-to-good fit of the four-factor SAT model.
Test-retest reliability	r = 0.85; p = 0.421	High temporal stability and no significant mean shift.

3.3. Institutional dynamics, 2020-2025

All five universities registered substantial improvement over the observed period. In 2025, the highest IRSI scores were recorded by UzMU (93) and SamDU (92), followed by TATU (88), TDU (87), and KarDU (82). In absolute terms, every university improved by at least 34 points between 2020 and 2025, demonstrating that digital transformation was not confined to a single leading institution.

The strongest growth was observed among universities that started from a lower base, particularly KarDU and TDU, suggesting that later adopters can still narrow the gap when institutional strategy, quality control, and digital support systems improve. Nevertheless, the final ranking shows persistent stratification, implying that digitization alone does not erase inequalities related to management capacity, staff preparedness, and infrastructure quality.

Table 3. IRSI performance of selected universities, 2020 and 2025

University	IRSI 2020	IRSI 2025	Change
UzMU	59	93	34
SamDU	57	92	35
TATU	54	88	34
TDU	52	87	35
KarDU	47	82	35

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 57, April, 2026
ISSN: 2749-3628,

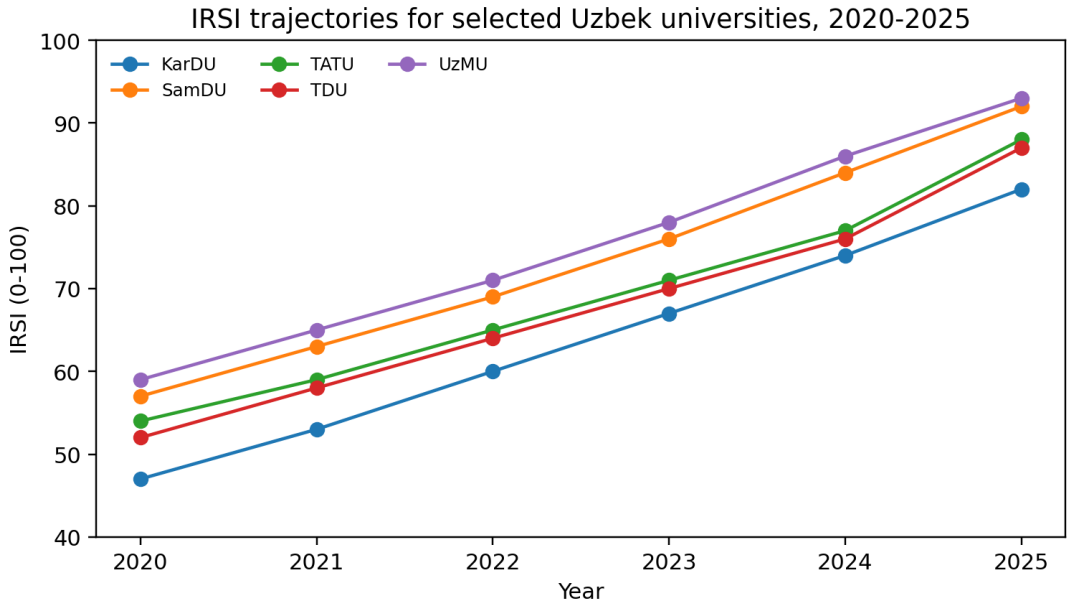

Figure 1. IRSI trajectories for selected Uzbek universities, 2020-2025.

3.4. Exploratory forecasts to 2030

The forecasting exercise indicates continued improvement under all three scenarios, but the pace of convergence differs sharply. Under the realistic scenario, UzMU and SamDU are projected to reach 98.5 and 98.0 points by 2030, while KarDU is projected to reach 91.5. Under the pessimistic scenario, the leading institutions still remain above 96 points, but the lowest-ranked university levels off at 84.5, preserving a sizable inter-institutional gap.

The forecast spread between optimistic and pessimistic scenarios is widest for universities with more fragile baseline conditions, which reinforces the policy importance of targeted regional support. The results imply that digital transformation remains path dependent: universities with stronger initial infrastructure and governance can capitalize on digital investments more quickly, while others require sustained support to translate technology adoption into educational quality gains.

Table 4. Forecasted IRSI values for 2030 under alternative scenarios

University	Optimistic	Realistic	Pessimistic
UzMU	100.0	98.5	96.5
SamDU	100.0	98.0	96.0
TATU	96.5	94.5	91.5
TDU	95.5	93.5	90.5
KarDU	94.5	91.5	84.5

4. DISCUSSION

The study contributes to the literature in three ways. First, it proposes a context-specific composite measure for evaluating digital transformation in higher education in Uzbekistan. Existing studies on digitalization in education often rely on single proxies such as connectivity, platform use, or enrollment growth. IRSI instead combines educational performance, participation, engagement, and user perceptions into a single framework that can be tracked longitudinally.

Second, the findings suggest that the most influential dimensions of digital transformation are not purely technical. Learning outcomes and LMS engagement received the largest weights, which implies

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 57, April, 2026
ISSN: 2749-3628,

that experts interpreted successful digital transformation as pedagogically embedded rather than infrastructure driven. This is consistent with the broader literature showing that technology improves access and institutional reach only when it is integrated into teaching practice and learner support [3-5].

Third, the Uzbek case shows that digital transformation may play a dual role in system development. At the national level it can support expansion and make universities more attractive to diverse student groups. At the institutional level, however, transformation still depends heavily on managerial quality, faculty competence, and the ability to convert digital resources into better learning experiences. This helps explain why the five universities improved together but did not converge fully by 2025.

The policy implications are straightforward. Investments in broadband connectivity and devices remain necessary, but they are not sufficient. Regional universities need sustained support in staff training, platform design, technical support, and digital content renewal. Student satisfaction should also be monitored routinely because weak content quality and unstable internet access can undermine the visible gains produced by infrastructural modernization.

Several limitations should be acknowledged. The analysis covers only five universities and therefore should not be generalized mechanically to the full higher education system. Institutional attractiveness is measured indirectly through a composite index rather than through application behavior or revealed-preference data. In addition, the forecasting exercise is based on short institutional time series and should be treated as exploratory. Finally, the underlying source material refers to multi-factor regression analysis, but full regression coefficients were not reported in the available manuscript version; future work should add these estimates and conduct robustness checks using a larger panel.

5. CONCLUSION

This article developed and applied the IRSI composite index to evaluate digital transformation in higher education institutions in Uzbekistan. The index proved internally consistent, statistically stable, and usable for comparative institutional analysis. Learning outcomes and LMS engagement were the most influential dimensions, while the SAT instrument provided a reliable way to integrate user experience into the overall framework.

Between 2020 and 2025, all five universities improved markedly, although meaningful differences in institutional performance persisted. The forecasting exercise indicates that further progress is likely through 2030, but that regional disparities will remain unless infrastructure, pedagogy, and student support are upgraded in a balanced way. Taken together, the findings suggest that digital transformation can strengthen the attractiveness of higher education in Uzbekistan when technology is tied to academic performance, pedagogical practice, and user-centered service design.

REFERENCES

1. Republic of Uzbekistan. Concept of Development of the Higher Education System of the Republic of Uzbekistan until 2030. Tashkent: Presidential Decree No. UP-5847; 2019.
2. National Statistics Committee of the Republic of Uzbekistan. Higher Education in the Republic of Uzbekistan. Press release. Tashkent; 28 May 2025.
3. OECD. OECD Digital Education Outlook 2021: Pushing the Frontiers with Artificial Intelligence, Blockchain and Robots. Paris: OECD Publishing; 2021.
4. Goodman J, Melkers J, Pallais A. Can online delivery increase access to education? Journal of Labor Economics. 2019;37(1):1-34.
5. Bettinger EP, Fox L, Loeb S, Taylor ES. Virtual classrooms: How online college courses affect student success. American Economic Review. 2017;107(9):2855-2875.
6. Saaty TL. Decision making with the analytic hierarchy process. International Journal of Services Sciences. 2008;1(1):83-98.
7. Saaty RW. The analytic hierarchy process - what it is and how it is used. Mathematical Modelling. 1987;9(3-5):161-176.
8. Tavakol M, Dennick R. Making sense of Cronbach's alpha. International Journal of Medical Education. 2011;2:53-55.
9. Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics. 1977;33(1):159-174.
10. Fornell C, Larcker DF. Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research. 1981;18(1):39-50.
11. Mincer J. Schooling, Experience, and Earnings. New York: National Bureau of Economic Research; 1974.
12. UNESCO IITE. ICT Skills Development in the Republic of Uzbekistan: Insight Report with Recommendations. Moscow: UNESCO Institute for Information Technologies in Education; 2025.