

RESEARCH

Strengthening the Quality Education Strategy (SDG 4) through a Digital Transformation Strategy in Selected Iraqi Universities

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ABSTRACT

PURPOSE: This study examines the role of digital transformation strategy in strengthening quality education outcomes aligned with Sustainable Development Goal 4 (SDG 4) in selected Iraqi public universities.

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DESIGN/METHODOLOGY/APPROACH: A quantitative, cross-sectional design was employed. Data were collected from 237 academic leaders across three Iraqi universities using a structured questionnaire. Descriptive statistics and linear regression analysis were conducted to test the proposed hypotheses.

FINDINGS: The results reveal a significant positive relationship between the availability of digital transformation requirements and quality education indicators ($\beta=0.744$; $R^2=0.617$; $p < 0.05$). While digital infrastructure readiness was high, organisational and training-related barriers remain substantial.

ORIGINALITY/VALUE: The originality of this study stems from filling a research gap concerning the role of digital transformation in enhancing the quality of education and achieving SDG 4 in Iraqi higher education. It also provides empirical evidence that contributes to enriching the scientific literature and offers practical guidance for universities and policymakers.

PRACTICAL IMPLICATIONS: Universities should align digital transformation policies with sustainable development objectives, strengthen leadership commitment, and invest in continuous digital capacity-building initiatives.

KEYWORDS: *E-Learning; Quality Education Strategy; Sustainable Development Goal 4 (SDG 4); Digital Transformation; Higher Education; Iraq.*

INTRODUCTION

Technological change and institutional shifts towards digitalisation are transforming higher education worldwide. Digital transformation is not only about integrating e-learning platforms, but about new roles, changed ways of teaching, new curriculum design, new strategies for using resources, and new administration within universities (Matt *et al.*, 2015). It thus reinvents the way universities function and provide education in digital environments.

Digital transformation is also a crucial tool in enhancing the quality of education of Sustainable Development Goals (SDGs4). In educational environments, digital leadership can transform the institutional systems and improve the effectiveness of the institutions (Alawamleh *et al.*, 2025), and artificial intelligence (AI) and advanced technologies can also enhance the performance of the institutions and improve the educational outcomes (Al-Haraizah *et al.*, 2026; Hammad, 2025; Khasawneh *et al.*, 2025). Sustainable digital transformation, however, requires an integrated organisational strategy that supports long-term institutional change (Hashem *et al.*, 2025; Rzepka *et al.*, 2024).

SDG 4 focuses on inclusive, equitable and good quality education and lifelong learning opportunities. Digital technologies help achieve these goals by enhancing access, engagement,

flexibility and effectiveness of learning (Gibreel and Abdalla, 2025; Saleh and AlAli, 2022; Zhao, 2023). At the higher education level, digital transformation has been linked to academic productivity, the quality of services, and institutional competitiveness (Mohammed *et al.*, 2024; Muhsen and Alwan, 2024).

However, universities in developing and post-conflict countries are severely constrained in their structures. Iraqi public universities are facing challenges such as financial constraints, lack of infrastructure, and limited access to electronic devices. While digital initiatives have grown, their sustainability and strategic coherence has not been sufficiently explored. The literature review revealed that digital transformation can positively affect the performance of institutions with proper leadership and strategic orientation (Abdullah and Ahmed, 2024; Danook and Al-Obaidy, 2024). However, poor infrastructure, limited institutional capacity and low digital skills of faculty members are still major barriers (Haddadou, 2025; AlAli and Wardat, 2024).

Previous research often addresses the adoption of technology or operational implementation without considering digital transformation and its link to SDGs (Alnajdawi *et al.*, 2025; Mustafa *et al.*, 2026; Escobar-Rodriguez and Monge-Lozano, 2012; Speer, 2020). Research on educational quality and wastage also fails to pay much attention to the strategic aspect of transformation (AlAli and Wardat, 2024). Based on this, the research question in this study is: How does digital transformation strategy contribute to the improvement of SDG 4 quality-education indicators in Iraqi public universities?

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Higher Education: Digital Transformation Strategy in Higher Education

Digital transformation in the higher education sector is not just about the use of one technology or platform. It refers to the restructuring of institutions and the reconfiguration of their strategy, systems and culture to enhance academic and administrative processes (Matt *et al.*, 2015). This process encompasses redesigning procedures, embedding digital infrastructure, boosting data-driven decision making, strengthening institutional capacity and linking digital projects with long-term strategic and sustainability goals.

In the academic environment, digital transformation has been linked to better administrative efficiency, communication, effective use of resources, and more access to learning materials (Mohammed *et al.*, 2024; Speer, 2020). However, these benefits can be achieved not only through technology but also through leadership, organisational capacity and the integration of digital programmes into university plans.

Strategic Leadership and Absorptive Capacity can enhance institutional competitiveness by helping universities to identify and implement knowledge created through digital transformation (Abdullah and Ahmed, 2024; Danook *et al.*, 2024). However, most literature continues to be

technology-focused and knowledge of how the platform is accepted, how digital tools are adopted or any specific learning technology (Escobar-Rodriguez and Monge-Lozano, 2012). Digital transformation has received little attention so far as an institutional approach that brings together the infrastructure, policies, staff capabilities, planning and organisational readiness, as well as for SDG 4 (See Figure 1).

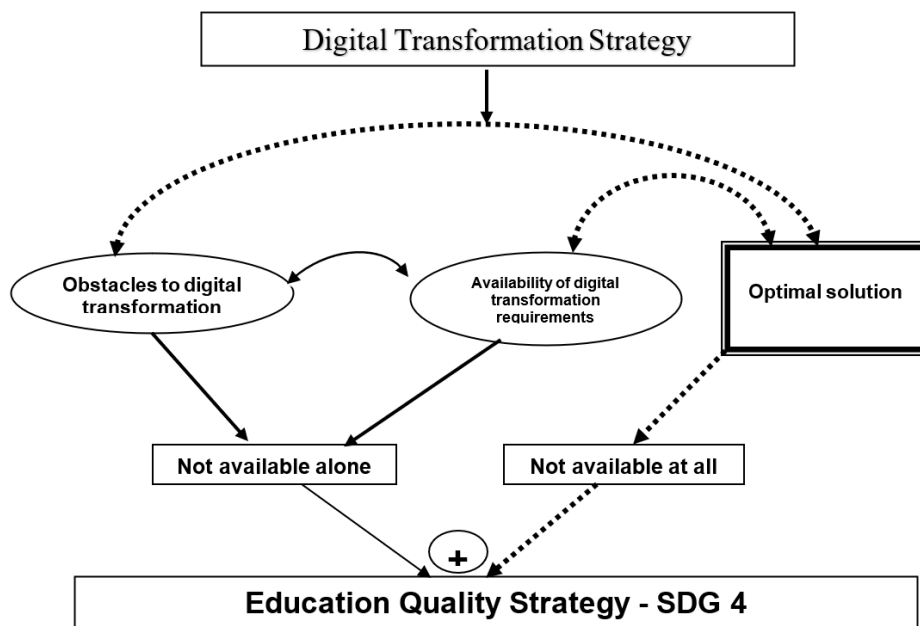


Figure 1: Research Framework

Source: Developed by the authors (2026).

Digital Transformation and Quality Education (SDG 4)

Inclusive, equitable and quality education is highlighted under Sustainable Development Goal 4, alongside opportunities for lifelong learning. Digital technologies have been identified as tools that can enhance access, equity and participation in the educational setting (Saleh and AlAli, 2022; Zhao, 2023). Digital platforms can enhance educational offerings beyond the classroom and offer students more opportunities to access materials and engage in learning activities. In addition, digital learning could help to implement flexible curricula, personalised pathways, academic interaction, and a variety of methods of content delivery (Muhesen and Alwan, 2024). Online learning can help to alleviate geographical constraints and promote the inclusion of underserved and/or vulnerable students (AlAli and Wardat, 2024). However, digital transformation does not necessarily translate into quality in education. Digital platforms will not have a significant impact without appropriate policies, effective leadership, qualified staff, and reliable infrastructure. Digital transformation

has rarely been studied as an institutional factor affecting educational quality, efficiency and the reduction of educational wastage (Qawasmeh *et al.*, 2026). The literature is thus fragmented, and empirical evidence linking strategic digital transformation aspects with SDG 4 indicators is limited.

Barriers and Organisational Readiness

Organisational, behavioural, technological, and infrastructural barriers can limit digital transformation. Some of the common challenges include limited resources, resistance to change, weak planning, inadequate institutional support, and inadequate faculty competencies, along with inadequate infrastructure (Haddadou, 2025; AlAli and Wardat, 2024). These obstacles may hinder the success of digital investments and the ability of universities to incorporate technology into their basic activities.

Organisational readiness indicates whether a university has the structure, capabilities, policies, support from leadership and vision needed to put into place and maintain digital change. Danook and Al-Obaidy (2024) found that universities with strong digital leadership and strategic intent are more likely to link digital initiatives to education goals. However, readiness cannot be considered separately from implementation barriers. A university can have digital infrastructure but at the same time still face inadequate training, weak coordination, resistance and unclear governance. There have been very few empirical studies that have concurrently explored these conditions in transitional higher education systems, especially in Iraq.

Research Gap and Competitive Advantage of the Study

There have been previous studies that have focused on digital transformation and educational quality separately. The available literature is mostly about technology acceptance, platform adoption or administrative efficiency without addressing how an integrated approach of a digital transformation strategy can influence SDG 4 outcomes (Matt *et al.*, 2015; Escobar-Rodriguez and Monge-Lozano, 2012). In the same way, studies on educational quality and wastage have not given much consideration to the strategic and structural aspects of digital transformation.

Regional studies highlight the challenges of infrastructure, leadership, institutions, and lack of digital competencies, but they fail to provide a holistic framework for the impact of digital transformation needs and barriers on quality education results (Abdullah and Ahmed, 2024; Haddadou, 2025). This gap is particularly important in Iraq, where public universities face technological, institutional and resource constraints.

Based on this, this study proposes and evaluates an integrated model that connects digital transformation needs and challenges to SDG 4 indicators related to quality education in Iraqi universities. It views digital transformation as a strategic institutional process, and provides evidence on the relationship between readiness and barriers to inclusive and sustainable educational outcomes.

Theoretical Contribution and Study Positioning

To address these gaps, the present study introduces and empirically validates a conceptual model of digital transformation strategy and quality education outcomes based on SDG4 indicators. The research moves the analytical lens from technology adoption to digital transformation, which is an institutional strategy that includes structural, strategic and cultural aspects.

In theory this study adds to the literature by taking the discussion on digital transformation in higher education beyond the operational aspects. It brings together aspects of sustainability related educational quality frameworks (SDG4) with strategic management theory, providing a more comprehensive understanding of the effect of digital transformation on educational outcomes.

In practice, the study provides empirical evidence from Iraqi higher education institutions, a context that has not been widely explored in the international literature. This may enrich theory, increase the external validity of existing theory and expand knowledge of digital transformation in developing and transitional educational systems.

HYPOTHESES (H) DEVELOPMENT

Digital Transformation Requirements and Quality Education

Operational efficiency and pedagogical effectiveness are improved by the availability of digital infrastructure, institutional policies, trained staff, and strategic planning of digital infrastructure (Matt *et al.*, 2015; Mohammed *et al.*, 2024). Higher education institutions that incorporate the use of digital systems in their administration and curriculum delivery have better opportunities to enhance the quality of the curriculum, student experience and accessibility to learning. Therefore:

H1: The availability of digital transformation requirements has a positive and significant impact on SDG 4 indicators in Iraqi universities.

Obstacles to Digital Transformation and Quality Education

A lack of training, poor strategic alignment, and organisational resistance can reduce the effectiveness of digital implementation (Haddadou, 2025). These obstacles decrease the congruence of digital efforts with the outcomes of educational quality. Accordingly:

H2: Obstacles to digital transformation negatively influence the achievement of SDG 4 indicators.

Integrated Impact of Digital Transformation Strategy

Universities are supposed to perform better in terms of educational quality when digital transformation requirements are present and limitations are well controlled. This cross-cutting view brings digital maturity to sustainable education goals. Thus:

H3: Digital transformation strategy implementation significantly explains variance in SDG 4 indicators.

METHODOLOGY

The research design was a quantitative, cross-sectional study, where analysis was done on the influence of digital transformation strategy on quality education indicators in relation to SDG 4 in sampled universities in Iraq. The hypothesised of relationships and finding the predictive effects among variables are best explained using a quantitative approach.

The study population included academic leaders (deans, assistant deans, heads of departments and department rapporteurs) at Tikrit University, Kirkuk University and Northern Technical University, a total of 729 people. At a 95% confidence level and a 5% margin of error, the sampling formula formulated by Stephen Thompson provided the sample size of 252. A total of 250 questionnaires were distributed, with 237 valid responses analysed, resulting in a response rate of 94.8%.

The structured questionnaire was used to gather data based on earlier research on the topic of digital transformation and the quality of education (Matt *et al.*, 2015; Saleh and Al Ali, 2022; Mohammed *et al.*, 2024). The instrument included three constructs, namely availability of digital transformation requirements (6 items), obstacles to digital transformation (7 items), and quality education indicators (7 items). Everything was measured using a 5-point Likert scale. questionnaire.

Cronbach's alpha was used to test the reliability of the instrument, and all the constructs had a value above the suggested threshold of 0.70, showing acceptable internal consistency.

Hypothesis tests at a significance level of 0.05 were conducted using descriptive statistics and linear regression analysis.

Participation was voluntary, informed consent was obtained and the responses were anonymised as required by research ethics standards. AI tools were only utilised in refining the language; all data analysis and interpretation was undertaken by the authors.

The study adhered to the ethical standards of scientific research, with participation being entirely voluntary after participants were informed of the study's objectives and gave their informed consent. Data confidentiality and participant anonymity were ensured in accordance with research ethics principles. Artificial intelligence tools were used solely for linguistic enhancement, while the researchers were solely responsible for data analysis and interpretation.

RESULTS

Table 1 gives the population distribution across the three public universities selected for the study. The total population was 729 academic leaders, comprising deans, assistant deans, heads of

departments and department rapporteurs. Tikrit University accounted for the largest share of the population (297), followed by Northern Technical University (218) and the University of Kirkuk (214).

The distribution is based on the relative administrative size and organisational structure of the institutions to ensure proportionate representation in the sampling process.

Table 1: Research Community Distribution at Public Universities

Position	Tikrit University	University of Kirkuk	Northern Technical University	Total
Dean	23	18	16	
Assistant Dean	46	36	32	
Head of Department	114	80	85	
Department Rapporteur	114	80	85	
Total	297	214	218	729

Source: Developed by authors based on SPSS statistical analysis.

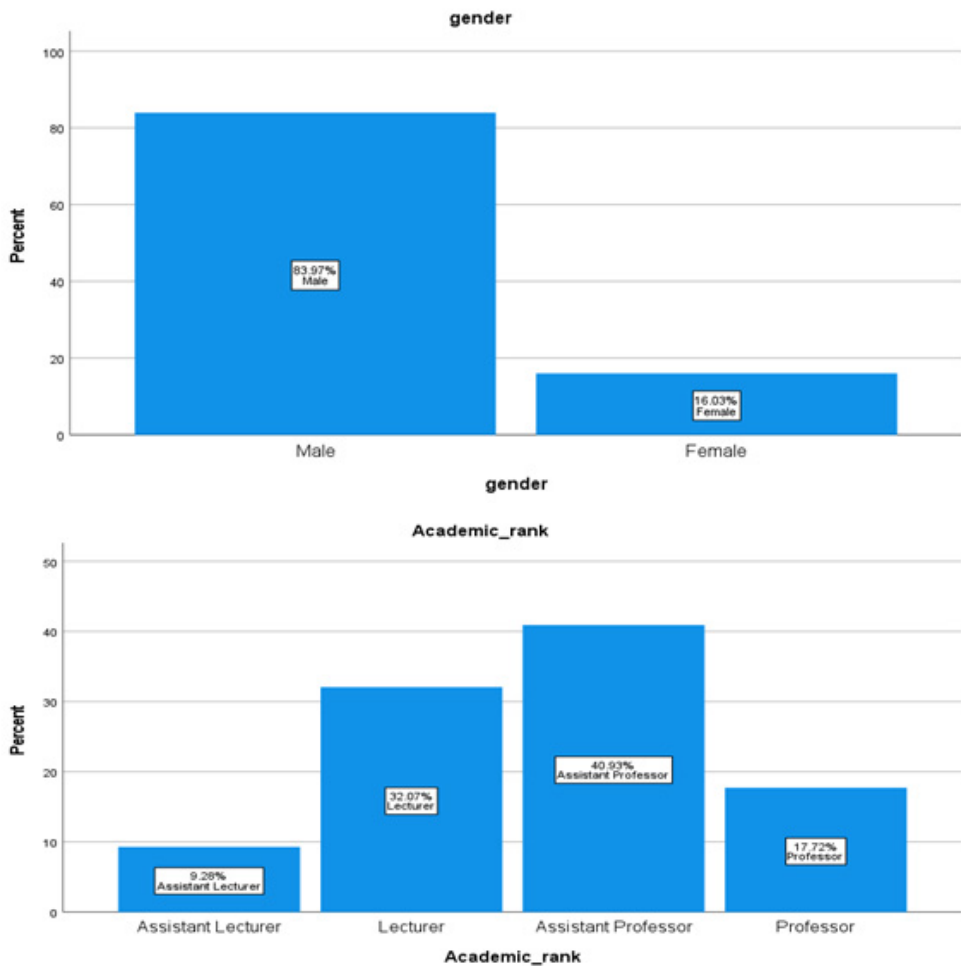
Table 2 and Figure 2 summarise the demographic profile of the 237 respondents. Descriptive data were analysed using SPSS descriptive statistics via frequencies and percentages to describe the sample's characteristics. The sample was male-dominated (84%), indicating the gender representation of higher education institutions in Iraq. Academically, assistant professors were the most represented (40.9%), then lecturers (32.1%), professors (17.7%), and assistant lecturers (9.3%), which is a solid representation of mid- and senior-level academics. In terms of institutional affiliation, Tikrit University accounted for the highest percentage of participants (44.7%), followed by the University of Kirkuk (30.4%) and Northern Technical University (24.9%). On the topic of digital competency, the majority of respondents reported intermediate (44.7%) or high (37.6%) levels of experience in using digital technologies; this correlates with a sufficient level of familiarity with digital transformation practices.

Table 2: Profiles of Respondents

		Frequency	Percentage
Gender	Male	199	84
	Female	38	16
	Total	237	100
University	Tikrit University	106	44.7
	University of Kirkuk	72	30.4
	Northern Technical University	59	24.9
	Total	237	100

		Frequency	Percentage
Academic Rank	Assistant Lecturer	22	9.3
	Lecturer	76	32.1
	Assistant Professor	97	40.9
	Professor	42	17.7
	Total	237	100
Experience in using digital technologies	Beginner	42	17.7
	Intermediate	106	44.7
	Advanced	89	37.6
	Total	237	100

Source: Developed by authors based on SPSS statistical analysis.



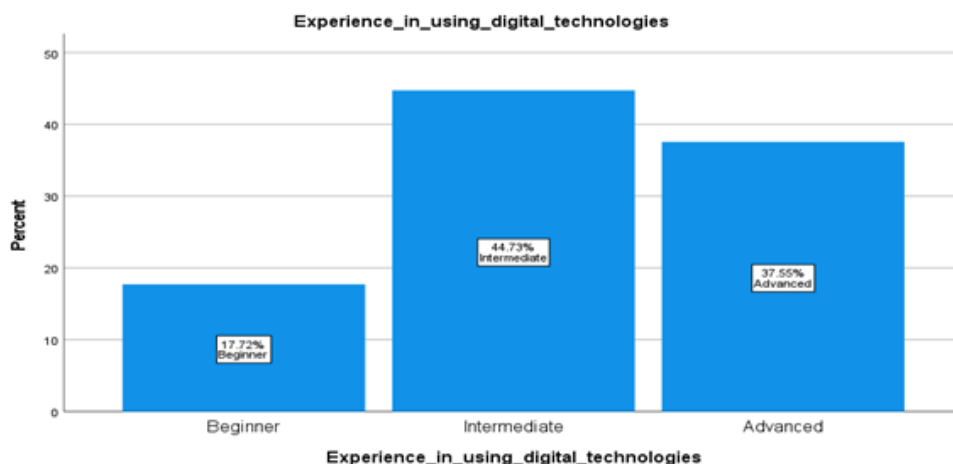


Figure 2: Graphical Representation of the Sample Distribution by Demographic Characteristics

Source: Constructed by authors based on SPSS statistical analysis.

Table 3 shows the evaluation of the reliability of the measurement tool using Cronbach's alpha. Internal consistency was acceptable, as all reliability coefficients were above the recommended threshold of 0.70. The reliability coefficients were 0.72, 0.814, and 0.81 for digital transformation requirements, digital transformation obstacles, and SDG 4, respectively. The questionnaire also demonstrated high overall internal consistency, with a reliability coefficient of 0.918, supporting the appropriateness of the instrument for statistical analysis.

Table 3: Assessment of Measurement

Variable	Number of items	Cronbach's alpha value
Availability of digital transformation requirements	6	0.72
Obstacles facing digital transformation	7	0.814
SDG 4	7	0.81
Reliability of questionnaire items	20	0.918

Source: Developed by authors based on SPSS statistical analysis.

The findings show that the overall availability of digital transformation requirements is rather high, with a mean of 3.72 (SD = 1.11). The maximum mean was for Item 1 (4.02), implying a high level of readiness in terms of technical infrastructure, with the lowest mean being in Item 4 (3.52), indicating a relative lack of institutional policies and strategic planning to undergo digital transformation. Even though the rating of all items was at a high level, the difference in the ranking points to the necessity of enhancing strategic and organisational aspects to make digital integration sustainable (See Table 4).

Table 4: Digital Transformation Requirements

Question Number	Mean	Standard deviation	Level	Rank
1	4.02	0.93	High level	1
2	3.54	1.09	High level	5
3	3.58	1.18	High level	4
4	3.84	1.16	High level	3
5	3.84	1.09	High level	2
6	3.52	1.22	High level	6
	3.72	1.11	High level	

Source: Developed by authors based on SPSS statistical analysis.

Table 5 indicates that the degree of perceived barriers to digital transformation was high among the respondents, with a mean of 3.75 (SD = 0.99). The highest mean was obtained for Item 11 (4.05), meaning that this barrier was perceived as the greatest challenge, although Items 7 and 12 had relatively lower means (3.60). Although all items were rated at a high level, the findings indicate that organisational, behavioural, and institutional constraints are still significant barriers that can potentially restrict the success and sustainability of digital transformation projects.

Table 5: Barriers to Digital Transformation

Question Number	Mean	Standard deviation	Level	Rank
7	3.60	0.95	high level	6
8	3.62	1.10	high level	4
9	3.90	1.02	high level	2
10	3.89	0.94	high level	3
11	4.05	0.83	high level	1
12	3.60	0.95	high level	7
13	3.62	1.10	high level	5
	3.75	0.99	high level	

Source: Developed by authors based on SPSS statistical analysis.

Table 6 shows that the general level of perceived educational quality is high and aligned with SDG 4, with a mean of 3.77 (SD = 0.99) obtained. The means for Items 14 and 15 were the highest (3.90), implying that there were strong perceptions of the effectiveness of learning and quality of the content. Item 20 had the lowest average (3.55), implying that it is a relatively poor-quality dimension in some aspects. Despite the fact that the ratings of all indicators were high, the difference between the items implies that additional efforts by the institutions are necessary to attain comprehensive sustainable alignment with SDG 4 goals.

Table 6: Educational Quality (SDG 4)

Question Number	Mean	Standard deviation	Level	Rank
14	3.90	1.01	high level	2
15	3.90	0.94	high level	1
16	3.59	1.10	high level	6
17	3.81	0.91	high level	4
18	3.81	0.93	high level	5
19	3.84	0.97	high level	3
20	3.55	1.10	high level	7
	3.77	0.99	high level	

Source: Developed by authors based on SPSS statistical analysis.

The regression analysis in Table 7 shows that SDG 4 has a statistically significant positive relationship with the availability of digital transformation requirements. This model is meaningful ($F = 378.894$, $p < 0.001$) and has a strong impact coefficient ($\beta = 0.744$). According to the coefficient of determination ($R^2=0.617$), 61.7% of the variance in educational quality is explained by readiness for digital transformation. These findings support the conclusion that educational results conducive to SDG 4 can be boosted by improving digital infrastructure, institutional support, and strategic alignment.

Table 7: Regression Analysis

Independent Variable	dependent variable	Beta Coefficient (β)	Coefficient of Determination (R^2)	F-statistic (F)	t-statistic (t)	Significance Level (p-value) Sig	Meaning
Availability of digital transformation requirement	Quality of Education SDG 4	0.744	0.617	378.894	19.465	0.001	Semantic

Source: Developed by authors based on SPSS statistical analysis.

DISCUSSION

The findings of this study provide solid empirical evidence that digital transformation strategy has a significant positive impact on quality education outputs in accordance with SDG 4 in Iraqi state higher education institutions. The regression findings ($\beta = 0.744$; $R^2 = 0.617$; $p < 0.05$) suggest that readiness for digital transformation is a significant predictor of the quality of education. This validates the finding that digital facilities, institutional engagement, and strategic integration are pivotal factors in sustainable educational enhancement.

These results can be compared with the existing literature emphasising the importance of digital transformation for the efficiency of the academic process and the quality of services (Matt *et al.*, 2015; Mohammed *et al.*, 2024). The current research adds to the literature since it empirically synthesises digital transformation strategy and SDG 4 indicators into a unitary analytical model in a transitional context of higher educational systems. Although the antecedent literature has analysed digital adoption or educational wastage in isolation, this research illustrates that digital maturity acts as a structural-level facilitator of quality education.

The descriptive results also indicate that despite the fact that Iraqi universities have good digital infrastructure preparedness, there are still considerable organisational and behavioural obstacles. The levels of obstacles, such as lack of training and resistance to change, are high and this implies that technological investment is not enough. This is in line with Haddadou (2025), who pointed out that effective transformation can only be achieved through institutional capacity-building and leadership commitment. This study is consistent with the findings of previous research, which confirms that the effectiveness of digital transformation in universities does not depend solely on infrastructure, but requires institutional capabilities and leadership commitment to achieve its impact on the SDG 4.

In addition, differences between universities imply varying levels of digital maturity. The educational quality perceptions were greater in the institutions whose leadership was more determined and had more clearly defined digital strategies. This suggests that digital transformation should be planned and not initiated through disjointed initiatives.

Digital transformation has an SDG perspective that has led to greater accessibility and delivery of content, as well as greater inclusion in education. Nevertheless, a comparatively low score on lifelong learning and flexible access indicates that the total alignment with SDG 4 needs further integration of digital governance, faculty development, and policy restructuring.

On the whole, the results confirm that digital transformation is not merely a technological change but a strategic institutional change process, which is necessary for sustainable educational development.

PRACTICAL IMPLICATIONS

The results of this study have a number of relevant implications for university administrators and policy-makers. First, institutions in Iraq should focus on developing clear digital transformation plans directly matching the targets of SDG 4. The implementation of digital initiatives should be part of long-term, overall strategic plans and not presented in the form of separate, isolated projects.

Second, investment should not be limited to infrastructure, but should also include the continuous training of faculty and development of digital skills. The clear understanding of the barriers that are related to training highlights the need to develop human capital in order to achieve sustainable digital maturity.

Third, university leadership should take the initiative to instill a digital innovation culture. Effective digital governance systems, a solid change-management process, and a powerful strategic vision are essential to overcome resistance in an organisation. Fourth, the Ministry of Higher Education should develop national guidelines that combine digital transformation performance indicators with sustainable development goals. The association of funding mechanisms with quantifiable indicators of digital preparedness can contribute to faster institutional change.

Lastly, higher education institutions should aim to strengthen relationships with technology vendors and online service platforms to improve the resilience of infrastructure, cybersecurity infrastructure, and the ability to make decisions based on data. Through these recommendations, the Iraqi universities will be able to increase their ability to provide high-quality, inclusive, and sustainable education in line with the requirements of SDG 4.

CONCLUSIONS

This paper explored how a digital transformation strategy can enhance the outcomes of educational quality according to SDG 4 in the selected universities in Iraq. The results support the hypotheses, showing that the supply of digital transformation resources significantly increases the educational quality indicators; this explains a significant percentage of the variance in perceived educational performance. The findings indicate that digital infrastructures, institutional support, and strategic alignment are indispensable for sustainable education enhancement.

Despite the fact that Iraqi universities have achieved remarkable milestones in the implementation of digital systems and e-learning networks, institutional and behavioural challenges remain barriers to achieving complete digital maturity. The main limitations were found to be a lack of training, resistance to change, and disjointed strategic planning. These results demonstrate that digital transformation should not be limited to technological investment but should also involve institutional governance reforms, leadership commitment and human capital development.

The paper concludes that digital transformation is a strategic facilitator of sustainable higher education and not an initiative that is purely technical in nature. Through institutionalising digital transformation in the context of the 10-15-20-year plans of the organisation, together with its explicit alignment with SDG 4 aims, universities will be able to improve their accessibility, the effectiveness of learning, and academic inclusivity.

A future replication of this study could involve the use of superior modelling methods, longitudinal data and cross-regional analysis of digital maturity levels to further enhance understanding of how digital transformation has contributed to the sustainable growth of the educational system.

AUTHOR CONTRIBUTIONS

- **Ahmed Abdullah Danook and Ahmad Wasfi Mohammad Albdour:** Conceptualisation; Methodology; Investigation; Writing – original draft; Writing – review and editing; Supervision and Project administration.
- **Belal Ahmad Mathani:** Conceptualisation; Methodology; Investigation; Validation; Writing – review and editing.
- **Ahmed Abdullah Danook and Ahmad Yahia Ahmad Al-Omari:** Methodology; Investigation; Validation; Visualisation; Writing – review and editing.

All authors reviewed and approved the final version of the manuscript.

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