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The Impact of Digital Transformation on the Saudi Higher Education Administration

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This study examines how the Saudi higher education administration is affected by the digital transformation, with a particular emphasis on student services management, data management, communication, administrative effectiveness, and decision-making. A representative sample of 930 administrative staff and information technology (IT) personnel from (6) public and private universities including; (Hail, Majmaah, Prince Satam bin Abdel- Aziz, Prince Sultan, Prince Meqren, and El-Faisal) universities, were given structured surveys as part of the research's quantitative, cross-sectional design, which was informed by the Technology-Organization-Environment paradigm. The results showed that digital transformation greatly improves decision-making and administrative efficiency, especially for administrative staff and in public universities. There are significant distinctions in staff positions and institutional types, meanwhile, with leadership seeing larger transformation advantages and public institutions benefiting more from government-backed efforts than IT professionals. Resistance to change, cybersecurity concerns, and a lack of technical skills are some of the main obstacles that have been found; these difficulties differ depending on the type of institution and personnel role. Improvements in data management, communication approaches, and student services were consistently indicated by respondents working across university departments and university contexts. The findings of the study indicated that although digitization has encouraged significant organizational improvements within Saudi higher education, it is necessary for organizational leaders and policymakers to encourage greater internal cohesion and growth opportunities to build more sustainable, competitive institutions in line with the goals of Vision 2030.

Keywords: digital transformation, higher education administration, digital leadership, administrative efficiency, implementation barriers

INTRODUCTION

Background to the Study

In order to properly honor the shared global goals of the Fourth Industrial Revolution, it is necessary for higher education institutions to understand how to effectively incorporate new technologies into their research, administrative practices, and pedagogy

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(Bonfield et al., 2020; Bygstad et al., 2022). As new, integrated technologies combine to create novel solutions to problems of long-distance research collaboration and democratize access to high-quality education, a variety of platforms, tools, and networks must be developed and adopted across institutional contexts (Goulart et al., 2021). On a more local level, new technologies that automate the processing and organization of institutional data must be adopted at higher education institutions so students, faculty, staff, and administration can work in greater alignment, and so resources can be more efficiently distributed across departments (Cui, 2024; Han, 2024). To properly realize this vision and to remain competitive in a global knowledge market, higher education institutions must empower digital leaders to address deficiencies in their existing technological infrastructures, upskill their employees, identify impactful ways to use digital tools, and build highly adaptable security measures to guard sensitive data (Habeeb & Eyuboglu, 2024; Han, 2024; Sukandi, 2024). While these shifts in managerial, pedagogical, and research-related practices represent a necessary and inevitable set of changes, cumulatively, these changes create a significant short-term burden on a variety of stakeholders – including instructors, researchers, administrators, regents, and operations departments (Benavides et al., 2020).

This process of digitization is receiving considerable attention within Saudi Arabian higher education institutions. Alamoudi (2021) indicated that embrace of the digital is absolutely imperative in promoting the professional growth of individuals in developing nations. In line with Saudi Vision 2030, the kingdom's integrated short-term plan of rapid development that seeks to massively expand its information economy by the year 2030, Saudi universities are expanding their use of technological tools in pedagogy, but have run into significant backlash from old-guard academics (Al-Anzi, 2022; Alenexi & Akour, 2023). In Saudi Arabia, The Digital Government Authority (DGA) was established in 1442 AH. In keeping with the Kingdom's aspirational vision 2030, it seeks to improve client experiences with government agencies, boost digital performance within government agencies, improve service quality, elevate the beneficiary experience, support digital transformation, and increase investment returns and national economic value. Furthermore, it opens the door for government organizations to offer highly effective and high-quality digital services that boost investment returns and the value of the national economy.

To cope with the orientations of the The Digital Government Authority (DGA), The University of Hail had established a strategic plan for digital transformation to develop the various services to meet the directives of (DGA). Through the application of emerging technologies, automation of business operations and processes, data management governance, digital transformation governance, and qualifying digital leadership, it focuses on the digitalization of technological systems and services. This plan significantly improved the university's technological performance (University of Hail,2022).

Also, Majmaah University is committed to providing electronic and educational services through the automation of services provided by all university departments to beneficiaries and providing support and development for these electronic services to

achieve the university's goals in digital transformation in accordance with the Kingdom's Vision 2030. It also seeks to provide electronic educational programs and systems for university students to enhance their skills, diversify learning methods and establish educational laboratories that contribute to improving the quality of the educational environment in the university's colleges.

A case study on Prince Sultan University (PSU) highlights the importance of creating a sustainable digital transformation environment based on best practices to overcome challenges and to achieve the university's goals. This approach very aligns with Saudi Arabia's Vision 2030, which objectives to transform the education and scientific research (Alenezi & Akour, 2023).

Higher Education Institutions (HEIs) face several challenges when implementing digital transformation. These include the need for comprehensive strategic planning, overcoming resistance to change, and adapting to new organizational cultures and technological advancements (Fernández et al., 2023; Halkhoree et al., 2024). The COVID-19 pandemic accelerated the adoption of digital methods, highlighting the important need for digital transformation in HEIs (Robertson & Lapiņa, 2022).

A lack of IT infrastructure, a lack of leadership, a lack of policy backing, and teacher reluctance to change are just a few of the technical, social, cultural, and contextual barriers that universities may face while implementing digital technology. The research also carefully highlights clear risks such increasing educational disparity, a divide between students and teachers, and academic staff members who are overburdened with information (Saragih et al., 2023).

Highlighted below are the research questions that guided this study:

1.How has digital transformation affected administrative efficiency and decision-making processes in the Saudi higher education institutions?

2.To what extent has digital transformation improved communication, data management, and student services within the Saudi higher education administration?

3.What challenges and barriers do higher education administrators face in implementing and managing digital technologies in Saudi higher education institutions?

Theoretical Foundations

The Technology-Organization-Environment (TOE) framework, conceptualized by Tornatzky and Fleischer in 1990, constitutes a prevalent paradigm for the examination of technological innovation adoption within organizational settings (Madaki et al., 2023).

The TOE framework explores the efficacy of technological integration across technological, organizational, and environmental contexts, allowing for leaders and stakeholders to holistically understand the risks, benefits, and opportunities that the incorporation of a given technology pose (Angeles, 2014; Arpaci et al., 2012; Baker, 2012; Madaki et al., 2023). The current body of research suggests that though the TOE framework is relevant to many kinds of organizations (e.g. private, public, academic) and provides a means of integrating information on a wide swath of concerns relevant to

technological integration, published use cases inadequately emphasize environmental factors within their analyses (Angeles, 2014; Jara et al., 2023; Madaki et al., 2023; Micheni, 2015; Nguyen et al., 2022). The current study emphasizes sociopolitical context and affords scholars opportunities for comparison with countries at different stages of development engaging in similar digitization processes, which, in tandem, provide a practical and replicable example of environmental analysis.

LITERATURE REVIEW

Concept of Digital Transformation

As new technologies have become more user-friendly, accessible, and widely adopted by organizations of all types, education and research institutions – driven in equal parts by the need to prepare students for the realities of the job market, the need to invest in relevant research, the desire to maximize internal efficiency, and the pressure to follow global sustainability standards – have keenly felt the need to adapt to this new reality (Gurbaxani & Dunkle, 2019; Hong et al., 2025; Pihir et al., 2018). The use of technologies like artificial intelligence, cloud computing, and big data have already interrupted commonly held understandings of organizational behavior across industries and can only be expected to continue to define the landscape of development in the coming years (Almutairi et al., 2025; Chan, 2020; Tang, 2021). It is the responsibility of higher education institutions to train students in how to integrate these technologies in a practical, ethical, and system-oriented manner.

Higher education institutions (HEIs) are actively embracing digital transformation to evolve into a new model of the digital university, involving both organizational and technological changes (Fernández et al., 2023). This shift helps improve learning outcomes, boosts institutional efficiency, and prepares universities for the demands of the digital era (Halkhoree et al., 2024). Also, Advanced technologies like analytics, cloud computing, and artificial intelligence play a key role in developing management and supporting initiatives aimed at providing good quality, competitive education (Fernández et al., 2023). Furthermore, Digital transformation makes education more accessible to students from different backgrounds, equipping them with the skills to address global challenges and, it can helps reduce educational costs (Kaputa et al., 2022).

Empirical Review

Digital transformation has been undertaken by a great number of private sector organizations in the past, providing sets of general guidelines concerning ideal methods through which new technological systems can be adopted, as well as the cultural and infrastructural changes that leaders can anticipate as a result of those adoptions (Alenezi, 2021; Khatir & Madani, 2024). Diaz-Garcia et al. (2023) conducted a comprehensive single-case study of a higher education institution going through the process of digital transformation in the interest of building a stakeholder-centered framework for understanding the practical aspects of digitization. The researchers found that creating teaching strategies for all stakeholders, maintaining open internal communication, changing culture around technology, using data-driven management

practices, and using participatory leadership methods all helped improve the efficacy of internal systems while minimizing resistance to change.

In the same context, According to Papadakis & Yirci (2023), a variety of leadership models have been created in tandem with the changing demands and standards of educational institutions generally, and universities specifically. One of the most effective strategies for helping universities deal with the dynamic nature of the digital transformation is transformational leadership. It can help universities change to meet the growing demands for performance and accountability as well as the growing demands on university systems for increased administrative effectiveness.

Papadakis et al (2024) confirm that the use of some new, developing technologies and artificial intelligence tools is essential to the digital transformation of institutions. Blockchains, cloud-based AI education apps, cloud-based e-learning platforms, competency-based education platforms, computing clouding tools, adaptive cloud learning platforms, blended learning, immersive technology applications, and smart campus technologies are some of these tools.

To address enduring inefficiencies and the lag in digital transformation across higher education institutions (HEIs), Coronel and Trigos (2024) provided a strong, conceptually novel, and practically applicable transdisciplinary digital framework for university administration. This paper's integration of academic analytics (AA) and transdisciplinary engineering (TE) to establish a data-driven administrative ecosystem based on using metrics like student engagement, learning outcomes, and graduate employability, it suggests a paradigm change and makes a strong case for incorporating such metrics into institutional data models. The framework addresses topics including faculty development, risk modelling, student lifecycle management, and operational efficiency. (Coronel & Trigos, 2024).

A thorough and internationally minded empirical literature analysis by Saragih, Tjakraatmadja, and Pratama (2023) emphasizes the increasing importance of managing digitalization in higher education institutions (HEIs), especially in the context of the developing world. This work's main strength is its methodical identification of four fundamental pillars technology infrastructure, curriculum, training, and collaboration as crucial tactics for HEIs to successfully undergo digital transformation. The study identifies key factors like competition, the growing need for individualized learning experiences, and technological advancement (AI, IoT, MOOCs). (Saragih et al., 2023).

Using a combination of case study analysis, comparative institutional data, and hierarchical assessment models, Li Yang (2024) provides an empirically clear examination of digital transformation routes in university education management. Using AHP (Analytic Hierarchy Process), multi-source feedback models, and real-world data from ten universities, the paper builds a multi-layered evaluation framework that yields quantifiable insights like a 30% reduction in administrative time, a 25% increase in student satisfaction, and a 20% rise in education quality metrics post-digital transformation. For example, it reveals that rural students suffer in career planning and self-management, while "dual teacher" faculty maintain higher expectations for student autonomy and goal setting (Yang, 2024).

Moreover, the study of Okasha et al (2024) offered scenarios for how university administration can evolve in the context of the digital revolution. The study created a mechanism to carry out the innovative scenario by establishing a number of requirements. These requirements include the issuance of legally binding legislation to improve university and administration performance in accordance with the digital transformation, the provision of funding, and efforts to create organizational structures that support the desired development process by equipping the required leaders with the most up-to-date training techniques developed by the global administration to deal with the digital transformation.

According to the report by Assiri (2023), Saudi institutions are utilizing digital administration to improve the caliber of their teaching and learning procedures and to increase the effectiveness of their administrative systems. It is now a part of excellence and quality as well. Every institution has a unique system in place to handle administrative, technical, and teaching and learning procedures. In conversation with the work of both Assiri (2023) and Diaz-Garcia et al. (2023), Al-Othman's (2025) study on sustainable leadership building within Saudi academic institutions undergoing digitalization emphasized the importance of engaging all stakeholders with shared experiences aimed at creating consensus understandings of the digital. Al-Othman (2025) found that focusing on increasing stakeholders' levels of general digital literacy and formalizing procedures for using data analysis tools for use in research and administrative decision-making helped build a base on which a grander culture of organizational technology incorporation could be built.

Al-Shamirey's study from 2022 tried to ascertain how readily available each component is for the institution to meet the demands of digital transformation. The study produced a number of findings, the most significant of which is that the University of Hail has a high degree of availability of all the components required for the digital transformation, with a degree of 65.48%. Additionally, there are statistically significant differences in gender, favoring males, and in scientific degree, favoring professors.

METHOD

Research Design

The impact of digital transformation on the administration of higher education in Saudi Arabia was investigated in this study using a quantitative, cross-sectional research approach. The design made it easier to get numerical data from administrative staff and IT personnel from (6) public and private universities at one time, allowing for the comparison of factors including decision-making, administrative efficiency, and implementation difficulties.

Population, Sample, and Selection Technique

Administrative staff and IT personnel from (6) public and private universities including; (Hail, Majmaah, Prince Satam bin Abdel- Aziz, Prince Sultan, Prince Meqren, and El-Faisal) universities made up the target population. To guarantee representation across institution types and staff roles (administrative staff: n = 350; IT personnel: n = 580), 930 participants (represents 12.6% of the original population) were randomly chosen

(470 from public universities and 460 from private universities). This approach ensured relevance to the research objectives by focusing on those directly involved in digital transformation activities. Table 1 shows the descriptive statistics of the demographics of the sample.

Table 1
Demographic Profile of Respondents (N=930)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	620	66.7%
	Female	310	33.3%
Age Group	Under 30	210	22.6%
	30–39	350	37.6%
	40–49	220	23.7%
	50 and above	150	16.1%
Position	Administrative Staff	350	37.6%
	IT personnel	580	62.4%
Institution Type	Public University	470	50.5%
	Private University	460	49.5%
Experience	<2 years	180	19.4%
	2–5 years	220	23.7%
	6–10 years	350	37.6%
	>10 years	180	19.4%

The demographic data shows a majority male sample (66.7%), reflective of the gendered hiring-related imbalances that continue to exist within the region. The majority of respondents (61.3%) are between the ages of 30 and 49, with 57% of respondents having at least 6 years of experience in their current role. In tandem, this suggests that the perspectives of people in the middle of their careers are disproportionately represented, with many of these people falling in an age range for whom long-term familiarity with technology can be expected. Along similar lines, the majority of respondents worked in IT roles (62.4%) and a minority worked in administration (37.4%), suggesting that there may be an artificially inflated sense of familiarity with technology among respondents.

Instrumentation

In addition to the demographic questions discussed in Table 1, respondents were asked to indicate their level of agreement with a variety of statements pertinent to administrative efficiency, decision-making, communication, data management, student services, and implementation obstacles in order to create an objective base for comparison between different groups. The level of agreement with these statements was evaluated using five-point Likert scales (1= “strongly disagree”, 5= “strongly agree”). Cronbach’s α (α>0.7) and low standard deviations demonstrated reliability across constructs. The researcher evaluated distribution patterns of each scale for skewness and kurtosis.

Data Administration, Collection and Analysis

An online questionnaire was created by the researchers and sent out to 930 IT employees and university administrators across six different universities. Through the

answers to the questionnaire, the researchers sought to better understand the changes that occurred within organizational functioning as a result of digitization. Using SPSS 26, the researchers calculated descriptive statistics and made inferential analyses to better understand the conclusions reached by the quantitative data. Correlation matrices, Cohen's d, Cramer's V, and Tukey HSD tests were used to explore the contours of the findings.

FINDINGS

In this section, the researcher presents the key findings regarding the effect of the digital transformation on HE administration through focusing on the administrative efficiency, decision-making processes, communication, data management, and student services within the Saudi higher education administration. These findings can be displayed as follows:

The Effect of Digital Transformation on Administrative Efficiency and Decision-making Processes in Higher Education Institutions in Saudi Arabia

The study attempts to clarify the effect of digital transformation on administrative efficiency and decision-making processes in higher education institutions in Saudi Arabia, the results can be shown as follows.

Table 2
Descriptive Statistics of Administrative Efficiency and Decision-Making in Higher Education Institutions

Variable	N	Mean	Std. Dev	95% CI	Min	Max
Administrative Efficiency	930	4.12	0.98	[4.03,4.21]	1	5
Decision Making	930	4.20	0.95	[4.12,4.28]	1	5

The results in table (2) show that the administrative staff and IT personnel in Saudi higher education have very positive judgments regarding the consequences of digital transformation, as indicated by the descriptive data in table (2). According to their comments, there is broad consensus that digital technologies have enhanced operational procedures, data-driven decision-making abilities, and administrative efficiency. Together, the findings demonstrate that digital transformation has been effectively applied to improve administrative processes and provide leadership with useful information. The narrow confidence intervals provide additional evidence of the reliability of these positive assessments across the Saudi higher education sector.

Table 3
Independent Samples T-Test Comparing Administrative Efficiency and Decision-Making by Institution Type and Staff Position

Variable	Group	N	Mean	Std. Dev	t-value	Df	p-value
Administrative Efficiency	Public	470	4.25	0.85	3.21	928	0.001**
	Private	460	3.92	0.91			0.001**
Decision Making	Public	470	4.30	0.82	3.45	928	0.001**
	Private	460	3.95	0.88			

The findings of the independent samples t-test show a statistically significant difference between Saudi Arabian public and private universities in terms of the perceived impact of digital transformation. Public institutions reported significantly higher mean scores

than private universities, and the mean ratings for administrative efficiency were statistically significant. Similarly, public universities again agreed more with the improvements in decision-making than private institutions, with a far greater gap. The continuously higher means for public universities across both dimensions suggest that these institutions may be benefiting from more government support, more standardized processes, or a wider use of digital tools, given the impact sizes fall into the small-to-medium range. Moreover, these results show that using new digital technologies and enhancing university leaders' digital competencies are necessary to close this performance gap in data-driven decision making and administrative effectiveness.

Table 4
Independent Samples T-Test by Staff Position

Variable	Group	N	Mean	Std. Dev	t-value	Df	p-value
Administrative Efficiency	Administrative staff	350	4.35	0.80	4.12	928	<0.001***
	IT personnel	580	3.98	0.92			
Decision Making	Administrative staff	350	4.45	0.75	5.01	928	<0.001***
	IT personnel	580	4.05	0.88			

The findings of the independent samples t-test indicate that there are statistically significant differences in the views of IT personnel and administrative staff regarding digital transformation in Saudi higher education institutions. There was a highly significant variation in the level of agreement between administrative workers and IT personnel about administrative efficiency. The disparity was even more pronounced when it came to decision-making improvements, with administrative staff showing more agreement than IT staff. While sdministrative leaders strongly embrace the benefits of digital transformation for both operational efficiency and strategic decision-making, IT professionals appear to be more reserved in their assessments. These results show that technical workers and leadership have somewhat different perspectives. The pattern suggests that either leadership is more aware of the benefits of transformation, or IT professionals have more direct experience with implementation challenges that dampen their enthusiasm. Leadership may have privileged access to analytics and reporting tools that enhance their decision-making skills in comparison to frontline IT workers, which could account for the notable disparity in how decision-making is perceived. These findings highlight the importance of cross-departmental communication in ensuring that attitudes are aligned and that the full advantages of digital transformation are realized at all organizational levels.

Table 5
One-Way ANOVA Results for Digital Transformation Outcomes by Experience Level

Variable	Source	SS	df	MS	F	p-value
Administrative Efficiency	Between	8.75	2	4.38	4.92	0.007**
	Within	825.32	927	0.89		
Decision Making	Between	12.33	2	6.17	7.15	0.001**
	Within	800.45	927	0.86		

The results of the ANOVA show that the effects of digital transformation varied statistically significantly depending on the experience group. Administrative efficiency shows significant between-group variances, and the between-groups sum of squares explains a significant amount of variance beyond random fluctuations. In decision-

making improvements, experience-based differentiation is considerably more evident, with larger between-groups sum of squares and mean squares indicating more substantial differences across experience levels. These findings suggest that years of experience have a significant impact on how staff members view the outcomes of digital transformation, with decision-making enhancements showing the greatest benefits.

Challenges and Barriers Higher Education Administrators Face in Implementing and Managing Digital Technologies in KSA.

Table 6
Frequency Distribution of Digital Transformation Challenges by Institution Type

Challenge Category	Public Univ	Private Univ	Total
Resistance to Change	110 (23.4%)	85 (18.5%)	295
Cyber-security Concerns	95 (20.2%)	120 (26.1%)	215
Lack of Technical Expertise	130 (27.7%)	70 (15.2%)	200
Poor Infrastructure	75 (16.0%)	90 (19.6%)	165
Inadequate Funding	60 (12.8%)	95 (20.7%)	155
Total	470 (100%)	460 (100%)	930

The findings in table (6) demonstrate distinct patterns in the challenges Saudi institutions face during their digital transition. While "Cybersecurity Concerns" are more prevalent at private universities, "Lack of Technical Expertise" is more prevalent at public institutions. There is a pronounced institutional divide: public institutions are 1.8 times more likely to indicate a lack of technical expertise, whereas private colleges are 1.6 times more likely to mention funding issues. Resistance to change is somewhat common in both sectors, but infrastructure challenges differ less. The distribution highlights that public institutions mostly struggle with human capital (technical skills), while private colleges have more resource-based constraints (money and security). These developments highlight the need for tailored solutions to overcome sector-specific risks in the digital transformation process of Saudi higher education.

Table 7
Chi-Square Test Results for Position-Based Differences in Digital Transformation Challenges

Pearson χ^2	Value	df	p-value
Chi-Square	58.34	4	<0.001***
Likelihood Ratio	57.92	4	<0.001***
Linear-by-Linear	8.76	1	0.003**
N of Valid Cases	930		

The substantial link between staff position and reported concerns related to digital transformation is confirmed by the likelihood ratio test, which is displayed in table (7). The findings demonstrate that during digital transformation, IT personnel and administrative workers encounter essentially different difficulties.

Table 8
Percentage Distribution of Key Digital Transformation Challenges by Institution Type

	Public Univ	Private Univ	Total
Cybersecurity Concerns	20.2%	26.1%	23.1%
Lack of Tech Expertise	27.7%	15.2%	21.5%

The cross-tabulation reveals significant sector-specific tendencies in the challenges of digital transformation. While cybersecurity concerns are more common at private colleges (26.1%) than public ones (20.2%), the opposite is true of lack of tech expertise (15.2% private, 27.7% public). This difference may stem from changes in perception over different stages within the wider process of digitization, may indicate different challenges stemming from different funding structures, or may indicate different divisions of IT and administrative employees at different types of organizations.

Table 9
Percentage Distribution of Key Digital Transformation Challenges by Staff Position

	administrative staff	IT Staff	Total
Cybersecurity Concerns	20.0%	25.0%	23.1%
Lack of Tech Expertise	14.3%	25.9%	21.5%

The results in table (9) show that there are notable differences in how IT personnel and administrative workers view implementation problems. IT professionals report higher prevalence rates for cybersecurity issues and weaknesses in technical skills than do leaders. This shows a 25% relative increase in cybersecurity reporting and an 81% higher likelihood of technical staff members reporting a lack of technical abilities. The results show that IT employees, who are directly involved in implementation, see more technical obstacles than top management does.

The Reach of Digitalization within Saudi Universities

Through this study, the researchers sought to understand the changes in internal communication, data management, and student services within higher education administration. The following section demonstrates this data.

Table 10
Descriptive Statistics for Digital Transformation Impact Areas (Communication, Data Management, and Student Services)

Variable	N	Mean	Std. Dev	Min	Max	Skewness	Kurtosis
Communication	930	4.05	1.05	1	5	-0.32	2.15
Data Management	930	3.88	1.15	1	5	-0.45	2.78
Student Services	930	4.10	0.99	1	5	-0.28	2.03

The descriptive statistics in Table 10 represent the perceptions of Saudi higher education administrators concerning the impact that digitization has had on communication, data management, and student services. The means of all of these categories are around 4 (communication, 4.05; data management, 3.88; student services, 4.10) and the standard deviations are all around 1 (communication, 1.05; data management, 1.15; student services, 0.99). This suggests that the majority of respondents understood digitization as having a meaningful, positive impact on all three of these facets of organizational functioning. That student services appears to be the most impactful of these facets may suggest that students are more readily adapting to changes in technological utilization.

Table 11
One-Way ANOVA Results Comparing Digital Transformation Outcomes Between Public and Private Universities

Dependent Variable	Sum of Sq	df	Mean Sq	F-value	p-value
Communication	8.75	1	8.75	7.92	0.021*
Data Management	4.12	1	4.12	3.12	0.085
Student Services	12.33	1	12.33	12.57	0.009**

The ANOVA results in table (11) above demonstrate notable institutional differences in the perceived results of digital transformation. In terms of communication improvements, public colleges did better than private ones; a mean square difference of 8.75 indicates a substantial difference between the groups. In terms of service improvements, public institutions outperform private ones, as seen by even greater differences in student services. Perceptions of data management did not reach statistical significance, even though the tendency continued to favor public organizations. When taken as a whole, these findings suggest that institutional performance varies, with public institutions demonstrating more improvements in communication and student-facing services and data management innovations appearing to be more sector-wide. Significant between-group differences that go beyond chance are confirmed by the significant F-values (all >3).

Table 12
Leadership vs. Technical Staff Perceptions of Digital Transformation: ANOVA Results

Dependent Variable	Sum of Sq	df	Mean Sq	F-value	p-value
Communication	15.22	1	15.22	13.78	0.003**
Data Management	9.45	1	9.45	7.15	0.018*
Student Services	18.67	1	18.67	19.03	0.001***

According to the ANOVA analysis, administrative and IT staff have distinct perspectives on the outcomes of the digital transformation. Significant between-group variation was indicated by a considerable mean square difference, with administrative staff reporting significantly better scores for communication improvements than IT personnel. Variations in student services were far more pronounced; the extremely high total of squares suggests that leadership believes there have been much greater advancements in this field. That administrative leadership claims a greater degree of success than IT staff may suggest that leadership is less keenly aware of the shortcomings of the current technology in place, or that there is a gap between what IT staff would like to have accomplished and what they have done thus far. P-values are much smaller for communication and student services than data management (0.003, 0.001, and 0.018, respectively) which suggests that administrators may be more eager to react to topics that are in their direct scope of influence.

Table 13
Relationships Between Digital Transformation Impact Areas: Correlation Matrix

	Communication	Data Management	Student Services
Communication	1.00		
Data Management	0.38**	1.00	
Student Services	0.62***	0.45***	1.00

The correlation matrix in Table 13 demonstrates a strong statistical correlation between improvements in communication and improvements in data services ($r=0.62$, $p < 0.001$). Data management skills are strongly related to improvements in student services ($r=0.45$, $p< 0.001$) and have a moderate relationship with communication ($r=0.38$, $p < 0.01$). This demonstrates that these improvements are interrelated and mutually support each other.

Table 14
Institutional Performance Gaps in Digital Transformation: Tukey HSD Post-Hoc Results

Comparison	Mean Diff	Std. Error	p-value	95% CI
Public-Pri	0.23	0.08	0.021*	[0.04,0.42]
Public-Pri	0.25	0.07	0.009**	[0.06,0.44]

According to the post-hoc investigation, the data in table (14) demonstrate a considerable difference in performance between Saudi public and private institutions.

Public institutions performed marginally better in terms of communication performance (mean difference 0.23, p= 0.021) but performed substantially better in terms of student services (mean difference 0.25, p=0.009). This suggests that administrators at public universities feel more strongly about their performance in these areas than do administrators at private universities. This may suggest that public universities have spent more time collecting data on these types of changes than private universities, or may suggest that public universities' approaches are generally stronger than those of private universities.

Table 15
Post-Hoc Analysis of Position-Based Differences in Digital Transformation Perceptions (Tukey HSD Test)

Comparison	Mean Diff	Std. Error	p-value	95% CI
Mgmt-IT	0.35	0.09	0.003**	[0.17,0.53]
Mgmt-IT	0.35	0.08	0.001***	[0.19,0.51]
IT-Mgmt	-0.35	0.13	0.018*	[-0.61,-0.09]

The results of the Tukey HSD in Table 15 suggest that administration and IT staff had different views on the outcomes of digitization, likely owing to differences in perspective. Administrators indicated higher scores on communication improvements (mean diff. = 0.35, p=0.003) and on student service performance (mean diff.= 0.35, p=0.001) than IT workers, while IT workers rated data management outcomes more highly (mean diff. = -0.35, p=0.018) than administrators. Attributing this difference to exposure – as IT workers have more to do with data management than administrators and administrators have more to do with communications and students than IT workers do – would contextualize these perceptions well.

Table 16
Effect Size Measures for Digital Transformation Impact Analyses

Analysis	Eta²	Cohen's d	Interpretation
InstType	0.08	0.52	Medium effect
Position	0.12	0.71	Medium-large effect
Comm-StudServ Corr		0.62	Strong relationship

Key findings from the study on digital transformation are quantified in terms of their substantive significance using the effect size analysis. About 8% of the difference in student service improvements can be attributed to the kind of institution (private vs. public), according to the student services outcome (Q16) for institutional comparisons, which showed a medium impact. In the medium-large range, position-based differences had a higher effect for the same result, suggesting that staff roles explain about 12% of the variance in the result. Even though all of the correlations examined were practically significant, position-based differences have the most impact among all the components investigated, according to these measurements.

DISCUSSION

In line with Yang's (2024) study, which found that digital systems improved decision-making using analytics-driven frameworks and reduced administrative time by 30%, the study found that digital transformation significantly improved Saudi higher education administrators' decision-making (M = 4.20) and administrative efficiency (M = 4.12). administrative staff saw the biggest benefits (M = 4.35 for efficiency; M = 4.45 for decision-making), particularly in public universities where digital adoption seemed more established. This result is consistent with that of Coronel and Trigos (2024) that highlighted how academic analytics made it possible for data-centered university models to maximize strategic leadership and administrative workflows. By the nature of their roles and responsibilities, administrators can see the university more holistically than IT professionals and can consequently understand the multifaceted ways in which digitization policies are impacting the campus. To synthesize Diaz-Garcia et al. (2023) and Saragih et al. (2023), leadership is most active in the promotion of digitalization but also sees the impacts of such initiatives come to fruition most completely, while IT staff may focus more on the ongoing challenges they face rather than considering the “big picture” view of digital integration. There may be benefits to administrators exploring these positive outcomes alongside IT staff, both as a means of closing perceptual gaps and identifying new improvements that may be made in the future. Public universities scored higher in decision-making and administrative effectiveness (4.25, 4.3, respectively) than private institutions (3.92, 3.95, respectively).

This study’s results suggest that in Saudi Arabia, private and public universities have significant differences with regards to strategic alignment and resource allocation strategies. Under Saudi Vision 2030, public universities are better positioned to receive significant government support, with other areas within the public sector also positioned to follow similar paths to digitization (Al-Anzi, 2022; Alenezi & Akour, 2023). The high degree of systemic unity and financing strategies within public universities allow for greater stability in the course of establishing new systems, while limited resources lead to less coherence in system implementation (Coronel & Trigos, 2024; Yang, 2024). Levying subsidies for infrastructural development and specialized trainings may help Saudi higher education better cohere in its approach to digitization.

Lack of technical expertise (21.5%), cybersecurity concerns (23.1%) and resistance to change (22.6%) were the most significant barriers to digitization, according to respondents. In line with Saragih et al.’s (2023) observations about differences in

obstacles to digital integration in developing countries, public university respondents indicated problems with skill shortages while private university respondents indicated problems with securing funding and cybersecurity. Per Saragih et al. (2023), governmental organizations in developing countries often run into obstacles concerning human resources, while private organizations encounter problems with capital flow and security – the latter often worsened by a lack of governmental oversight (Coronel & Trigos, 2024). As typified by the gap in reporting difficulties between administrators and IT workers (25.9% vs. 14.3%), generational differences and inertia within organizational culture often slow down the processes of digital integration – something that organizational leaders must aggressively advocate for to effect true, lasting change (Habeeb & Eyupoglu, 2024; Onan, 2024). Organizational leaders must promote digital literacy, plan with employee resistance in mind, and establish a strong approach to digital security.

Respondents from both IT backgrounds and administrative backgrounds consistently indicated significant improvements in student services (M = 4.10), communication (M = 4.05) and data management (M = 3.88). This echoes existing research that indicates expansion of learning management platforms and the digitization of student services drives student engagement and satisfaction (Fernandez et al., 2023; Yang, 2024). Digital communication platforms, email integration, and the use of digital meeting spaces similarly allow for increases in flexibility and subsequent increases in stakeholder satisfaction (Diaz-Garcia et al., 2023). The correlative relationship between communication performance and student service performance (r = 0.62) suggests that the universities studied substantially improved their approaches to outreach.

CONCLUSION

This study's findings demonstrate the holistic improvement of Saudi Arabia's education system as it relates to internal decision-making, administrative efficacy, intraorganizational communication, and data management. Though public universities experienced more pronounced gains than private universities, consistent organizational improvements were found across organizational contexts. Administrative staff – informed by their wide view of their organizations' approaches to digital integration – had more positive points of view on digital incorporation than IT staff, demonstrating how point of view governs perceptions within organizations. Limitations in technological knowledge, cybersecurity threats, budgetary challenges, and cultural obstacles have all been identified as problems within Saudi universities trying to digitize. Directly engaging all stakeholders in the process of digitization, clearly outlining a vision for digital adoption, providing trainings for new digital platforms, and emphasizing the necessity of change can all help organizations better integrate into the digital world.

As it advances its Vision 2030 goals, Saudi Arabia will need to invest in staff development, cross-functional cooperation, and fair access between public and private institutions to fully exploit the potential of digital transformation in the higher education sector.

RECOMMENDATIONS

Based on the findings of this study, several targeted recommendations are proposed to enhance the impact of digital transformation in Saudi higher education administration:

- Spreading a positive culture that supports digital transformation and employs its technologies to enhance the university's administrative efficiency, improve decision-making processes, and enhance institutional communication.
- Utilize the digital transformation technologies and tools to develop administrative services and improve communication between university management and staff, as well as between administrative units, contributes to achieving organizational efficiency.
- Develop a plan to complete the infrastructure and technology of universities, and complete their equipment to facilitate the implementation of the digital transformation program, and to continuously monitor it and measure its impact on university performance.
- Enhance technical awareness of the importance of digital transformation in improving university efficiency, developing its institutional and technical capabilities, and thus enabling it to achieve its goals, mission, and future directions.
- Enhance the inclusive access to digital decision-making tools by providing administrative and IT staff with intuitive dashboards, analytics tools, and data interpretation training.
- Attract outstanding technical talent to leverage their expertise in enhancing digital transformation, developing skilled digital leaders, and training them on big data analytics tools.
- Build and support the technical capacity and strengthen Cyber-security by creating specialized cyber-security units and providing incentives for IT certifications.
- Integrate data systems for improved communication and service delivery by establishing unified platforms. This will be reflected on increasing the institutional and improving the student services.
- Develop the skills of both the administrative and IT staff through Ongoing employee training programs to enhance digital literacy and familiarize staff with data analytics tools and generative artificial intelligence in administrative work and linking the annual employee performance evaluations to their utilization of technological tools and reduction of paper usage.
- Allocate sufficient funds from university budgets to purchase artificial intelligence systems, technologies, and tools, and employ them in developing support services and managing student services.

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