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From Traditional Universities to Digital Institutions

Exploring the Drivers of Transformation

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Abstract

Universities worldwide are under growing pressure to reinvent themselves as digital institutions, yet the factors that actually drive this shift are rarely examined systematically. Using the Technology–Organization–Environment (TOE) framework, this study investigates the relative influence of technological, organizational, and environmental drivers on the digital transformation progress of higher education institutions (HEIs). Data were collected from 245 administrators, faculty, IT staff, and student affairs personnel across public and private universities at varying stages of digital maturity. Hierarchical regression results show that all three TOE dimensions significantly predict institutional transformation progress, with organizational context (leadership vision, culture, resource allocation) emerging as the strongest predictor ($\beta = .36$, $p < .01$), followed by technological context ($\beta = .27$, $p < .01$) and environmental context ($\beta = .22$, $p < .01$), together explaining 36% of additional variance beyond institutional controls. Ranked driver analysis further reveals that student expectations, leadership vision, and competitive pressure are perceived as the most influential individual drivers, while budget constraints and crisis-driven urgency (e.g., COVID-19) rank comparatively lower. Institutions in advanced transformation stages weight organizational drivers more heavily than early-stage institutions, which instead report environmental pressure as more salient. These findings suggest that sustained digital transformation in higher education depends less on external shocks or infrastructure alone than on deliberate organizational leadership and culture-building. Strategic implications for HEI leaders are discussed.

Keywords: digital transformation, higher education, TOE framework, transformation drivers, university leadership, institutional change.

1. Introduction

The traditional university — organized around physical classrooms, paper-based administration, and geographically bounded enrollment — is increasingly giving way to a digitally mediated model of higher education (Alenezi, 2021). This shift has been driven by a convergence of forces: rising student expectations for on-demand digital services, intensifying competition from online and hybrid providers, advances in cloud and learning-technology infrastructure, and, more recently, the operational disruption of the COVID-19 pandemic (Rof et al., 2020). Yet despite widespread agreement that transformation is underway, there is comparatively little systematic evidence on which drivers actually matter most, and whether their relative importance differs across institutions at different stages of digital maturity.

This study uses the Technology–Organization–Environment (TOE) framework (Tornatzky & Fleischer, 1990) — a well-established model for explaining organizational technology adoption — to classify and test the drivers of digital transformation in higher education institutions (HEIs). The TOE framework distinguishes technological context (available tools and infrastructure), organizational context (leadership, culture, structure, and resources), and environmental context (competitive, regulatory, and student-demand pressures) as three interacting sources of adoption pressure (Baker, 2012; Oliveira & Martins, 2011). This study asks: (1) which TOE dimensions most strongly predict institutional digital transformation progress? and (2) does the relative importance of individual drivers differ between institutions in early versus advanced stages of transformation?

2. Literature Review and Hypotheses

2.1 The TOE Framework and Higher Education

The TOE framework has been widely applied to explain organizational adoption of innovations across sectors (Oliveira & Martins, 2011), complementing innovation-diffusion perspectives that emphasize the characteristics of an innovation and its adopters (Rogers, 2003). Applied to HEIs, technological context captures the availability and compatibility of digital tools such as learning management systems and cloud infrastructure; organizational context captures leadership commitment, digital culture, governance structure, and resource allocation; and environmental context captures external pressures such as student demand, competitor behavior, and regulatory or accreditation requirements (Baker, 2012).

H1: Technological, organizational, and environmental drivers are each significantly and positively associated with institutional digital transformation progress.

2.2 The Relative Weight of Organizational Drivers

While external and technological pressures are often the most visible triggers of digital initiatives, transformation scholars increasingly argue that sustained transformation depends on internal organizational capability — leadership vision, willingness to reallocate resources, and cultural readiness for change (Vial, 2019; Verhoef et al., 2021). Because HEIs are typically characterized by decentralized governance and strong professional norms, organizational-context factors may play an outsized role relative to purely external or technological pressures in translating transformation intent into sustained progress.

H2: Organizational context is the strongest of the three TOE driver dimensions in predicting institutional digital transformation progress.

2.3 Differences Across Transformation Stages

Institutions early in their digital transformation journey may be more reactive to environmental pressures — competitor moves, urgent policy mandates, or crisis events — that initially trigger action. As institutions mature, the locus of driving force may shift inward, toward organizational routines, culture, and leadership sustaining transformation over time (Teece, 2007). This suggests that the relative salience of TOE dimensions is not static but shifts across the transformation lifecycle.

H3: Environmental drivers are perceived as more influential among early-stage institutions, while organizational drivers are perceived as more influential among advanced-stage institutions.

3. Methodology

3.1. Sample and Procedure

An online survey was distributed to administrators, faculty, IT staff, and student affairs personnel at public and private universities, drawing on institutional research office contact lists. Of 330 individuals invited, 245 usable responses were obtained (response rate = 74.2%). Respondents also self-assessed their institution's overall digital transformation stage as either early (exploring or piloting digital initiatives) or advanced (institution-wide digital integration). Table 1 summarizes the sample profile.

3.2 Measures

Technological context was measured with a 6-item scale assessing infrastructure availability and compatibility (α = .84). Organizational context was measured with an 8-item scale covering leadership vision, digital culture, and resource allocation (α = .89). Environmental context was measured with a 7-item scale covering student demand, competitive pressure, and regulatory factors (α = .82). Institutional digital transformation progress, the dependent variable, was measured with a 9-item composite index spanning strategy, process digitization, and digital service delivery (α = .90). Individual driver items (used for the ranking analysis in Figure 1) were rated separately on 5-point importance scales. All scales used 5-point Likert response

formats unless noted.

3.3 Analytical Strategy

Hierarchical multiple regression was used to test the incremental predictive contribution of the three TOE dimensions on transformation progress, controlling for institution size and type. Independent-samples comparisons were used to test differences in TOE dimension importance between early- and advanced-stage institutions.

4. Results

Table 1 presents the demographic and institutional profile of the sample. Table 2 reports the hierarchical regression results predicting institutional digital transformation progress.

Characteristic	Category	n	%
Role	Senior administrator / Provost office	34	13.9
	Dean / Department head	52	21.2
	Faculty member	89	36.3
	IT / Digital services staff	45	18.4
	Student affairs / Registrar staff	25	10.2
Institution type	Public university	142	58.0
	Private university	103	42.0
Transformation stage (self-assessed)	Early stage (exploring/piloting)	112	45.7
	Advanced stage (institution-wide integration)	133	54.3
Institution size	Small (< 5,000 students)	61	24.9
	Medium (5,000–15,000 students)	104	42.4
	Large (> 15,000 students)	80	32.7

Table 1. Demographic and Institutional Profile of Respondents (N = 245)

Predictor	Model 1 (Controls)	Model 2 (+ TOE Drivers)
Institution size (large = 1)	β = .11	β = .07
Institution type (private = 1)	β = .14*	β = .09
Technological context	—	β = .27**
Organizational context	—	β = .36**
Environmental context	—	β = .22**
R^2	.05	.41
ΔR^2	—	.36**

Note. N = 245. Dependent variable: institutional digital transformation progress (composite index). Standardized coefficients shown. *p < .05, **p < .01.

As shown in Table 2, all three TOE dimensions were significant predictors of transformation progress in Model 2, supporting Hypothesis 1. Consistent with Hypothesis 2, organizational context showed the largest standardized coefficient (β = .36, p < .01), exceeding both technological context (β = .27, p < .01) and environmental context (β = .22, p < .01). The full model explained 41% of variance in transformation progress (R^2 = .41), with the addition of TOE drivers accounting for a significant increment beyond institutional controls (ΔR^2 = .36, p < .01).

Figure 1 presents the ranked mean importance of eight individual drivers spanning all three TOE dimensions. Student expectations for digital services and leadership vision and commitment emerged as the two most highly rated individual drivers, followed by competitive pressure and infrastructure availability. Budget constraints and crisis-driven urgency were rated comparatively lower in importance.

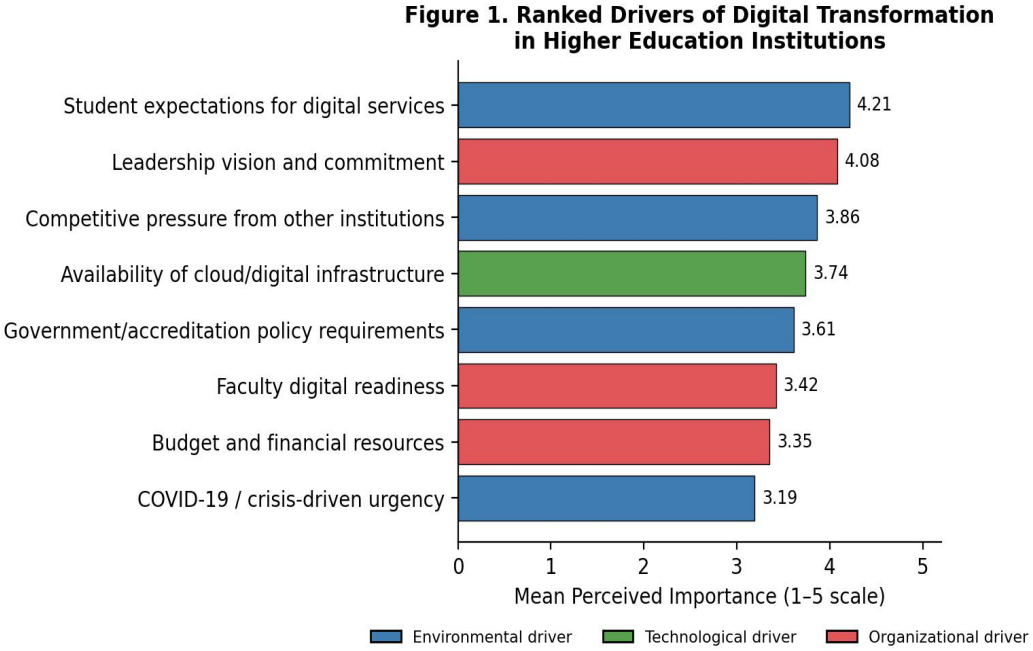


Figure 1. Ranked drivers of digital transformation in higher education institutions.

Figure 2 compares mean TOE dimension importance between early-stage and advanced-stage institutions. Consistent with Hypothesis 3, early-stage institutions rated environmental context as more influential than organizational context, whereas advanced-stage institutions showed the reverse pattern, rating organizational context notably higher than environmental context.

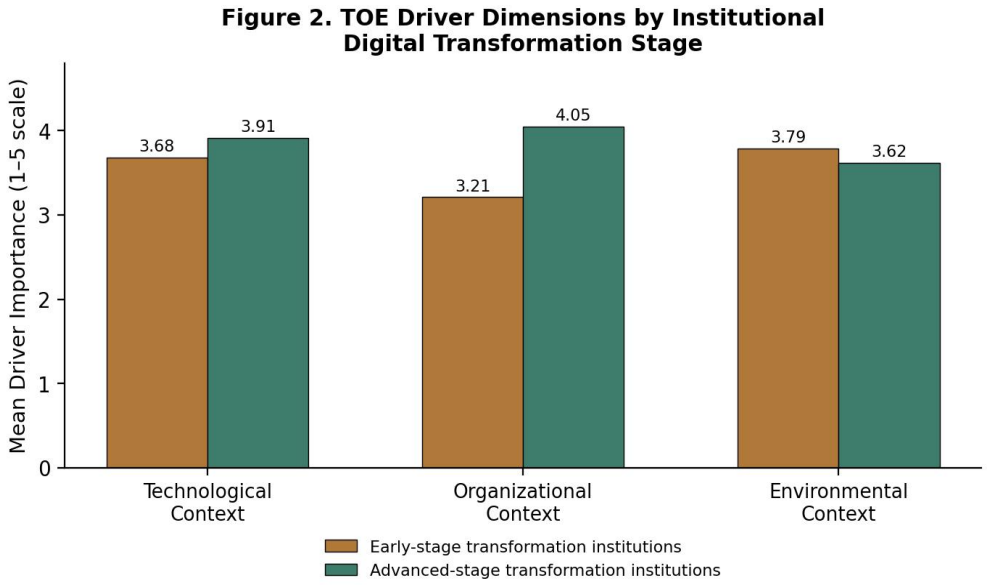


Figure 2. TOE driver dimensions by institutional digital transformation stage.

5. Discussion

This study demonstrates that digital transformation in higher education is shaped by a combination of technological, organizational, and environmental drivers, consistent with the TOE framework's broader applicability beyond its original corporate-sector origins (Baker, 2012; Oliveira & Martins, 2011). The particularly strong effect of organizational context echoes recent digital transformation scholarship emphasizing that transformation is fundamentally an organizational and cultural undertaking rather than a purely technological one (Vial, 2019; Verhoef et al., 2021).

The stage-based shift observed in Figure 2 — from environmental to organizational driver salience — is consistent with a lifecycle account of institutional change: external shocks and competitive pressure may be sufficient to initiate digital initiatives, but sustaining transformation appears to depend on institutions building internal organizational capability, echoing dynamic capabilities perspectives on reconfiguration as a distinct and more difficult capacity than initial sensing (Teece, 2007). This has a practical corollary: institutions that rely primarily on external urgency (e.g., pandemic-driven necessity) without building corresponding organizational capacity may see transformation efforts stall once the initiating pressure subsides.

5.1 Practical Implications

HEI leaders should recognize that early transformation momentum, often triggered by external or crisis-driven pressure, is not self-sustaining. Institutions should deliberately transition from reactive, environment-driven initiatives toward embedded organizational routines — dedicated digital leadership roles, cross-departmental governance structures, and recurring resource commitments — to sustain progress once initial urgency fades. Because student expectations and leadership vision rank as the most influential individual drivers, communicating a clear leadership narrative around digital strategy, paired with visible responsiveness to student-facing digital service gaps, may be an efficient way to build and sustain institutional buy-in.

5.2 Limitations and Future Research

The cross-sectional design does not allow strong causal claims about how driver salience changes over time within the same institution; a longitudinal panel design following institutions across transformation stages would strengthen this inference. Self-assessed transformation stage is also a subjective measure and could be supplemented with objective digital maturity benchmarks in future research. Finally, this study was conducted within a single national higher education system; replication across systems with different funding, regulatory, and governance models would help establish the generalizability of the TOE driver hierarchy observed here.

6. Conclusion

The shift from traditional to digital higher education institutions is driven by an interacting set of technological, organizational, and environmental forces, but organizational context — leadership vision, culture, and resource commitment — emerges as the most consequential of the three. While environmental pressures such as competition and crisis events often provide the initial spark for transformation, this study's findings suggest that converting that spark into durable institutional change depends on deliberate organizational capability-building. HEI leaders seeking lasting digital transformation should therefore treat organizational readiness not as a downstream implementation detail, but as the central strategic lever.

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