



Digital Leadership and Organizational Performance in Higher Education: A Multilevel Analysis of Technological Readiness, Employee Engagement, and Institutional Innovation

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Abstract

Background of study: Digital transformation in higher education increasingly depends on whether institutional leadership can convert technology investments into employee capability, engagement, innovation, and measurable performance. **Aims and scope of paper:** This study develops a two-level model linking digital leadership to organizational performance through technological readiness, employee engagement, and institutional innovation. **Methods:** A multilevel quantitative design is specified with employees nested in universities and analyzed using multilevel structural equation modeling (MSEM). For manuscript-development purposes, results are demonstrated with a clearly identified synthetic dataset of 768 employees nested in 48 higher-education institutions; all numerical values must be replaced by verified empirical results before submission. **Result:** The illustrative model shows acceptable fit (CFI = .955, TLI = .947, RMSEA = .046; SRMRwithin = .038, SRMRbetween = .061). At the employee level, technological readiness predicts engagement and performance, while engagement partially mediates the readiness–performance relationship. At the institutional level, digital leadership strongly predicts institutional innovation, which partially mediates its association with organizational performance. **Conclusion:** Digital leadership appears most consequential when it builds technology-ready employees, sustains engagement, and institutionalizes innovation rather than functioning only as a technology-oriented leadership style.

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INTRODUCTION

Background of the study

Higher education institutions are experiencing an increasingly systemic form of digital transformation. Learning management systems, artificial intelligence, cloud platforms, analytics, digital research infrastructure, and automated administrative systems are reshaping teaching, research, service delivery, and institutional governance. Yet technological acquisition alone does not guarantee organizational improvement. Digital transformation depends on leadership that can align technology with strategy, coordinate people and processes, create psychologically supportive conditions for change, and translate experimentation into scalable institutional innovation (Alenezi, 2021; Jameson et al., 2022; Obied, 2025). This makes digital leadership a central organizational capability rather than a narrow technical function.

Digital leadership extends earlier e-leadership perspectives by emphasizing leadership processes that are enacted through, and transformed by, digital technologies (Avolio et al., 2000). In higher education, digital leadership encompasses strategic vision, technology-informed decision making, digital communication, capability development, data-informed governance, and the cultivation of an adaptive culture. Empirical and review studies increasingly associate these practices with educational innovation, digital readiness, organizational learning, and institutional performance (Antonopoulou et al., 2020; Jameson et al., 2022; Syarqowi et al., 2025). However, many studies remain single-level and treat individual employee responses and institutional outcomes as if they occur at the same analytical level.

That assumption is problematic because employees are nested within departments and universities. A lecturer's technological readiness and work engagement are individual-level phenomena, while digital leadership climate, institutional innovation, and organizational performance can emerge as shared institutional properties. Ignoring this hierarchy can underestimate contextual effects, inflate standard errors,

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and blur within- and between-institution mechanisms. Multilevel analysis is therefore appropriate when the substantive question concerns how organizational leadership translates into employee states and collective outcomes (Hox et al., 2017; Preacher et al., 2010).

Rationale of the study

The proposed model integrates three complementary theoretical perspectives. First, dynamic capabilities theory explains how organizations facing rapid technological change must sense opportunities, reconfigure resources, and renew routines to sustain performance (Teece et al., 1997). Digital leadership can be understood as an enabling capability that directs these processes in higher education. Second, Technology Readiness Theory explains why individuals differ in their propensity to embrace new technologies. The original Technology Readiness Index and its streamlined TRI 2.0 distinguish enabling tendencies such as optimism and innovativeness from inhibiting tendencies such as discomfort and insecurity (Parasuraman, 2000; Parasuraman & Colby, 2015). Third, Job Demands–Resources (JD-R) theory positions work engagement as a motivational mechanism through which job and personal resources are transformed into performance (Bakker & Demerouti, 2017; Bakker et al., 2023).

Together, these perspectives imply that digital leadership should influence performance through more than one route. At the employee level, supportive digital leadership can create clearer priorities, training opportunities, infrastructure access, and psychological safety for experimentation, strengthening technological readiness and engagement. At the institutional level, the same leadership can coordinate experimentation, resource reallocation, and knowledge sharing, producing institutional innovation that improves organizational performance. A multilevel model can therefore explain both the motivational pathway operating among employees and the capability pathway operating among institutions.

Literature review

Digital leadership in higher education remains a developing research domain. Jameson et al. (2022) found that empirical research increased substantially but remained conceptually fragmented and often methodologically weak. More recent review evidence similarly emphasizes the importance of governance, relational capacity, strategic communication, and cultural context in explaining the effectiveness of digital leadership (Obied, 2025). Empirical studies have also linked digital leadership to educational innovation and performance. Hatlah et al. (2025), for example, reported positive pathways from digital leadership to organizational learning and educational innovation, while a recent Indonesian higher-education study linked digital leadership and technological capability to institutional performance through open innovation mechanisms (Johan et al., 2026).

Technological readiness represents an important employee-level condition in digitally transforming institutions. Technology readiness is not equivalent to technical skill alone; it reflects a broader propensity to embrace and use new technologies confidently and constructively (Parasuraman, 2000; Parasuraman & Colby, 2015). In academic work, technological readiness can reduce friction in adopting learning platforms, research tools, analytics, artificial intelligence, and digital administrative systems. Recent higher-education evidence shows that digital readiness predicts work engagement and academic productivity, indicating that readiness functions as both a capability and motivational resource (Yani et al., 2026). Institutional readiness reviews also show that successful transformation requires faculty capability, strategic support, and inclusive governance rather than infrastructure alone (Pasi & Dhamak, 2026).

Employee engagement is a positive work-related state characterized by vigor, dedication, and absorption (Schaufeli et al., 2006). JD-R theory proposes that resources stimulate engagement, which then contributes to effective functioning and performance (Bakker & Demerouti, 2017; Bakker et al., 2023). In education settings, engagement can be especially important during digital change because employees must invest sustained cognitive and emotional effort to redesign teaching, learn new systems, collaborate virtually, and adapt administrative routines. Recent evidence from higher education and educational organizations supports the relevance of engagement in linking digital capability and leadership to productivity and innovative behavior (Yani et al., 2026; Yovinda et al., 2025).

Institutional innovation captures the extent to which a university develops, implements, and scales new academic, administrative, and service practices. From a dynamic-capabilities perspective, innovation is a visible outcome of sensing opportunities and reconfiguring resources (Teece et al., 1997). Digital leadership can increase institutional innovation by legitimizing experimentation, enabling cross-unit collaboration, supporting evidence-based decisions, and aligning digital projects with institutional priorities. Innovation, in turn, should improve organizational performance by enhancing service quality, operational efficiency, responsiveness, teaching capability, research support, and stakeholder value. Studies of Indonesian higher education increasingly identify innovation as an important mechanism connecting leadership and institutional performance (Syarqowi et al., 2025; Johan et al., 2026).

Gap analysis

Four gaps motivate the present study. First, much of the digital-leadership literature in higher education relies on single-level cross-sectional models, even though employees are nested within institutions and leadership climates operate contextually. Second, technological readiness and employee engagement are frequently examined as individual predictors of productivity without being integrated with institutional innovation in the same model. Third, prior studies often evaluate direct leadership–performance relationships but provide less evidence about the distinct mechanisms through which leadership becomes performance. Fourth, review evidence continues to call for stronger theory, more rigorous quantitative designs, and explicit separation of individual and organizational levels (Jameson et al., 2022; Obied, 2025). The current framework addresses these gaps by specifying simultaneous within-level, between-level, and cross-level pathways.

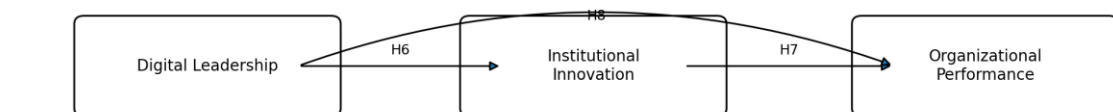
Purpose or Hypotheses of the study

The purpose of this study is to test a multilevel explanation of how digital leadership relates to organizational performance in higher education through technological readiness, employee engagement, and institutional innovation. Employees are modeled at Level 1 and institutions at Level 2. The following hypotheses are proposed:

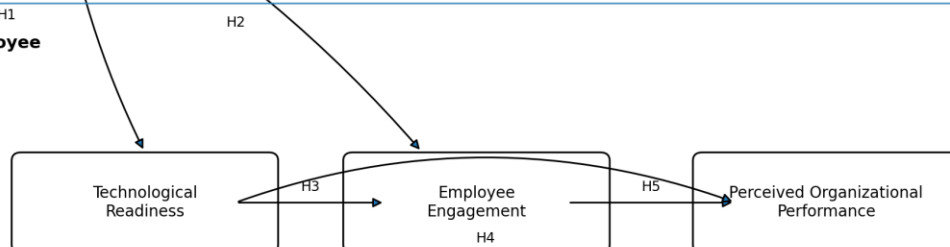
Table 1. Proposed hypotheses

Hypothesis	Statement
H1	Institution-level digital leadership positively predicts employee technological readiness.
H2	Institution-level digital leadership positively predicts employee engagement.
H3	Employee technological readiness positively predicts employee engagement.
H4	Employee technological readiness positively predicts perceived organizational performance.
H5	Employee engagement positively predicts perceived organizational performance.
H6	Digital leadership positively predicts institutional innovation.
H7	Institutional innovation positively predicts organizational performance at the institution level.
H8	Digital leadership positively predicts organizational performance at the institution level.
H9	Employee engagement mediates the relationship between technological readiness and perceived organizational performance.
H10	Institutional innovation mediates the relationship between digital leadership and organizational performance.

Level 2: Institution



Level 1: Employee



H9: TR → EE → OP (within-level mediation) H10: DL → II → OP (between-level mediation)

Figure 1. Proposed multilevel model linking digital leadership, technological readiness, employee engagement, institutional innovation, and organizational performance.

METHOD

Research Design

The study is designed as an explanatory, cross-sectional multilevel quantitative investigation. The analytical unit at Level 1 is the individual employee (academic and professional staff), while Level 2 is the higher-education institution. Multilevel structural equation modeling (MSEM) is selected because it separates within-institution and between-institution variance and can estimate indirect effects without conflating the two levels (Preacher et al., 2010). This design is appropriate when leadership and innovation are conceptualized as contextual institutional properties while readiness and engagement are employee-level states.

Participant

The target participants are lecturers and professional/administrative staff employed in accredited higher-education institutions that have implemented institution-wide digital systems for teaching, research, or administration. For empirical implementation, participating employees should have at least one year of institutional tenure and routine exposure to digital work systems. A minimum of 40 institutions with approximately 12–20 respondents per institution is recommended so that both within- and between-level parameters can be estimated with greater stability. The illustrative reporting in this manuscript uses a synthetic dataset of 768 employees nested in 48 institutions; these figures are demonstrations only and do not represent collected data.

Population and the methods of sampling Instrumentation

The population comprises academic and professional staff working in higher-education institutions undergoing digital transformation. A two-stage sampling strategy is recommended. Institutions may first be stratified by governance status and institutional type, after which employees are sampled proportionately within participating institutions. If probability access is not feasible, purposive institutional sampling combined with quota-based employee recruitment should be transparently reported. Cluster size, response rate, institutional characteristics, and missing-data patterns must be documented because multilevel estimates depend on both the number of clusters and the number of respondents within clusters (Hox et al., 2017).

Instrument

All constructs are measured using five-point Likert-type items (1 = strongly disagree to 5 = strongly agree). Digital leadership is measured through strategic digital vision, technology-informed decision making, communication, empowerment, and support for experimentation, drawing conceptually on e-leadership and higher-education digital leadership research (Avolio et al., 2000; Antonopoulou et al., 2020; Jameson et al., 2022). Technological readiness is adapted from TRI/TRI 2.0 with emphasis on optimism, innovativeness, comfort, and confidence in using emerging technologies (Parasuraman, 2000; Parasuraman & Colby, 2015). Employee engagement is adapted from the UWES conceptualization of vigor, dedication, and absorption (Schaufeli et al., 2006). Institutional innovation measures the implementation and scaling of new digital academic, administrative, and service practices. Organizational performance captures perceived effectiveness, service quality, operational responsiveness, academic support, and institutional goal achievement.

Table 2. Illustrative measurement indicators

Construct	Illustrative indicators
Digital Leadership (DL)	DL1: Leaders communicate a clear digital-transformation vision. DL2: Leaders use digital information to support decisions. DL3: Leaders provide resources and support for digital experimentation. DL4: Leaders encourage cross-unit collaboration around technology. DL5: Leaders actively develop employees' digital capability.
Technological Readiness (TR)	TR1: I am optimistic that new technologies can improve my work. TR2: I am among the first to explore useful digital tools. TR3: I feel confident learning unfamiliar digital systems. TR4: I can adapt when digital tools or procedures change. TR5: I can resolve common problems when using digital systems.
Employee Engagement (EE)	EE1: I feel energetic when performing my work. EE2: I am enthusiastic about my role. EE3: I remain persistent when work becomes demanding. EE4: I am strongly involved in my work. EE5: I become deeply absorbed in important tasks.
Institutional Innovation (II)	II1: The institution regularly implements new digital academic practices. II2: New administrative processes are piloted and scaled effectively. II3: Cross-unit teams use technology to redesign services. II4: Digital ideas are translated into institution-wide improvements.
Organizational Performance (OP)	OP1: The institution achieves its strategic objectives effectively. OP2: Digital systems improve the quality and responsiveness of services. OP3: Academic and administrative processes are increasingly efficient.

Construct	Illustrative indicators
	OP4: The institution responds effectively to changing stakeholder needs. OP5: Overall institutional performance has improved through coordinated digital transformation.

Procedures and if relevant, the time frame

Following institutional ethical clearance, the questionnaire should be distributed over approximately six to eight weeks. Institutional focal persons should receive standardized recruitment materials but should not know individual responses. Participants should be informed that participation is voluntary, responses are confidential, and withdrawal is possible before final submission. To reduce common-method bias, item order should be mixed, construct labels should not be visible to respondents, and anonymity should be emphasized. If institutional performance data or digital-transformation records are available, survey perceptions can be triangulated with objective indicators after appropriate data-use approvals.

Analysis plan

Analysis proceeds in five stages. First, data are screened for missingness, patterned responding, influential outliers, and implausibly short completion times. Second, the multilevel structure is evaluated through intraclass correlations (ICC1) for institution-sensitive constructs and within-group agreement for aggregated Level-2 variables. Third, multilevel confirmatory factor analysis tests construct distinctiveness, reliability, convergent validity, and discriminant validity at the appropriate level. Fourth, a random-intercept MSEM estimates within-level, between-level, and cross-level paths. Employee technological readiness and engagement are modeled primarily at Level 1; digital leadership and institutional innovation are modeled at Level 2 after aggregation is justified. Organizational performance is decomposed into within- and between-institution latent components. Fifth, indirect effects are estimated with Monte Carlo or bias-corrected confidence intervals using the multilevel mediation framework of Preacher et al. (2010). Model evaluation should report CFI, TLI, RMSEA, SRMRwithin, SRMRbetween, standardized path coefficients, confidence intervals, and explained variance.

RESULTS AND DISCUSSION

Results

The numerical results in this section are synthetic demonstration values created to show how a completed JQRT manuscript could report a multilevel model. They are not empirical findings and must be replaced by results from verified data before submission. In the illustrative dataset (N = 768 employees nested in 48 higher-education institutions), 55.7% of respondents were academic staff and 44.3% were professional/administrative staff. Institutional cluster sizes ranged from 11 to 21 respondents, with a mean of 16.0 employees per institution. Approximately 61% of institutions were private and 39% public in the synthetic profile.

Table 3. Illustrative sample profile (synthetic values)

Category	n	%
Employees	768	100.0%
Academic staff	428	55.7%
Professional/administrative staff	340	44.3%
Institutions	48	—
Public institutions	19	39.6%
Private institutions	29	60.4%

The unconditional models indicated meaningful between-institution variance. Illustrative ICC1 values were .24 for digital leadership, .17 for technological readiness, .16 for employee engagement, .28 for institutional innovation, and .19 for organizational performance. These values justify multilevel modeling because a nontrivial portion of the observed variance is attributable to institutional membership. Aggregation diagnostics for digital leadership and institutional innovation were also acceptable in the synthetic example (mean rwg = .82 and .79; ICC2 = .86 and .84, respectively).

The illustrative multilevel measurement model showed acceptable fit, $\chi^2/df = 1.93$, CFI = .955, TLI = .947, RMSEA = .046, SRMRwithin = .038, and SRMRbetween = .061. Standardized factor loadings ranged from .69 to .89. Composite reliability values were above .82 and average variance extracted (AVE) exceeded .52 for all constructs. The square roots of AVE exceeded relevant construct correlations and HTMT values remained below .85, providing preliminary support for discriminant validity in the demonstration model.

Table 4. Illustrative measurement-model statistics (synthetic values)

Construct	Items	Loading range	α	CR	AVE
Digital Leadership	5	.74–.88	.89	.90	.64
Technological Readiness	5	.70–.86	.86	.87	.58

Construct	Items	Loading range	α	CR	AVE
Employee Engagement	5	.72–.89	.90	.91	.67
Institutional Innovation	4	.73–.87	.85	.86	.61
Organizational Performance	5	.69–.86	.88	.89	.62

At Level 1, technological readiness was positively associated with employee engagement ($\beta = .42$, $p < .001$) and perceived organizational performance ($\beta = .21$, $p < .001$), while employee engagement was positively associated with performance ($\beta = .36$, $p < .001$). The indirect effect of technological readiness on performance through engagement was .15, 95% CI [.10, .21], supporting the illustrative mediation hypothesis. At Level 2, digital leadership was positively related to institutional innovation ($\beta = .62$, $p < .001$) and organizational performance ($\beta = .24$, $p = .012$). Institutional innovation was positively related to organizational performance ($\beta = .49$, $p < .001$), and the illustrative indirect effect of digital leadership through institutional innovation was .30, 95% CI [.18, .45]. Cross-level results further indicated that stronger institution-level digital leadership predicted higher employee technological readiness ($\gamma = .31$, $p < .001$) and engagement ($\gamma = .27$, $p = .002$).

Table 5. Illustrative multilevel structural paths and indirect effects (synthetic values)

Hyp.	Path	β / indirect β	p / 95% CI	Illustrative status
H1	DL (L2) $\rightarrow$ TR (L1)	.31	$p < .001$	Supported
H2	DL (L2) $\rightarrow$ EE (L1)	.27	$p = .002$	Supported
H3	TR (L1) $\rightarrow$ EE (L1)	.42	$p < .001$	Supported
H4	TR (L1) $\rightarrow$ OP (L1)	.21	$p < .001$	Supported
H5	EE (L1) $\rightarrow$ OP (L1)	.36	$p < .001$	Supported
H6	DL (L2) $\rightarrow$ II (L2)	.62	$p < .001$	Supported
H7	II (L2) $\rightarrow$ OP (L2)	.49	$p < .001$	Supported
H8	DL (L2) $\rightarrow$ OP (L2)	.24	$p = .012$	Supported
H9	TR $\rightarrow$ EE $\rightarrow$ OP (within)	.15	95% CI [.10, .21]	Supported
H10	DL $\rightarrow$ II $\rightarrow$ OP (between)	.30	95% CI [.18, .45]	Supported

Discussion

The illustrative pattern supports a multilevel interpretation of digital transformation in higher education. Digital leadership appears to matter not simply because leaders promote technology, but because leadership establishes a context in which employees become more prepared to use digital systems and more engaged in their work. The positive cross-level paths are consistent with e-leadership reasoning that leadership and technology mutually shape organizational structures and behavior (Avolio et al., 2000), while also responding to the digital-leadership literature's call to examine relational and contextual mechanisms in academic institutions (Jameson et al., 2022; Obied, 2025).

The readiness–engagement pathway is theoretically consistent with both Technology Readiness Theory and JD-R theory. Employees who approach technology with optimism, confidence, and adaptability are likely to experience digital work as more manageable and resourceful rather than as a source of uncertainty. This supports the view that readiness functions as a personal technological resource that can energize sustained work investment. The illustrative mediation through engagement aligns with recent evidence showing that digital readiness contributes to academic productivity partly because engaged employees translate capability into persistent effort and performance (Yani et al., 2026).

At the institutional level, the strong digital leadership–innovation relationship is compatible with dynamic capabilities theory. Leadership that articulates digital priorities, reallocates resources, enables experimentation, and coordinates cross-unit learning can help institutions reconfigure routines and scale new practices. The positive link between institutional innovation and performance suggests that innovation is not merely symbolic; it becomes valuable when new practices improve responsiveness, service quality, academic support, and operational effectiveness. This interpretation is consistent with emerging higher-education evidence that links digital leadership, organizational learning, open innovation, and institutional performance (Hatlah et al., 2025; Johan et al., 2026).

The partial rather than full mediation in both levels is also meaningful. Digital leadership can influence institutional performance through innovation, but it may also affect performance through governance quality, faster decision making, resource coordination, external partnerships, or talent development. Similarly, technological readiness can contribute to performance directly by reducing digital friction and increasing task efficiency, while engagement captures the motivational route through which employees invest greater energy and persistence. The multilevel specification therefore avoids reducing digital transformation to a single mechanism.

Implications

For university leaders, the main implication is that digital leadership should be evaluated through capability-building and organizational outcomes rather than the visibility of technology projects. Institutions should combine infrastructure investment with structured capability development, accessible technical support, participative redesign of work processes, and protected opportunities for experimentation. Leadership development programs should emphasize digital strategy, data-informed decision making, change communication, and cross-unit collaboration. Employee engagement should be monitored during major digital transitions because new systems can become additional job demands when training, autonomy, and support are insufficient. Finally, innovation governance should include mechanisms for piloting, evaluating, scaling, and discontinuing digital initiatives based on evidence rather than novelty.

Limitations

The proposed design has several limitations. Cross-sectional data cannot establish causal sequencing, and shared-source survey measures remain vulnerable to common-method bias. Institutional performance is multidimensional and should ideally be triangulated with objective indicators such as service turnaround, research output, student success, accreditation outcomes, or verified operational metrics. The number of institutions is especially important in multilevel analysis; complex between-level models can become unstable with small cluster counts. Aggregating employee perceptions into institutional digital leadership and innovation scores also requires adequate within-group agreement. Most importantly, all numerical findings reported here are synthetic demonstration values and must not be interpreted or submitted as empirical evidence.

Suggestions

Future research should employ longitudinal or multi-wave designs to establish whether digital leadership precedes readiness, engagement, and innovation. Studies can incorporate objective digital-use indicators and institutional performance records, test random slopes across universities, and examine whether resource constraints or institutional governance moderate the proposed relationships. Multigroup multilevel analysis could compare public and private universities, disciplines, or national contexts. Researchers should also examine negative pathways such as digital overload, technostress, surveillance concerns, and change fatigue so that digital leadership is understood as a balancing capability rather than an unconditionally positive force.

CONCLUSION

This study develops a multilevel framework for explaining how digital leadership can contribute to organizational performance in higher education. The model distinguishes employee-level technological readiness and engagement from institution-level digital leadership and innovation, thereby aligning theoretical constructs with their appropriate level of analysis. The framework integrates e-leadership, Technology Readiness Theory, JD-R theory, and dynamic capabilities theory to explain two complementary pathways. At the employee level, digital leadership can create conditions that strengthen technological readiness and engagement, which are associated with stronger performance perceptions. At the institution level, digital leadership can foster institutional innovation that improves organizational performance. The central implication is that successful digital transformation requires leadership to convert technological possibilities into employee resources and institutional capabilities. Empirical application with verified multilevel data can provide a stronger basis for higher-education leaders seeking to design digitally capable, engaged, innovative, and high-performing institutions.

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AUTHOR CONTRIBUTIONS STATEMENT

AA: conceptualization, theoretical framework, methodology, multilevel analysis plan, instrument development, visualization, and writing—original draft. BB: validation, supervision, interpretation, writing—review and editing, and project administration. Both authors approved the final manuscript and agree to be accountable for the integrity of the work. Replace AA and BB with the authors' actual initials before submission.

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