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Digital Transformation in a Vietnamese Public University: Beyond Software Acquisition

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Abstract
Digital transformation in higher education is often reduced to the acquisition of software, digital platforms, and hardware. This study examines how technology, organizational conditions, environmental pressures, and internal resources are associated with institutional digital transformation in a Vietnamese public university. A quantitative cross-sectional survey was conducted among employees of Hanoi University of Natural Resources and Environment with direct operational experience of institutional digital systems. Of 300 questionnaires distributed, 269 were returned and 250 valid responses were analyzed using IBM SPSS Statistics 26.0. The 28-item instrument covered five constructs, and the analysis included reliability testing, exploratory factor analysis, Pearson correlation, and multiple regression. All four factor groups were positively associated with digital transformation. Internal resources had the strongest standardized coefficient ($\beta = 0.389$), followed by organization ($\beta = 0.272$), technology ($\beta = 0.140$), and environment ($\beta = 0.138$); the model explained 38.7% of the variance after adjustment. The findings indicate that software is an enabling foundation but is insufficient on its own. Sustainable institutional transformation also depends on data quality, infrastructure, financing, specialized personnel, digital skills, leadership, coordination, and maintenance. The study contributes by distinguishing organizational governance capacity from internal resource capacity within an integrated TOE-RBV perspective.

Keywords: Digital Transformation, Higher Education, TOE Framework, Resource-Based View, Internal Resources, Vietnam

1. Introduction

Digital technologies are increasingly embedded in university teaching, research, administration, and services. Learning management systems, digital libraries, electronic offices, online procedures, cloud infrastructure, and institutional databases can improve access, speed, transparency, and coordination. However, the presence of these tools does not automatically indicate digital transformation. Digitizing records or transferring existing procedures to an online environment may improve convenience while leaving fragmented data, duplicated tasks, and unit-based decision making unchanged.

Digital transformation is a strategic and organization-wide process in which technology and data are integrated with people, processes, governance, and resources to change how an institution operates and creates value [1-3]. In higher education, this means more than using digital media in teaching. It includes connected data, redesigned workflows, evidence-based governance, digital research support, consistent services, and the institutionalization of continuous improvement. Previous studies show that technology availability alone does not ensure pedagogical or organizational change; leadership, culture, competence, and resources remain critical [4, 5].

Vietnamese universities are actively responding to national policies aimed at promoting digital infrastructure, platforms, data ecosystems, and digital competence [6-8]. However, public universities may differ substantially in their capacity to translate policy direction and technological investment into sustained operational change. Within the analytical framing adopted here, an important distinction is therefore made between organizational governance capacity and internal resource capacity. The former concerns leadership, planning, responsibility, coordination, incentives, and implementation support, whereas the latter concerns finance, infrastructure, specialized personnel, workforce digital skills, data quality, and maintenance capability. This study examines these dimensions together with technology and environment at Hanoi University of Natural Resources and Environment as a context-specific empirical setting. The central research question is: how strongly are technology, organization, environment, and internal resources associated with perceived institutional digital transformation, and which factor shows the strongest relative association in the estimated model?

2. Literature Review

Digitization converts physical information into digital form; digitalization uses digital tools to improve existing activities; digital transformation changes strategy, processes, capabilities, and value creation [2, 3]. A university may deploy several applications without reaching the transformation stage if systems do not exchange data, workflows remain fragmented, and digital practices depend on temporary projects or individual employees.

The Technology-Organization-Environment (TOE) framework explains organizational innovation through three contexts [9, 10]. Technology concerns the benefits, compatibility, connectivity, usability, and security of digital solutions. Organization concerns leadership commitment, strategy, role allocation, coordination, incentives, communication, and training. Environment concerns public policy, regulatory requirements, stakeholder demand, competition, partners, and technology providers. TOE is appropriate because the phenomenon is institutional rather than an individual user intention.

The Resource-Based View (RBV) complements TOE by explaining why organizations exposed to similar technologies and external pressures may achieve different outcomes [11, 12]. In this study, internal resources include finance, infrastructure, specialized personnel, workforce digital skills, data quality, and the capacity to maintain, support, and improve systems. The integrated TOE-RBV model therefore separates contextual and governance conditions from the assets and capabilities needed to translate those conditions into sustained institutional outcomes.

The value of this integration lies not merely in adding another factor to TOE, but in avoiding an undifferentiated notion of organizational readiness. Organization and internal resources are treated as related but conceptually distinct: organization captures how digital transformation is directed and coordinated, while internal resources capture whether the institution has the financial, technical, human, and data capabilities required to operate and sustain it. This distinction provides the basis for comparing the relative associations of the four factor groups within a public-university context.

3. Methodology

3.1 Research Design and Measurement

The study used a quantitative cross-sectional survey. The substantive phenomenon was digital transformation at the institutional level, whereas data were collected and analyzed at the individual respondent level. Accordingly, the scores are interpreted as employee perceptions of institution-level conditions based on direct operational experience; they are not treated as independent organizational observations. The design therefore estimates relationships among perceived institutional conditions within one university rather than differences across universities.

The questionnaire used a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree) and contained 28 observed variables: five technology items, six organization items, five environment items, six internal-resource items, and six digital-transformation items. Technology measured perceived solution benefits, fit, connectivity, convenience, and security. Organization measured leadership, planning, responsibility, coordination, incentives, and implementation support. Environment measured policy, regulatory requirements, stakeholder demand, competition, and partner support. Internal resources measured finance, infrastructure, specialized staff, digital skills, data quality, and maintenance capability. Digital transformation measured the integration of technology and data, process redesign, data use, digital services, and the institutionalization of digital work. The measurement domains were aligned conceptually with the TOE-RBV framework used in the study, while their empirical structure was examined exploratorily through reliability analysis and EFA.

3.2 Participants and Data Collection

Participants were employees of Hanoi University of Natural Resources and Environment, including managers, lecturers, administrative and service staff, information technology personnel, and other positions involved in digital activities. Eligibility required current employment and direct use of at least one university digital system, platform, or service during the preceding 12 months. This criterion was intended to ensure that responses reflected recent practical exposure to the institution's digital environment.

A combination of purposive and convenience sampling techniques was employed. Three hundred questionnaires were distributed in paper and online forms; 269 were returned and 19 were excluded during data screening. The final dataset contained 250 valid responses, equivalent to 92.94% of returned questionnaires and 83.33% of distributed questionnaires. Lecturers accounted for 65.2% of respondents, administrative and service staff 19.6%, managers 5.6%, and IT or digital-transformation personnel 5.2%. Sixty percent used university digital systems daily and 28.4% several times per week, indicating substantial operational exposure.

3.3 Data Analysis

Data were processed using IBM SPSS Statistics 26.0. The analysis sequence included descriptive statistics, Cronbach's Alpha, exploratory factor analysis (EFA), Pearson correlation, multiple linear regression, and diagnostic checks. Principal Axis Factoring with Promax rotation was applied to the independent variables. The regression used the Enter method because the four predictors were specified from the theoretical framework. The model was specified as $CDS = \beta_0 + \beta_1(\text{Technology}) + \beta_2(\text{Organization}) + \beta_3(\text{Environment}) + \beta_4(\text{Internal Resources}) + \varepsilon$. Because all constructs were measured through the same cross-sectional, self-reported questionnaire, common-method bias cannot be ruled out. Consequently, coefficients are interpreted as statistical associations within the sample rather than causal effects.

4. Research Results

4.1 Descriptive Statistics and Reliability

All constructs had mean scores above the midpoint of 3.0. Organization received the highest mean (3.711), followed by environment (3.681), the level of digital transformation (3.423), internal resources (3.373), and technology (3.299). Technology also showed the largest standard deviation (0.918), indicating that respondents' experiences of system benefits, fit, connectivity, usability, and security were less uniform than their assessments of other conditions.

Cronbach's Alpha values were 0.860 for technology, 0.679 for organization, 0.682 for environment, 0.782 for internal resources, and 0.820 for digital transformation. All corrected item-total correlations exceeded 0.30; therefore, all 28 items were retained. The organization and environment coefficients fall slightly below the conventional 0.70 threshold and should therefore be interpreted cautiously. However, values above 0.60 can be acceptable in exploratory social-science research and early-stage construct assessment [13].

4.2 Exploratory Factor and Correlation Results

For the 22 independent-variable items, the Kaiser-Meyer-Olkin value was 0.802 and Bartlett's test was significant (chi-square = 1,485.836; df = 231; $p < 0.001$). Four factors corresponding to technology, organization, environment, and internal resources were extracted, accounting for 39.136% of common variance. For the six digital-transformation items, the KMO value was 0.856 and Bartlett's test was significant (chi-square = 450.112; df = 15; $p < 0.001$). One factor was extracted, explaining 43.792% of variance. The factor structure was interpretable for exploratory purposes, although the variance explained was modest and is considered explicitly in the study limitations.

All predictors were positively correlated with digital transformation. Internal resources had the strongest bivariate association ($r = 0.519$; $p < 0.001$), followed by organization ($r = 0.409$; $p < 0.001$), technology ($r = 0.316$; $p < 0.001$), and environment ($r = 0.288$; $p < 0.001$). Correlations among the independent variables ranged from 0.118 to 0.258, suggesting a low preliminary risk of multicollinearity.

4.3 Multiple Regression Results

The overall regression model was statistically significant ($F(4, 245) = 40.353$, $p < 0.001$). The model explained 39.7% of the variance in digital transformation ($R^2 = 0.397$), and 38.7% after adjustment (Adjusted $R^2 = 0.387$). The Durbin-Watson value was 2.019.

All regression coefficients were positive and statistically significant. Internal resources had the largest standardized coefficient ($\beta = 0.389$; $B = 0.444$; $p < 0.001$), followed by organization ($\beta = 0.272$; $B = 0.366$; $p < 0.001$), technology ($\beta = 0.140$; $B = 0.128$; $p = 0.008$), and environment ($\beta = 0.138$; $B = 0.171$; $p = 0.008$). Tolerance values ranged from 0.867 to 0.930 and VIF values from 1.075 to 1.154, indicating no serious multicollinearity. Residual diagnostics were acceptable for the estimated model.

5. Discussion

5.1 Why Software Alone Is Insufficient

Technology was statistically significant, but its standardized coefficient was smaller than those of internal resources and organization. This does not imply that technology is unimportant. Rather, the pattern is consistent with the interpretation that procurement is only one component of transformation. Software cannot by itself standardize data, redesign workflows, coordinate units, create user competence, or guarantee long-term support. A university may own multiple platforms and still operate through disconnected databases, repeated data entry, and paper-based logic transferred to online forms.

The low technology mean reinforces this interpretation. Respondents did not evaluate the technological conditions as strongly as organizational and environmental conditions. The broad dispersion also suggests uneven user experiences. Digital transformation therefore requires attention not only to whether a system exists, but whether it fits professional work, connects with other systems, is easy to use, and protects data.

5.2 Internal Resources as the Strongest Predictor

Internal resources had the largest standardized coefficient in the estimated model. This pattern is consistent with the RBV argument that institutions exposed to similar technologies can achieve different outcomes because they possess different capabilities [11, 12]. Stable finance supports acquisition and recurring operating costs. Infrastructure supports reliability and continuity. Specialized staff provide technical competence, while digital skills enable employees to use systems meaningfully. High-quality data support integrated reporting and decision making, and maintenance capability helps prevent digital systems from becoming short-lived projects.

The practical implication is clear: digital transformation does not end when software is delivered or accepted. Universities must plan for integration, data cleansing, security, user support, updates, and process improvement. Budget decisions should therefore include total lifecycle costs rather than only initial procurement. Data must also be treated as an institutional resource with defined standards, ownership, quality responsibilities, and access rules.

5.3 Organization, Technology, and Environment

Organization had the second-largest standardized coefficient. Leadership commitment, a clear roadmap, responsibility allocation, inter-unit coordination, incentives, communication, and training are therefore important organizational conditions associated with the institutionalization of digital initiatives. Digital transformation should not be treated as the exclusive responsibility of an IT unit because many workflows cross academic and administrative boundaries. Process owners, data owners, technical teams, and end users need coordinated accountability.

Technology and environment had similar but smaller standardized coefficients. Technology investment should therefore be considered alongside overall architecture, interoperability, user-centered design, security, and scalability. External policy, regulatory requirements, stakeholder demand, competition, and technology partners can provide direction, opportunities, and pressure, but the results suggest that these contextual conditions are less strongly associated with the reported level of transformation than internal resources and organization in this sample.

5.4 Comparison with Previous Studies

The findings are consistent with the broader digital-transformation literature, which treats technology as an enabling condition rather than an independent source of institutional change. Vial [2] emphasizes strategic response, structural change, and organizational barriers, while Verhoef *et al.* [3] connect digital transformation with assets, capabilities, and redesigned structures. In higher education, Bond *et al.* [4] show that frequent use of digital tools does not necessarily transform teaching practice, and Alenezi [5] identifies leadership, culture, people, and resources as persistent institutional challenges. The present results provide quantitative support for these arguments in a

Vietnamese public-university setting.

The relative importance of internal resources also extends the analytical logic of prior TOE studies. Zhu *et al.* [14] show that technological competence, compatibility, and environmental pressures are relevant to e-business assimilation. In the present study, treating resource capacity as a separate construct provides distinct explanatory value within the estimated model. The results suggest that organizational readiness should not be treated as a single undifferentiated category. Governance mechanisms and resource capacity perform related but distinct functions: organization concerns how transformation is directed and coordinated, whereas internal resources concern whether the institution has the financial, technical, human, and data capabilities required to operate and sustain digital systems.

5.5 Theoretical Contributions

The study makes three theoretical contributions within its context-specific and exploratory design. First, it treats digital transformation as an organizational outcome reflected in technology-data integration, process redesign, digital services, data use, and institutionalized digital work, rather than equating transformation with individual acceptance or the presence of a single application. Second, the integrated TOE-RBV framework separates organizational governance capacity from internal resource capacity. Technology captures characteristics of digital solutions; organization captures leadership and coordination; environment captures external pressures and support; and internal resources capture finance, infrastructure, people, data, and maintenance capability. This separation clarifies two components that may otherwise be collapsed into a broad concept of organizational readiness.

Third, the findings provide empirical support for using this combined framework to examine a public-university setting in which external policy direction coexists with internally accumulated capabilities. The model therefore offers a structured way to connect contextual pressure, governance, technology, and institutional execution. The adjusted R-squared of 0.387 also indicates substantial unexplained variance; accordingly, the contribution is not a claim that TOE-RBV fully explains digital transformation, but that a technology-only interpretation is incomplete within the surveyed context.

6. Managerial Implications

The results suggest four connected management priorities for the surveyed institutional context. First, strengthen internal resources by improving data quality, infrastructure, specialized personnel, workforce digital skills, and recurring finance. Second, strengthen organization through an institution-wide strategy, inter-unit coordination, clear responsibility, process standardization, and change management. Third, improve technology through architectural review, system integration, user testing, information security, and performance monitoring. Fourth, use the environment strategically by aligning with public policy, listening to user demand, expanding partnerships, and learning from other institutions. These are evidence-informed priorities rather than causal prescriptions and should be adapted to institutional conditions.

Table 1: Strategic Priorities for Institutional Digital Transformation

Dimension	**Strategic Focus**	**Operational Actions**	**Key Performance Indicators**
Internal Resources (Strongest Predictor)	Lifecycle Funding & Human Capital	• Allocate recurring budget for operational maintenance & security. • Invest in data engineering and staff data literacy. • Establish strict data governance and quality standards.	• Data completeness & accuracy rate • System uptime and incident response time • Training coverage across departments
Organization (Second-Strongest Predictor)	Cross-Functional Governance	• Establish clear process ownership across academic/admin units. • Limit parallel paper-and-digital workflows during transitions. • Align incentive structures with digital adoption.	• Process cycle-time reduction • Inter-departmental data sharing rate • User adoption & satisfaction metrics
Technology (Enabler)	Architecture & Interoperability	• Prioritize system integration over isolated software purchases. • Conduct rigorous UI/UX testing before deployment. • Implement robust cybersecurity & single sign-on (SSO).	• Number of integrated core platforms • System usability score (SUS) • Security compliance rate
Environment (Context)	Policy Alignment & Partnerships	• Align university roadmap with national digital frameworks. • Establish vendor contracts with data portability & exit rights. • Benchmark best practices with peer institutions.	• Regulatory compliance status • Knowledge transfer efficiency from partners

These priorities should be integrated rather than implemented as separate programs. Before automating a procedure, the responsible units should simplify it, remove duplicated steps, and identify the authoritative data source. Each new digital project should demonstrate compatibility with the university architecture, specify ownership and maintenance arrangements, and define measurable benefits. Evaluation should focus on processing time, data reuse, service quality, user satisfaction, decision support, security, and sustainability, not merely the number of platforms installed.

6.1 Technology: Integrate Before Expanding

The university should review its portfolio of systems, data stores, and workflows to identify core platforms, shared services, specialized applications, and required interfaces. New investments should be assessed against an institution-wide architecture and common data standards. Priority should be given to connecting teaching, student administration, finance, human resources, research management, document management, and digital-service portals. Systems that create additional isolated databases or require repeated data entry should be redesigned or integrated.

User experience and security must be treated as design requirements. Before institution-wide deployment, workflows and interfaces should be tested with lecturers, administrators, technical staff, and service users. Authentication, authorization, backup, incident response, privacy protection, and continuity arrangements should be defined from the beginning. Technology performance should be measured through reliability, processing time, task completion, integration, error reduction, and actual user value.

6.2 Organization: Make Digital Transformation an Institution-Wide Program

Leadership should translate digital-transformation objectives into a roadmap with priorities, responsible units, milestones, resources, and measurable outcomes. Each cross-unit process needs a clearly identified owner. Data ownership and technical system ownership should be distinguished, because responsibility for data accuracy normally belongs to professional units while technical teams manage infrastructure and applications. A coordinating mechanism should resolve conflicts over standards, priorities, and system changes.

Communication, training, and change management should accompany every major implementation. Training should be tailored to work roles and should continue after launch through help desks, user guides, peer support, and feedback channels. Incentives and performance expectations should encourage data sharing, consistent system use, and process improvement. During transition periods, managers should limit unnecessary parallel operation of paper and digital procedures, because dual systems increase workload and weaken adoption.

6.3 Environment: Convert External Pressure into Institutional Opportunity

National policies, regulatory requirements, student expectations, competition, and technology partners should be used as sources of direction and learning. The university should regularly map external requirements to internal projects, participate in sector-wide data and platform initiatives, and develop partnerships that transfer knowledge rather than create long-term vendor dependence. Procurement and partnership contracts should specify data portability, interface requirements, service levels, security responsibilities, documentation, and exit arrangements.

6.4 Internal Resources: Finance the Full Lifecycle and Build Capability

Internal resources warrant particular managerial attention because they had the largest standardized coefficient in the estimated model. Digital budgets should include not only acquisition but also integration, licenses, cloud or infrastructure costs, security, data preparation, training, user support, maintenance, upgrades, and replacement. Multi-year financial planning is preferable to isolated annual projects because digital systems require continuous operation and improvement.

The university should strengthen both specialized and distributed capabilities. Specialized teams need competence in architecture, cybersecurity, data engineering, system administration, analytics, and project management. Lecturers and administrative staff need role-specific digital skills and data literacy. Institutional data should be managed as a strategic resource through common definitions, metadata, validation rules, quality monitoring, access control, and accountability. These measures reduce dependence on individual employees and improve the ability to maintain systems after implementation.

7. Limitations and Future Research

The study has several limitations. First, data were collected at one public university using purposive and convenience sampling. The results therefore describe relationships within the surveyed context and should not be generalized statistically to all Vietnamese universities or to higher education systems in other countries. Multi-institutional studies are required to examine whether the relative associations differ across public, private, specialized, and regional institutions.

Second, the research used a single-wave, cross-sectional questionnaire and self-reported perceptions for both predictors and the dependent construct. Common-method bias therefore cannot be excluded, and the design does not establish causal direction over time. Future studies should combine survey responses with objective indicators such as system usage, service-processing time, data completeness, error rates, user-support volume, operating cost, and service quality. Longitudinal and multi-source designs would provide stronger evidence about how organizational mechanisms and resources are related to transformation across implementation stages.

Third, the organization and environment scales had Cronbach's Alpha values of 0.679 and 0.682. The four independent factors explained 39.136% of common variance, and the dependent factor explained 43.792%. Although all items met the minimum exploratory criteria used in this study and the factor structure was interpretable, these results indicate that the measurement model should be treated as exploratory rather than confirmatory. Further research should refine the scales through expert review, pilot testing, confirmatory factor analysis, and assessment of convergent and discriminant validity.

Finally, the model considered only four direct associations and explained 38.7% of variance after adjustment. Future research should examine digital leadership, organizational culture, data governance, dynamic capabilities, employee engagement, service quality, and user participation.

Mediation, moderation, group comparisons, qualitative interviews, and structural-equation modeling could provide a more complete explanation of digital transformation in higher education.

8. Conclusion

This study examined factors associated with digital transformation at a Vietnamese public university by integrating TOE and RBV. Based on 250 valid responses, all four factor groups were positively associated with the reported level of digital transformation. Internal resources had the largest standardized coefficient, followed by organization, technology, and environment. The model explained 38.7% of the variance after adjustment. These results support a distinction between the governance mechanisms that direct and coordinate transformation and the resource capabilities required to operate and sustain digital systems.

The central interpretation is that software provides an enabling foundation but is insufficient on its own. Substantive institutional transformation is also associated with reliable data, infrastructure, finance, digital skills, specialized personnel, leadership, coordination, redesigned processes, and sustained improvement. This conclusion should be read within the study's boundaries: one institution, non-probability sampling, cross-sectional self-reported data, and exploratory measurement. Future research should test the framework across multiple universities, combine subjective and objective indicators, refine the measurement scales, and apply confirmatory, multi-source, or longitudinal designs.

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