



E-Procurement Readiness in a Multi-Campus Public University in Northern Ghana: A Mixed-Methods TOE Analysis of Barriers, Enablers, and Implementation Priorities

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ABSTRACT: E-procurement has become central to public-sector digital transformation, yet implementation in resource-constrained, multi-campus universities remains uneven. This study assessed e-procurement readiness, barriers, enablers, and implementation priorities across three campuses of the University for Development Studies (UDS) in Northern Ghana. Guided by the Technology-Organization-Environment (TOE) framework, a sequential explanatory mixed-methods design combined a survey of 168 staff with 22 semi-structured interviews spanning academic, administrative, procurement, information-technology, and senior-management roles. The achieved quantitative sample exceeded the approximately 158 cases required to detect a medium omnibus effect ($f = .25$) across three campus groups at 80% power; achieved power was approximately .82. Descriptive analysis, principal component analysis, cross-campus readiness profiling, and thematic analysis were integrated in a joint display. Results show that procurement remained predominantly paper-based (88.7%), while the overall e-procurement readiness index was moderate ($M = 3.15/5$). Readiness differed descriptively across Tamale Main Campus (3.4), City Campus (3.1), and Nyankpala Campus (2.8). Five barrier components explained 72.4% of perceived implementation constraints, led by technological infrastructure (28.1%) and financial limitations (19.5%). Four enabler components explained 70.3% of perceived facilitating conditions, with leadership and management support accounting for the largest share (32.4%). Qualitative evidence reinforced concerns about multi-campus coordination, user capability, workload, system

reliability, and supplier readiness. The findings extend TOE-based e-procurement research by demonstrating that institutional heterogeneity within a single university can materially shape readiness. A phased, campus-sensitive implementation pathway emphasizing connectivity, cybersecurity, user training, vendor onboarding, and post-go-live support is recommended.

Keywords: e-procurement, GHANEPS, higher education, Technology-Organization-Environment, digital transformation, Ghana, mixed methods

1. Introduction

Public procurement is increasingly mediated by digital platforms designed to strengthen efficiency, transparency, traceability, competition, and control. In Ghana, the Ghana Electronic Procurement System (GHANEPS) was launched in 2019 and has been progressively rolled out to public entities, including tertiary institutions. The Public Procurement Authority has framed the transition as a means of improving procurement efficiency and transparency while reducing transaction costs and strengthening digital auditability. For public universities, however, successful e-procurement is not merely a software deployment problem; it requires alignment among technological infrastructure, organizational routines, users, suppliers, and the regulatory environment.

Higher education institutions present a particularly demanding setting for e-procurement because procurement activity is dispersed across academic departments, administrative units, research projects, laboratories, estates functions, and multiple approval levels. Multi-campus universities add another layer of complexity: infrastructure quality, user capability, managerial support, and access to technical assistance may vary across locations even when a common procurement policy governs the campuses. Consequently, institution-wide adoption can fail when implementation assumes uniform readiness across geographically dispersed units.

The source study was conducted at three campuses of the University for Development Studies (UDS) in Northern Ghana: Tamale Main Campus, Nyankpala Campus, and City Campus. The institutional context matters because it combines public-sector procurement obligations, a geographically distributed campus structure, and uneven technological capacity. Existing work on technology adoption in African higher education documents persistent constraints related to connectivity, digital capability, technical support, and financing, but comparatively little research has examined how these conditions interact specifically in public-university procurement workflows.

This study therefore addresses three linked questions: (1) What technological, organizational, and environmental barriers constrain e-procurement readiness across the selected UDS campuses? (2) Which enabling conditions are most strongly associated with implementation potential? (3) How should a multi-campus public university sequence implementation when campuses and stakeholder groups exhibit different levels of readiness? The study contributes a campus-sensitive TOE interpretation, a mixed-methods readiness profile, and a practical implementation pathway grounded in the realities of Northern Ghana.

The article makes four contributions. First, it shifts attention from generic public-sector e-procurement to a multi-campus higher-education setting. Second, it integrates quantitative readiness evidence with qualitative stakeholder explanations rather than treating adoption as a purely technical decision. Third, it distinguishes institution-wide policy readiness from campus-level operational readiness, showing why a single rollout strategy may be inappropriate. Fourth, it converts the empirical findings into an implementation sequence that connects infrastructure, human capability, supplier readiness, cybersecurity, and change management.

2. Literature Review and Theoretical Foundation

2.1 E-procurement and public-sector digital transformation

E-procurement refers to the use of networked digital systems to support procurement activities such as planning, tender publication, supplier participation, bid submission, evaluation, award, ordering, contract administration, and reporting. The expected benefits include shorter cycle times, improved traceability, reduced paper handling, broader supplier access, and better audit trails. Ghana's GHANEPS rollout reflects these objectives and has included entity onboarding, user training, supplier training, and post-go-live support through the Public Procurement Authority.

Evidence from developing-country public institutions nevertheless shows that adoption outcomes depend on more than formal policy mandates. Infrastructure reliability, user competence, management commitment, procurement-process redesign, supplier capability, cybersecurity, and sustained support all shape whether a digital procurement platform becomes embedded in routine work. This distinction between formal adoption and effective use is especially important in higher education, where administrative procedures interact with decentralized academic structures and specialized purchasing requirements.

2.2 Technology adoption in African higher education

Digital transformation across African universities has accelerated, but institutional capacity remains uneven. Recent higher-education studies in Ghana and other African contexts identify disparities in connectivity, digital skills, technical support, and organizational readiness. The COVID-19 period accelerated digitization, yet emergency adoption did not eliminate structural inequalities in infrastructure or user capability. These conditions imply that e-procurement readiness must be assessed at the level where systems will actually be used, not inferred solely from national policy or institutional strategy.

Multi-campus universities are particularly exposed to center-periphery differences. Headquarters or main campuses often possess stronger connectivity, newer hardware, denser technical support, and closer access to senior decision makers, while peripheral campuses may experience slower support response and weaker equipment access. A readiness assessment that averages across campuses can therefore conceal implementation risks.

2.3 Technology-Organization-Environment framework

The Technology-Organization-Environment (TOE) framework conceptualizes organizational technology adoption as the product of three interacting contexts. The technological context includes existing infrastructure, compatibility, reliability, security, and perceived complexity. The organizational context includes leadership, resources, user capabilities, formal processes, and change readiness. The environmental context includes regulation, supplier ecosystems, external support, and institutional pressures. TOE is appropriate for e-procurement because procurement systems are organization-wide platforms whose effectiveness depends simultaneously on internal capacity and external market participation.

The present study uses TOE as the primary organizing framework while recognizing complementary insights from technology-acceptance and diffusion perspectives. Perceived usefulness, ease of use, social influence, and facilitating conditions help explain individual willingness to use systems, whereas TOE captures the institutional and environmental conditions that determine whether such willingness can translate into sustained operational adoption.

2.4 Research gap and propositions

Three gaps motivate the study. First, empirical work on e-procurement in Ghana has concentrated largely on public-sector adoption generally rather than multi-campus university operations. Second, many adoption studies treat the organization as a single homogeneous unit and therefore understate within-institution variation. Third, quantitative barrier rankings are rarely integrated with qualitative evidence explaining why particular constraints matter in daily procurement work. Consistent with TOE, the study expects stronger technological readiness, stronger organizational support, and a more enabling external environment to correspond with higher implementation readiness, while campus heterogeneity is expected to produce differentiated readiness profiles.

3. Methodology

3.1 Research design and setting

The study adopted a pragmatic, sequential explanatory mixed-methods design. Quantitative survey data provided the primary readiness profile, while semi-structured interviews were used to interpret implementation concerns and practical priorities. The research focused on Tamale Main Campus, Nyankpala Campus, and City Campus of UDS. The campuses were selected because they represent distinct operational contexts within the same public university and therefore permit examination of within-institution heterogeneity under a common governance and procurement environment.

3.2 Participants and sampling

The quantitative sample comprised 168 respondents drawn from academic staff (n = 96; 57.1%), administrative staff (n = 53; 31.5%), procurement officers (n = 12; 7.1%), and senior managers (n = 7; 4.2%). Campus representation was Tamale Main Campus (n = 89; 53.0%), Nyankpala Campus (n = 67; 39.9%), and City Campus (n = 12; 7.1%). The qualitative strand included 22 interviewees: six senior managers, five procurement

officers, seven academic staff, three administrative staff, and one IT professional. The qualitative strand used maximum-variation selection to capture perspectives across organizational levels and functions.

Because the source dataset contains 168 completed surveys, the sample size was not artificially altered. Instead, we evaluated statistical adequacy using an omnibus one-way ANOVA sensitivity benchmark. For three groups, $\alpha = .05$, and a conventional medium effect ($f = .25$), approximately 157 observations are required for 80% power; the achieved $n = 168$ yields power of approximately 0.83. This indicates adequate sensitivity for medium between-campus effects, while smaller effects would require a larger multi-institutional sample.

Table 1. Sample Composition and Analytical Coverage

Dimension	Category	n	%
Campus	Tamale Main	89	53.0
Campus	Nyankpala	67	39.9
Campus	City	12	7.1
Role	Academic staff	96	57.1
Role	Administrative staff	53	31.5
Role	Procurement officers	12	7.1
Role	Senior managers	7	4.2
Qualitative strand	Semi-structured interviews	22	—

Note. Percentages are based on the quantitative sample ($n = 168$) except the qualitative interview count.

Table 2. Quantitative Sample Adequacy Check

Parameter	Value
Observed quantitative sample	168
Number of campus groups	3
Alpha level	.05
Benchmark effect size (Cohen f)	0.25 (medium)
Approximate n for 80% power	157
Approximate achieved power	0.82

Note. Power calculation is a design-adequacy check; it does not replace effect sizes from raw-data inferential models.

3.3 Data collection instruments and procedures

Survey data were collected between March and May 2024 using a 67-item instrument covering demographics, technological infrastructure, organizational readiness, environmental factors, and e-procurement adoption intentions. Likert-type items used a five-point response format from 1 (strongly disagree) to 5 (strongly agree). Administration combined online and paper modes to reduce exclusion associated with variable internet access. Semi-structured interviews were conducted from April to June 2024 using role-sensitive guides addressing current procurement workflows, infrastructure,

organizational readiness, implementation barriers and enablers, and strategic recommendations.

3.4 Analytical strategy

The quantitative analysis used descriptive statistics, cross-campus and cross-role readiness profiling, and principal component analysis (PCA) as reported in the source study. PCA was used to summarize correlated barrier and enabler items into interpretable components, with the proportion of explained variance used to assess the relative empirical prominence of each component. The available manuscript did not report the raw item-level dataset, factor loadings, KMO statistic, Bartlett test, regression coefficients, or post-hoc ANOVA estimates; these statistics were therefore not fabricated in this revision. The inferential claims are limited to analyses for which numerical results are actually available.

Interview data were analyzed thematically using an iterative process of familiarization, coding, theme development, review, naming, and integration. Quantitative and qualitative findings were combined in a joint display to identify convergence, complementarity, and implementation implications. This integration is central to the analysis because numerical readiness scores indicate where weaknesses occur, while interview themes clarify how those weaknesses are experienced by users and decision makers.

3.5 Quality assurance and ethics

The source study reports expert review of the questionnaire, pilot testing with 16 participants, a minimum Cronbach's alpha criterion of .70 for internal consistency, test-retest assessment with a subsample of 24 participants, member checking of interview summaries, triangulation across stakeholder groups, and maintenance of an audit trail. Hence, the manuscript can only report the original quality assurance procedures and acceptance criteria. Participation was voluntary, and informed consent, confidentiality, anonymization, and secure data storage procedures were reported. A formal ethics committee name and approval number were not provided in the source manuscript and should be inserted by the authors if applicable to the target journal's requirements. Ethical clearance was sought and gained from the Institutional Review Board of the University of Development Studies with the approval number UDS/IRB/0045/26

4. Results

4.1 Procurement baseline and digital readiness

The procurement baseline indicates a system still dominated by manual workflows. Paper documentation accounted for 88.7% of procurement activity, while only 11.3% involved a digital component. Routine purchases required an average of 24.1 days and complex acquisitions 65.8 days. Only 36.3% of respondents reported satisfaction with current procurement processes. The most frequently reported operational problems were slow processing (76.8%), difficulty tracking request status (71.4%), and limited transparency (68.5%). Administrative costs were estimated at 11.8% of procurement value in the source study, indicating a substantial perceived efficiency burden.

Table 3. Baseline Procurement Process Indicators

Indicator	Observed value	Interpretation
Paper-based procurement activity	88.7%	Very high dependence on manual documentation
Digital component in current activity	11.3%	Low baseline digitization
Routine procurement cycle	24.1 days	Extended processing time
Complex acquisition cycle	65.8 days	Very extended processing time
Overall process satisfaction	36.3%	Low satisfaction
Slow processing reported	76.8%	Major workflow concern
Difficulty tracking requests	71.4%	Weak visibility/traceability
Limited transparency reported	68.5%	Major governance concern

Note. Values reproduce the empirical results reported in the source manuscript.

4.2 Technological context

Technology readiness was uneven. Although 69.2% of respondents considered internet connectivity adequate overall, the campus pattern was sharply differentiated: 78.7% at Tamale Main Campus, 62.3% at Nyankpala, and 45.8% at City Campus. Dedicated computer access was available to only 44.6% of respondents, adequate printing facilities to 33.9%, confidence in network security to 31.5%, and adequate IT support to 19.6%. By contrast, smartphone ownership was high (88.7%), suggesting that mobile-compatible interfaces could partially mitigate limitations in fixed-device access, although mobile access cannot substitute for institutional cybersecurity, workflow integration, or reliable connectivity.

Table 4. Technological Readiness Indicators

Indicator	Overall / campus value	Implementation implication
Internet adequacy—overall	69.2%	Moderate connectivity base
Internet adequacy—Tamale Main	78.7%	Strongest connectivity position
Internet adequacy—Nyankpala	62.3%	Intermediate readiness
Internet adequacy—City	45.8%	Priority infrastructure gap
Dedicated computer access	44.6%	Hardware constraint
Adequate printing facilities	33.9%	Workflow support constraint

Network-security confidence	31.5%	Cybersecurity readiness gap
Adequate IT support	19.6%	Critical post-go-live support risk
Smartphone ownership	88.7%	Potential for mobile-compatible access

Note. Campus internet ratings and infrastructure percentages are as reported in the source study.

4.3 Organizational context

Digital competency averaged 3.47/5, but readiness differed substantially by role. Senior management reported the highest digital literacy (3.9), followed by procurement officers (3.7), administrative staff (3.4), and academic staff (3.1). Campus digital-literacy scores followed a similar pattern: Tamale Main Campus 3.7, City Campus 3.4, and Nyankpala 3.1. Change receptivity averaged 3.5/5. Senior-management support was very strong (90.5% of participants identified leadership commitment as critical), whereas middle-management support was more variable (69.0% positive). Respondents estimated that approximately 33.8 hours of training would be needed for proficient system use, with system-specific training (89.3%) and basic computer skills (76.8%) as leading priorities.

Table 5. Organizational Readiness and Capacity Indicators

Indicator	Value
Overall digital competency	3.47/5
Senior management digital literacy	3.9/5
Procurement officer digital literacy	3.7/5
Administrative staff digital literacy	3.4/5
Academic staff digital literacy	3.1/5
Overall change receptivity	3.5/5
Middle-management support	69.0% positive
Estimated training requirement	33.8 hours
Need for system-specific training	89.3%
Need for basic computer-skills training	76.8%
Need for procurement-process training	44.6%

Note. Higher scores indicate stronger readiness on the five-point scales.

4.4 Environmental context

Environmental pressure for adoption was high but external readiness was incomplete. Awareness of GHANEPS-related government mandates reached 94.6%, yet detailed understanding varied by role: procurement officers reported 91.7% detailed understanding compared with 47.2% among general administrative staff and 25.0% among academic staff. Only 42.9% rated government training resources as adequate, while 77.4% requested stronger technical assistance. Supplier readiness was especially weak: only 24.4% of regular vendors were perceived as compatible with e-procurement

processes. In addition, 53.6% of respondents expressed uncertainty about electronic-signature validity and contract enforceability.

Table 6. Environmental and Policy Readiness Indicators

Indicator	Value	Risk/Opportunity
Awareness of government e-procurement mandate	94.6%	Strong institutional pressure
Detailed compliance knowledge—procurement officers	91.7%	Strong specialist knowledge
Detailed compliance knowledge—administrative staff	47.2%	Knowledge gap
Detailed compliance knowledge—academic staff	25.0%	Large end-user knowledge gap
Government training resources rated adequate	42.9%	External support gap
Request for enhanced technical assistance	77.4%	High support demand
Supplier e-procurement compatibility	24.4%	Critical ecosystem bottleneck
Legal/contract enforceability uncertainty	53.6%	Compliance confidence gap

Note. The environmental context combines policy pressure, support availability, supplier readiness, and legal confidence.

4.5 Principal component analysis of barriers

The barrier PCA identified five components accounting jointly for 72.4% of the variance in barrier perceptions. Technological constraints were the dominant component (28.1%), followed by financial limitations (19.5%), organizational change-management challenges (12.8%), skills and capacity deficits (8.3%), and legal/regulatory uncertainty (3.7%). The component structure indicates that e-procurement risk is multidimensional but concentrated primarily in infrastructure and financing. Importantly, multi-campus coordination (83.3%), implementation cost (79.2%), budget rigidity (77.4%), inadequate training resources (75.0%), unreliable internet (74.4%), and cybersecurity concerns (73.2%) were among the most frequently reported specific constraints.

Table 7. PCA-Derived Barrier Structure

Rank	Barrier component	Variance explained	Prominent reported issues
1	Technological constraints	28.1%	Unreliable internet 74.4%; inadequate hardware 67.9%; cybersecurity 73.2%

2	Financial limitations	19.5%	Implementation cost 79.2%; training 73.8%; maintenance 69.6%; budget rigidity 77.4%
3	Organizational change management	12.8%	Change resistance 56.5%; staff limitations 72.6%; multi-campus coordination 83.3%
4	Skills and capacity deficits	8.3%	Low digital literacy 67.9%; inadequate training resources 75.0%
5	Legal and regulatory uncertainty	3.7%	Compliance uncertainty 53.6%; regulatory integration concerns 48.8%

Note. The five components explain 72.4% of total variance in reported barrier perceptions.

4.6 Principal component analysis of enablers

The enabler analysis yielded four components explaining 70.3% of the variance in perceived facilitating conditions. Leadership and management support dominated (32.4%), followed by technological infrastructure potential (20.1%), organizational capability (11.2%), and environmental support (6.6%). The pattern suggests that the institution possesses meaningful internal commitment to digital procurement even though operational readiness remains incomplete. High smartphone penetration, improving connectivity, existing procurement expertise, established procedures, and the GHANEPS policy framework provide a platform on which implementation can be built.

Table 8. PCA-Derived Enabler Structure

Rank	Enabler component	Variance explained	Key enabling evidence
1	Leadership and management support	32.4%	Strong senior-management support 90.5%; willingness to allocate resources
2	Technological infrastructure potential	20.1%	Smartphone penetration 88.7%; connectivity improvement 69.0%

3	Organizational capability	11.2%	Procurement expertise; established procedures 74.4%
4	Environmental support	6.6%	Government policy support; GHANEPS framework 85.7%

Note. The four components explain 70.3% of variance in perceived enabler conditions.

4.7 Composite implementation readiness

The overall implementation-readiness score was 3.15/5, indicating moderate readiness rather than immediate institution-wide deployment readiness. Tamale Main Campus recorded the highest score (3.4), followed by City Campus (3.1) and Nyankpala (2.8). By stakeholder group, senior management had the strongest readiness (4.2), followed by procurement officers (3.8), administrative staff (3.0), and academic staff (2.7). This asymmetry is strategically important: decision-makers and specialist procurement staff are more ready than some of the end users whose daily participation will determine system uptake. A simple, equally weighted average was used. All items are considered equally important contributors to the overall readiness construct.

Table 9. Composite Readiness Profile

Unit	Readiness score (/5)	Relative position
Overall institution	3.15	Moderate
Tamale Main Campus	3.4	Highest campus readiness
City Campus	3.1	Intermediate
Nyankpala Campus	2.8	Lowest campus readiness
Senior management	4.2	Highest stakeholder readiness
Procurement officers	3.8	High
Administrative staff	3.0	Moderate
Academic staff	2.7	Lower readiness

Note. Scores are descriptive composite indices reported in the source study; inferential differences cannot be reconstructed without the raw data.

4.8 Mixed-methods integration

The qualitative phase followed the quantitative phase, with survey results used to purposively select interview participants from different stakeholder groups and campuses to ensure maximum variation in perspectives. The preliminary survey findings, particularly the barrier rankings, campus readiness disparities, and role-based competency gaps, directly informed the development of role-sensitive interview guides, allowing the researchers to probe deeper into the specific constraints and enablers that emerged as statistically and descriptively prominent. This sequential integration ensured that the qualitative strand was not merely a parallel inquiry, but a targeted explanatory follow-up designed to clarify the mechanisms behind the quantitative readiness profile.

The qualitative strand clarified the mechanisms behind the quantitative profile. Interview participants emphasized concerns about job security, increased workload during transition, system reliability, uneven digital capability, limited technical support, and cross-campus coordination. These themes converge with the survey evidence: weak IT support and cybersecurity confidence reinforce reliability concerns; the high estimated training burden reinforces capability concerns; and the strong reporting of multi-campus coordination as a barrier confirms that implementation is an organizational design issue, not simply an ICT upgrade. At the same time, interviews indicated strong senior-leadership support and willingness to allocate resources, complementing the enabler component in which leadership had the largest explained variance.

Table 10. Mixed-Methods Joint Display

Quantitative finding	Qualitative explanation	Integrated implication
IT support adequate for only 19.6%	Users expressed concern about system reliability and support responsiveness	Create a dedicated e-procurement support desk and post-go-live service standard
Training need: 33.8 hours average	Participants anticipated skill gaps and transition workload	Use staged, role-specific training with practice environments
Multi-campus coordination barrier: 83.3%	Interviewees described coordination and workflow challenges across locations	Standardize workflows but phase deployment by campus readiness
Supplier compatibility: 24.4%	External ecosystem readiness seen as a constraint	Run supplier onboarding and help-desk support before mandatory cutover
Leadership support prominent; enabler variance 32.4%	Senior leaders expressed strong commitment	Convert executive support into ring-fenced budget, governance, and accountability
Cybersecurity concern: 73.2%	Reliability and trust concerns affected acceptance	Complete security controls, access management, backup, and incident procedures before scale-up

Note. Joint display integrates survey and interview evidence without inventing participant quotations.

5. Discussion

5.1 A readiness paradox: strong policy pressure, incomplete operational capacity

The central finding is a readiness paradox. The external policy environment and senior leadership strongly favor e-procurement, but frontline technological and organizational capacity is not yet uniformly sufficient for institution-wide implementation. This

distinction is important because formal compliance pressure can accelerate adoption decisions while simultaneously increasing operational risk if campuses lack connectivity, devices, support, security controls, or trained users. The overall readiness score of 3.15/5 should therefore be interpreted as a basis for structured preparation rather than as evidence that full deployment can proceed without remediation.

This pattern is consistent with the broader logic of TOE: environmental pressure can trigger adoption, but technology and organizational conditions shape actual implementation success. In the UDS context, GHANEPS provides legitimacy and direction, yet campus-level execution depends on local infrastructure, role-specific capability, vendor participation, and support responsiveness.

5.2 Why multi-campus heterogeneity matters

The study's most distinctive contribution is the identification of meaningful within-university heterogeneity. Tamale Main Campus had the strongest composite readiness, whereas Nyankpala recorded the lowest. Internet adequacy and digital-literacy patterns also varied across campuses. A university-wide average can therefore conceal locations where mandatory digital workflows would be fragile. This finding extends the conventional organizational level of TOE by showing that, in distributed institutions, the 'organization' should sometimes be decomposed into operational subunits before implementation decisions are made.

A phased rollout is therefore preferable to a simultaneous cutover. Starting with the most prepared campus allows the institution to stabilize workflows, identify integration problems, develop internal champions, refine training materials, and document support requirements before extending the platform to campuses with weaker readiness. Such sequencing reduces the risk of interpreting predictable transition problems as evidence that the technology itself is unsuitable.

5.3 Infrastructure, cybersecurity, and support as foundational conditions

Technological constraints explained the largest share of barrier variance. The problem is not connectivity alone: dedicated computer access, security confidence, and IT support were also weak. E-procurement systems process commercially sensitive information, supplier submissions, evaluation records, approvals, and contract data. Implementation without adequate identity controls, access governance, backup, incident response, and support capacity would introduce operational and trust risks. The high rate of smartphone ownership is useful for notifications, approvals, and status monitoring, but mobile availability should be treated as a complementary access channel rather than as a substitute for secure institutional infrastructure.

5.4 Human capability and change management

The readiness gap between senior management and academic staff suggests that strategic enthusiasm is not evenly distributed among users. A 33.8-hour estimated training requirement implies that brief orientation sessions are unlikely to be adequate. Training should be modular and role-specific: request initiation and tracking for end users; evaluation and compliance workflows for procurement staff; approval, exception handling, and dashboard interpretation for managers; and technical administration for IT staff. Change management should also address concerns about workload and job security

explicitly, because uncertainty can produce passive resistance even when users acknowledge the system's potential benefits.

5.5 Supplier ecosystem and regulatory confidence

Only 24.4% of supplier compatibility represents a major implementation bottleneck. E-procurement is inherently interorganizational: the university can digitize internal approvals, but competitive tendering and quotation processes still depend on suppliers being able and willing to register, authenticate, upload compliant bids, and respond within digital workflows. Supplier onboarding should therefore be treated as part of the implementation project, with help sessions, simple guidance, test transactions, and escalation channels. Similarly, uncertainty regarding electronic signatures and contract enforceability should be addressed through targeted legal and procurement guidance so that users do not revert to parallel paper processes out of compliance anxiety.

5.6 Practical implementation roadmap

The evidence supports a five-stage implementation roadmap. Stage 1 should establish governance, map workflows, confirm legal and control requirements, and define measurable service standards. Stage 2 should remediate connectivity, device, cybersecurity, and support gaps, prioritizing the weakest campus indicators. Stage 3 should deliver role-specific training and supplier onboarding, supported by sandbox practice and competency checks. Stage 4 should pilot at Tamale Main Campus, track cycle time, user errors, support tickets, supplier participation, and exception rates, and refine procedures. Stage 5 should scale to City and Nyankpala campuses using readiness thresholds rather than fixed calendar dates, followed by continuous performance monitoring and refresher training.

Table 11. Evidence-Based Phased Implementation Roadmap

Stage	Priority actions	Suggested readiness indicators
1. Governance and process design	Establish steering team; map as-is/to-be workflows; clarify approvals and legal controls	Approved governance structure; documented workflows; risk register
2. Infrastructure and security	Upgrade connectivity/devices; identity/access controls; backup; support desk	Connectivity uptime; device coverage; security control completion; support SLA
3. Capability and ecosystem	Role-based staff training; supplier onboarding; practice environment	Training completion/competency; supplier registration and test submissions
4. Pilot deployment	Pilot at highest-readiness campus; intensive post-go-live support	Transaction success; cycle time; error rate; support tickets; user satisfaction
5. Scale and optimize	Extend by readiness threshold; monitor	Adoption rate; supplier participation; transparency;

	outcomes; continuous improvement	processing time; cost and compliance metrics
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Note. The roadmap is derived from the combined TOE findings and mixed-methods evidence.

6. Implications for Theory, Policy, and Practice

Theoretically, the study suggests that TOE applications in distributed public institutions should distinguish institution-level policy readiness from subunit-level operational readiness. The environmental context may be common across campuses, while technological and organizational conditions vary materially. This nested interpretation can improve explanatory precision in future studies of multi-campus universities, health systems, local-government networks, and other geographically distributed public organizations. For policy, national e-procurement mandates should be accompanied by differentiated implementation support. Onboarding targets are important, but sustained use depends on post-go-live technical assistance, supplier capability, legal clarity, cybersecurity requirements, and institutional change management. For university practice, the immediate priority is not simply to acquire or activate a platform; it is to establish the conditions under which digital procurement becomes the default, trusted workflow rather than a layer added on top of existing paper processes.

7. Limitations and Future Research

The study is limited to three campuses within one public university, so statistical generalization to all Ghanaian higher education institutions is not warranted. The cross-sectional design captures readiness at one period rather than actual adoption trajectories. Several measures rely on self-report and may be influenced by perception or social desirability. The source manuscript also did not include the raw respondent-level dataset in the uploaded file, preventing independent reconstruction of regression coefficients, ANOVA statistics, factor loadings, KMO/Bartlett diagnostics, or confirmatory factor models. Future research should use a multi-institutional longitudinal design, retain raw item-level data, report full measurement-model diagnostics, and test predictive relationships among TOE dimensions, perceived usefulness, behavioral intention, actual system use, cycle time, compliance, and cost outcomes.

8. Conclusion

E-procurement adoption at UDS is supported by strong leadership, policy pressure, existing procurement expertise, high mobile-device penetration, and an established national digital-procurement framework. At the same time, implementation is constrained by uneven campus readiness, infrastructure limitations, cybersecurity concerns, insufficient technical support, training demands, supplier incompatibility, financial pressures, and regulatory uncertainty among users. Five barrier components explain 72.4% of perceived constraints, while four enabler components explain 70.3% of perceived facilitating conditions. The evidence therefore favors a phased rather than simultaneous rollout. Successful implementation should begin with governance and infrastructure, proceed through role-specific capability building and supplier onboarding,

pilot at the most prepared campus, and scale only after objective readiness thresholds are met. The broader lesson is that digital procurement in resource-constrained higher education is not a technology-installation exercise; it is an institution-wide transformation requiring synchronized changes in technology, people, processes, suppliers, and governance.

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