

An Integrated TOE–TAM Framework for the Adoption of Decentralized E-Government in Iraqi Higher Education: A Conceptual Model

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Abstract

Electronic government (e-government) has become a central instrument through which public institutions seek to deliver services with greater efficiency, transparency, and accessibility. In Iraq's higher education sector, however, adoption remains constrained by centralized decision-making, underdeveloped information and communication technology (ICT) infrastructure, unclear regulatory frameworks, and limited institutional autonomy. While the Technology-Organization-Environment (TOE) framework and the Technology Acceptance Model (TAM) have each been used extensively to explain technology adoption, they are rarely combined, and no validated model yet captures how institutional readiness and individual user perceptions jointly shape e-government use in a fragile, post-conflict governance setting such as Iraq. This paper develops and theoretically justifies an integrated TOE–TAM conceptual framework for the adoption of decentralized e-government systems in Iraqi public universities. Eight constructs are proposed across three dimensions: technological (IT skills, technical support, technological infrastructure), environmental (rules and regulations, awareness, culture), and governmental (trust in government, quality of information). For each construct, the paper reviews the supporting literature and formulates a corresponding hypothesis linking it to the use of e-government in higher education. The resulting eight-hypothesis model offers a theoretically grounded, context-sensitive lens for studying digital governance reform in Iraq and comparable post-conflict, decentralizing states, and provides the conceptual foundation for the empirical validation reported in a companion study. The paper concludes by discussing the framework's theoretical contribution and its implications for policymakers seeking to design more effective ICT governance and decentralization strategies in higher education.

Keywords: *e-government; decentralization; higher education; Technology-Organization-Environment (TOE); Technology Acceptance Model (TAM); Iraq*

1. Introduction

Over the past two decades, e-government has emerged worldwide as a transformative mechanism for modernizing public institutions, embedding information and communication technologies into the daily operation of government to improve service efficiency, transparency, and stakeholder engagement (Twizeyimana & Andersson, 2019). While many developed nations have integrated e-government strategies deeply into their governance structures, developing and post-conflict countries continue to encounter persistent political, institutional, and technological obstacles that slow implementation (Ahmed, Kaya, & Karanfiller, 2025). Iraq exemplifies these challenges acutely, particularly within its higher education sector, where administrative centralization and constrained digital infrastructure intersect.

Iraqi public universities largely continue to operate under centralized, bureaucratic governance models in which decision-making authority is concentrated at the level of the Ministry of Higher Education and Scientific Research, leaving individual institutions with little autonomy to design or manage their own digital transformation initiatives (Al-Yawer & Ahmad, 2018).

Despite repeated government commitments to administrative decentralization, this policy intention has yet to translate meaningfully into higher education practice (Darwish & Mihiawi, 2023). Universities continue to face inadequate ICT infrastructure, limited technical capacity among staff, low levels of trust in government-run digital platforms, and cultural resistance to technological change, all of which constrain the effective use of e-government services (Fattah, Mousa, Mohsen, Khalaf, & Mousa, 2022; AlKaabi, Enayati, Mousavi, & Ghashghaeizadeh, 2024).

A substantial body of research has examined e-government adoption using either the Technology Acceptance Model (TAM), which emphasizes individual users' perceived usefulness and perceived ease of use (Davis, 1989), or the Technology-Organization-Environment (TOE) framework, which explains adoption through an organization's technological, organizational, and environmental readiness (Tornatzky & Fleischer, 1990). These two theoretical traditions are typically applied in isolation. Yet in fragile governance settings such as Iraq, where weak institutional structures intersect with considerable public skepticism toward digital services, adoption behaviour cannot be fully explained by institutional readiness or individual perception alone; a more integrated explanatory approach is required (Al Jumaili, 2023).

Despite the volume of e-government research produced on Iraq in recent years, most existing studies remain descriptive or address isolated dimensions of adoption; comparatively little work has combined TOE and TAM into a single, empirically testable model tailored to the higher education context (Totonchi, 2023). This paper addresses that gap by developing and theoretically justifying an integrated TOE–TAM conceptual framework for explaining the use of decentralized e-government systems in Iraqi public universities. The framework identifies eight constructs, organized into technological, environmental, and governmental dimensions, and proposes eight corresponding hypotheses. The remainder of the paper is organized as follows: Section 2 reviews e-government concepts and practice in higher education; Section 3 discusses decentralization in public administration and higher education; Section 4 examines the evolution and status of e-government in Iraq and Iraqi higher education; Section 5 presents the theoretical foundations of TOE and TAM; Section 6 develops the proposed integrated framework and its hypotheses; Section 7 discusses the framework's implications; and Section 8 concludes.

2. E-Government: Concepts, Goals, and Practice in Higher Education

E-government refers broadly to the use of ICT, particularly internet-based platforms, by public sector institutions to deliver information and services to citizens, businesses, and internal stakeholders more efficiently and transparently (UN Department of Economic and Social Affairs, 2018). Beyond the simple digitization of existing processes, e-government is increasingly understood as a vehicle for broader public sector transformation, reshaping how institutions communicate, make decisions, and account for their performance (Twizeyimana & Andersson, 2019).

The principal goals commonly attributed to e-government initiatives include improving service delivery speed and accessibility, reducing bureaucratic overhead, enhancing transparency and accountability, and strengthening stakeholder trust in public institutions. When effectively implemented, e-government has been associated with reduced administrative costs, improved data

accuracy, greater responsiveness to stakeholder needs, and a broadened portfolio of accessible public services (UN Department of Economic and Social Affairs, 2018). These benefits, however, are contingent on adequate technological readiness and supportive institutional and regulatory conditions, which are not uniformly present across national contexts.

Common barriers to e-government implementation include insufficient ICT infrastructure, limited digital literacy among both providers and users, weak legal and regulatory frameworks, cybersecurity and data-privacy concerns, and, in many developing contexts, low institutional trust (Fattah et al., 2022). These barriers tend to compound one another: weak regulatory clarity can suppress investment in infrastructure, while low digital literacy can undermine confidence in newly deployed systems.

Within higher education specifically, e-government, often implemented through integrated campus management or administrative information systems, supports functions ranging from admissions and registration to human resource management, financial administration, and research reporting. Universities that successfully adopt such systems typically report efficiency gains in administrative workload, improved data-driven decision-making, and enhanced accessibility of services for academic and administrative staff alike. Higher education institutions in developing and post-conflict states, however, often lag behind national e-government strategies because of resource constraints, fragmented governance, and limited technical capacity (AlKaabi et al., 2024).

3. Decentralization and Higher Education Governance

Decentralization, the transfer of administrative authority and decision-making responsibility from central government bodies to lower-level or institutional units, is widely regarded as a mechanism for improving the responsiveness, efficiency, and contextual relevance of public administration (Crook, 2003). By granting local units greater autonomy over resource allocation and service design, decentralization is expected to allow institutions to tailor their operations more closely to local needs, rather than depending on uniform, centrally imposed directives.

In higher education specifically, decentralization can mean granting individual universities greater autonomy over curricular, financial, technological, and administrative decisions, including the authority to design and manage their own digital transformation initiatives. Comparative evidence from other national contexts suggests that greater institutional autonomy is often associated with more effective, contextually adapted use of digital administrative systems (Ko, Cheng, & Lee, 2016). By contrast, when decision-making remains centralized, institutions may lack both the incentive and the practical capacity to adopt and adapt e-government tools to their specific operational contexts.

Although the Iraqi government has publicly committed to administrative decentralization as a national policy goal, this commitment has not yet been effectively translated into practice within the higher education sector (Darwish & Mihyawi, 2023). Universities are rarely empowered to initiate or manage digital transformation independently; instead, policy decisions concerning e-government systems are typically imposed from the central level, particularly by the Ministry of Higher Education and Scientific Research. This centralization limits institutions' ability to tailor

e-government services to their specific operational needs and constrains the pace and depth of digital adoption across the sector.

4. E-Government in Iraq and Iraqi Higher Education

E-government development in Iraq has proceeded unevenly since the early 2000s, shaped by a combination of post-conflict reconstruction priorities, political instability, and constrained public investment in ICT infrastructure (Totonchi, 2023). While national strategies for digital governance have been articulated at various points, implementation has generally lagged behind stated policy ambitions, with core applications concentrated in a small number of ministries and services rather than diffused broadly across the public sector (Totonchi & Mohadis, 2025).

Several structural conditions distinguish Iraq's e-government trajectory from that of more stable developing economies. These include the legacy of prolonged conflict and its effect on institutional capacity, a highly centralized decision-making culture that limits local experimentation, underdeveloped and inconsistently maintained ICT infrastructure, and a regulatory environment that has not kept pace with technological change (Abdali, Hussain, Abduljabbar, Nyangaresi, & Aldarwish, 2024). Public trust in government institutions, including their digital services, also remains comparatively low, a legacy of years of institutional instability (Al Jumaili, 2023).

For Iraqi higher education specifically, e-government adoption carries the potential to modernize admissions, registration, examination, and human-resource processes; reduce paper-based bureaucracy; and improve transparency in academic administration. Realizing these benefits, however, is complicated by resource constraints and a shortage of trained IT personnel, including the loss of qualified technical staff away from the public higher education system (Fattah et al., 2022; Katheeth, Alathari, & Noor, 2022). Universities across the country vary considerably in their technological readiness and administrative capacity, producing uneven progress even among institutions operating under the same national policy framework.

Addressing these challenges will likely require coordinated investment in ICT infrastructure, sustained capacity-building for administrative and academic staff, clearer regulatory guidance, and, critically, a genuine devolution of decision-making authority to individual institutions. Absent such a shift, e-government initiatives in Iraqi higher education risk remaining centrally mandated but locally under-utilized.

5. Theoretical Foundations

5.1 The Technology-Organization-Environment (TOE) Framework

The TOE framework, developed by Tornatzky and Fleischer (1990), explains organizational technology adoption through three contextual dimensions: the technological context (the internal and external technologies relevant to the organization, including current practices and available infrastructure), the organizational context (firm size, structure, and resources), and the environmental context (the regulatory, competitive, and social environment in which the organization operates). TOE has been applied extensively in information systems research,

including studies of e-government adoption at the institutional level, because it captures readiness factors that lie outside any single user's control (Alzahrani, Al-Karaghoul, & Weerakkody, 2017). In this study, the TOE framework is adapted to capture how technological, environmental, and governmental conditions, the last a context-specific adaptation of the organizational dimension that reflects the centrality of government policy and institutional trust in the Iraqi setting, shape the use of decentralized e-government in Iraqi higher education institutions.

5.2 The Technology Acceptance Model (TAM)

TAM, developed by Davis (1989), explains individual technology-adoption behaviour through two central beliefs: perceived usefulness, the degree to which a person believes a system will enhance their performance, and perceived ease of use, the degree to which a person believes using the system will be free of effort. TAM has demonstrated strong and consistent predictive power for user acceptance across public sector, higher education, and developing-country contexts (Al-Hujran, Al-Debei, Chatfield, & Migdadi, 2015). Its inclusion in the present framework addresses a core dimension of the research problem: the limited engagement and uptake of e-government systems among individual institutional users, which institutional-level readiness factors alone cannot fully explain.

5.3 Rationale for an Integrated Framework

TOE and TAM address complementary but distinct levels of explanation: TOE captures institutional and contextual readiness, while TAM captures individual user perception and behavioural response. Prior e-government research has tended to apply these models separately, which risks omitting either the institutional conditions that enable or constrain adoption, or the individual perceptions that ultimately determine system use. Combining the two traditions allows the present framework to capture both dimensions simultaneously: whether the institutional environment, technological, environmental, and governmental, is conducive to e-government use, and whether individual users perceive the resulting systems as useful and usable. This integration is particularly relevant in fragile governance contexts such as Iraq, where institutional weaknesses and individual scepticism are likely to interact and jointly shape actual usage behaviour.

6. Proposed Integrated Framework

Building on the theoretical foundations outlined above, this paper proposes an integrated framework comprising eight constructs organized into three dimensions: technological factors (IT skills, technical support, technological infrastructure), environmental factors (rules and regulations, awareness, culture), and governmental factors (trust in government, quality of information). Each construct is hypothesized to exert a direct, positive influence on the use of decentralized e-government systems in Iraqi higher education institutions, the model's dependent construct. Figure 1 depicts the proposed framework schematically, and Table 1 summarizes the same eight hypotheses in tabular form.

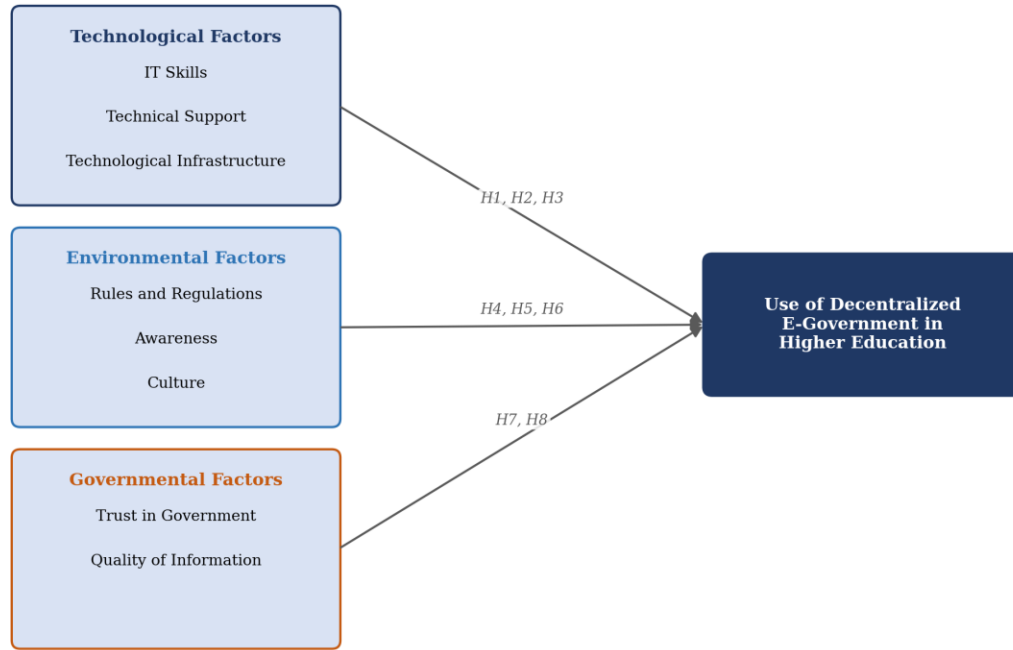
Figure 1. Proposed integrated TOE-TAM framework

Figure 1. Proposed integrated TOE-TAM framework: three dimensions of institutional and individual readiness, each linked to the use of decentralized e-government in higher education.

Table 1. Constructs, dimensions, and hypotheses of the proposed integrated TOE-TAM framework

Dimension	Construct	Hyp.	Hypothesized relationship
Technological	IT Skills	H1	IT skills → Use of e-government (+)
	Technical Support	H2	Technical support → Use of e-government (+)
	Technological Infrastructure	H3	Technological infrastructure → Use of e-government (+)
Environmental	Rules and Regulations	H4	Rules and regulations → Use of e-government (+)
	Awareness	H5	Awareness → Use of e-government (+)
	Culture	H6	Culture → Use of e-government (+)
Governmental	Trust in Government	H7	Trust in government → Use of e-government (+)
	Quality of Information	H8	Quality of information → Use of e-government (+)

6.1 Technological Factors

IT skills refer to the level of technical competence among institutional staff needed to implement, manage, and effectively use e-government platforms, encompassing both general digital literacy and specialized technical expertise. In Iraqi public universities, capacity constraints, including limited investment in technical training and susceptibility to skilled-staff attrition, are

frequently cited as obstacles to effective e-government implementation (Mahmood, Shakir, & Ibrahim, 2022, as cited in the wider Iraqi e-government literature). Building on this reasoning, the framework proposes:

H1: *IT skills have a significant and positive effect on the use of e-government in Iraqi higher education.*

Technical support encompasses the systems, protocols, and personnel required to provide assistance and troubleshooting for e-government platforms, including help-desk services, system maintenance, and data backup and integration mechanisms. Reliable technical support reduces resistance to system use by minimizing service disruption and building user confidence in digital platforms. Accordingly:

H2: *Technical support has a significant and positive effect on the use of e-government in Iraqi higher education.*

Technological infrastructure refers to the availability, quality, and reliability of the hardware, network connectivity, and system architecture that underpin e-government platforms. In resource-constrained settings such as Iraq's public university system, inconsistent infrastructure quality is frequently identified as a binding constraint on digital service delivery. Accordingly:

H3: *Technological infrastructure has a significant and positive effect on the use of e-government in Iraqi higher education.*

6.2 Environmental Factors

Rules and regulations refer to the clarity, consistency, and enforceability of the legal and policy frameworks governing e-government implementation, including data protection, institutional accountability, and procedural standards. Clear regulatory frameworks are widely regarded as a precondition for institutional confidence in adopting new digital systems. Accordingly:

H4: *Rules and regulations have a significant and positive effect on the use of e-government in Iraqi higher education.*

Awareness refers to the extent to which institutional staff understand the purpose, availability, and benefits of e-government services. Limited awareness has been linked to underutilization or misapplication of otherwise available digital services, underscoring the importance of communication and training initiatives. Accordingly:

H5: *Awareness has a significant and positive effect on the use of e-government in Iraqi higher education.*

Cultural factors encompass the shared values, beliefs, and attitudes within an institution that shape receptiveness to technological change, including institutional and broader national orientations toward digital transformation. Accordingly:

H6: *Culture has a significant and positive effect on the use of e-government in Iraqi higher education.*

6.3 Governmental Factors

Trust in government reflects institutional staff's perception of the credibility, integrity, and reliability of government-run digital platforms and the entities that operate them. Trust is considered a key behavioural driver of public digital-service acceptance, particularly in contexts where institutional credibility has been historically contested (Alzahrani et al., 2017). Accordingly:

H7: *Trust in government has a significant and positive effect on the use of e-government in Iraqi higher education.*

Quality of information refers to the accuracy, relevance, timeliness, and clarity of the information delivered through e-government platforms. Users are more likely to engage consistently with systems they perceive as providing reliable, useful information. Accordingly:

H8: *Quality of information has a significant and positive effect on the use of e-government in Iraqi higher education.*

7. Discussion and Implications

The integrated framework proposed in this paper extends the current body of information systems and digital governance knowledge by combining two well-established but historically separate theoretical traditions. Rather than treating institutional readiness and individual user perception as competing explanations for e-government use, the framework treats them as complementary dimensions of a single adoption process. This offers a more holistic lens for studying digital governance in fragile or post-conflict environments, where both dimensions plausibly matter and neither can be assumed away.

For policymakers and university administrators, the framework highlights eight concrete levers, spanning technological, environmental, and governmental dimensions, through which e-government adoption in higher education might be strengthened. It suggests that interventions focused solely on infrastructure investment, for example, are unlikely to succeed in isolation from parallel efforts to build institutional trust, clarify regulatory frameworks, and raise staff awareness. A multi-dimensional intervention strategy, addressing several constructs simultaneously, is more likely to yield sustained adoption than any single-factor approach.

As a conceptual contribution, the framework presented here requires empirical testing to establish the relative strength and statistical significance of each proposed relationship. A companion study, drawing on survey data collected from academic and administrative staff across five Iraqi public universities and analysed using structural equation modelling, undertakes this validation (Fuad, Aboobaider, & Abd Ghani, 2023). The present paper's contribution lies specifically in the theoretical development and justification of the model that such empirical work then tests.

8. Conclusion

This paper has developed an integrated TOE–TAM conceptual framework for explaining the use of decentralized e-government systems in Iraqi higher education institutions. Motivated by the

persistent gap between Iraq's stated decentralization ambitions and the realities of centralized, under-resourced digital governance in its public universities, the framework combines institutional-level readiness factors (technological, environmental, and governmental) with individual-level user perception, organized into eight constructs and eight corresponding hypotheses. The framework contributes theoretically by integrating two traditions of technology-adoption research that are rarely combined, and practically by offering policymakers a structured, multi-dimensional basis for designing decentralization and ICT governance reforms. Future work, including the empirical validation summarized in the companion study to this paper, should continue to test, refine, and extend the framework across different institutional types and national contexts, including comparative work in other post-conflict or transitional governance settings.

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