Faculty of Information and Communication Technology

Integrated Framework on Decentralized E-Government in Iraqi Higher Education using Hybrid Approach

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Integrated Framework on Decentralized E-Government in Iraqi Higher Education using Hybrid Approach

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Faculty of Information and Communication Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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2025

DECLARATION

I declare that this thesis entitled “An Integrated Framework for the Use of Decentralized E-Government in Iraqi Higher Education: A TOE–TAM Approach” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Doctor of Philosophy.

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DEDICATION

I would like to present my work to those who did not stop their daily support, my dear mother, my kindness father, my lovely wife and my beatuful daughter. They provide me all facilities to push me foreword as much as they can. This work is a simple and humble reply to their much goodness I have taken over during that time. Also, to my brother, sisters, my late Grandmother, friends and those entire how I love

(May Allah's bless all of them).

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ABSTRACT

Many governments around the world have increasingly adopted electronic government (e-government) systems to improve the efficiency, accessibility, and transparency of public services. In Iraq, however, the implementation of e-government in the higher education sector remains limited, largely due to centralized decision-making, underdeveloped ICT infrastructure, legal and cultural barriers, and a lack of institutional autonomy. Despite the recognized benefits of decentralization and digital governance, few empirical studies have explored the combined impact of technological, environmental, and governmental factors on the actual use of e-government in Iraq's universities. This study addresses this gap by proposing and validating an integrated framework that combines the Technology Organization Environment (TOE) model with the Technology Acceptance Model (TAM). The research investigates eight independent variables categorized as technological factors (IT skills, technical support, and technological infrastructure), environmental factors (rules and regulations, awareness, and cultural aspects), and governmental factors (trust in government and quality of information). These factors are examined for their influence on the use of decentralized e-government systems in Iraqi higher education institutions. A quantitative research approach was employed using a structured questionnaire distributed to academic and administrative staff across five public universities: University of Baghdad, University of Mosul, University of Babylon, University of Al-Qadisiyah, and University of Al-Muthanna. The collected data was analyzed using Structural Equation Modeling with Partial Least Squares (SEM-PLS) to evaluate the proposed framework. The findings indicate that all eight factors have a statistically significant influence on the use of e-government systems. Technological infrastructure, awareness, and trust in government emerged as the most critical predictors. The validated framework offers both theoretical and practical contributions. It fills a gap in existing literature by empirically integrating TOE and TAM to explain actual e-government usage within a post-conflict higher education environment. Practically, it provides policymakers and institutional leaders with evidence-based insights to design more effective decentralization strategies and ICT governance reforms in Iraq's public university system.

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Rangka Kerja Bersepadu dalam Sistem E-Kerajaan secara tidak berpusat dalam sektor Pendidikan Tinggi Iraq menggunakan Pendekatan Hibrid

ABSTRAK

Banyak kerajaan di seluruh dunia telah mempercepatkan pelaksanaan e-kerajaan mereka, untuk meningkatkan kecekapan, keberkesanan, kualiti, kelajuan dan kebolehcapaian perkhidmatan mereka. Setiap kerajaan melaksanakan program individunya sendiri, sambil mengambil kira ciri-ciri negara yang melibatkan faktor sosial, budaya, ekonomi dan politik. Ciri-ciri seperti ini boleh membantu atau menghalang pelaksanaan dan penggunaan e-kerajaan. Penggunaan e-kerajaan telah dikaji secara meluas dari perspektif faktor teknikal dan pengurusan. Oleh itu, adalah penting untuk menganjurkan penyelidikan yang banyak untuk menyokong penggubal dasar, aktivis dan ahli akademik, yang mempunyai kefahaman yang ketara tentang e-kerajaan. Ini akan membantu untuk mengenal pasti pelbagai faktor yang mempengaruhi e-kerajaan dalam keadaan yang berbeza, khususnya di negara membangun yang menghadapi pelbagai cabaran untuk menerima pakai e-kerajaan seperti Iraq. Tujuan kajian ini adalah untuk menentukan pembolehubah yang menyumbang kepada kejayaan membangunkan rangka kerja e-kerajaan untuk pendidikan tinggi di Iraq. Seterusnya, kajian ini bertujuan untuk mengkaji perkaitan antara teknologi, persekitaran organisasi (TOE) dan e-kerajaan. Oleh itu, kajian ini, dengan cara ini berusaha untuk mengisi kekosongan dalam literatur semasa. Kajian ini menggunakan kaedah penyelidikan kuantitatif untuk mengkaji penentu (pembolehubah) yang mempunyai kesan penting ke atas penggunaan e-kerajaan, yang akhirnya menghasilkan peningkatan penggunaan e-kerajaan dengan menggunakan alat statistik SEM-PLS. Kajian ini telah mengkaji kesan peramal seperti Kemahiran IT, Sokongan Teknikal, Infrastruktur Teknologi, Peraturan dan Peraturan, Kesedaran, Budaya, Kepercayaan dalam Kerajaan, dan Kualiti Maklumat terhadap niat untuk menggunakan perkhidmatan e-kerajaan. Hasil statistik kajian ini telah menunjukkan bahawa semua peramal adalah signifikan terhadap niat untuk menggunakan perkhidmatan e-kerajaan. Rangka kerja itu boleh membantu pembuat keputusan kerajaan untuk menggambarkan pelan tindakan strategik yang sesuai untuk masa depan kerajaan elektronik dengan mengenal pasti isu utama dan potensi cabaran yang berkaitan dengan penggunaan projek e-kerajaan.

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LIST OF ABBREVIATIONS

DV	-	Dependent Variable
G2B	-	Government-To-Business
G2C	-	Government-To-Citizen
G2E	-	Government-To-Employee
G2G	-	Government-To-Government
ICT	-	Information And Communication Technologies
IV	-	Independent Variable
MOU	-	Memorandum Of Understanding
PEOU	-	Perceived Ease Of Use
PLS	-	Partial Least Squares
PLS-SEM	-	Partial Least Squares Structural Equation Modelling
P-P	-	Probability–Probability
Ppps	-	Public-Private Partnerships
PU	-	Perceived Usefulness
SEM	-	Structural Equation Modelling
SPSS	-	Statistical Package for the Social Sciences
TAM	-	Technology Acceptance Model
TOE	-	Technology Organization Environment
USAID	-	United States Agency For International Development

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LIST OF PUBLICATIONS

The followings are the list of publications related to the work on this thesis:

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The purpose of this chapter is to provide a concise summary of this doctorate study on higher education in Iraq within the framework of Iraqi e-government. This chapter will contextualise the research problem and define the research questions that will be empirically investigated through a very large-scale survey of Iraqi individuals enrolled in higher education. Additionally, this chapter will discuss the study's objectives, significance, and scope. Then, an outline of the contents of each chapter in this study will be presented.

1.2 Research background

Over the past two decades, electronic government (e-government) has emerged as a transformative tool that enables public sector institutions to deliver services with greater efficiency, transparency, and accessibility. The integration of information and communication technologies (ICTs) into government operations has revolutionized the way institutions engage with citizens, businesses, and internal stakeholders. While many developed nations have successfully embedded e-government strategies into their governance structures, developing countries continue to face considerable barriers in implementation and actual system usage. Iraq, in particular, faces unique political, institutional, and technological challenges that complicate the realization of e-government benefits, especially within the higher education sector (Ahmed et al., 2025; Al-Yawer and Ahmad, 2019).

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Iraq's higher education institutions are among the most affected by administrative centralization and underinvestment in digital infrastructure. Universities continue to operate within outdated governance models where decision-making is highly centralized and bureaucratic, and digital platforms are either underdeveloped or inconsistently used. Despite the government's strategic interest in digital reform, higher education institutions remain constrained by limited autonomy, insufficient technical capacity, and a lack of clearly defined regulatory frameworks (AlKaabi, Enayati, Mousavi, and Ghashghaeizadeh, 2024). In addition to institutional constraints, the human factor presents equally critical barriers. Low digital literacy among staff, limited awareness of e-government services, cultural resistance to change, and a lack of trust in public systems contribute to the slow uptake of e-government tools (Salman, 2019). These multidimensional barriers highlight the need for a framework that captures both institutional readiness and user-related enablers of e-government use in the Iraqi higher education sector.

Although global research has explored e-government adoption using various models, most studies have focused narrowly on either the technological capabilities of institutions or the behavioral intentions of users. The Technology Acceptance Model (TAM) has been widely employed to examine how perceived usefulness and ease of use affect user acceptance of technology (Davis, 1989; Venkatesh and Davis, 2000). However, TAM alone does not account for the broader organizational or environmental conditions required for successful implementation. Conversely, the Technology Organization Environment (TOE) framework examines institutional and external factors such as infrastructure, organizational support, and policy readiness (Tornatzky and Fleischer, 1990), but does not include user-centric behavioral variables like trust or information perception. In fragile governance

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systems such as Iraq, where both structural and individual-level barriers coexist, neither TAM nor TOE alone is sufficient.

The need for a more comprehensive perspective is particularly urgent in Iraq's public universities, where digital transformation efforts have been fragmented and largely unsupported by empirical research. Although national policies reference the importance of digital governance, there remains a lack of validated models that consider the specific conditions affecting higher education institutions (Ahmed et al., 2025; Al-Yawer and Ahmad, 2019). Past studies conducted in Iraq are largely descriptive, often failing to capture the combined impact of technological, environmental, and human factors on actual system usage. Moreover, existing research does not reflect the contextual realities of post-conflict governance, where trust in public institutions is weak, resources are limited, and administrative processes are heavily centralized (O'Driscoll and Costantini, 2024). Without a detailed understanding of these constraints, it is difficult for institutions to design effective e-government strategies or for policymakers to support higher education reform through ICT.

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To address these gaps, this study proposes a validated framework that integrates TOE and TAM to assess the actual use of e-government systems in Iraq's public universities. This approach allows for a more holistic analysis of the conditions that enable or hinder successful implementation. Specifically, the study examines eight critical constructs identified through extensive literature review and contextual analysis: IT skills, technical support, technological infrastructure, rules and regulations, awareness, cultural orientation, trust in government, and information quality (Abdullah and Ahmed, 2024; Al Jumaili, 2023). Each of these variables reflects a real and observed barrier in Iraq's higher education institutions. The technological factors represent the baseline capabilities necessary for system

functionality. The environmental factors capture regulatory clarity, cultural norms, and institutional awareness that shape adoption. The governmental factors address trust and perceived information reliability, both of which are essential for building legitimacy and long-term system use.

The integration of these variables into a unified TOE–TAM framework reflects the complex interplay between organizational capacity and user perception that characterizes Iraq's higher education environment. Through empirical testing, this study contributes not only to theoretical advancement but also to the practical design of more effective, context-sensitive e-government strategies. By focusing specifically on Iraqi public universities, the research directly supports national goals of decentralization and higher education reform, while also filling a critical gap in both global and regional e-government literature.

1.3 Research problem

E-government is widely recognized as a transformative tool for modernizing public sector institutions, increasing transparency, and improving the delivery of services (Balaji, 2025). Globally, many countries have embraced e-government in sectors such as education, using digital platforms to enhance access, streamline processes, and reduce administrative burdens. In contrast, Iraq continues to lag behind in the adoption and utilization of e-government, particularly within the higher education sector (Ahmed et al., 2025). Most Iraqi universities still operate under rigid, paper-based systems, where decision-making is highly centralized and institutional autonomy is minimal (AlKaabi, Enayati, Mousavi, and Ghashghaeizadeh, 2024). This centralization hinders responsiveness and efficiency, and it prevents institutions from tailoring services to their specific operational needs.

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Although the Iraqi government has declared its intention to promote decentralization, this goal has not been effectively translated into higher education practice (Darwish and Mihyawi, 2023). Universities are rarely empowered to initiate or manage digital transformation independently. Instead, most policy decisions are imposed from the central level, particularly from the Ministry of Higher Education and Scientific Research (Al-Yawer and Ahmad, 2019). This lack of autonomy is compounded by widespread challenges such as inadequate ICT infrastructure, low IT skill levels, weak technical support, and inconsistent access to reliable internet services (Ntorukiri et al., 2022). These technical limitations are accompanied by environmental constraints, including outdated regulatory frameworks, low institutional awareness of digital systems, and cultural resistance to technological change (Abdullah and Ahmed, 2024). Furthermore, trust in government remains low, and the quality and reliability of online information are frequently questioned by both staff and students (Salman, 2019).

While numerous studies have explored e-government adoption in various countries, most of them apply either the TAM or the TOE framework. TAM emphasizes user perceptions such as perceived usefulness and perceived ease of use (Davis, 1989), while TOE focuses on the readiness of an institution's technological, organizational, and environmental context (Tornatzky and Fleischer, 1990). However, these models have typically been used in isolation, without considering the simultaneous influence of institutional structures and user behavior. In fragile governance environments like Iraq, where institutional weaknesses intersect with public skepticism, a more integrated model is required. Most research in the Iraqi context is either descriptive or focused on general awareness, and does not empirically test a framework for explaining actual usage of e-government in higher education (Balaji, 2025; Ahmed et al., 2025).

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This study identifies eight variables that are particularly relevant to Iraq's higher education context. These include three technological factors (IT skills, technical support, technological infrastructure), three environmental factors (rules and regulations, awareness, culture), and two governmental factors (trust in government and quality of information). Previous literature supports the importance of these factors individually (Abdullah and Ahmed, 2024; Al-Yawer and Ahmad, 2019; Al Jumaili, 2023), but no study has combined them into a single validated model that explains the actual use of e-government services in Iraqi universities. This absence of an empirically tested, locally relevant framework limits both the academic understanding and practical implementation of digital governance in Iraq's higher education sector.

To address this gap, the present study develops and validates an integrated TOE–TAM framework that examines how these eight factors influence the use of decentralized e-government services in public universities. The framework is tested through a quantitative approach using data collected from five major Iraqi universities. The goal is to contribute to theory by integrating and empirically validating constructs from both TOE and TAM, and to provide practical insights for policymakers, university leaders, and ICT planners working to implement effective and sustainable e-government systems in Iraq. Ultimately, this research aims to support a more responsive, decentralized, and technology-enabled higher education environment in the country.

1.4 Research questions

A well-formulated set of research questions plays a critical role in guiding both theoretical development and empirical investigation. As Alam et al. (2025) emphasize, clearly defined research questions are essential for structuring complex studies and

addressing multifaceted challenges. In Iraq's higher education sector, efforts to adopt e-government remain limited due to a combination of centralized decision-making, weak digital infrastructure, unclear regulatory frameworks, and low levels of trust in government services. Addressing these obstacles requires an integrated approach that considers both institutional readiness and user-related enablers of system use.

This study draws on the TOE framework and the TAM to examine the factors influencing the actual use of decentralized e-government in public universities. The research is guided by the following questions:

(i) What are the technological factors, including IT skills, technical support, and technological infrastructure, that influence the use of e-government systems in Iraq's higher education institutions?

(ii) How do environmental and governmental factors, including rules and regulations, awareness, culture, trust in government, and quality of information, affect the use of decentralized e-government services in Iraqi universities?

(iii) How can an integrated TOE and TAM framework be developed and empirically validated to assess its effectiveness in explaining the use of decentralized e-government in Iraq's higher education sector?

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1.5 Research objectives

In response to the growing need for decentralized governance in Iraq's higher education sector, the adoption of e-government offers a strategic pathway to improve administrative performance, service delivery, and institutional autonomy. However, successful implementation requires a clear understanding of the factors that support or hinder