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Nexus between Iraqi SMEs cloud computing adoption intention and firm performance: moderating role of risk factors

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ABSTRACT

Cloud computing has been adopted in many developing nations, namely Iraq and Ghana, for its multiple benefits. Nonetheless, there is a dearth of studies on cloud computing adoption in developing nations. This study aims to investigate the factors influencing cloud computing adoption among Iraqi small and medium-sized enterprises (SMEs) and the implication of cloud computing on the SME firm performance. The diffusion of innovation (DOI) theory served as the foundation for the research model. Primary data from 396 SMEs were analysed using the structural equation modelling (SEM) approach through SmartPls 3.0 software for model testing. Resultantly, the use of cloud computing enhances firm performance. The technological factor also positively affects firm performance and cloud computing. The findings provide cloud service providers, managers, and government regulators with important recommendations to encourage the adoption and effective implementation of cloud computing in Iraq.

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1. INTRODUCTION

The integration of information technology (IT) and physical and/or intangible resources could be a potent instrument for gaining a competitive advantage in turbulent settings. In transitioning towards more competitive IT leverage, a technology called cloud computing, has been developed [1], [2]. Cloud computing, a more contemporary paradigm of computing, offers businesses access to high-end computational capabilities through the internet for a per-service price. The hallmark of cloud computing is its capacity to provide extensive computing and data storage while also enhancing flexibility and scalability. In addition to the capacity and political economy of proportion, cloud computing technology service is not only a cost-effective tool but also adequate for creating and expanding IT benefits, which are highly desired by organizations

Access to virtualized and distributed computing resources (hardware, software, networks, servers, storage, and databases) is widely available, convenient, and on-demand to cloud computing [3], [4]. The use of rental cloud services allows adjustments of the degree of consumption to the current needs [5] as cloud computing increases organizational capabilities without investing in new infrastructure, hiring new staff, or licensing new software. Cloud services also ensure a level playing field for SMEs to achieve desirable outcomes as previously unaffordable advanced technologies can be utilized [6], [7].

The limitless flexibility, improved dependability, and high security of cloud computing allow SMEs to adapt services and data for enhanced availability. Additionally, cloud computing delivers values at both strategic and operational levels by boosting yearly cloud computing has been adopted in many developing nations, namely Iraq and Ghana, for its multiple benefits. Nonetheless, there is a dearth of studies on cloud computing adoption in developing nations. This study aims to investigate the factors influencing cloud computing adoption among Iraqi small and medium-sized enterprises (SMEs) and the implication of cloud computing on the SME firm performance. The diffusion of innovation (DOI) theory served as the foundation for the research model. Primary data from 396 SMEs were analysed using the structural equation modelling (SEM) approach through SmartPls 3.0 software for model testing. Resultantly, the use of cloud computing enhances firm performance. The technological factor also positively affects firm performance and cloud computing. The findings provide cloud service providers, managers, and government regulators with important recommendations to encourage the adoption and effective implementation of cloud computing in Iraq revenue and lowering operating expenses [8], [9]. As a result, cloud computing adoption can enhance corporate operations and benefit SMEs, including those in emerging economies, such as Iraq, thus allowing them to compete in the present dynamic business market.

According to International Finance Corporation (IFC), approximately two thirds of employment in the private sector in Iraq are now provided by approximately 1 million micro, small, and medium-sized businesses in the country. According to recent surveys of IFC, 80% of businesses encounter challenges in scaling up and obtaining financing, in which many of the businesses fail to do so during the first five years of operation. One of the possible solutions to these challenges is cloud computing adoption in SMEs. This study hence aims to investigate the factors influencing SME cloud computing adoption and the effect of cloud computing on the SME firm performance. Studies have revealed that innovation positively impacted firm performance. Nevertheless, studies investigating the factors of cloud computing adoption and the adoption-performance relationship were lacking [10]. Furthermore, most of the research on cloud computing adoption only focuses on large enterprises instead of SMEs [11]–[13]. Previous empirical studies on cloud computing that used conventional statistical analysis and lacked a thorough model also drew criticism from this present study; particularly studies examining the effects of numerous organisational and unified theory of acceptance and use of technology (UTAUT) elements on business performance [14]–[16]. This study therefore investigated the different factors in adopting cloud computing among Iraqi SMEs based on the DOI theory.

2. LITERATURE REVIEW

2.1. Organisational factors

Top management support and technological preparedness are organizational factors that influence the adoption of cloud computing. Chief executive officers, who are the owners or chief managers, often lead and manage the firm as SMEs comprise simple, centralised structures. As a result, the top management determines the adoption of information systems (IS)/IT, particularly cloud technology, as they make all operational, strategic, and tactical decisions. Adequate support from senior management, a strong determinant of cloud computing adoption, is empirically evident [7], [10] as their support is crucial in assigning numerous resources, connecting services, and re-engineering corporate processes. Additionally, the top management urges organisational members to adopt the change created by new technology [1], [2].

In terms of technology readiness, the availability of IT infrastructure and human resources is pivotal in cloud computing adoption. As access to internet connectivity is required to use cloud services [10], [17], the decision of a company to employ cloud services therefore depends, in part, on having a reliable internet connection with high capacity and speed. Additionally, prior research show that companies with a strong technological foundation and the required technical expertise are much more likely to adopt new technologies. This study thus formulated the following hypotheses in assessing the impact of top management commitment and technology readiness on cloud computing adoption in SMEs [6], [7].

- H1: Organizational factors (OFs) have a positive effect on Iraqi SMEs firm performance (FP).
- H2: OFs have a positive effect on Iraqi SMEs cloud computing adoption (CCAI).
- H3: Iraqi SMEs CCAI mediates the relationship between OFs and Iraqi SMEs FP.

2.2. Individual factors

Individual factors of cloud computing adoption consist of computer self-efficacy, social influence, and resistance to change. The level of one's confidence to execute a task in their capacity is referred to as self-efficacy. Computer self-efficacy measures a person's level of assurance in performing essential activities using computer-based technology. A person with sophisticated computer self-efficacy is expected to feel more at ease when learning novel information through technology-based resources. Notwithstanding, few researchers

have claimed that consumers' impressions of the implementation of cloud storage services and their continued use in the future are influenced by their level of computer self-efficacy [6], [15].

Social influence is a term describing how personal or collective interactions may alter a person's beliefs, feelings, attitudes, or behaviours. Earlier studies on cloud computing adoption demonstrated that social influence directly impacts people's behavioural intention to use online services [2], [16]. For example, decision-makers in SMEs could be highly personally influenced by other owners, managers, co-workers, clients, business partners, suppliers, rivals, and stakeholders in the research context [6]. Additionally, social influence may also substantially impact technology adoption at the organisational level.

Technology adoption alters human behaviours and requires humans to accept the change. Nevertheless, adopters may instead reject the change by giving negative responses, which is referred to as resistance to change. Resistance to change is a key determinant of technology adoption and of the failure or success of some novel systems and services [18]. Reportedly, one of the barriers to cloud computing adoption in SMEs is resistance to change. Changes may include those caused by the implementation of cloud services in the current organisation structure, systems, operations, and procedures. As the challenges of addressing transitions effectively and efficiently are anticipated by decision-makers, many decision-makers [9], [18] resultantly experience anxiety and discomfort while considering employing new technologies, such as cloud computing. Hence, the relationship between individual factors and firm performance and cloud computing adoption was hypothesised as:

- H4: Individual factors (IFs) have a positive effect on Iraqi SMEs FP.
- H5: IFs have a positive effect on Iraqi SMEs CCAI.
- H6: Iraqi SMEs CCAI mediates the relationship between IFs and Iraqi SMEs FP.

2.3. Environmental factor

In adopting disruptive and new technologies, the impact of technology suppliers or cloud providers on cloud computing adoption is prominent [6], [8]. For instance, to accommodate to internet technology, businesses akin to Cisco Systems have raised awareness, among many enterprises, of the strategic competitive need to modify their company operations and procedures. Nonetheless, businesses today emphasise more on the importance of technology partners instead of technology providers due to the partners' continuous assistance and renowned expertise [3], [14]. Accordingly, numerous well-known cloud service providers such as Google, IBM, and Salesforce are engaging in various marketing initiatives to attract users to utilise cloud services. The marketing initiatives may include the various subsidies provided by cloud providers that would likely motivate cloud computing adoption among businesses. Hence, the following hypotheses of the relationship between cloud providers' influence and firm performance and cloud computing adoption were proposed.

- H7: Environmental factor (EF) has a positive effect on Iraqi SMEs FP.
- H8: EF has a positive effect on Iraqi SMEs CCAI.
- H9: Iraqi SMEs CCAI mediates the relationship between EF and Iraqi SMEs FP.

2.4. Technological factors

Cloud computing adoption is also affected by technological factors, which are relative advantage and compatibility. One of the components of the DOI theory is relative advantage [19]. When an organisation perceives new technology as having considerable advantages and value, they are more likely to embrace it [20]. More specifically, the organisation is more likely to adopt cloud computing due to the advantages of utilising the cloud, which facilitates an organisation to complete work more quickly, decreases expenses, and boosts productivity and flexibility in organisations [21]. Organisations are more likely to accept the latest technology when it is suitable to their requirements and current work. The degree to which an invention is viewed as compatible with the current values, prior experiences, and requirements of potential adopters is referred to as compatibility. As such, the following hypotheses of the relationship between technological factors, firm performance, and cloud computing adoption were developed.

- H10: Technological factors (TFs) have a positive effect on Iraqi SMEs FP.
- H11: TFs have a positive effect on Iraqi SMEs CCAI.
- H12: Iraqi SMEs cloud computing adoption mediates the relationship between TFs and Iraqi SMEs FP.

2.5. Moderating role of risk factors

A major reason for many businesses not using cloud services is security concerns. Security is the degree of control in place in the cloud provider to protect the data or system of the organisation from threats or assaults [2], [13], [15], [22]. One of said security concerns is the shared environment of cloud resources and the persistence of the identity management problem [2]. Many organisations hosting their data and apps in the

cloud are faced with privacy risk as one of their major concerns [2], [13], [15], [22], [23]. If organisations employ cloud services, they will lose full control over information that is held and maintained by a third party. Resultantly, their data confidentiality will be jeopardised, which will result in privacy violation. Thus, the following hypotheses were put forth:

- H13: Risk factors (RFs) moderate the relationship between OFs and Iraqi SMEs.
- H14: RFs moderate the relationship between IFs and Iraqi SMEs FP.
- H15: RFs moderate the relationship between EFs and Iraqi SMEs FP.
- H16: RFs moderate the relationship between TFs and Iraqi SMEs FP.

3. CONCEPTUAL AND THEORETICAL FRAMWORK

The framework used is based on the DOI theory, which explains the relationship among the different factors (organisational, individual, environmental, technological, and risk factors), cloud computing adoption intention, and firm performance. The independent variables of this model were the factors of cloud computing adoption, which are (a) organisational factors (top management support and technology readiness), (b) individual factors (computer self-efficacy, social influence, and resistance to change), (c) environmental factors (cloud provider's influence), and (d) technological factors (relative advantage and compatibility). The dependent variable of this model was firm performance. The mediating variable was cloud computing adoption intention. Finally, the moderating variables were the risk factors, which were privacy risk and security concerns. Figure 1 illustrates the relationship between factors of cloud computing adoption, the moderating role of risk factors, cloud computing adoption intention, and firm performance.

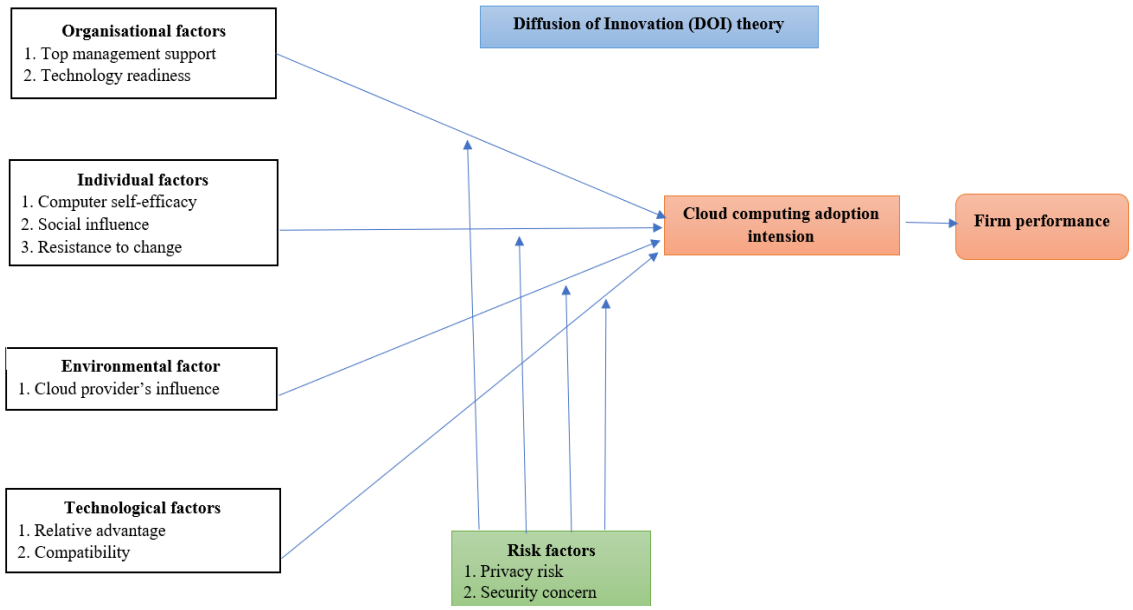

Figure 1. Conceptual framework of cloud computing adoption intention and firm performance

4. METHOD

In this study, the questionnaire method was utilised to investigate the correlations between variables and assess the hypotheses proposed. Overall, the 12 factors in the research model and the intention to adopt cloud computing were measured using 51 closed-ended statements and questions. These were modified to fit this study and the Iraqi SMEs, some of which were adopted from earlier studies context. The closed-ended statements and questions were created using a five-point Likert scale, with 5 being strongly agree and 1 being strongly disagree, in both English and Arabic. To ensure the instrument had all the necessary pieces for measuring each build, an evaluation of the instrument was conducted. Seven professionals with expertise in survey questionnaire evaluated the research instrument by offering comments and recommendations for the instrument to ensure content validity. Based on their evaluation, a few typographic errors were fixed, and certain ambiguous questions and statements were revised. The units of analysis were Iraqi SMEs (managers or owners of SMEs). A simple random sampling technique was applied to collect the primary data. Table 1 describes the sources of each construct.

Table 1. Instrument sources

Variables	Constructs	Items	Sources
Organizational factors	Top management support	4	[24]
	Technology readiness	5	[25]
Individual factors	Computer self-efficacy	3	[26]
	Social influence	3	[27]
	Resistance to change	3	[22]
Environmental factor	Cloud provider's influence	3	[15]
Technological factors	Relative advantage	5	[28]
	Compatibility	4	[29]
Risk factors	Privacy risk	3	[30]
	Security concern	3	[31]
Cloud computing adoption intention		10	[32]
Firm performance		5	[33]

5. DATA ANALYSIS, FINDINGS, AND DISCUSSION

5.1. Demographic information

Among the distributed questionnaires, 396 valid responses were run with the statistical analysis. Among the valid respondents, 45% were owners and 55% were IT managers of Iraqi SMEs. Additionally, 39% of respondents had 6 to 10 years of experience in SMEs and 61% had more than ten years. The total number of employees per SME ranged from 128 to 10, more than 50% of the SMEs were 11 to 20 years old, and a further 29% were more than 20 years old.

5.2. Model analysis, hypothesis testing, and discussion

To perform the partial least squares-structural equation modelling (PLS-SEM) analysis, the researcher employed the SmartPLS 3.0 software package by [34]; a popular method across many social scientific fields [34]. The PLS-SEM analysis was carried out in two stages; the evaluation of the measurement model followed by the evaluation of the structural model [34]–[37]. After being analysed, the PLS-SEM results were applied to address the research objectives. The primary evaluating criteria in the assessment of measurement models (cross-loadings and heterotrait-monotrait ratio of correlations) for ensuring the validity and reliability of the measurement model were internal consistency reliability (composite reliability and cronbach's alpha), convergent validity (outer loadings and average variance extracted), and discriminant validity [38].

Hair *et al.* [37] suggested a procedure for assessing the measurement model, of which the first step was examining the indicator loadings. After determining internal consistency reliability using composite reliability in the second stage, the convergent validity of each construct measure was evaluated in the third step. Lastly, the discriminant validity was evaluated in the fourth phase. The measurement model was reviewed and presented in the following sections based on [37] proposed steps. The current study ensured that all of the assessment model criteria were met. The model was then analysed to test the 16 hypotheses, see Figure 2.

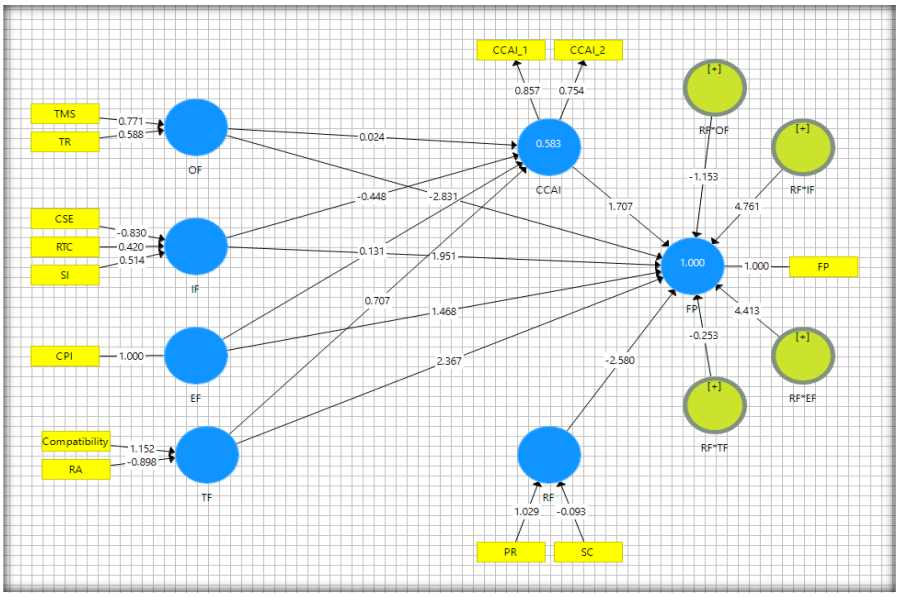

Figure 2. Model analysis

Path coefficient estimations were created to examine the proposed relationships between the components. The individual route coefficients of the structural model could be considered standardised beta coefficients of conventional least square regressions [36]. A coefficient value close to +1 denotes a strong positive association, whereas a coefficient value close to 0 denotes a weak relationship between the independent and dependent constructs, which is often non-significant (ibid). To test the significance of the route coefficients, a bootstrapping procedure with 5,000 samplings was conducted, and the t and p values, as well as bootstrapping confidence intervals, were checked [34].

The critical values t=1.96 (significant level=5%) for the two-tailed test and t=1.64 (significant level=5%) for the one-tailed test were used to assess the statistical significance of the hypothesised connections. The path coefficients, standard errors, t-values, and p-values for all pathways were presented using a 5,000-sample bootstrapping procedure as suggested by [37], [38]. Table 2 summarises the criteria used to evaluate the 16 hypotheses made between the constructs in this study. According to the estimated statistics, 11 hypotheses (H1, H2, H4, H5, H6, H10, H11, H12, H13, H14, and H16) supported the null hypothesis and five hypotheses (H3, H7, H8, H9, and H15) were not supported.

Table 2. Hypothesis summary result

		t Statistics	p Values	Result
HI	OF>FP	2.06	0.00	Supported
H2	OF>CCAI	2.15	0.00	Supported
H3	OF>CCAI>FP	0.01	0.98	Not supported
H4	IF>FP	6.37	0.00	Supported
H5	IF>CCAI	2.85	0.00	Supported
H6	IF>CCAI>FP	5.61	0.00	Supported
H7	EF>CCAI	1.76	0.07	Not supported
H8	EF>FP	0.05	0.95	Not supported
H9	EF>CCAI->FP	0.05	0.95	Not supported
H10	TF>FP	7.95	0.00	Supported
H11	TF>CCAI	2.18	0.03	Supported
H12	TF>CCAI->FP	5.47	0.00	Supported
H13	RF*OF>FP	2.27	0.02	Supported
H14	RF*IF>FP	2.11	0.00	Supported
H15	RF*EF>FP	0.14	0.88	Not supported
H16	RF*TF>FP	3.68	0.00	Supported

As SMEs are the backbone of the economy that comprise most business organisations, particularly in developing nations, SMEs represent an expanding market for cloud service providers. Resultantly, this study provides cloud service providers and IT professionals with important ramifications that will help them identify the driving forces behind cloud adoption [8], [11], [12]. Nonetheless, especially in underdeveloped nations like Iraq, businesses remain unaware of the advantages of using cloud services. Despite cloud computing still being perceived as novel and disruptive [9], [15] the findings suggest that organisational, individual, and technological factors are crucial considerations in SMEs cloud computing adoption intention. This study discovered a strong influence of cloud computing adoption, particularly the use of cloud-assisted processes and operations, on SMEs firm performance. The findings suggest that SMEs would benefit strategically and operationally from adopting cloud computing including growing yearly revenue, cutting costs, boosting flexibility, and improving performance. Similarly, these findings align with prior studies demonstrating firm performance due to the implementation of any IT [2], [3], [10].

6. CONCLUSION

To encourage the usage of cloud computing in Iraq, top management support is key. This study demonstrated that several businesses among Iraqi SMEs continue to struggle with cloud computing adoption due to the lack of top management support, which emphasises that cloud computing adoption intention is also based on the viewpoints of those beyond and above the IT department. This study further indicates that Iraqi SMEs face challenges with cloud computing adoption due to the lack of cloud provider assistance, the trialability of such a technology, and ongoing security and privacy concerns. Cloud service providers must then boost the rate of cloud computing adoption in Iraq by overcoming said challenges. Additionally, technological factors and organisational factors have also accelerated cloud computing adoption intention.

Some of the shortcomings of this study might inspire new directions for investigation. Although this investigation was rigorously carried out to support the accuracy of the research model, the results might have been influenced by the research context. Firstly, as the sample was limited to a single nation, this study only sheds light on said national situation. Resultantly, this research recommends conducting an additional

investigation with data from other comparable nations. Secondly, statistics were only gathered from cities; businesses in rural regions might not rely on cutting-edge technology. Thirdly, longitudinal data may have been used to validate the study model that was proposed. Finally, this study used linear statistical approaches to analyze the data; future work can use non-linear and non-compensatory tools such neural networks, support vector machines, random forests, and fuzzy sets for reliable prediction.

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