

# ACC-PH: a Comprehensive Framework for Adopting Cloud Computing in Private Hospitals

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□ **Abstract**—The healthcare sector is of paramount importance as it provides necessary medical services to sustain human lives. In the private healthcare sector, organisations place equal emphasis on profits as on providing essential medical services. Thus, to offer optimal health aids at low cost, private healthcare organisations try to acquire the best technologies available. Cloud computing offers a solution to cutting business expenses while boosting productivity because it supplies computing services through third parties more cost-effectively. Nonetheless, recent studies have shown that adopting cloud computing services in private healthcare facilities in Saudi Arabia is behind when compared to other sectors. This study presents an optimal data collection and framework validation methodology, combining qualitative and quantitative approaches to examine proposed factors influencing Adopting Cloud Computing in Private Hospitals (ACC-PH) in Saudi Arabia. Accordingly, this research is expected to enhance the implementation of cloud computing in Saudi private hospitals.

**Index Terms**—cloud computing, technology adoption models, Saudi private healthcare sector.

## I. INTRODUCTION

THE healthcare sector is an essential pillar of all civic assemblies worldwide. They supply imperative conditions for human existence on Earth. Accordingly, they seek to keep pace with all developments to render exemplary medical services. This incorporates a shift from traditional health systems management to modern electronic systems. Thus, in light of their continuous endeavour toward development, hospitals have tried moving toward implementing Information and Communication Technologies. That movement is called Health Systems.

E-Health systems have provided numerous advantages for healthcare organisations and their stakeholders. They have facilitated sharing of data for doctors, patients, and other health practitioners [1]. Implementing E-Health systems has also raised healthcare quality and safety [2]. In addition, several E-Health programmes have been used to enhance education and positively change the behaviour of many patients and

health practitioners [2]. However, despite the dramatic paradigm shift in the medical care field caused by the utilisation of E-Health systems, these systems have undergone challenges vastly.

The higher cost and shortage of technical experts primarily hinder the implementation of E-Health systems in hospitals. These obstacles further complicate the situation, particularly for the private healthcare sector, which is more concerned with profitability principles. Technologies used in E-Health systems need periodic maintenance, updates, and technical support, which increases the financial burden on healthcare organisations [2]. Also, healthcare organisations face a significant barrier to the availability of skilful technicians [3]. As technicians' presence operates E-Health systems, their absence is a hurdle. Consequently, hospitals ought to employ contemporary technologies to resolve such issues.

Cloud computing is the desired innovation that can help hospitals overcome their E-health problems. Cloud computing removes upfront capital investments in technical infrastructure and maintenance from hospitals' shoulders to be cloud providers' responsibility [4]. Cloud adoption benefits further reduce the need for technical experts, whose availability is essentially a dilemma facing hospitals. This will also indirectly contribute to a reduction in costs associated with recruiting technicians. And given the profitability model of private hospitals, using cloud technology in E-Health programmes is a compelling solution. It would therefore be surprising not to embrace cloud computing in this vital sector in countries that want inclusive development and economic prosperity.

In Saudi Arabia, which seeks a digital transformation to achieve an extraordinary economic renaissance according to a new vision, the private healthcare sector remains technically underdeveloped. Some private hospitals in Saudi Arabia still generate health records only in paper versions [5]. This makes it seem like certain private hospitals in Saudi Arabia will never make the leap to more cutting-edge technologies like

cloud computing. Previous research has revealed that the use of cloud technology in the Saudi medical care sector, including the private industry, is the lowest in the nation [5]. Given the critical role of these hospitals in Saudi Arabia, their reluctance to adopt suitable technologies poses a danger.

The latest recent data from Saudi Arabia's Ministry of Health show that private hospitals served more than 43 per cent of patients in the country in 2021 [6]. Hence, it is of the utmost importance that these types of hospitals continue to exist and grow to serve a large portion of the Saudi population with necessary medical care. This necessary sustainability and development drive Saudi private hospitals to catch up with technical development by adopting appropriate modern technologies such as cloud computing.

Therefore, this study aims to help Saudi private hospitals in adopting cloud computing by establishing a framework to comprehend the most effective aspects influencing the adoption decision. The remainder of this research will be constructed, beginning with a literature review to identify elements that have proven influence in a similar context. The construction of the comprehensive framework presented in this study comes next. Finally, the study will be ended by determining the most appropriate methodologies for data collection and validating the proposed model.

## II. LITERATURE REVIEW

Prior studies on cloud technology adoption topics in the Saudi healthcare industry are investigated in this section. The discussion includes the studies of [7]–[10]. This analysis seeks to discover determinants that have proven to affect cloud technology implementation in Saudi hospitals. Consequently, these factors will serve as primary pillars of a comprehensive framework designed to assist private hospitals in Saudi with cloud computing's successful utilisation.

All the papers analysed in our research focused on the technological context of analysing potential implications from this perspective. Prior research in the Saudi healthcare industry indicated positive effects of relative advantage, compatibility, security, and reliability as technological factors.

The relative advantage factor, which means the extent to which adopting the cloud raises the efficiency of other current technologies in institutions, has emerged as an influential factor in the studies of [7], [10]. In contrast, concerns of healthcare institutions in Saudi Arabia towards security issues with the cloud have shown its impact in the other two studies [8], [9]. In addition, [7]–[9] argued that adopting cloud technology in Saudi hospitals is positively affected by cloud compatibility with healthcare organisations' current policies and principles. Moreover, the reliability of providing cloud services with no interruptions positively impacts the adoption in Saudi hospitals as solely approved by [8].

Although there are apparent conflicts in the findings, as shown in Table I., the literature showed the importance of some technological factors. However, the technological context was not the only context influencing cloud computing adoption.

TABLE I.  
THE CLOUD TECHNOLOGY DEPLOYMENT IN SAUDI'S  
HEALTHCARE SECTOR: TESTED VARIABLES

	Reference [7]	Reference [8]	Reference [9]	Reference [10]
Relative Advantage	√	∅	×	√
Technology Readiness	∅	∅	∅	×
Compatibility	√	√	√	×
Complexity	×	∅	×	×
Regulations and Rules	×	∅	×	√
Competitive Pressure	×	∅	√	∅
External Expertise	∅	∅	×	×
Costs Analysis	∅	∅	∅	√
Top Management Support	√	∅	√	×
Attitude toward Change	∅	√	×	√
Internal Expertise	∅	∅	∅	×
Prior Experience	√	∅	×	×
Security	∅	√	√	∅
Organisational Readiness	×	∅	√	∅
Data Control	∅	×	∅	∅
Data Privacy	∅	×	∅	∅
Reliability	∅	√	∅	∅

\* × = negative impact, √ = positive impact, ∅ = not investigated.

Several crucial variables originated from the organisation's scope and positively influenced cloud technology deployment in Saudi medical centres. Ayadi's [9] research indicated that organisational readiness with required human, technological, and financial resources positively affected cloud adoption in Saudi hospitals. Human resources, in particular, have played a prominent role in shaping influences of adopting from the organisational context.

Human resources impact was proved in [7], [9], which revealed a positive effect of involvement and support from senior executives (top management support) on the decision to embrace the cloud. Their prior technological experience is another significant factor, as [7] claimed. In addition, [8], [10] emphasised that the desire, feeling, and orientation of workers, particularly Information Technology (IT) department employees, towards the new technology was a major factor in the cloud adoption decision. However, this factor and others were studied in contexts other than organisational context.

The attitude towards change was not investigated by [8] as an organisational but technological factor. However, we believe this factor relies on human elements that are an integral part of an organisation, meaning it must be considered in that setting. The same point of view applies to another variable that has strongly influenced cloud migration in Saudi hospitals and was addressed from a business perspective. This factor is cost analysis which refers to the extent that analysing returned benefits and expense cost of adopting cloud computing can affect the adoption decision [10]. We argue that cost analysis is carried out by relevant employees within healthcare organisations, which places it in the organisational context. While we place cost analysis as a determining factor within organisational influencers, prior research has identified other influencers originating from external contexts.

The literature revealed some influencing factors on the cloud adoption decision came from the surrounding environment of Saudi healthcare organisations. According to [9], Saudi hospitals' use of the cloud is largely influenced by industry competition as they are inspired by competitors' use of cloud computing and its unique benefits. Another environmental factor is the impact of government rules and regulations which was proven in a study conducted by [10]. However, the impact of environmental context was rejected or neglected in the other studies.

Almubarak's [7] study did not show the influence of any environmental factors. And a study by [8] did not investigate the environmental context at all. However, this cannot be an argument not to investigate this crucial context. Specifically, this study is situated within the context of a developing country, necessitating the examination of critical environmental factors, notably cloud providers and Internet connection, which have not been investigated in prior studies.

In short, this literature review contributes to highlighting the most significant influencing factors in the same context of our research. It also highlighted significant gaps represented in the lack of research targeting the Saudi healthcare sector and its total absence in the private healthcare sector. In addition, prior studies have been unable to analyse the impact of some factors that cannot be ignored, particularly in the setting of a developing nation like Saudi Arabia. Therefore, to fill these gaps, developing a novel comprehensive framework for cloud deployment in Saudi private hospitals becomes an essential necessity.

### III. FRAMEWORK

This section discusses the development of a comprehensive framework for Adopting Cloud Computing in Private Hospitals (ACC-PH) in Saudi Arabia. The framework is going to be constructed by merging two of the most significant theories in deploying new technology: the theory of Technology, Organisation, and Environment (TOE) and the model of Diffusion of Innovation (DOI).

#### A. The Theory of Technology, Organisation, and Environment

Tornatzky [11] established the model of the TOE to determine constraints and opportunities that influence adopting an innovation within an organisation. It considers technical and non-technical issues, like the surrounding environment and internal structure. The TOE framework examines how an organisation embraces and executes a new technology and how the technology, organisation, and environmental contexts can influence that adoption [10]. The significant advantage of TOE is that it provides researchers with an open land in which they can categorise features based on each circumstance within a wide sphere [7]. However, this theory suffers some glaring flaws that cannot be ignored. Researchers have contended that TOE does not account for all variables in every context; for example, cloud computing requires multiple conceptual approaches to articulate a fuller insight into the adoption choice [2].

The TOE theory alone is insufficient to determine all factors impacting the choice to uptake cloud technology in the healthcare industry; hence, additional approaches must supplement it. Many studies used the framework of TOE along with the model of Diffusion of Innovation (DOI) to handle the technological and operational challenges of embracing cloud technology involving the medical care sector [12].

#### B. The Model of Diffusion of Innovation

The DOI model is the most often used in conjunction with the TOE framework because they complement one another and are used together in the Saudi healthcare context [7]. Roger [13] developed the DOI model to evaluate variables that influence innovations' deployment. According to Roger's theory, adopting technology involves numerous steps, from initial awareness of innovation to accepting or refusing, executing, and affirming the decision. The DOI theory states that each innovation has a set of features that affect its prevalence, and these features are: "relative advantage, compatibility, complexity, trialability, and observability" [14].

Relative advantage examines the impact of an innovation on the system, compatibility assesses how well the innovation aligns with current systems, complexity determines the usability of the technology, trialability analyses the accessibility of the innovation, and observability reflects the innovation's visibility level [15]. According to previous studies, relative advantage and compatibility have proven to affect the selection process to uptake cloud technology. They will therefore be taken to form the ACC-PH framework factors proposed in this research.

#### C. The Comprehensive Framework for Adopting Cloud Computing in Private Hospitals

Most of the ACC-PH framework components presented in Fig. 1 will be derived from the literature as they proved their positive impact in the same context. In addition, other factors will be added to bridge the lacunae in literature and develop an essential comprehensive framework. The ACC-PH framework will investigate novel variables not yet explored in the

research literature within our research context. These factors are *cloud providers* and *Internet connection*.

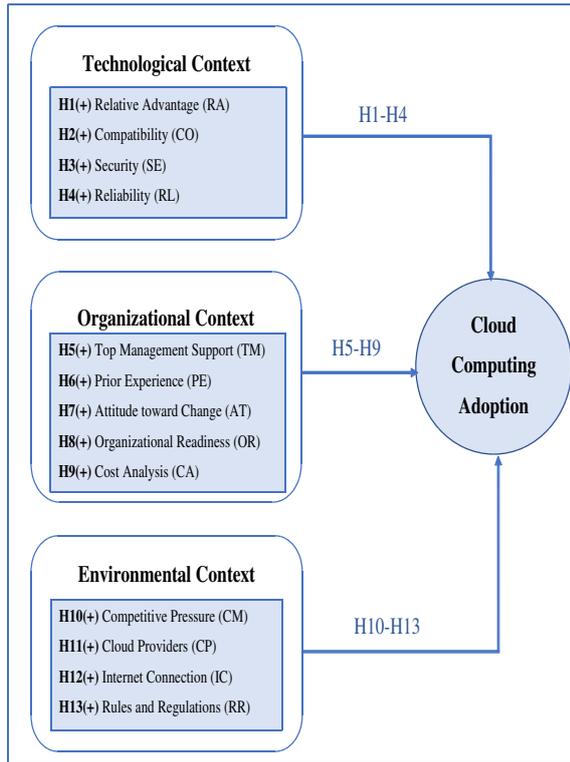


Fig. 1 The Comprehensive Framework for Adopting Cloud Computing in Private Hospitals (ACC-PH)

*Cloud providers* and *Internet connection* factors considerably increase the likelihood of utilising cloud technology in the developing world. However, they have not been sufficiently investigated in Saudi Arabia's medical care sector. Hence it is essential to analyse these aspects in Saudi Arabia, which is a country characterised as a developing nation, where cloud service providers are scarce [16] and Internet connectivity is limited [17]. Therefore, adding these factors to the ones that have demonstrated a positive influence in earlier research will undoubtedly contribute to developing a comprehensive framework to facilitate embracing cloud technology in the Saudi Private medical care industry. Importantly, each variable will be examined in its proper context and based on the established TOE theory, which includes technological, organisational, and environmental aspects. Thus, all ACC-PH factors will be analysed and hypothesised within these three contexts.

1) *The Technological Context*  
a. *Relative Advantage*

**The Relative Advantage (RA)** factor describes the extent to which a hospital can acquire additional advantages by utilising cloud computing [9]. Organisations are captivated by the cloud because of its decentralised structure, instantaneous provisioning of computing resources, and expansive storage capabilities [18]. In addition, cloud systems are cost-effective, so businesses are more likely to invest in cutting-edge tech-

nology that contributes directly to their bottom line [19]. Furthermore, healthcare decision-makers widely believe that implementing cloud computing can improve medical services by increasing responsiveness and reducing technological infrastructure failures [7].

Although the deployment of cloud computing in healthcare facilities may provide significant benefits, it is crucial to acknowledge the presence of some risks associated with its adoption. The storage of confidential medical information on remote computer systems raises concerns about privacy and security [20]. The lock-in effect poses additional hazards that result in cloud users becoming dependent on the services offered by the cloud service provider, so limiting customers' flexibility in their choices [21]. In addition, the adoption of cloud computing has the potential to amplify the risk of data loss and exacerbate system downtime when utilising an inadequate cloud provider [22]. Moreover, cloud adoption could cause compliance problems if the cloud provider violates data protection and healthcare sector requirements [23], [24].

However, healthcare organisations can mitigate these risks in order to optimise the considerable advantages offered by cloud computing. To protect hospital operations and patient data, hospitals should conduct risk assessments, evaluate multiple cloud providers, review service level agreements, encrypt data, restrict access, and create contingency plans [25], [26]. These proactive measures can bolster their security posture and mitigate potential risks associated with cloud adoption.

Therefore, it is of the utmost importance to investigate the relative advantage factor as a positive element in deploying cloud technology in private medical facilities in Saudi Arabia. Hence the following hypothesis is proposed.

**H1: Recognising the relative advantage of cloud technology enhances the likelihood of adopting cloud computing in Saudi private hospitals.**

b. *Compatibility*

**Compatibility (CM)** refers to evaluating how well the to-be-adopted technology aligns with the enterprise's current values, historical experience, and operational requirements [13]. Some perceive compatibility as a crucial factor for encouraging the implementation of technologies that are deemed to align with present organisations' strategies, principles, and employee abilities [27]. Precisely, compatibility in the view of cloud adoption confronts more unique requirements, which include ensuring the simplicity of exchanging data between traditional and cloud systems (integration) and the adjustment of services (customisation) [28].

However, many believe that compatibility issues hinder widespread technological adoption, including cloud computing [29], [30]. Yet, this argument could be obscured by numerous studies that have validated the significance of the compatibility factor by demonstrating its impact on cloud acceptance [27], [31]. Therefore, to experience the advantages of cloud adoption, medical institutions must realise the necessity of compatibility and implement necessary up-

grades to the current system. Based on that, we posit compatibility as a key influencing variable in deploying cloud computing in Saudi private hospitals. The next hypothesis is, therefore, proposed.

**H2: Higher compatibility enhances the likelihood of adopting cloud computing in Saudi private hospitals.**

*c. Security*

**Security (SE)** refers to how well a cloud provider safeguards and protects the data of both users and organisations [32]. Security cannot be overlooked when implementing cloud technology in the healthcare industry, which varies significantly from other sectors due to its primary security and privacy concerns that can sometimes be life-threatening [12]. In current E-Health systems, ensuring the safety and privacy of healthcare data remains crucial even without migrating to an Internet-based technology such as the cloud [33]. Adopting cloud computing in E-Health systems raises risks associated with trust and confidentiality of data sharing [34]. Integrity and availability are other security concerns related to migrating E-Health systems to the cloud [20].

The preservation of confidentiality, integrity, and availability has significant importance in ensuring robust cloud security within E-Health systems. Ensuring the security of confidential health-related information, preserving data accuracy, and guaranteeing uninterrupted access to data and applications are fundamental aspects [20], [34]. Protecting these vital components in the cloud calls for outstanding encryption, access restrictions, data integrity mechanisms, and a solid infrastructure [20].

Therefore, security must maintain high standards to encourage hospitals to benefit from cloud computing and its numerous benefits. Cloud computing can enable a highly secure software environment [35]. However, healthcare institutions must ensure that cloud providers implement proper security measures [10].

Providers of cloud services have an important part to play in helping the healthcare industry conform to regulations and safeguard sensitive patient data. To comply, they must establish strong access restrictions, encryption techniques, perform frequent security audits, and have disaster recovery plans in place [23]. Accurate documentation and independent verification boost healthcare organisations' confidence and encourage wider use of cloud computing [36].

However, the price of moving to the cloud may rise if strict security measures are implemented [37]. There are a number of factors that contribute to this, including strong access restrictions, encryption, security inspections, external certifications, disaster recovery, and data redundancy.

Therefore, healthcare organisations should collaborate with cloud service providers to strike a good balance between security levels and economic efficiency [37]. Various levels of security tiers may be accessible, and allocating resources towards comprehensive security measures might result in enduring advantages, mitigating the likelihood of data breaches

and minimising regulatory penalties [38]. Ultimately, this investment is necessary to maintain the confidentiality, availability, and integrity of sensitive healthcare data in the cloud.

Thus, we assert it is pertinent that ensuring high-level security standards will increase acceptance of cloud technology deployment in the Saudi private medical care industry. The next hypothesis is, thus, proposed.

**H3: Higher security levels enhance the likelihood of adopting cloud computing in Saudi private hospitals.**

*d. Reliability*

**Reliability (RL)** refers to a system's capacity to accomplish expected tasks, including delivering high-quality services at high speed while lowering failure rates and offering data recovery in case of such failures [39]. In healthcare delivery, system reliability takes on a greater significance. Access to accurate and trustworthy patient data is crucial for healthcare providers [40]. Thus delays in responding to urgent instances that could endanger a patient's life highlight the increasing importance of computing environments with scalable capabilities and reliability [41].

Therefore, cloud computing's capacity to maintain a highly dependable computing environment has the potential to improve healthcare delivery significantly [42]. Since data are kept and accessed from numerous distinct places, the system will not be down if one server crashes, which is the essential characteristic of cloud computing [41].

Accordingly, considerable research has demonstrated that the reliability variable is crucial and positively influences cloud computing deployment, particularly in the Saudi medical care industry [8], [39]. Hence the next hypothesis is proposed.

**H4: Higher reliability enhances the likelihood of adopting cloud computing in Saudi private hospitals.**

*2) The Organisational Context*

*a. Top Management Support*

**Top Management Support (TM)** is meant by the degree to which an organisation's leaders are behind the initiative to embrace innovation and give it the resources it needs to succeed [7]. Top executives are taking their important role from being the ones who are in charge of making critical decisions [43]. A recent study identified senior management's acceptance and understanding of new technology as a critical factor influencing adoption intentions [44]. It is perceived that if upper-level management realises the value of the technology, they will encourage their employees to utilise it. If they do not, they will act as a roadblock [45]. In addition, when leaders can understand what is needed to implement cloud computing and how to accomplish it, they can then provide human resources and equipment essential for cloud adoption [46].

Therefore, the decision to implement new technologies within organisations is heavily influenced by the support of top management [47]. Numerous studies have indicated that the level of support from high management influences cloud computing embracing [48], [49], including Saudi healthcare

organisations [7], [10]. Therefore, the next hypothesis can be proposed.

**H5: Top management support enhances the likelihood of adopting cloud computing in Saudi private hospitals.**

*b. Prior Experiences*

**Prior Experiences (PE)** allude to the degree to which the impact of past technical skills influences the choice to adopt new technology [7]. The lack of technological expertise among decision-makers exacerbates the resistance to changes towards up-taking technology like cloud computing [19]. Some studies suggest that the absence of technical expertise among top executives regarding cloud computing impedes adoption [43]. In contrast, top managers' familiarity with the technical aspects of cloud computing can help them see the potential advantages of making the switch [7].

In the Saudi medical care sector, the influence of top managers' prior experience has positively impacted cloud computing deployment [7]. Thus, the next hypothesis can be proposed.

**H6: Top managers' sufficient prior technical experience enhances the likelihood of adopting cloud computing in Saudi private hospitals.**

*c. Attitude towards Change*

**Attitude towards Change (AT)** alludes to the degree to which favourable or unfavourable emotions, cognitive aspects, behavioural control, and beliefs that employees hold about new technology can affect embracing innovation [8], [44]. Employees are firms' primary pillars of introducing new technology [47]. This is certainly relevant within information technology departments. They are the ones who are accountable for the majority of the adoption process. If they have a negative attitude, they will not put forth their best effort in training, learning, and engaging in the adoption [47].

Some ascribe resistance to adopting new technology to the extensive training required for employees to grasp the skills necessary to work with these systems [8]. Others, however, believe that this training is crucial for preparing workers within institutions to adopt a more optimistic stance towards emerging innovations, hence facilitating the adoption process [48].

Therefore, the attitude towards change can positively influence new technology deployment. And this has been proven in past research that examined the deployment of cloud technology in Saudi private medical care institutions [8], [10]. Hence, the next hypothesis is proposed.

**H7: Positive employees' attitudes towards change enhance the likelihood of adopting cloud computing in Saudi private hospitals.**

*d. Organisational readiness*

**Organisational Readiness (OR)** refers to how the availability of people, financial, and technological resources and an organisation's ability to absorb and apply new information and knowledge can influence the acceptance of new technology [7], [28], [50]. Transforming non-technological institutions, like healthcare institutions, from traditional E-Health systems to modern cloud systems requires readiness to absorb

knowledge and information associated with these technologies. In addition, access to sufficient human, financial, and technological resources is crucial for modernising healthcare organisations with such a transition, as it directly influences the ease of adopting and implementing new technology within an institution [51].

Research has examined how much organisational readiness, including human, financial, and technological resources, can affect cloud computing adoption. Specifically, this factor has been investigated at the level of healthcare institutions in Saudi Arabia and has demonstrated its influence on cloud technology development [7]. The next hypothesis is, therefore, proposed.

**H8: Organisational readiness enhance the likelihood of adopting cloud computing in Saudi private hospitals.**

*e. Cost Analysis*

**The Cost Analysis (CA)** factor refers to the extent to which a comprehensive organisation-wide evaluation of benefits versus anticipated costs of deploying new cloud technology can impact the adoption decision [2]. The perceived usefulness of a technological innovation hinges on the balance between its advantages and expenditures, causing businesses constant concern over the price tag of adopting cutting-edge innovations [52]. It is no secret that the staggering expense of upgrading to modern technologies is a major obstacle for organisations when it comes to IT deployment and acceptance [4].

The deployment costs of cloud computing adoption can include capital expenditure (CAPEX), which includes one-time costs and operating expenditure (OPEX), which includes recurring costs [53]. The capital expenses of deploying cloud computing may include the cost of building up network and Internet connections, while the operating costs pertain to data transfers between customers and providers of the cloud [53]. Based on [2], for organisations seeking the utilisation of cloud technology, "The cost should be analysed in both capital expenditure (CAPEX) and operational expenditure (OPEX)". Moreover, it is essential for the cost analysis to consider all relevant elements that impact the decision-making process for potential cloud clients.

The phenomenon of customer lock-in can provide additional complexity to the decision-making process of adopting a certain product or service. This is particularly relevant in cases when certain features are only provided by a specific vendor and are not accessible through open-source alternatives [54]. This can cause consumers to become reliant on a single service provider, restricting their flexibility and options.

Furthermore, the possible hazards associated with the removal of key services from the market raise substantial apprehensions for organisations, particularly in vital sectors such as healthcare [55]. Within the context of a hospital's daily operating processes, the absence of specific essential services might result in interruptions and difficulties in identifying appropriate substitutes.

On the other hand, organisations are increasingly turning to cloud computing as an on-demand IT service model to cut costs and increase productivity [12]. Cloud computing eliminates the need for initial and ongoing investments in an organisation's information technology infrastructure, lowering overall costs [8]. Cloud computing technology helps organisations save money on start-up expenses by eliminating the need to purchase and set up expensive hardware to power computing services [56].

Therefore, weighing the advantages and drawbacks of using cloud technology in terms of cost analysis as a potential influencer to the decision to adopt the cloud is important. Numerous past research has shown the positive impact of analysing cost on cloud adoption [10], [52]. Therefore, the next hypothesis is proposed.

**H9: Efficient cost analysis enhances the likelihood of adopting cloud computing in Saudi private hospitals.**

3) *The Environmental Context*  
a. *Competitive Pressure*

**Competitive Pressure (CP)** alludes to the influence that rival enterprises within an industry have on whether or not a certain institute adopts a given invention [7], [57]. Competitors using cutting-edge technology exert pressure on non-adopters in the same industry by enhancing work productivity and delivering superior services [58]. Also, competitors exert influence on executives to deploy innovative technologies like cloud computing to meet market demands and enhance operational effectiveness [59].

Prior studies have found that the competitive pressure variable effect on the deployment of cloud technology ranged from being natural to having a negative or positive impact. Gutierrez' [60] study concluded that the competitive pressure variable did not impose any influence on Cloud technology utilisation, while [7] demonstrated the neutrality of the factor impact. However, the vast majority of research has proven the significant positive influence of the competitive pressure factor in adopting cloud systems [9], [10], [61]. The next hypothesis is, thus, proposed.

**H10: Competitive pressure enhance the likelihood of adopting cloud computing in Saudi private hospitals.**

b. *Cloud Providers*

**The Cloud Providers (CP)** factor refers to how the availability and location of providers impact organisations' decisions regarding the adoption of cloud computing. Cloud providers are third-party individuals, businesses, non-profits, or government agencies that store data for another organisation [62]. Since cloud providers are responsible for most cloud functions, they also have the primary burden of ensuring the safety of stored data [63]. The fundamental cause for concern regarding cloud providers is the location where the information is stored.

Users who store sensitive information, like health information, in the cloud generally desire to be aware of the location at which their data are stored. They may prefer to choose a particular location [64]. However, many cloud users are unaware of the cloud provider's data centre location where their

data are stored [65]. Data may be maintained in a country other than the one where the adopting institution is situated, contributing to increased threats to data security and privacy and complications of different laws governing data [66]. Hence, data location is a core principle of successful cloud computing deployment [67]. Therefore, we propose that the existence of a cloud provider in the same country as cloud consumers can increase the likelihood of adoption.

In the context of this research, there is a severe shortage of providers of the cloud in Saudi Arabia [16]. Therefore, adding new service providers in the country may positively affect the deployment of this innovation, particularly by institutes extremely concerned about data security and privacy, such as healthcare institutions. Thus, the next hypothesis is proposed.

**H11: Cloud providers' availability within the same country enhances the likelihood of adopting cloud computing in Saudi private hospitals.**

c. *Internet Connection*

**The Internet Connection (IC)** factor refers to how the availability of a capable Internet connection influences organisations' decisions to adopt cloud computing. Access to the Internet is crucial for the functionality of cloud technology, as it leverages Internet technology to deliver computer services to users [68], [69]. Cloud technology must maintain a high-speed, stable, and highly accessible connection at an affordable price [70]. If the Internet connection is inadequate, the benefits of employing cloud computing in businesses will be non-existent [17]. Thus, a fast and reliable Internet connection is essential as it is the primary link between clients and providers within the cloud, ensuring optimal speed and performance [71].

Several studies indicate that network connection is the most effective element in cloud technology deployment, particularly in developing nations [72], [73]. Specifically, in Saudi Arabia, the Internet connection was a significant worry for organisations planning to adopt cloud computing [74]. Some high-level Saudi executives complain about the poor infrastructure for Internet connections and the high cost of the Internet [17].

Therefore, before developing cloud systems, suppliers of Internet services should seek to enhance Internet architecture and ensure full functionality for the Internet backbone service at an affordable price [17]. Thus, improving Internet connectivity infrastructure by communications companies in Saudi Arabia may enhance the decision likelihood of private hospitals to deploy cloud technology. The next hypothesis is, hence, proposed.

**H12: Internet connection availability and high functionality enhance the likelihood of adopting cloud computing in Saudi private hospitals.**

d. *Rules and Regulations*

**The Rules and Regulations (RR)** factor means the extent to which government policies governing the utilisation of a given innovation influence institutions' adoption of this technology, particularly in data security and privacy standards [2]. In every country, the operation of any technology is regulated

by establishing explicit policies to protect its users. Regulatory policies become more urgent and essential when enterprises with a high data sensitivity and privacy level, such as healthcare institutions, implement modern technology [12]. As a result, there is a potential obstacle to technology adoption in the healthcare sector without appropriate rules and standards [2], [75].

However, in 2014, the government of Saudi appointed a special commission to create the required cloud computing rules [76]. In addition, the Ministry of Communication and Information Technology in Saudi Arabia updated the cloud computing rules and regulations in 2020 [77]. The new objective for the public and private organisations in the nation is to "accelerate the adoption of cloud computing services by directing these entities to consider cloud options when making new IT investment decisions".

Therefore, we propose that flexible rules and regulations established by the Saudi government can positively encourage cloud computing deployment. Thus, the next hypothesis is proposed.

**H13: Flexible rules and regulations enhance the likelihood of adopting cloud computing in Saudi private hospitals.**

#### IV. CONCLUSION AND FUTURE WORK

This position study developed a comprehensive framework for Adopting Cloud Computing in Private Hospitals (ACC-PH) in Saudi Arabia. The developed model is based on merging the well-known theories of TOE and DOI. The proposed variables in the model were largely derived from prior studies in the same context to produce a new framework approach. In addition, some other factors were nominated to be tested in the Saudi healthcare sector for the first time. All factors were then grouped to be explored under three primary contexts: technology, organisation, and environment. The next step in developing our framework will involve collecting and analysing data to validate the framework.

A mixed methods approach is proposed since it gives a comprehensive understanding of the studied problem by IS researchers, allowing us to collect the data necessary to validate the proposed framework [78]. Using a qualitative method to discover the most effective variables in embracing cloud technology in Saudi private hospitals: and then examining the influencing factors in this adoption by conducting a quantitative approach will enhance the accuracy of the findings. The design of questionnaires, which is the preferred method for collecting quantitative data, will be informed based on the analysis of interviews, which serves as the preferred method for collecting qualitative data.

Semi-structured interviews will be conducted to explore and validate the proposed framework. Eight to ten interviews will be in-person or online mode. The targeted sample for the interviews will be only the hospital directors, medical directors, and heads of IT departments. The questionnaire will then be structured and distributed through email and Google Forms. The questionnaire's target sample size is at least 400

participants, including administrative at Saudi private hospitals. In short, the research will combine interviews and questionnaires as the optimal methods for gathering the data necessary to evaluate the new cloud computing adoption framework (ACC-PH).

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