Modelling Cloud Computing Adoption in the Malaysian Healthcare

A Resource-Based View and Technology-Organisation-Environment (TOE) Perspective

Normilah Mohd Noh[1], Nurhizam Safie Mohd Satar[2], Hasimi Sallehudin[3], Ibrahim Hassan Mallam[4],
Surya Sumarni Hussein[5], Nur Azaliah Abu Bakar[6]
School of Digital Health, KPJ Healthcare University, Malaysia[1]
Faculty of Information and Science Technology, Universiti Kebangsaan Malaysia, Malaysia[1, 2, 3]
Library Department, Nasarawa State University, Nigeria[4]
Faculty of Computer Science and Mathematics, Universiti Technology MARA, Malaysia[5]
Faculty of Artificial Intelligence, Universiti Teknologi Malaysia, Malaysia[6]

***Abstract*—Cloud computing is increasingly reshaping the global IT landscape, offering scalable and efficient solutions across industries, including the healthcare sector. This study investigates the determinants of cloud computing adoption in the Malaysian healthcare industry by integrating the Resource-Based View (RBV) and Technology-Organisation-Environment (TOE) frameworks. Emphasising internal organisational capabilities, the study excludes traditional Information Systems (IS) models to maintain theoretical coherence with RBV's strategic orientation toward firm-level resource advantages. Data were collected from 265 respondents across 127 healthcare organisations and analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM). The study also proposes an extended taxonomy of cloud services contextualised for healthcare, strengthening the theoretical underpinnings and practical applicability of cloud adoption strategies in this domain. The findings reveal that among IT capabilities, managerial IT capability exerts the most substantial influence on adoption, followed by relational and technical capabilities. Within the TOE dimensions, regulatory support emerged as the most critical enabler, while business resources, change management, organisational culture, and vendor support also demonstrated significant positive effects. The results offer empirical validation for a comprehensive conceptual model grounded in RBV and TOE, providing both theoretical insights and practical guidance for healthcare organisations aiming to strengthen IT capabilities, optimise organisational readiness, and align with external institutional drivers for successful cloud migration.**

Keywords—Adoption; cloud computing; Malaysian healthcare; partial least squares-structural equation modelling; resource-based view (RBV)

I. Introduction

In recent years, cloud computing has experienced significant global growth, evolving into a fundamental component of modern organisational IT infrastructures. As businesses face intensifying market pressures and increasing demands for agility, many have adopted cloud-based solutions not merely as a technological upgrade but as a strategic enabler of innovation and operational efficiency. Defined as the delivery of computing services, such as servers, storage, applications, and platforms over the internet, cloud computing builds upon the principles of distributed and parallel computing [1], offering a scalable and reliable environment for resource sharing and remote access [2] [3]. The National Institute of Standards and Technology (NIST) defines cloud computing as "a model for enabling convenient, on demand network access to a shared pool of configurable computing resources (e.g., network, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" [4]. The NIST definition reveals the main advantages of cloud computing as shareability, scalability, and cost reduction.

The transition to greater cloud computing adoption in some industries is propelled by firms utilising the benefits of cloud computing to maintain market competitiveness. Numerous pieces of evidence indicate that company agility and competitiveness, cost-effective disaster recovery, swift resilience, and rapid deployment are significant advantages of cloud usage [5]. In [6], the authors indicate that small organisations derive profits via enhanced collaboration with customers and staff, whereas medium enterprises achieve profitability through the establishment and expansion of new ventures, positioning themselves for global growth. In addition, the adoption of cloud computing aligns with the Fourth Industrial Revolution (IR4.0), and numerous entities, including those in the healthcare sector, have begun their journey towards complete digitisation. For healthcare organisations, this initiative is intended to enhance the quality of systems for managing patient or health treatment information [7]. In summary, a variety of research has shown how cloud computing's IT features enhance organisational value. Here are several specific ways in which adopting cloud computing can be advantageous for the healthcare sector:

1) It enables healthcare organisations to reduce capital expenditure by eliminating the need for costly on-premises data centres, which are typically expensive due to the mission-critical, lifesaving functions they must support [8]. Additionally, it minimises service downtime through high availability features essential for uninterrupted clinical operations and reduces operational inefficiencies through scalable, on-demand resource provisioning tailored to dynamic healthcare demands.

2) Cloud computing also enhances information systems and business agility by enabling rapid execution, supporting critical healthcare operations through high availability, and facilitating swift recovery via built-in disaster recovery capabilities [9].

3) Strengthens the quality of patient health and well-being through innovative implementations such as Electronic Health Records (EHR), Personal Health Records (PHR), diagnostic and pharmaceutical cloud services, and support for first responders.

Although cloud computing offers benefits such as enhanced organisational agility, flexibility, and reduced IT infrastructure costs, many organisations, particularly in the healthcare sector, face challenges in developing effective strategies for cloud deployment, including internal readiness assessments and vendor selection (e.g., [9]). Moreover, the rapid pace of cloud adoption has led to shortened IT planning horizons, potentially undermining long-term implementation success [10]. These challenges are further compounded by the unique characteristics of the healthcare industry, which differ significantly from sectors such as manufacturing, transportation, and financial services, as reported in previous information systems studies. The operational complexities of the healthcare sector, along with the participation of constitutional bodies, result in a complex environment that significantly influences the adoption of cloud computing. The diverse organisational structures within healthcare, encompassing for-profit, non-profit, government-owned, and privately owned entities, each with distinct objectives and motivations, contribute to this complexity. This duality, characterised by medical professionals alongside administrative and support staff, further shapes the industry's unique administrative landscape. The reliance of private hospitals on insurance companies and external agencies for reimbursement introduces additional layers of complexity, as these entities often operate with their own agendas. Such complexities can impact the implementation of cloud computing solutions within the healthcare sector. The integration of cloud computing necessitates careful consideration of strategic planning to align technological advancements with organisational goals [11].

Despite the promise of cloud computing to improve organisational agility and operational flexibility, many healthcare organisations continue to face difficulties in devising coherent implementation and deployment strategies [12]. These challenges often result in delayed adoption, potentially placing them at a competitive disadvantage in an increasingly digital healthcare environment. To address this issue, the study proposes a conceptual model that integrates the TOE framework with IT capability, grounded in the RBV theory, to examine the factors influencing cloud computing adoption in the Malaysian healthcare sector.

The remainder of this study elaborates on the theoretical background underpinning the study, particularly the integration of the RBV and the TOE framework. It then defines the key factors influencing cloud computing adoption, along with the research hypotheses. This is followed by a description of the research methodology and a discussion of the empirical findings. The study concludes with a reflection on the study's limitations and suggests for future research possibilities.

II. Theoretical Background and Research Framework

A. Cloud Computing in Healthcare

Cloud computing has evolved into a foundational technology in the digital economy, enabling scalable, on-demand access to computing resources via the internet. It supports not only traditional IT functions but also emerging technologies such as big data analytics and the Internet of Things (IoT), which generate and process vast volumes of data in real-time. By abstracting physical infrastructure into a virtualised environment, cloud computing allows organisations to store, manage, and analyse data seamlessly, regardless of geographical location. According to [13], the taxonomy of cloud services is classified into six categories based on their characteristics from the perspective of IT vendors, cloud service users and software. This classification has been restructured by [14] into three basic groups based on the characteristics of the tree-structure taxonomy and is summarised in Table I.

Given the multifaceted nature and specialised demands of cloud computing in the healthcare industry, it differs significantly from its application in other sectors. Several taxonomies have been proposed to conceptualise its various dimensions. Among them, the taxonomy developed by [15] provides a foundational classification by organising cloud computing knowledge into two primary dimensions, which are principle knowledge and how-to knowledge. The principal knowledge includes service models, deployment types, and technical characteristics such as scalability, elasticity, ubiquity, cost efficiency, shareability, interoperability, and security, whereby the how-to knowledge relates to practical applications such as task support, user types, device integration, and the degree of patient data involvement. This framework offers a structured view of how cloud services are characterised and operationalised in healthcare environments. However, while it provides useful categorisation, it does not explicitly account for the organisational capabilities or contextual factors that influence adoption decisions. Therefore, this study seeks to advance through further theoretical integration.

B. IT Capabilities and Resource-Based View Theory (RBV)

The Resource-Based view or theory (RBV) is a well-established strategic management theory that emphasises the internal resources of an organisation as the foundation for achieving sustainable competitive advantage. In the context of information systems, RBV suggests that firms can enhance performances by effectively integrating external IT resources with internal IT capabilities [16]. This theoretical perspective has been widely applied in IT research to conceptualise how organisations derive value from technological investments and leverage IT assets to strengthen operational effectiveness and strategic positioning.

TABLE I COMPUTING TAXONOMY BY TREE-STRUCTURE FRAMEWORK AND STAKEHOLDER PERSPECTIVES

Taxonomy	Characteristics	Example
Cloud Architecture	is the design of software applications that leverage the internet to deliver on-demand services • Software-as-a-Service (SaaS) • Platform-as-a-Service (PaaS) • Developers implementing cloud applications • Infrastructure-as-a-service (IaaS) • [(Virtualization, Storage Network) as-a-Service] • Hardware-as-a-Service • Cloud Layered Architecture	
Virtualization Management	is a technology that abstracts the coupling between hardware and operating systems	Server, Storage, and Network virtualization
Service	Three different categories of cloud services: • Software-as-a-Service (SaaS) • Is a multi-tenant platform • Platform-as-a-Service (PaaS) • Supported programming languages and environment • Supported operating systems • Supported applications and frameworks • Infrastructure-as-a-service (IaaS) • Supported operating systems • Supported applications and frameworks • Provided infrastructure management tools • Virtualization technology	• Email services, Google Docs, and Dropbox usage – (SaaS) • Supports platforms for system/application development from a programming perspective – (PaaS) • Offer similar functions as data centre – (IaaS)
Fault Tolerance	Is the capability of a system to remain fully operational despite hardware or software failures, achieved through redundancy.	
Security	Is the focal concern in terms of data, infrastructure and virtualization etc.	
Other Issues	Relate to critical operational and architectural mechanisms, including: • Load balancing • Interoperability • Scalable data storage • Internal security • Cloud performance	

While resources such as physical assets, human capital, and organisational processes must be valuable, rare, and inimitable to confer competitive advantage [16], capabilities are distinct in that they refer to an organisation's ability to combine, mobilise, and deploy these resources effectively [17]. Capabilities enable organisations to synthesise knowledge, integrate technologies, and adapt to dynamic environments, making them harder for competitors to replicate [18]. For instance, [19] introduced the concept of IT capabilities as a form of organisational competency that supports core functions and strategy execution.

According to RBV, internal resources that contribute to organisational success must possess three essential characteristics, i.e., value, heterogeneity, and imperfect transferability [17]. Building on this premise, [20] examined how various organisational resources influence firm performance and adopted RBV to explore the role of modern IT resources in developing strategic core competencies. Their study further extended the IT competency model proposed by [19] by integrating organisational capacity dimensions and investigating the complementary effect of resources. The findings demonstrated that synergistic combinations of organisational capabilities and IT resources create complex, path-dependent assets that are deeply embedded in a firm's history, culture, and experience, making them extremely difficult to imitate. Furthermore, their research empirically validated the mediating role of organisational capability in the relationship between IT resources and firm performance. Organisational capability, in this context, reflects the firm's responsiveness to environmental changes and managerial challenges, reinforcing the idea that synergy between IT resources and organisational capabilities is crucial for superior performance.

In separate contemporary research, [21] state that different IT capabilities depend on different structural mechanisms, and this reinforces the concept that the value of various IT capabilities may derive from more complex relationships [19]. The variety of IT capabilities includes Management IT Capabilities, Technical IT Capabilities, and Relationship IT Capabilities.

C. TOE Framework

The TOE framework, created in 1990 by Tornatzky and Fleischer, contends that the firm's adoption and implementation of technological innovations are influenced by the technological context, the organisational context, and the environmental context. Technological context describes factors describing the adoption of an existing technology as well as new technologies relevant to the firm. The term organisational context describes how organisational factors like scope, organisational size, and the amount of available slack resources affect an organisation. Meanwhile, the environmental context refers to the influence of external factors, including those related to industry, competitors, and government, on the adoption of technology.

TOE has been widely recognised for its suitability in studying technology adoption due to its holistic perspective and flexibility in application across various industries, including healthcare. The healthcare sector, in particular, presents unique challenges in adopting cloud computing, such as compliance with data security regulations, complex stakeholder structures, and critical operational sensitivity. Previous studies have validated the robustness of TOE in cloud adoption research, such as [6] [22] [23] and [24] which demonstrated its effectiveness in identifying influential factors in diverse organisational settings, including the Malaysian public sector. Furthermore, as cloud computing represents a significant paradigm shift in IT service delivery, the integration of TOE with complementary theories such as the RBV can offer deeper insights into how contextual conditions interact with internal capabilities to influence adoption outcomes. Numerous previous studies have utilised either the RBV or the TOE framework to examine cloud computing adoption, but with restricted integration or a lack of sector-specific emphasis. Table II indicates that although RBV-based research (e.g., [19], [18]) has highlighted the strategic significance of IT capabilities, the majority of studies lack application within the healthcare context. Conversely, TOE-based studies (e.g., [22], [12]) have investigated external and organisational factors influencing adoption, but neglecting the internal IT capability as a resource. This study, therefore, addresses these gaps by integrating IT capability (from RBV) into the TOE framework and contextualising the model specifically for the Malaysian healthcare sector.

D. Integrating RBV and TOE in Cloud Computing Taxonomy

To suit the theoretical orientation of this study, the original taxonomy of cloud computing services developed by [12] has been adapted to reflect the integration of IT capability within the RBV and contextualised using the TOE framework. While the original taxonomy classifies cloud computing knowledge into principle and how-to dimensions, the revised version introduces a strategic layer by aligning each element with relevant IT capability attributes and the three TOE contexts. This adaptation allows for a more structured analysis of cloud computing adoption, particularly in understanding how specific service characteristics interact with organisational capabilities and environmental influences within the healthcare sector. The extended taxonomy of cloud computing services in healthcare organisations, as shown in Table III, synthesises key constructs from the Resource-Based View and TOE frameworks, offering a structured lens through which cloud adoption determinants can be categorised. This taxonomy was developed to guide the identification of strategic and contextual factors relevant to cloud implementation in healthcare settings.

TABLE II COMPARATIVE REVIEW OF CLOUD ADOPTION STUDIES IN HEALTHCARE

Study	Domain	Framework / Theory	Focus Area	Healthcare Context	Key Contribution	Gap Addressed by Current Study
[20]	Telehealth	RBV	Telehealth systems and organisational performance	√	Telehealth system analysis	Does not extend TOE taxonomy
[18]	Cloud Computing	RBV	Cloud capability impact	X	Cloud capabilities and business impact	No TOE or healthcare link
[19]	General IS	RBV	IT capability and firm performance	X	Empirical study on IT as resource	No cloud or healthcare context
[17]	Strategic Management	RBV	Resource advantage	X	Foundational RBV theory	Not applied to IT or healthcare
[6]	SMEs	TOE	Cloud adoption & performance	X	Analytical model using TOE	Not applied to healthcare
[15]	Healthcare	TOE (contextual factors)	Adoption determinants	√	Systematic TOE-based review	Does not integrate RBV
[22]	Manufacturing firms	TOE	Usage and performance	X	Survey-based TOE adoption study	Lacks IT capability dimension
[11]	Public Sector	ROCCA and TOGAF	Strategic planning	X	Adoption planning framework	Not TOE or RBV-based
[25]	IT Outsourcing	Theoretical synthesis	Cloud-sourcing decisions	X	Literature reflection on IT sourcing	Lacks empirical healthcare context
[8], [26]	Healthcare	CHIS Utilization Determinants	HIS utilization	√	Empirical studies - behavioural & system-related determinants	No RBV/TOE integration
[9]	Healthcare	Systematic Review	Opportunities and issues	√	Comprehensive review of cloud healthcare	No model or framework
[21]	Cloud Computing	IT Capabilities	Success factors	X	Cloud delivery models and performance	No TOE or healthcare scope
[27]	Public Sector (General)	Extended UTAUT + Performance Impact Model	Cloud adoption drivers, IT personnel performance, organizational factors	X	Cloud adoption impact on IT staff in public sector	Does not examine cloud adoption in healthcare using an integrated RBV–TOE lens

TABLE III EXTENDED TAXONOMY OF CLOUD COMPUTING SERVICES ALIGNED WITH IT CAPABILITIES & TOE FRAMEWORK

Dimension 1: ***Principal Knowledge*** and its Characteristics		
Attribute	**IT Capability Alignment**	**TOE Alignment**
1a) Service Form (SaaS, PaaS, IaaS)	Technical IT Capability (ability to deploy/manage various cloud service models)	Technological (nature of technology adopted)
1b) Deployment Model (Public, private, hybrid, community)	Managerial IT Capability (decision-making, policy, and governance around deployment models)	Technological
1c) Targeted cloud advantage (Scalability, elasticity, ubiquity, cost efficiency, shareability, interoperability, security)	Technical & Managerial IT Capability (technical – achieving performance; managerial – aligning benefits to business goals)	Technological & Organisational
1d) Timeliness (Real time, not real time)	Technical IT Capability (infrastructure readiness)	Technological
Dimension 1: How-to Knowledge and its Characteristics		
Attribute	**IT Capability Alignment**	**TOE Alignment**
2a) Supported task (Clinical, administrative, strategy, research)	Managerial IT Capability (process integration, alignment with business/clinical goals)	Organisational
2b) User (Patient, medical staff, family member)	Relational IT Capability (coordination among stakeholders, user-oriented design)	Organisational & Environmental
2c) Service Delivery device (Independent, adapted, specialized)	Technical IT Capability (device-level implementation and configuration)	Technological
2d) Patient data involvement (Internal, external, no involvement)	Relational IT Capability (data sharing, collaboration with external entities)	Environmental

III. FACTORS DEFINITION AND RESEARCH ASSUMPTIONS

The development of this research model involves identifying critical factors that influence cloud computing adoption in the healthcare industry. The constructs and measures used in this study are informed by an extended taxonomy of cloud computing services adapted for the healthcare context (Table III), allowing for more context-sensitive operationalisation of cloud-related capabilities. Drawing upon validated constructs from prior literature, each factor is conceptually defined to reflect its relevance within the Malaysian healthcare context. These factors are categorised according to their theoretical origin, whether rooted in IT capability dimensions or TOE contextual elements, and operationally based on their expected influence on cloud adoption. The following section outlines these factors and their definitions, followed by the formulation of the research assumptions underpinning this study:

A. *IT Capability*

- Managerial IT capability

Managerial IT capability reflects an organisation's ability to leverage the knowledge and expertise of its IT leaders to align emerging technologies with strategic objectives. This capability encompasses both business acumen and technical proficiency, enabling IT managers to evaluate technological potential, orchestrate complex implementation efforts, and integrate new solutions into existing workflows efficiently and cost-effectively [19] [21]. Within the RBV, such capabilities are classified as strategic assets that are rare, valuable, and difficult to imitate, thereby contributing to sustained competitive advantage [20]. In the context of healthcare, where operational complexity and regulatory demands are high, managerial IT capability plays a critical role in guiding cloud adoption decisions. Past studies also suggest that strong managerial capability enhances technology assimilation by enabling better alignment of IT with organisational goals and mitigating risks such as obsolescence or resource misallocation [19] [21]. Accordingly, the following hypothesis is proposed:

H1: Managerial IT capability has a positive influence on the adoption of cloud computing.

- Technical IT capability

Technical IT capability refers to an organisation's ability to acquire, manage, and utilise both tangible and intangible IT assets to support operational and strategic needs. Tangible assets include infrastructure components such as servers, databases, and networking equipment, while intangible assets comprise specialised technical expertise, domain-specific knowledge, and collaborative IT practices across business units [19] [28]. Within the RBV framework, these technical resources serve as foundational enablers that, when effectively deployed, can enhance organisational agility, streamline business processes, and reduce operational cycle times [21] [28]. In the context of cloud computing adoption, especially within healthcare organisations where data sensitivity, interoperability, and infrastructure readiness are critical, strong technical capability enables seamless integration, scalability, and responsiveness. This study suggests that the extent to which healthcare organisations adopt cloud computing is significantly influenced by the maturity of their technical IT capabilities. We, therefore, made the hypothesis as follows:

H2: Technical IT capability has a positive influence on the adoption of cloud computing.

- Relational IT capability

Relational IT capability refers to an organisation's ability to cultivate enduring, trust-based relationships with stakeholders, including technology partners, cloud vendors, and inter-organisational collaborators [21]. Under the lens of the RBV, this capability is considered an intangible strategic resource that is valuable, rare, and difficult to replicate, thereby contributing to sustained competitive advantage [20]. In the context of cloud computing adoption, especially in the healthcare sector where data privacy, regulatory compliance, and trust are critical, relational IT capability plays a vital role in reducing uncertainty, enabling knowledge-sharing, and enhancing mutual commitment between partnering organisations.

Trust is a core element of relational capability which facilitates seamless collaboration, minimises perceived risks, and lowers transaction costs, particularly when adopting externally hosted services. When healthcare organisations possess strong relational capabilities, they are better positioned to coordinate with cloud providers, resolve implementation challenges, and derive strategic value from the adoption process. Therefore, relational IT capability serves as an essential enabler of cloud computing adoption, consistent with RBV's proposition that organisational capabilities can be leveraged to secure competitive advantages.

H3: Relational IT capability has a positive influence on cloud computing adoption. That is, a relational IT capability characterised by trust contributes to the factor for cloud computing adoption.

B. TOE Framework

- Technological capability

Technological capability refers to the ability of a company to mobilise and apply technological resources in support of innovation and strategic objectives. Within the TOE framework, it is typically conceptualised through three critical dimensions, consisting of technology resources, human resources and business resources [22]. These dimensions encompass the technological infrastructure, the technical expertise of personnel, and the alignment of technology with core business functions.

In the context of the RBV, technological capability is considered a strategic organisational resource that can contribute to competitive advantage when it exhibits characteristics of value, rarity, inimitability, and non-substitutability. Particularly in the healthcare industry, where technology adoption involves complex integration and regulatory sensitivities, technological capabilities are key enablers of cloud computing adoption. By framing these capabilities through RBV, this study emphasises how the deployment of cloud solutions depends not only on the availability of technology but also on the organisation's internal capacity to exploit these resources effectively.

1) Technology resources: Technology resources refer to the foundational assets, including hardware, software, communication technologies, IT applications, and personnel, that enable the implementation of information systems. These resources underpin cloud computing environments by facilitating access, scalability, and data management. From the RBV perspective, the strategic value of such resources depends not merely on their availability but on how they are integrated and leveraged to create organisational advantage. Well-developed and effectively utilised technological infrastructures are expected to enhance operational agility and support innovation. Based on this rationale, the following hypothesis is proposed:

H4: Technology resources have a positive influence on cloud computing adoption.

2) Human resources: Human resources refer to the technical knowledge, skills, and experience of IT personnel and professionals within an organisation. Their ability to design, implement, and manage cloud-based systems is crucial in healthcare settings where data security, compliance, and service availability are critical [22]. Under RBV, these human competencies are intangible yet valuable resources that contribute to the effective use of technology and foster innovation. It is therefore highlighted here that human resource (as denoted by skills and capability to manage cloud services) has a significant effect on cloud computing adoption:

H5: Human resources have a positive influence on cloud computing adoption.

3) Business resources: Business resources are defined as the capabilities and assets, including relations with suppliers, training, planning and financial resources [22]. In other words, the drive for business resources relates to consumers' personal commitment towards issues faced by the suppliers and their individual-level activities that are intended to develop a conducive environment for effective usage of technology. They are important factors in the appropriate and continuing use of this technology. H6 thus describes the nature of the relationship between the use of cloud computing and business resources.

H6: Business resources have positive influence on cloud computing adoption.

- Organisational capability

Organisational capability in the TOE framework encompasses the internal characteristics of a firm that influence its readiness and ability to adopt new technologies [22]. In cloud computing adoption, particularly within the healthcare sector, organisational capability determines how effectively a firm can align its people, processes, and internal structures to facilitate change and integrate innovations. When viewed through the RBV, organisational capabilities such as adaptability, leadership support, and shared cultural values are considered intangible yet strategic resources that enable firms to transform technical potential into realised value. These capabilities affect the success of cloud adoption by shaping internal readiness, fostering collaboration, and promoting innovation acceptance.

4) Change management: Cloud-based services differ from other technologies as they require changes in business processes and the customisation of the cloud-based services to fit existing business processes. Cloud implementation involves a series of coordinated IT customisation and implementation projects [22]. This requires firms to acquire the capability to manage individual projects, as well as multiple projects operating in a coordinated and integrative manner. In the context of RBV, this ability represents a dynamic capability that allows the firm to reconfigure existing competencies and adapt swiftly to disruptive technologies. We contend that businesses that can modify and integrate cloud services as well as alter or redesign business processes increase the use of cloud computing services. Therefore, on the basis of these discussions, H7 is developed for testing the relation between change management and cloud computing adoption:

H7: The cloud computing adoption will be negatively correlated with resistance to change.

5) Organisation culture: Organisational culture refers to the shared beliefs, values, and norms that influence behaviour within the firm. A culture that supports learning, innovation, and openness to technological advancement is believed to be critical to the success of technology implementation and usage [29]. From the RBV perspective, such a culture constitutes a firm-specific resource that is difficult to replicate and serves as a foundation for continuous improvement and competitive advantage in technology use. The purpose of H8 is to determine whether corporate culture has a significant impact on cloud computing adoption.

H8: Organisation cultures have a positive influence on cloud computing adoption.

- Environmental capability

The environmental context within the Technology-Organisation-Environment (TOE) framework captures external factors that shape an organisation's ability and readiness to adopt technological innovations [22]. In cloud computing, especially within regulated and mission-critical sectors like healthcare, these environmental enablers or barriers play a significant role in adoption decisions. From the perspective of the RBV, environmental capability is not traditionally classified as a firm-internal resource. However, when organisations are able to leverage external support, such as from technology vendors or regulatory bodies, effectively, they can transform these external enablers into strategic assets. The ability to cultivate strong partnerships and align with regulatory frameworks becomes a valuable dynamic capability that complements internal resources and contributes to sustained competitive advantage.

6) Vendor support: Vendor support refers to the assistance and collaboration provided by cloud service providers during implementation, integration, and maintenance. This includes technical support, training, and knowledge transfer, which are crucial for healthcare organisations with limited internal IT capabilities. As noted by [21], vendor competence, reliability, and credibility are instrumental in reducing uncertainty and facilitating adoption. When organisations can establish cooperative, trustworthy relationships with vendors, this inter-organisational trust and knowledge flow becomes a valuable relational resource aligned with the RBV, enhancing the organisation's ability to exploit technological innovation. H9 is an experiment to see if vendor support influences the cloud computing adoption:

H9: Vendor support has a positive influence on cloud computing adoption.

7) Regulatory support: Regulatory support pertains not only to external government initiatives but also to how organisations internally interpret, respond to, and operationalise such regulations. This includes maintaining compliance practices, ensuring vendor accreditation, and aligning operations with legal frameworks such as Malaysia's PDPA 2010. From the RBV perspective, an organisation's ability to systematically respond to regulatory requirements is by embedding compliance mechanisms, legal safeguards, and governance practices into internal routines, which can be considered a valuable and rare organisational capability. Such capability enables the organisation to mitigate legal risks, build legitimacy, and sustain operational continuity, thereby transforming external institutional pressure into strategic advantages. This view is reinforced by [22], who recognised regulatory support as a key enabler in cloud computing adoption. Thus, the following theories are put forth:

H10: Regulatory support has a positive influence on cloud computing adoption.

Grounded in the resource-based theory and aligned with the proposed hypothesis, the integration of IT Capability and the TOE framework informs the development of the proposed model, as depicted in Fig. 1.

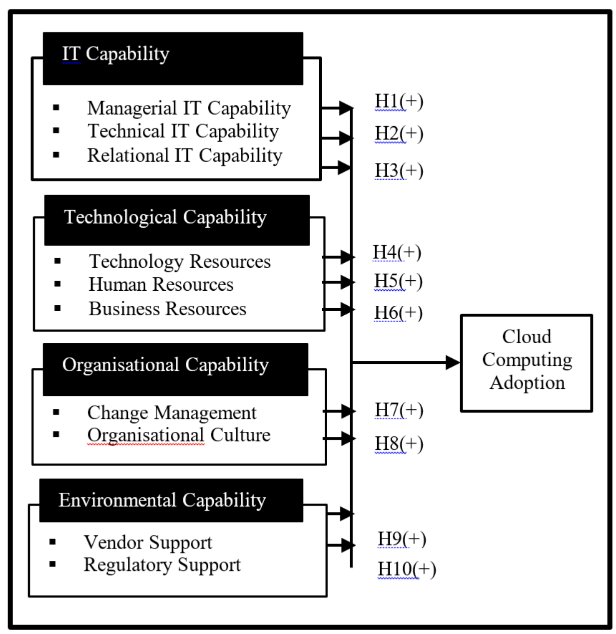

Fig. 1. Conceptual model.

IV. Methodology

A. Data Collection and Sample

This study employed a purposive sampling technique targeting key personnel involved in strategic IT decision-making within healthcare institutions. Respondents were selected based on their organisational roles that influence or oversee cloud computing adoption processes. These included Chief Executive Officers (CEOs)/ *Timbalan Pengarah Pengurusan*, Chief Financial Officers (CFOs)/ *Ketua Unit Kewangan*, Chief Information/ Technology Officers (CIOs/CTOs), IT/IS

Managers/ *Ketua Unit IT*, and IT Executives. Data were gathered through a combination of online surveys and the drop-off and pick-up method, allowing flexibility in participation while ensuring a high response rate.

The sample was drawn from three distinct groups of healthcare organisations, namely KPJ Specialist Hospitals, private healthcare facilities unaffiliated with KPJ, and tertiary public hospitals under the Ministry of Health Malaysia (MOH). According to the National Medical Research Register (NMRR), there were 238 registered healthcare organisations at the time of the study, of which 233 were active.

Out of 37 MOH tertiary hospitals, 28 (75.7%) participated, with 26 confirming active cloud usage. In the private sector, 130 out of 196 licensed private hospitals responded (66.3%), of which 56 reported cloud adoption. This includes a high response from KPJ Specialist Hospitals (26 of 29, or 89.7%), as well as contributions from other private networks such as Columbia Asia (9 of 20, or 45%) and IHH (3 of 18, or 16.7%). Among 129 standalone private hospitals, 92 (71.3%) responded to the survey.

In total, 127 healthcare organisations responded to the survey, yielding a 54.5% response rate. Of these, 82 organisations (64.6%) reported having adopted cloud computing to varying degrees. This moderate level of adoption reflects a gradual yet cautious progression toward digital transformation within Malaysia's healthcare sector. It further highlights the importance of examining the technological, organisational, and environmental conditions, as well as internal IT capabilities, that influence cloud computing adoption.

The research was ethically approved by the Medical Research and Ethics Committee (MREC) Malaysia under reference number NMRR-23-03142-NH7 (IIR). Respondents were asked to evaluate a conceptual model comprising both exogenous and endogenous variables influencing cloud computing adoption. The instrument included 29 measurement items adapted from established technology adoption frameworks and TOE literature [30], [22] – [31], alongside 12 items representing IT capability dimensions as conceptualised in the Resource-Based View (RBV). Responses were captured using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree).

Describing the descriptive statistics, the positions of respondents in the survey reveal that the majority (59.9%) are IS senior executives or managers. This dominant group reflects a strong representation from operational and technology management roles within healthcare institutions. Additionally, 14.7% of the respondents are CEOs, while CFOs and CIOs/CTOs each constitute 12.7%. In terms of industry experience, a significant portion of the respondents (56%) have been in the industry for more than 10 years, indicating a mature and experienced respondent base. This is critical as it adds depth and credibility to the survey findings. Meanwhile, 23% have 6 to 10 years of experience, and only a small percentage (21.1%) have less than 6 years in the field. The operational longevity of hospitals in the survey is also notable. Over half (54.8%) have been in operation for more than 20 years, and another 42% fall within the 2 to 20-year category. Only 3.2% are newly established (less than 1 year). Regarding staff size, the distribution shows that a large number of hospitals (65%) employ fewer than 1,000 full-time staff, with 32.9% having less than 500 employees. Conversely, around 35% of hospitals are larger institutions with over 1,000 employees. The patient bed capacity further reinforces the predominance of smaller healthcare facilities in the sample. Approximately 61.1% of the hospitals have fewer than 250 beds, while 21.8% have between 250 and 400 beds. Only 17.1% of the hospitals are large facilities with more than 400 beds. In terms of financial strength, nearly half (49.2%) of the hospitals reported annual sales of less than RM100 million, and another 43.7% earned between RM100 and RM500 million. Only a small minority generated revenues above RM500 million.

B. Data Analysis

- The measurement model

SmartPLS 4.1.1.2 was used to analyse the research model in order to estimate the relationships within the structural model and evaluate the psychometric qualities of the measurement items. To get stable standard error estimates, a bootstrapping process using 5,000 resamples of the original dataset (n = 252) was used. The analysis began with an evaluation of reliability and validity. As shown in Table III, the composite reliability (CR) values ranged from 0.936 to 0.988, and Cronbach's alpha values ranged from 0.91 to 0.987, both exceeding the recommended threshold of 0.70 [32]. These results demonstrate that the constructs exhibit strong internal consistency. Furthermore, the Average Variance Extracted (AVE) values also surpassed the 0.50 benchmark, indicating that more than 50% of the variance in each indicator is explained by its corresponding latent construct, thereby supporting convergent validity [33].

Discriminant validity was also confirmed. As detailed in Table IV, the square root of the AVE for each latent construct (bolded along the diagonal) is greater than the corresponding inter-construct correlations, affirming that the constructs are statistically distinct. Additionally, all inter-item correlations were below the 0.90 threshold [33], further reinforcing construct distinctiveness.

Table V displays the item loadings and cross-loadings, confirming that each indicator aligned most strongly with its designated construct. Items that failed to meet the minimum recommended loading threshold of 0.70 [32] were excluded from subsequent analysis to ensure the integrity of the measurement model. The remaining indicators showed strong convergent validity, as evidenced by high t-statistics in the outer model, indicating significant contributions to their respective latent variables. To evaluate multicollinearity, the Variance Inflation Factor (VIF) values were examined for all ten latent constructs. As presented in Table VI, the VIF values ranged between 1.141 and 4.163, remaining well below the conservative cut off of 5.0 [34], thus confirming the absence of problematic multicollinearity. Furthermore, the f^2 effect size was computed to determine the relative influence of exogenous constructs on endogenous variables. Based on thresholds provided by [35], 0.02 (small), 0.15 (medium), and 0.35 (large), i.e., the f^2 values in this study ranged from 0 to 0.118, reflecting predominantly small effect sizes.

TABLE IV CONSTRUCT CORRELATIONS, CONSISTENCY AND RELIABILITY

Construct	CR	Alpha	AVE	1	2	3	4	5	6	7	8	9	10	11	12
Business Resources	0.963	0.942	0.897	**0.947**	**0.947**										
Change Management	0.983	0.979	0.907	0.727	0.727	**0.952**									
Cloud Computing Adoption	0.988	0.987	0.903	0.079	0.786	0.811	**0.951**								
Human Resources	0.973	0.959	0.924	0.786	0.804	0.694	0.731	**0.961**							
Managerial IT Capability	0.956	0.939	0.845	0.804	0.128	0.112	0.21	0.102	**0.919**						
Organisational Culture	0.936	0.91	0.786	0.128	0.469	0.483	0.558	0.395	0.044	**0.886**					
Regulatory Support	0.972	0.962	0.897	0.469	0.684	0.738	0.802	0.627	0.008	0.527	**0.947**				
Relational IT Capability	0.956	0.94	0.812	0.684	0.565	0.641	0.717	0.543	-0.033	0.452	0.758	**0.901**			
Technical IT Capability	0.972	0.956	0.919	0.565	0.439	0.553	0.597	0.425	-0.084	0.359	0.593	0.586	**0.959**		
Technology Resources	0.974	0.964	0.902	0.439	0.575	0.585	0.643	0.527	-0.034	0.423	0.678	0.683	0.614	**0.95**	
Vendor Support	0.986	0.982	0.934	0.575	0.692	0.575	0.695	0.639	0.177	0.467	0.611	0.53	0.341	0.477	**0.966**

*Bold numbers on the diagonal are the square root of the AVE

TABLE V LOADINGS AND CROSS-LOADINGS

	Business Resources	Change Management	Cloud Computing Adoption	Human Resources	Managerial IT Capability	Organisational Culture	Regulatory Support	Relational IT Capability	Technical IT Capability	Technology Resources	Vendor Support
MC1	0.145	0.116	0.19	0.112	**0.917**	0.021	-0.024	-0.076	-0.127	-0.029	0.181
MC2	0.093	0.061	0.156	0.091	**0.91**	0	-0.017	-0.067	-0.153	-0.067	0.16
MC3	0.128	0.113	0.194	0.096	**0.931**	0.044	0.029	0.006	-0.056	-0.037	0.179
MC4	0.101	0.113	0.221	0.078	**0.919**	0.084	0.034	0.002	-0.001	-0.004	0.133
TR1	0.594	0.61	0.677	0.545	0.027	0.397	0.676	0.652	0.598	**0.939**	0.497
TR2	0.538	0.535	0.578	0.484	-0.09	0.417	0.622	0.65	0.549	**0.948**	0.439
TR3	0.52	0.556	0.589	0.49	-0.031	0.398	0.642	0.663	0.588	**0.955**	0.435
TR4	0.522	0.512	0.586	0.475	-0.047	0.397	0.627	0.626	0.594	**0.956**	0.434
HR1	0.776	0.682	0.682	**0.96**	0.068	0.392	0.607	0.516	0.421	0.503	0.587
HR2	0.778	0.654	0.71	**0.957**	0.078	0.354	0.601	0.523	0.398	0.519	0.616
HR3	0.766	0.667	0.715	**0.966**	0.146	0.393	0.598	0.527	0.408	0.498	0.639
BR1	**0.935**	0.741	0.714	0.766	0.066	0.427	0.664	0.543	0.424	0.577	0.65
BR2	**0.95**	0.63	0.737	0.751	0.123	0.43	0.633	0.536	0.406	0.534	0.665
BR3	**0.956**	0.696	0.78	0.768	0.169	0.472	0.649	0.529	0.417	0.524	0.653
CM1	0.723	**0.934**	0.76	0.71	0.111	0.475	0.686	0.62	0.546	0.575	0.545
CM2	0.661	**0.948**	0.749	0.64	0.106	0.447	0.688	0.602	0.537	0.545	0.514
CM3	0.688	**0.955**	0.784	0.648	0.096	0.452	0.716	0.609	0.503	0.57	0.572
CM4	0.688	**0.964**	0.757	0.637	0.105	0.45	0.685	0.597	0.491	0.545	0.567
CM5	0.691	**0.954**	0.783	0.666	0.075	0.468	0.734	0.636	0.548	0.574	0.518
CM6	0.702	**0.959**	0.799	0.667	0.147	0.468	0.708	0.602	0.534	0.534	0.567
OC1	0.502	0.517	0.602	0.423	0.1	**0.89**	0.532	0.414	0.328	0.425	0.481
OC2	0.359	0.373	0.441	0.299	0.007	**0.881**	0.429	0.408	0.307	0.355	0.416
OC3	0.348	0.348	0.404	0.262	0.038	**0.867**	0.387	0.34	0.286	0.278	0.301
OC4	0.418	0.438	0.489	0.381	-0.006	**0.906**	0.489	0.429	0.344	0.415	0.424
VS1	0.711	0.614	0.746	0.68	0.18	0.5	0.66	0.575	0.388	0.518	**0.962**

VS2	0.629	0.534	0.654	0.59	0.186	0.44	0.557	0.471	0.303	0.432	**0.971**
VS3	0.666	0.538	0.644	0.593	0.177	0.434	0.564	0.501	0.312	0.443	**0.967**
VS4	0.663	0.534	0.652	0.593	0.122	0.445	0.592	0.523	0.342	0.483	**0.959**
VS5	0.67	0.548	0.649	0.622	0.187	0.429	0.57	0.48	0.297	0.419	**0.971**
TC1	0.415	0.528	0.582	0.404	-0.036	0.344	0.562	0.544	**0.961**	0.597	0.354
TC2	0.399	0.52	0.542	0.391	-0.108	0.322	0.543	0.535	**0.954**	0.568	0.281
TC3	0.447	0.542	0.59	0.428	-0.1	0.366	0.6	0.605	**0.961**	0.601	0.343
RS1	0.708	0.716	0.816	0.631	0.089	0.468	**0.936**	0.705	0.548	0.661	0.623
RS2	0.62	0.688	0.74	0.585	-0.031	0.489	**0.956**	0.733	0.58	0.647	0.539
RS3	0.645	0.704	0.743	0.593	0	0.527	**0.95**	0.722	0.558	0.626	0.569
RS4	0.612	0.687	0.731	0.56	-0.035	0.514	**0.947**	0.714	0.563	0.632	0.58
RC1	0.481	0.537	0.609	0.467	-0.033	0.375	0.657	**0.936**	0.505	0.603	0.429
RC2	0.497	0.521	0.617	0.495	-0.075	0.435	0.645	**0.932**	0.508	0.601	0.489
RC3	0.471	0.521	0.587	0.454	-0.052	0.358	0.631	**0.935**	0.518	0.584	0.438
RC4	0.51	0.543	0.631	0.479	-0.032	0.37	0.674	**0.94**	0.522	0.617	0.487
RC5	0.553	0.712	0.732	0.521	0.031	0.465	0.759	**0.748**	0.555	0.634	0.511
CA1	0.751	0.784	**0.964**	0.697	0.197	0.564	0.75	0.704	0.608	0.635	0.693
CA2	0.783	0.796	**0.952**	0.703	0.195	0.535	0.762	0.67	0.567	0.581	0.668
CA3	0.744	0.75	**0.94**	0.694	0.186	0.542	0.745	0.669	0.549	0.6	0.617
CA4	0.737	0.748	**0.941**	0.675	0.211	0.459	0.726	0.664	0.541	0.617	0.654
CA5	0.708	0.735	**0.939**	0.679	0.222	0.544	0.738	0.674	0.565	0.586	0.654
CA6	0.748	0.786	**0.956**	0.698	0.178	0.49	0.803	0.683	0.595	0.63	0.645
CA7	0.768	0.781	**0.956**	0.701	0.18	0.636	0.781	0.687	0.579	0.629	0.67
CA8	0.735	0.785	**0.951**	0.693	0.193	0.494	0.791	0.707	0.586	0.629	0.649
CA9	0.752	0.773	0.954	0.71	0.234	0.51	0.76	0.67	0.51	0.592	0.693

TABLE VI VARIANCE INFLATION FACTOR (VIF)

	VIF	F-Square
Business Resources → Cloud Computing Adoption	4.163	0.044
Change Management → Cloud Computing Adoption	3.276	0.105
Cloud Deployment → Cloud Computing Adoption	1.158	0.023
Human Resources → Cloud Computing Adoption	3.273	0.013
Managerial IT Capability → Cloud Computing Adoption	1.141	0.118
Organisational Culture → Cloud Computing Adoption	1.601	0.03
Regulatory Support → Cloud Computing Adoption	3.896	0.077
Relational IT Capability → Cloud Computing Adoption	3.007	0.032
Technical IT Capability → Cloud Computing Adoption	1.979	0.052
Technology Resources → Cloud Computing Adoption	2.578	0
Vendor Support → Cloud Computing Adoption	2.379	0.044

- The structural model

Table VII shows the results of the structural model, which shows that there are several statistically significant direct effects between the latent constructs and the use of cloud computing. Managerial IT capability exhibits a robust and highly significant influence on adoption outcomes ($\beta = 0.138$, $t = 5.028$, $p < 0.001$), underscoring the critical role of IT leadership in strategic alignment, planning, and decision-making processes. This finding backs up earlier research [21] [19] [20] which emphasises that effective managerial orchestration of IT resources substantially facilitates the assimilation of cloud technologies. As for the technical IT capability, although the empirical findings indicate that technical IT capability exerts a statistically significant yet modest influence on cloud computing adoption ($\beta = 0.121$, $t = 2.525$, $p = 0.012$), this does not diminish its theoretical importance. Within the RBV framework, technical IT capability remains a foundational enabler that supports system integration, scalability, and agility [28] especially in healthcare settings, where infrastructure robustness and data governance are critical. The relatively moderate effect size may suggest that while technical readiness is essential, it operates alongside other organisational and environmental factors in influencing adoption decisions. Hence, its strategic value may be more catalytic than direct, setting the groundwork upon which other enablers exert stronger influence. Relational IT capability was found to have a statistically significant positive influence on cloud computing adoption (β = 0.116, t = 2.672, p = 0.008), underscoring the role of effective collaboration, mutual understanding, and trust between IT personnel and other organisational stakeholders. This finding reinforces the hypothesis that strong relational ties facilitate smoother coordination and reduce uncertainties associated with cloud adoption. However, the strength of this relationship appears to be moderate in the current study, differing from previous work by [21], which identified relational IT capability as the most dominant predictor in the context of Korean firms. This discrepancy may reflect contextual differences, particularly in Malaysia's healthcare sector, where relational dynamics are shaped by distinct regulatory, cultural, and operational factors. From an RBV standpoint, trust-based relationships are central to relational IT capability and represent a valuable and inimitable organisational asset that can foster integration with cloud service providers, support shared problem-solving and enhance adoption readiness. These results are also consistent with [12], who emphasised the role of trust and collaboration in promoting successful cloud initiatives.

These findings are consistent with earlier research [21] that affirmed the relevance of IT capabilities in shaping cloud computing adoption. Unlike prior studies that considered this relationship within the context of moderating variables such as deployment models, the current study offers a direct evaluation of the influence exerted by IT capabilities. This approach provides clearer insight into their standalone strategic importance. Viewed through the lens of the RBV, the results underscore that managerial, technical, and relational IT capabilities are not merely operational enablers but serve as critical organisational resources that drive cloud adoption in Malaysia's healthcare sector.

TABLE VII DIRECT EFFECT RESULTS

Hypothesis	Path	Coefficient	SD	T	Results
1	Managerial IT Capability → Cloud Computing Adoption	0.138	0.028	5.028	Supported
2	Technical IT Capability → Cloud Computing Adoption	0.121	0.048	2.525	Supported
3	Relational IT Capability → Cloud Computing Adoption	0.116	0.044	2.672	Supported
4	Technology Resources → Cloud Computing Adoption	-0.006	0.043	0.139	Not supported
5	Human Resources → Cloud Computing Adoption	0.076	0.041	1.877	Not supported
6	Business Resources → Cloud Computing Adoption	0.162	0.057	2.848	Supported
7	Change Management → Cloud Computing Adoption	0.222	0.091	2.446	Supported
8	Organisational Culture → Cloud Computing Adoption	0.082	0.03	2.721	Supported
9	Vendor Support → Cloud Computing Adoption	0.122	0.043	2.838	Supported
10	Regulatory Support → Cloud Computing Adoption	0.207	0.06	3.471	Supported

Among the TOE dimensions, technology resources exhibit a negative and non-significant relationship with cloud computing adoption (β = -0.006, t = 0.139, p = 0.889), suggesting that the availability of technological infrastructure alone does not directly influence adoption within the studied context. This contradicts the assumption that having sufficient IT assets automatically facilitates adoption. While prior research [25] reported a positive link between technological readiness and cloud uptake, the discrepancy here may stem from contextual factors such as organisational readiness or sector-specific constraints in Malaysian healthcare. From the RBV standpoint, this finding implies that technology resources, unless effectively configured, integrated, and leveraged, may lack the strategic value necessary to drive adoption. In other words, possessing IT assets is insufficient unless those resources are transformed into capabilities that are valuable and difficult to replicate, characteristics essential for competitive advantage and innovation. Although the analysis reveals that human resources have a positive but marginally insignificant effect on cloud computing adoption (β = 0.076, t = 1.877, p = 0.061), the direction of the relationship is theoretically consistent with prior expectations. This suggests that, while the presence of skilled and knowledgeable IT personnel contributes to adoption readiness, their influence alone may not be sufficient to significantly drive adoption decisions within the studied context. The result resonates with previous findings [22], [25], which emphasise the enabling but not singularly decisive role of human capital in technological innovation. From the RBV perspective, human resources remain a critical intangible asset; however, their strategic contribution to cloud adoption may depend on how effectively these competencies are integrated with other organisational and environmental enablers. In contrast to the insignificant effects of technology and human resources, business resources demonstrate a significant positive relationship with adoption (β = 0.162, t = 2.848, p = 0.004). This finding highlights the critical role of organisational capabilities and assets, such as supplier relationships, employee training, strategic planning, and financial resources, in driving adoption. The result is consistent with the findings of [22], [25], who emphasised business resources as key enablers for effective and sustained use of cloud technology.

The results also show that change management has a moderate yet statistically significant positive influence on cloud computing adoption (β = 0.222, t = 2.446, p = 0.014). This finding suggests that healthcare organisations with stronger capabilities to manage organisational change, such as adapting workflows, realigning processes, and coordinating implementation efforts, are more likely to adopt cloud services effectively. Given that cloud-based solutions often require customisation and transformation of legacy processes, the ability to navigate change emerges as a key enabler. This supports the theoretical assertion that such adaptability constitutes a dynamic capability under the RBV lens, allowing organisations to reconfigure internal competencies and respond proactively to disruptive innovations. The evidence reinforces the hypothesis that overcoming resistance to change is instrumental in enhancing cloud adoption outcomes. Similarly, organisational culture shows a positive and statistically significant effect on cloud computing adoption ($\beta = 0.082$, $t = 2.721$, $p = 0.007$), underscoring the influence of a supportive internal environment in embracing technological change. A culture that encourages innovation, collaboration, and openness facilitates smoother adoption processes, particularly in complex sectors like healthcare. This finding supports the RBV perspective, where such culture is viewed as a valuable, non-replicable asset that enables firms to adapt and sustain technological advancements. The result affirms H8 and aligns with prior research [22] [25], highlighting culture as a critical determinant of adoption success.

With regard to environmental factors, vendor support ($\beta = 0.122$, $t = 2.838$, $p = 0.005$) and regulatory support ($\beta = 0.207$, $t = 3.471$, $p = 0.001$) both exhibit significant positive relationships with cloud computing adoption. This suggests that effective vendor collaboration through knowledge transfer and reliable partnerships, and supportive government policies, including regulations on privacy, security, and funding incentives, are key enablers of cloud implementation. These findings are consistent with [22] [25].

V. Results

A. Current Situation and Prospect of Cloud Adoption in the Healthcare Industry

The shift towards increasing the application of cloud computing in the healthcare industry is driven by the continuous efforts of the industry for the health and well-being of patients, that is to treat patients to be better and healthier, and also to prevent disease as much as possible, and ultimately to promote life peace. With cloud technology, many healthcare institutions benefit exponentially in terms of scalability, cost savings and cloud efficiency. Referring to [15], who studied cloud computing trends and the latest status in healthcare, the approach to using cloud healthcare increased exponentially. In Malaysia, Kumpulan Perubatan Johor, better known as KPJ, is the first private healthcare provider to use cloud computing. With 28 hospitals in Malaysia and two hospitals in Indonesia, they believe that cloud computing can lower their costs or enjoy savings of 30% to 40% of their IT expenses in the long run.

B. Main Influencing Factors of Cloud Computing Adoption

The analysis of structural relationships revealed that multiple factors significantly influence cloud computing adoption in the Malaysian healthcare industry. Among IT capability dimensions, managerial IT capability emerged as the strongest predictor, affirming that leadership proficiency in aligning IT with strategic goals facilitates technology adoption. This underscores the critical role of top management in orchestrating IT initiatives and integrating cloud technologies with organisational priorities.

Technical IT capability also showed a statistically significant, albeit modest, effect. While not the most dominant driver, its foundational role remains critical in enabling system integration, ensuring infrastructure readiness, and promoting cloud scalability, particularly in healthcare, where technological robustness and data sensitivity are paramount. Similarly, relational IT capability demonstrated a positive influence, highlighting the importance of inter-organisational collaboration and trust in navigating external dependencies such as vendor relationships and service reliability.

Within the technological context, human resources showed a near-significant effect, suggesting that while the availability of skilled personnel supports cloud readiness, its standalone impact may be limited unless complemented by broader organisational readiness. Conversely, technology resources showed no significant relationship, implying that infrastructure alone is insufficient to trigger adoption, potentially due to redundancy, underutilization, or a lack of strategic alignment.

For the organisational context, both change management and organisational culture were positively and significantly associated with adoption. These findings indicate that adaptability, readiness to restructure workflows, and an innovation-oriented culture are essential enablers of successful cloud integration. Such internal factors often mediate the effective deployment of technological investments, especially in highly regulated and process-intensive sectors, like healthcare.

Under the environmental context, vendor support and regulatory support emerged as significant external enablers. Effective vendor collaboration facilitates knowledge transfer and smoother system implementation, while robust regulatory frameworks enhance trust and reduce perceived risk, encouraging adoption. These findings affirm the role of institutional forces in shaping adoption decisions, especially in healthcare, where legal compliance, data governance, and policy alignment are critical.

VI. Discussion

The findings highlight the applicability of the integrated RBV-TOE framework in understanding cloud computing adoption in healthcare. The strong influence of managerial and relational IT capabilities supports the RBV view that firm-specific resources offer competitive advantages. These capabilities allow for the strategic alignment of IT initiatives and foster collaborative relationships that enhance cloud implementation outcomes.

In contrast, the limited role of technology resources indicates that hardware or infrastructure, in isolation, lacks strategic impact without corresponding organisational and managerial readiness. Similarly, human resource capability requires integration with broader organisational strategies to influence adoption meaningfully.

Within the TOE framework, organisational culture and change readiness emerged as essential internal enablers, reflecting healthcare institutions' need for adaptable and innovation-oriented environments. Meanwhile, vendor and regulatory support validate the significance of environmental conditions in shaping IT decisions, particularly in highly regulated sectors where compliance, trust, and policy alignment are crucial.

Overall, a multi-dimensional readiness anchored in robust IT capabilities, conducive organisational environments, and supportive external ecosystems is essential for effective cloud adoption. These results offer actionable insights for healthcare leaders navigating digital transformation and highlight that success depends on coordinated efforts across internal and external domains.

VII. RECOMMENDATIONS

Based on the findings, the following recommendations are proposed:

1) Define Strategic IT Capability Profiles Tailored to the Healthcare Context.

Given the unique operational demands and regulatory sensitivities of the healthcare industry, it is essential for healthcare organisations to develop targeted IT capability profiles that support the adoption and integration of cloud computing technologies. Strategic emphasis should be placed on strengthening managerial capacity for aligning IT initiatives with clinical and administrative goals, investing in technical expertise to ensure secure and interoperable systems, and nurturing relational capabilities that facilitate collaboration across departments and with cloud service providers. This tailored capability development will allow organisations to capitalise on cloud technologies while managing sector-specific constraints such as data privacy, compliance, and institutional readiness.

2) A Common Standard Model for a comprehensive and specific Cloud Adoption Framework for the Healthcare industry.

To further advance cloud computing adoption and value realisation, future strategies should consider expanding internal IT capabilities through targeted IT Outsourcing (ITO) and IT Innovation (ITI) initiatives. While this study has established the significance of managerial, technical, and relational IT capabilities in influencing adoption, the inclusion of external IT partners via ITO can complement resource constraints and enhance service scalability, especially in settings where internal capacity is limited. From an RBV perspective, outsourcing allows healthcare organisations to access rare and specialised resources, effectively extending their resource base without diluting strategic focus. Similarly, promoting IT innovation, such as adopting new service delivery models or leveraging AI-driven cloud tools, can foster dynamic capabilities, enabling firms to continuously adapt and reconfigure existing IT assets to meet evolving patient care and regulatory demands. These recommendations are particularly relevant under the TOE framework's technological and environmental dimensions, where responsiveness to external trends and technological advancement is key to sustaining competitive advantage.

VIII. LIMITATIONS AND FUTURE RESEARCH

While this study offers meaningful insights into cloud computing adoption by integrating the RBV with the TOE framework, several limitations merit acknowledgement. First, the research is geographic and sector-specific, focusing solely on healthcare organisations within Malaysia. The country's regulatory environment, technological maturity, and public-private healthcare dichotomy may limit the generalisability of the findings to other sectors or regions with different institutional and infrastructural characteristics.

Second, the study employed a cross-sectional design, which restricts the ability to capture temporal shifts in cloud adoption behaviour, such as changes influenced by evolving regulations, technological advancements, or organisational digital strategies. Longitudinal research could better reveal how internal capabilities and external pressures interact over time.

Third, although the study incorporated both internal (IT capabilities) and contextual (TOE) enablers, it did not examine interaction or mediation effects between constructs, such as how IT capabilities may moderate or mediate the influence of environmental or organisational factors on adoption. Investigating these relationships could further enrich theoretical understanding and practical strategies for cloud integration.

Future research may explore multi-level models that consider clinical, administrative, and policy-level dynamics in cloud computing decisions. In addition, the integration of IT Outsourcing (ITO) and IT Innovation (ITI) constructs within the RBV–TOE framework may yield deeper insights into how firms balance internal capabilities with external service acquisition to enhance digital transformation. Expanding the scope to include deployment models, cloud maturity levels, and cross-country comparisons can also enhance the robustness and applicability of the proposed model.

ACKNOWLEDGMENT

This research was conducted as part of the Ph.D. program at Universiti Kebangsaan Malaysia and received full financial support for the research grant from the Ministry of Higher Education (MoHE) and Universiti Kebangsaan Malaysia (UKM) via the Fundamental Research Grant Scheme (FRGS/1/2024/TK01/UKM/02/2).

The author would like to thank the participating healthcare organisations for their cooperation and all respondents for their valuable time and insights. The study also received ethical approval from the Medical Research and Ethics Committee (MREC), Malaysia, under NMRR-23-03142-NH7 (IIR), and KPJ Clinical and Research Ethics Review Committee (CRERC), Ref. kpj_002/2023.

REFERENCES

[1] A. Naseri and N. Jafari Navimipour, "A new agent-based method for QoS-aware cloud service composition using particle swarm optimization algorithm," J Ambient Intell Humaniz Comput, vol. 10, no. 5, pp. 1851–1864, May 2019, doi: 10.1007/s12652-018-0773-8.

[2] Y. Ebadi and N. Jafari Navimipour, "An energy-aware method for data replication in the cloud environments using a Tabu search and particle swarm optimization algorithm," Concurr Comput, vol. 31, no. 1, Jan. 2019, doi: 10.1002/cpe.4757.

[3] S. C. Park and S. Y. Ryoo, "An empirical investigation of end-users' switching toward cloud computing: A two factor theory perspective," Comput Human Behav, vol. 29, no. 1, pp. 160–170, 2013, doi: 10.1016/j.chb.2012.07.032.

[4] P. Mell and T. Grance, "The NIST-National Institute of Standars and Technology- Definition of Cloud Computing," NIST Special Publication 800-145, p. 7, 2011.

[5] L. Barthelus, "Adopting cloud computing within the healthcare industry: opportunity or risk?," Online Journal of Applied Knowledge Management, vol. 4, no. 1, pp. 1–16, 2016, doi: 10.36965/ojakm.2016.4(1)1-16.

[6] A. Khayer, M. S. Talukder, Y. Bao, and M. N. Hossain, "Cloud computing adoption and its impact on SMEs' performance for cloud supported operations: A dual-stage analytical approach," Technol Soc, vol. 60, no. September 2019, p. 101225, 2020, doi: 10.1016/j.techsoc.2019.101225.

[7] B. Nayak, S. K. Padhi, and P. K. Pattnaik, "Impact of cloud accountability on clinical architecture and acceptance of healthcare system," Advances in Intelligent Systems and Computing, vol. 701, pp. 149–157, 2018, doi: 10.1007/978-981-10-7563-6_16.

[8] A. Meri, M. K. Hasan, M. Danaee, M. Jaber, M. T. Jarrar, N. Safei, et al., "Modelling the utilization of cloud health information systems in the Iraqi public healthcare sector," Telematics and Informatics, vol. 36, pp. 132–146, 2019.

[9] O. Ali, A. Shrestha, J. Soar, and S. F. Wamba, "Cloud computing-enabled healthcare opportunities, issues, and applications: A systematic review," Int J Inf Manage, vol. 43, no. July, pp. 146–158, 2018, doi: 10.1016/j.ijinfomgt.2018.07.009.

[10] H. E. Newkirk, A. L. Lederer, and A. M. Johnson, "Rapid business and IT change: Drivers for strategic information systems planning?," European Journal of Information Systems, vol. 17, no. 3, pp. 198–218, 2008, doi: 10.1057/ejis.2008.16.

[11] N. Anggraini, Binariswanto, and N. Legowo, "Cloud computing adoption strategic planning using ROCCA and TOGAF 9.2: A study in government agency," in Procedia Computer Science, Elsevier B.V., 2019, pp. 1316–1324. doi: 10.1016/j.procs.2019.11.247.

[12] F. Gao and A. Sunyaev, "Context matters: A review of the determinant factors in the decision to adopt cloud computing in healthcare," Int J Inf Manage, vol. 48, no. July 2018, pp. 120–138, 2019, doi: 10.1016/j.ijinfomgt.2019.02.002.

[13] B. P. Rimal, E. Choi, and I. Lumb, "A taxonomy and survey of cloud computing systems," NCM 2009 - 5th International Joint Conference on INC, IMS, and IDC, pp. 44–51, 2009, doi: 10.1109/NCM.2009.218.

[14] C. N. Höfer and G. Karagiannis, "Cloud computing services: Taxonomy and comparison," Journal of Internet Services and Applications, vol. 2, no. 2, pp. 81–94, 2011, doi: 10.1007/s13174-011-0027-x.

[15] F. Gao, S. Thiebes, and A. Sunyaev, "Rethinking the meaning of cloud computing for health care: A taxonomic perspective and future research directions," J Med Internet Res, vol. 20, no. 7, pp. 1–16, 2018, doi: 10.2196/10041.

[16] S. Mithas, N. Ramasubbu, and V. Sambamurthy, "How information management capability influences firm performance," MIS Q, vol. 35, no. 1, pp. 237–256, 2011, doi: 10.2307/23043496.

[17] J. Barney, "Firm Resources and Sustained Competitive Advantage," J Manage, vol. 17, no. 1, pp. 99–120, 1991, doi: 10.1177/014920639101700108.

[18] X. (Robert) Luo, W. Zhang, H. Li, R. Bose, and Q. B. Chung, "Cloud computing capability: its technological root and business impact," Journal of Organizational Computing and Electronic Commerce, vol. 28, no. 3, 2018, doi: 10.1080/10919392.2018.1480926.

[19] A. S. Bharadwaj, "A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation Bharadwaj/IT Capability and Firm Performance MIS Quarterly A RESOURCE-BASED PERSPECTIVE ON INFORMATION TECHNOLOGY CAPABILITY AND FIRM PERFORMANCE," Source: MIS Quarterly, vol. 24, no. 1, pp. 169–196, 2000.

[20] C.-H. Chen, Y.-L. Lan, W.-P. Yang, F.-M. Hsu, C.-L. Lin, and H.-C. Chen, "Exploring the Impact of a Telehealth Care System on Organizational Capabilities and Organizational Performance from a Resource-Based Perspective," International Journal of Environmental Research and Public Health Article, 2019, doi: 10.3390/ijerph16203988.

[21] G. Garrison, R. L. Wakefield, and S. Kim, "The effects of IT capabilities and delivery model on cloud computing success and firm performance for cloud supported processes and operations," Int J Inf Manage, vol. 35, no. 4, pp. 377–393, 2015, doi: 10.1016/j.ijinfomgt.2015.03.001.

[22] H. Gangwar, "Cloud computing usage and its effect on organizational performance," Human Systems Management, vol. 36, no. 1, pp. 13–26, 2017, doi: 10.3233/HSM-171625.

[23] H. Sallehudin et al., "Performance and key factors of cloud computing implementation in the public sector," International Journal of Business and Society, vol. 21, no. 1, pp. 134–152, 2020.

[24] H. Sallehudin, R. Che Razak, M. Ismail, A. F. Md Fadzil, and R. Baker, "Cloud Computing Implementation in The Public Sector: Factors and Impact," Asia-Pacific Journal of Information Technology and Multimedia, vol. 07, no. 02(02), pp. 27–42, 2018, doi: 10.17576/apjitm-2018-0702(02)-03.

[25] S. Schneider and A. Sunyaev, "Determinant factors of cloud-sourcing decisions: Reflecting on the IT outsourcing literature in the era of cloud computing," Journal of Information Technology, vol. 31, no. 1, pp. 1–31, 2016, doi: 10.1057/jit.2014.25.

[26] A. M. Kadhum and M. K. Hasan, "Assessing the determinants of cloud computing services for utilizing health information systems: A case study," Int J Adv Sci Eng Inf Technol, vol. 7, no. 2, pp. 503–510, 2017, doi: 10.18517/ijaseit.7.2.1814.

[27] N. Mahusin, H. Sallehudin, N. S. Mohd Satar, A. H. Mohd Aman, and F. Yahya, "Modeling cloud computing adoption and its impact on the performance of IT personnel in the public sector," Int. J. Adv. Comput. Sci. Appl., vol. 16, no. 2, 2025.

[28] T. Ravichandran and C. Lertwongsatien, "Effect of information systems resources and capabilities on firm performance: A resource-based perspective," Journal of Management Information Systems, vol. 21, no. 4, pp. 237–276, 2005, doi: 10.1080/07421222.2005.11045820.

[29] Z. Shao, Y. Feng, and L. Liu, "The mediating effect of organizational culture and knowledge sharing on transformational leadership and Enterprise Resource Planning systems success: An empirical study in China," Comput Human Behav, vol. 28, no. 6, pp. 2400–2413, 2012, doi: 10.1016/j.chb.2012.07.011.

[30] J. Ferreira and C. Fernandes, "Resources and capabilities' effects on firm performance: what are they?," Journal of Knowledge Management, vol. 21, no. 5, pp. 1202–1217, 2017, doi: 10.1108/JKM-03-2017-0099.

[31] A. Zaheer, B. McEvily, and V. Perrone, "Does Trust Matter? Exploring the Effects of Interorganizational and Interpersonal Trust on Performance," Organization Science, vol. 9, no. 2, pp. 141–159, 1998, doi: 10.1287/orsc.9.2.141.

[32] Matthew C. Howarda, Christian Nitzl Joe F. Hair Jr.a, "Assessing measurement model quality in PLS-SEM using confirmatory composite analysis," J Bus Res.

[33] C. Fornell and D. F. Larcker, "Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and.pdf," Journal of Marketing Research, vol. XVIII, no. February, pp. 39–50, 1981.

[34] M. Sarstedt, C. M. Ringle, and J. F. Hair, Partial Least Squares Structural Equation Modeling. 2021. doi: 10.1007/978-3-319-05542-8_15-2.

[35] J. F. Hair, G. Tomas M. Hult, Christian M. Ringle, and Marko Sarstedt, A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM), 3rd ed. Sage Publishing, 2022.