Journal of Computer Science

Original Research Paper

The Role of Trust in Cloud Service Providers on the Adoption of Cloud Computing in Saudi Arabia: An Empirical Investigation

Waleed Alghaith

Department of Information Systems, Al Imam Mohammad Ibn Saud Islamic University (IMSIU), Saudi Arabia

Article history
Received: 04-02-2023
Revised: 16-04-2023
Accepted: 27-07-2023

Email: waalghaith@imamu.edu.sa

Abstract: Cloud computing has emerged as one of the most significant developments in the field of Information Technology (IT) in recent years, allowing others to leverage third-party services. Therefore, it is essential to identify and address trust in cloud service providers as one of the key predictors of the acceptance of cloud computing. Several prior studies covered the technological facets of cloud-based contexts, including cloud virtualization, scalability, and security. However, it is argued that the biggest barrier to cloud computing is not technical but rather cognitive or behavioral and in particular attitudinal. Thus, this research aims to study individuals' attitudes and perceptions toward cloud computing, with a particular concentration on the perception of trust and its constructs in the cloud computing environment, namely Service Level Agreements (SLA) verification and reputation, in order to investigate the factors influencing the adoption of cloud computing in Saudi Arabia. This study presents an extended Technology Acceptance Model (TAM) to include trust as a cognition, representing a person's perception of social influence to perform or not perform a behavior under consideration. The study model also identifies factors affecting cloud computing adoption by considering reputation-based trust and SLA verification-based trust variables, which have been rarely examined before. The proposed model was able to explain 64% of the variance in behavioral intention and 78% of individuals' attitudes toward the adoption of cloud computing in Saudi Arabia. The study's findings show that the proposed model explained a significant amount of variation in cloud computing adoption. It suggests that the model expansion by incorporating trust in cloud computing service providers, reputation-based trust, and SLA verification-based trust factors were valuable explorations. Further, the results also show that "reputation-based trust" alone explains 29.46% of individuals' attitudes and 23.45% of their "behavioral intentions" toward using cloud computing. This effect on people's attitudes and intentions towards adopting cloud computing was indirect and through the trust construct.

Keywords: Cloud Computing, Government Cloud, Technology Acceptance, Trust, Reputation-Based Trust, SLA Verification-Based Trust

Introduction

Emerging inventions in cloud computing have attracted the attention of IT professionals around the globe. Cloud computing is a contemporary form of distributed networking that allows for the sharing of software and hardware resources among numerous public and private sectors and businesses (Liu, 2012). The term "cloud computing" refers to the hardware and systems used to supply the services as well as the applications produced over the Internet (Chen and Nakayama, 2016). Although the term "cloud computing" did not become widely used until 2007, industries started investing in cloud computing in the 1990s, helping to shape the technology's future (Wang *et al*., 2010). For many businesses, the cloud has emerged as a vital pillar. Over 3.6 billion people use clouds worldwide; nearly half of all people on earth, which represents 47% of the world's population. As of 2022, the global market for cloud computing was worth $445.3 billion (Flynn, 2022).

In spite of the cloud publicity, migration from internal data centers to clouds contains definite compromises (Khajeh-Hosseini *et al*., 2010). On one side, migration provides numerous opportunities to decrease costs while enhancing management (Khajeh-Hosseini *et al*., 2010); On the other hand, it could put company data in jeopardy and decrease the quality of customer care. The migration of essential data and information to third-party infrastructures and the outsourcing of vital operations are more significant concerns with cloud adoption (Khajeh-Hosseini *et al*., 2010). As companies use cloud computing, they continue to leverage and use third-party services, so trusting cloud providers and identifying possible risks, such as privacy and security concerns, are critical to ensuring productive adoption (Buyya *et al*., 2009).

Several prior studies covered the technological facets of cloud-based contexts, including cloud virtualization, scalability, and security (Sharma and Singh, 2022; Sheik and Muniyandi, 2023). However, it is argued that the biggest barrier to cloud computing is not technical but rather cognitive or behavioral and in particular attitudinal (Marston *et al*., 2011; Khayer *et al*., 2020). Thus, this research aims to study individuals' attitudes and perceptions toward cloud computing, with a particular concentration on the perception of trust and its constructs in the cloud computing environment, namely SLA verification and reputation, in order to investigate the factors influencing the adoption of cloud computing in Saudi Arabia. This study proposes and develops a theoretical model based on the Technology Acceptance Model (TAM) that lends itself to investigating these factors. Moreover, this study extends TAM to investigate trust as a driver of cloud adoption in Saudi Arabia by placing SLA verification, reputation, and "trust" of cloud computing providers as new constructs within Technology Acceptance Models (TAMs). The scope of the study covers trust as a factor and examines its constructs in addition to the attitudes and intentions towards cloud computing in the context of end-users and IT professionals' perspectives.

An enormous amount of research has noted and predicted the importance of trust, SLA verification, and reputation in cloud computing contexts, but only a few studies have examined the impact of these variables on attitudes and intentions toward cloud computing usage. The study's purpose is to comprehend individuals' behaviors toward cloud computing.

This study will contribute to the current literature by elucidating the role of trust, SLA verification, and reputation in cloud adoption behavior. Additionally, it will validate whether the TAM is a reliable model based on its ability to explain users' attitudes and intents in the context of cloud computing.

This raises the following research question: What factors affect users' attitudes and their intention to adopt cloud computing? The rest of this study answers this question by presenting and extending the TAM as a potential theory to explain differences in adoption behavior. This study is organized as follows: The next section presents relevant prior research on cloud computing and the study's theoretical framework, which includes the TAM as the main theory that guides the development of the study model. The third section discusses the development of research hypotheses and the study model. The fourth section describes the study methodology, including its measurements and applied adata collection procedures. The fifth section presents the research data analysis and its findings, which cover the reliability and validity of the study instrument and the hypotheses testing results. The fifth section provides a discussion that includes the implications of the study results for theory and research. Finally, the sixth section presents conclusions.

Prior Research and Theoretical Framework

Cloud Computing

Cloud computing represents the convergence of two major trends in information technology: IT efficiency and business agility. IT efficiency involves using highly scalable hardware and software resources to make smarter use of the capabilities of current computers. Business agility, on the other hand, is the ability to use IT as a competitive tool through rapid development and mobile interactive applications that respond instantly to customer needs (Ali *et al*., 2022; Marston *et al*., 2011).

Cloud computing relies on three core technologies, namely virtualization, multitenancy, and Web services, all of which are rapidly taking shape.

Virtualization is a technology that presents users with an abstract, simulated computing platform instead of the actual, physical properties of a computing platform. By utilizing the underlying hardware resources, cloud computing builds various virtual environments. In order to build a virtual computer system, virtualization uses software to replicate hardware capabilities (Ahmad *et al*., 2015).

Unlike a physical system, this emulated computing platform behaves like an independent system; thus, it is very simple to maintain and replicate and can be configured on demand to work for all purposes. Virtualization has an impact on operational costs. Actually, lower initial and ongoing expenses are the result of optimum utilization of the computing infrastructure, which has occurred as a result of virtualization's benefit of reducing the need for data center real estate (Osanaiye *et al*., 2017).

Multitenancy refers to the concept of a single instance of application software serving multiple customers. This enables more efficient use of system resources, which can be quite demanding if an instance of the application needs to be recreated for each individual client (in terms of memory and processing overheads) (Jia *et al*., 2021).

A Web service is defined by the W3C as a software system created to facilitate interoperable machine-to-machine communication over a network (Ghobaei-Arani *et al*., 2018; Haas and Brown, 2004). The definition covers various systems; however, a Web service represents clients and servers that interact over the HTTP protocol used on the Web. The web service helps standardize the interfaces between applications and works without the need to share sensitive data, thus it enables different organizations, businesses, or applications from various sources to interact safely (Alouffi *et al*., 2021).

Cloud computing offers a variety of services in response to user demand. A cloud provider charges users according to their service consumption. Only the services that the users actually used are subject to payment. These services can be categorized into the following three main delivery models, which refer to the different layers of the cloud computing architecture (Younas *et al*., 2018). The first model is the Infrastructure as a Service (IaaS), whereby on-demand virtualization of compute capabilities, communications, and storage is offered as a service. Secondly, the Platform as a Service (PaaS) model facilitates a scalable cloud-based applications development and deployment environment without the cost and complexity of buying and managing the underlying hardware and software layers. The third model is Software as a Service (SaaS), whereby traditional desktop-based applications run on the web, eliminating the need to install the applications on the user's computer (Alouffi *et al*., 2021; Bagiwa *et al*., 2016). Additionally, the cloud also offers Backup as a Service (BaaS) also known as Storage as a Service (StaaS), which enables users to store and back up massive amounts of data, lightening the load on the organization (Martini and Choo, 2013).

Irrespective of the cloud service type, cloud computing has four main types of cloud infrastructure designs or deployment models that determine the type of admittance to the cloud. These main types include private, public, community, and hybrid clouds. The former refers to a cloud service operated by businesses and is typically internal data centers providing services to a specific organization, whereas the latter is defined as being available to individuals and organizations on a pay-per-usage basis, which is a cost-effective way to deploy IT solutions. Thirdly, the community cloud is shared and used by a group of organizations that have similar interests and need the same configuration, such as specific security requirements or a common mission. Within this deployment model, the cloud environment can be self-managed by these organizations or contracted out to a third party. Finally, the hybrid cloud is a combination of a private and public cloud. Within this type, organizations resort to using the computing capabilities provided by the public cloud in order to cope with sudden spikes in load, while their critical services and sensitive data are kept under the control of the organization in the private cloud (Bagiwa *et al*., 2016; Yousefpour *et al*., 2019).

Cloud computing significantly reduces the entrance barrier for smaller firms that are looking to take advantage of compute-intensive business analytics, which was previously only available to the largest organizations. These computational tasks often require large amounts of processing power for just a short period of time and cloud computing makes such effective allocation of resources possible for any organization. Cloud computing, with no prior financial commitments for customers, can offer almost immediate access to hardware resources, which accelerates time to market for many firms (Novais *et al*., 2019; Oliveira *et al*., 2019).

Furthermore, with cloud computing, computer resources are fully managed with little user engagement, so managers may concentrate more on their business models by scaling services up or down in accordance with changes in business requirements with minimal service-provider interaction. Cloud computing also allows businesses to work with better mobility, availability, and collaboration, which raises user satisfaction levels (Oliveira *et al*., 2019).

Technically speaking, cloud computing uses the virtualization of computer resources, which allows firms to efficiently control increases in demand. Additionally, by virtualizing storage resources, cloud computing can offer constant and immediate access to stored data via mobile devices, wherever they are used (Duan *et al*., 2015; Phaphoom *et al*., 2015). In conclusion, cloud computing is quickly replacing traditional software delivery models and offers several operational and financial advantages (Oliveira *et al*., 2019).

Despite the promising capabilities of cloud computing, it still faces a number of challenges. The prior literature identified five impediments. Firstly, cloud computing struggles to provide secure services for IT environments comparable to those available in internal data centers (Marinescu, 2022). Secondly, the extensive use of third-party infrastructures and hosting services has further exacerbated privacy difficulties (Marinescu, 2022). Thirdly, the advent of cloud computing presents legal and regulatory considerations about the geographic location of hosted data, since providers have so far been unable to ensure that a company's information is stored on a certain set of servers in a specific region, which makes it difficult to determine which data management laws should be applied to data breach situations (Sadeeq *et al*., 2021).

DOI: 10.3844/jcssp.2023.1107.1123

Fourthly, interoperability in cloud computing is costly for businesses. There are differences in the use of platforms, hypervisors, and policies, thus, clients should have the option to switch from one cloud provider to another (Asadi *et al*., 2017). Finally, the quality of cloud services in terms of reliability, availability, and performance must be predetermined through the use of service level agreements (SLAs) to meet customer expectations (Hani *et al*., 2015; Rajavel and Thangarathanam, 2021). The bottom line is that a number of challenges must be thoroughly resolved before cloud computing can be truly adopted.

The adoption of cloud computing has grown and become more pertinent to IT practice and research over the past few years. In response, it has become a growing trend among scholars to use several technology adoption models to comprehend how people adopted cloud computing (Sharma *et al*., 2020). For example, a study conducted by Asadi *et al*. (2020) used the Theory of Planned Behavior (TPB) to investigate the determinants of cloud computing services among 240 faculty members in a medical university. The study found that attitude, perceived privacy/security, perceived behavioral control, intention, and subjective norms factors altogether explained about 59% of individuals' behaviors toward the adoption of cloud computing services (Asadi *et al*., 2020). Another study by Chiniah *et al.* (2019) proposed a Hybrid model that includes Technology Acceptance Model (TAM) and Technology-Organization Environment Model (TOE) to evaluate the already known factors for cloud adoption/non-adoption by the ICT sector of Mauritius. The study surveyed 93 ICT-related companies/organizations and found that security is no longer the major concern for cloud adoption and companies are more focused on the advantages cloud computing can offer to their operations (Chiniah *et al*., 2019).

Technology Acceptance Model (TAM)

In IS adoption literature, the TAM is considered one of the most widely accepted models of technology adoption. Davis *et al*. (1989) proposed the TAM to explain or predict individuals' acceptance or rejection of IT. Conceptually, TAM is derived from the Theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1980), which defines two underlying behavioral factors, perceived usefulness and perceived ease of use, as determinants of attitude toward behavioral intentions and IT usage behavior (Alryalat *et al*., 2020; Chin *et al*., 2008). An actual IT usage behavior in TAM results from a behavioral intention to use. Together, attitude and perceived usefulness determine behavioral intention, whereas attitude is directly influenced by perceived usefulness. Meanwhile, attitude and perceived usefulness are directly influenced by perceived ease of use (Feng *et al*., 2022).

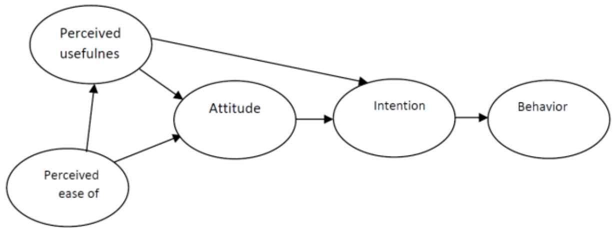

Fig. 1: The TAM model

Perceived usefulness is described as the extent to which an individual believes using a given technology will improve their capacity to accomplish their work, whereas perceived ease of use is defined as the level to which an individual believes using a specific technology would be effortless (Davis *et al*., 1989). According to Al-Ghaith (2016), scholars attribute the strength of TAM to its ubiquitous applicability. In TAM, beliefs regarding usefulness and ease of use are consistently the most important determinants of intention to use, and this belief set is "readily generalized to different computer systems and user populations" (Davis *et al*., 1989) (Fig. 1).

Other models, like TRA and TPB, rely on belief sets that are unique to each circumstance, making it challenging to apply them in different user contexts (Al-Ghaith, 2016). In addition, the TPB requires a pilot study to determine fruitful results, groups, and control variables in each situation in which it is applied, whereas the constructs of the TAM are always measured in the same way (Al-Ghaith, 2016; Mathieson, 1991). Due to its ubiquitous applicability and mainly to its parsimony, the TAM is considered one of the most widely accepted models of technology adoption (Al-Ghaith, 2016; Alryalat *et al*., 2020; Chin *et al*., 2008). Despite parsimony being one of TAM's advantages, it is also sometimes viewed as a limitation (Al-Ghaith, 2016; Venkatesh, 2000).

TAM, with its two original constructs of perceived usefulness and perceived ease of use, is able to provide some predictive information; however, that information is not considered sufficient to help designers anticipate the acceptance of a new system (Al-Ghaith, 2016). There is an argument among scholars that TAM ignores and excludes several theoretical constructs that have been proven to be crucial in predicting technological adoption. For instance, TAM does not explicitly take into account any social factors (Chen *et al*., 2004) or personal characteristics that might significantly affect TAM estimations (Djamasbi *et al*., 2010) or even have an influence on the relationships between TAM constructs (McCoy *et al*., 2007).

Thus, the current study extends TAM by including Service Level Agreement (SLA) verification, cloud service provider reputation, and cloud service provider trust with the purpose of being more suited to the environment or nature of cloud computing. The next section discusses this extension and the study hypotheses formulation, which was developed based on the original TAM model hypotheses.

Hypotheses Development and Research Model

This research aims to study individuals' attitudes and perceptions toward cloud computing, with a particular concentration on the perception of trust and its constructs in the cloud computing environment, namely SLA verification and reputation, in order to investigate the factors influencing the adoption of cloud computing in Saudi Arabia.

The study of trust antecedents in cloud computing environments and how trust affects other constructs of cloud adoption are both of interest to the research subject. The literature review that was undertaken pointed to a variety of factors that build trust in cloud computing. In particular, Service Level Agreement (SLA) verification and cloud service provider reputation were among these factors that could potentially affect cloud computing acceptance.

A Service Level Agreement (SLA) is a formally negotiated contract between a cloud service provider and a cloud user to ensure the expected level of service. Previous studies asserted that a multitude of businesses are reluctant to adopt cloud computing in their services due to a lack of trust in the cloud computing provider (Ahmad *et al*., 2012; Huang and Nicol, 2013). Published SLAs might reassure prospective clients of the trustworthiness of the cloud computing provider before a relationship between the two parties has been established (Stankov *et al*., 2012).

A clear and well-written SLA does not allow for opportunistic conduct. It gives potential clients the information they want as well as a sense of the reliability of their future business partners. It lets the customer know that the provider is (1) Sure of the service level they can provide, (2) Aware of the Quality of Service (QoS) level the customer needs, (3) Capable of expressing SLA conditions in a clear and understandable way and (4) Willing to provide details about the actual performance of the services they are offering. Prior studies have also demonstrated that legal contracts such as SLAs, which consider relational governance, lead to positive trust relationships (Alkhamees, 2022; Latif *et al*., 2021; Kapsoulis *et al*., 2021). Therefore, this study proposes the following hypothesis:

H_1: The SLA verification has a significant and positive influence on trust in cloud computing provider

Other scholars argue that SLAs (Service Level Agreements) alone are not sufficient to establish trust between cloud services. The best way to determine whether cloud services are reliable is to ask customers for feedback; this will enable them to make improvements in the future. This feedback also helps in assessing the quality of the individual transaction and the specific service provider and helps in making recommendations. Reputation is built by collecting those recommendations. Prior studies found that reputation also has a significant impact on trust (Dadhich *et al*., 2011; Govindaraj *et al*., 2021; Phoomvuthisarn, 2011). Thus, the study formulates the following hypothesis:

H_2: The reputation of a cloud service provider has a significant and positive influence on trust in cloud computing provider

In any business transaction, trust is a crucial component, especially in technological settings where there is uncertainty or insufficient product information (Belkhamza and Wafa, 2009). Previous studies on the adoption of cloud computing have not extensively studied trust as a multidimensional construct; however, the majority of the literature supports the significance of a generalized trust construct as a determinant in cloud computing adoption. To know the importance of trust in the use of cloud computing, let's take a look at one of the aspects that requires trust and that affects the user's attitude towards it.

Within the cloud computing context, the trusting intentions were subsequently influenced by the trusting beliefs regarding cloud service providers, which predicted cloud adoption and success factors (Lansing and Sunyaev, 2016). When analyzing trust in the cloud provider, a trust includes all related expectations, such as the conviction that the provider won't act opportunistically (Lansing and Sunyaev, 2016). Cloud providers can create adverse circumstances for organizations or individuals using their services and moving from one cloud provider to another can be costly and resource-intensive. Cloud providers may use standards, closed architectures, proprietary software, or complex licensing schemes to keep customers captive (Opara-Martins *et al*., 2014). It's also possible that a particular cloud provider will decide to disregard agreements, rules, or guarantees, or will otherwise falsify compliance, or will exploit the client organization in circumstances that aren't covered by the licensing agreement (Lansing and Sunyaev, 2016). Thus, the relationship between perceived trust in cloud service provider and individuals' attitude toward cloud technology adoption, have been shown to be significant and the key antecedent of behavioral intention to adopt the cloud (Udoh, 2012). Considering the above; the following hypothesis is formulated:

H_3: Trust in cloud service providers has a significant and positive influence on individuals' attitudes toward the cloud

DOI: 10.3844/jcssp.2023.1107.1123

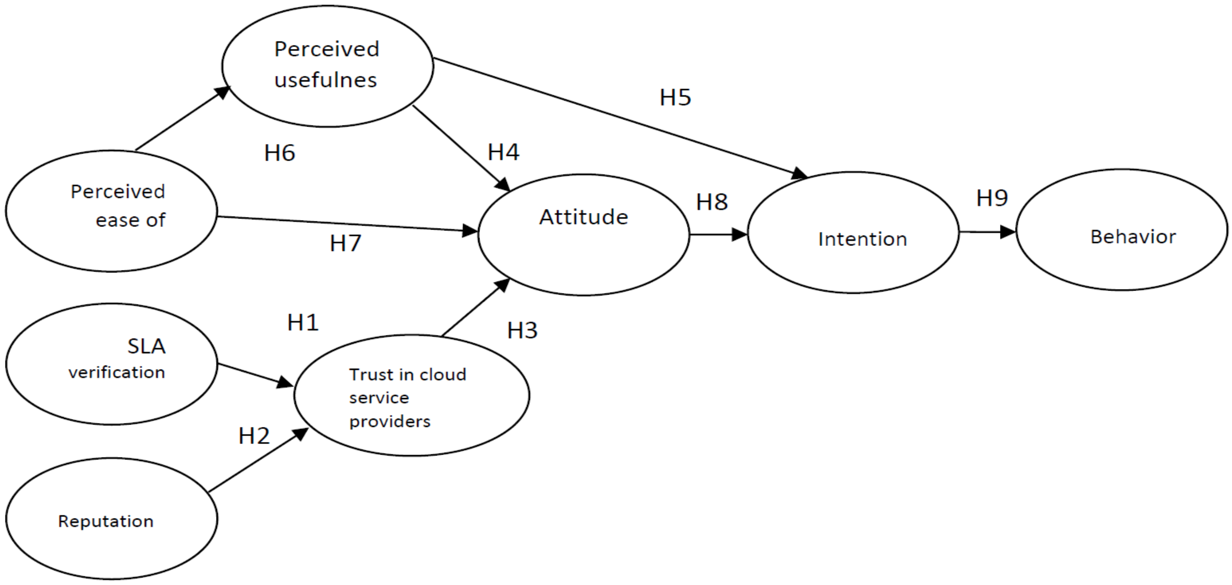

Fig. 2: Research model

To develop a theoretical model of trust in cloud computing technology, the author made an effort to place SLA verification, the reputation of cloud service providers, and trust in cloud service providers as new constructs within Technology Acceptance Models (TAMs) that were proposed by Davis (1989) to identify factors that influence users' acceptance of new technologies (Davis *et al*., 1989).

As aforementioned, TAM proposes that two constructs (1) Perceived usefulness and (2) Perceived ease of use form the behavioral beliefs to be predictors of an individual's attitude toward information technology, which in turn predicts their acceptance of IT. In addition, it hypothesized that perceived ease of use will have a significant effect on perceived usefulness.

Within the main fundamentals of the TAM, it hypothesized that user acceptance of information technology is determined by his or her behavioral intention to use the IT, which can be predicted by his/her attitude towards using IT and his/her perception of the usefulness related to use. Thus, the following six hypotheses were taken from the original TAM; however, they were adjusted for the existing study in order to fit the context at hand:

H_4: Perceived usefulness of the cloud has a significant and positive influence on attitudes toward the cloud
H_5: Perceived usefulness of the cloud has a significant and positive influence on behavioral intention to use the cloud
H_6: Perceived ease of use has a significant and positive influence on the perceived usefulness of the cloud
H_7: Perceived ease of use has a significant and positive influence on attitudes toward the cloud
H_8: Attitudes toward the cloud have a significant and positive influence on behavioral intention to use the cloud
H_9: Behavioral intention has a significant and positive influence on the actual use of the cloud

Through the above hypotheses that were derived from a review of the research literature and the basic elements of the TAM, we were able to form a measurement model as shown in Fig. 2.

Materials and Methods

The statistical analysis software Statistical Package for the Social Sciences (SPSS) was used for data analysis, as was AMOS, which was used for performing a structural analysis for the proposed model.

Measurement

Identifying the constructs that a study attempts to assess and choosing appropriate measurement techniques are crucial steps that have a significant impact on the accuracy of the study's results (Bell *et al*., 2022). In this study, the survey instrument was created by the researcher to test the research hypotheses. In order to guarantee the scale's face (content) validity; items from earlier studies were identified and utilized in the survey questionnaire to measure the constructs.

Table 1: List of items by construct

Construct	Items	Adapted from
SLA Verification-Based Trust (VT)	I am sure that the amount of availability specified in cloud computing SLA can be achieved by the provider	(Hamilton, 2015)
	I am positive that the SLA appropriately addresses the integrity of the data stored in the cloud and the data will be maintained by the provider	
	I believe that the SLA addresses concerns about data and privacy and Confidentiality	
	I am assured that the support response rate for cloud services being stated by the cloud service provider	
	Compensation for breaches of agreed SLA is well defined	
	I am certain that the cloud service provider is conducting periodic security audits and showing this as reports as part of the cloud computing SLA	
	SLA addresses how the reliability of the service will be guaranteed by the cloud service provider	
Perceived Usefulness (PU)	Cloud computing is more convenient than other traditional options	(Moore and Benbasat, 1991)
	Cloud computing makes it easier to do my work	(Taylor and Todd, 1995)
	Cloud computing improves my work	(Al-Ghaith, 2016)
	Cloud computing helps me to do my work more quickly	
	I think that cloud computing is useful	
	Overall, I think that using cloud computing is advantageous	
Perceived Ease of Use (EU)	Learning to use cloud computing was easy for me	(Moore and Benbasat, 1991)
	I find cloud computing easy to use	(Taylor and Todd, 1995)
	The English language is not a barrier when I use cloud computing	(Al-Ghaith, 2016)
Attitude (AT)	I have a positive opinion of cloud computing	(Ajzen, 1991)
	I think the usage of cloud computing is good for me	(Al-Ghaith, 2015)
	I think the usage of cloud computing is appropriate for me	(Al-Ghaith, 2021)
The Reputation of the cloud service provider (RT)	I feel very comfortable using cloud computing with this service provider	(Morgan and Hunt, 1994)
	Consider my cloud service provider as my first choice if I buy the same services through online	(Hooda *et al*., 2022)
	My cloud service provider is a name I can always trust	
	My cloud service provider always delivers on what they promise	
The Trust in cloud service provider (TT)	The cloud service provider guarantees the anonymity of users	(Ejdys, 2018)
	The cloud service provider ensures the security of my personal data	
	The cloud service provider is efficient and always works reliably	
	The cloud service provider is predictable and unchanging	
	I can rely on the cloud service provider	
Behavioral Intention (BI)	You intend to use cloud computing in the next three months	(Al-Ghaith, 2016)
	You expect your use of cloud computing to continue in the future	(Al-Ghaith, 2021)
Cloud Computing Usage (US)	On average, each week you use your cloud account often	(Al-Ghaith, 2015)
	Every morning, you check your cloud account	(Al-Ghaith, 2021)

The items were utilized frequently in the majority of prior studies showing a probable subjective consensus among scholars that these measuring instruments seem to accurately reflect the constructs of interest. The items created for each construct in this study are listed in Table 1, along with the previous studies from which they were adapted.

Data Collection Procedures

Data for this study were collected in 2022 by means of a survey. Due to that IT professionals play a crucial role in an organization's decision to adopt cloud computing (Lynn *et al*., 2020); the study's sample surveyed IT professionals who were residing and working in Saudi Arabia. A fully completed survey was obtained from 217 IT professionals. After checking the data for validity, 214 of them were deemed fit for use.

In information systems research, an appropriate sample size for Performing Partial Least Squares (PLS) path analysis is crucial (Marcoulides and Saunders, 2006). A regular Information systems study would have at least 0.25 R-squared values and a significance level of 5% with a statistical power of 80%. Using such attributes with a maximum 3 of arrows pointing to a latent variable as defined in the study's structural equation model (Fig. 1), a sample size of 59 is supposed to be adequate (Wong, 2013). However, if factor loadings are 0.5 with the aforementioned parameters; the ideal sample size is 78 (Marcoulides and Saunders, 2006). Consequently, the sample size of 214 seemed to be more than enough for this study.

Results

Reliability and Validity

The reliability and the instrument's internal consistency have been examined by utilizing collected data from the pilot study of each construct in the instrument. According to the results, the alpha values were between 0.942 and 0.996, with a mean of .969 (Table 2). This means that all of the model's constructs were reliable. As a result, the internal consistency was adequate.

Construct validity was assessed by using factor analysis to evaluate a principal components analysis with a Varimax rotation. This analysis estimated the convergent and discriminant validity of items. The convergent validity was assessed by testing whether items of a variable converged together on a single construct (Al-Ghaith, 2016) and whether the factor loading for every item was >0.45, as recommended by Mathieson (1991).

DOI: 10.3844/jcssp.2023.1107.1123

Table 2: Cronbach's alpha reliability of constructs

Construct	Number of items	Cronbach's alph
SLA Verification-based Trust (VT)	7	.996
Perceived Usefulness (PU)	6	.985
Perceived Ease of Use (EU)	3	.945
Attitude (AT)	3	.957
The Reputation of the cloud service provider (RT)	4	.993
The Trust in cloud service provider (TT)	5	.997
Behavioral Intention (BI)	2	.958
Cloud Computing Usage (US)	2	.942
Overall alpha value	32	.969

Table 3: Factor analysis of items sorted by construct (rotated Component matrix (a)

	Component					
	1	2	3	4	5	Its assessment
VT1	-.239	-.067	.896	-.065	.147	Excellent >0.710
VT2	.779	.474	.376	.070	.075	Excellent >0.710
VT3	.783	.472	.372	.064	.074	Excellent >0.710
VT4	.781	.470	.372	.065	.068	Excellent >0.710
VT5	.499	.752	.291	.082	.226	Excellent >0.710
VT6	.750	.249	-.138	.108	.417	Excellent >0.710
VT7	.736	.387	-.257	.385	.072	Excellent >0.710
PU1	.543	.584	-.234	.355	.041	Good >0.55
PU2	.580	.684	.327	-.015	.229	Very good >0.63
PU3	.620	.531	-.293	.340	.162	Very good >0.63
PU4	.677	.434	-.122	.452	.176	Very good >0.63
PU5	.598	.553	-.192	.316	.191	Good >0.55
PU6	.580	.684	.327	-.015	.229	Very good >0.63
EU1	.736	.387	-.257	.385	.072	Excellent >0.710
EU2	.467	.805	.257	-.034	-.131	Excellent >0.710
EU3	.495	.752	.300	.132	.188	Excellent >0.710
AT1	.677	.539	-.132	.240	.125	Very good >0.63
AT2	.640	.458	-.162	.514	.046	Very good >0.63
AT3	.595	.553	-.119	.409	.050	Good >0.55
RT1	.367	.863	-.144	.076	.057	Excellent >0.710
RT2	-.330	-.247	-.905	-.056	-.023	Excellent >0.710
RT3	.283	.897	-.171	.034	.182	Excellent >0.710
RT4	-.289	-.207	.232	-.295	.799	Excellent >0.710
TT1	.270	.889	-.163	.140	.155	Excellent >0.710
TT2	-.198	-.148	.835	-.213	-.143	Excellent >0.710
TT3	.283	.897	-.171	.034	.182	Excellent >0.710
TT4	-.289	-.207	.232	-.295	.799	Excellent >0.710
TT5	.736	.387	-.257	.385	.072	Excellent >0.710
BI1	.772	.485	-.146	.306	-.014	Excellent >0.710
BI2	.756	.486	.389	.115	.054	Excellent >0.710
US1	.620	.502	.353	.469	.018	Very good >0.630
US1	.735	.527	-.135	.281	-.088	Excellent >0.710

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. A Rotation converged in 6 iterations

Mathieson (1991) recommended that loadings in excess of 0.45 could be considered fair, whereas it might be deemed as good if loadings were more than 0.55 and those of 0.63 very good and those of 0.71 as excellent. The discriminant validity was calculated by analyzing the cross-loading of items on different factors. Table 3 shows no weak loading.

Hypotheses Testing

This study proposes and develops a theoretical model by adopting and extending TAM that lends itself to investigating trust as a driver of cloud adoption in Saudi Arabia (Fig. 2). The study's model was formulated through the test of 9 hypotheses. Pearson's correlation analysis was used to conduct a simple correlation between all of the study variables, as shown in Table 4. As variables presented significant associations ($p \leq 0.01$), we then applied the regression model to test multicollinearity by testing collinearity statistics; i.e., Variance Inflation Factor (VIF) and tolerance.

Table 4: Correlation analysis among the variables

	US	BI	AT	PU	EU	TT	VT
BI	.747*						
AT	.785*	.749*					
PU	.841*	.790*	.878*				
EU	.679*	.638*	.729*	.792*			
TT	.730*	.637*	.768*	.810*	.922*		
VT	.629*	.539*	.764*	.804*	.771*	.802*	
RT	.761*	.619*	.770*	.848*	.838*	.903*	.828*

US: Usage, BI: Behavioral Intention, AT: Attitude, PU: Perceived Usefulness, EU perceived ease of use, TT: Trust in cloud service provider, VT: SLA verification-based Trust, RT: Reputation-based trust.* $p \leq 0.01$

Table 5: Multicollinearity test

Dependent variable	Path direction	Independent variables (predictors)	Collinearity Statistics Tolerance	VIF
Usage	←	Intention	.400	2.502
Intention	←	Perceived Usefulness (PU)	.850	1.176
Intention	←	Attitude (AT)	.516	1.936
Attitude (AT)	←	The cloud computing Technology Trust (TT)	.938	1.066
Attitude (AT)	←	Perceived Usefulness (PU)	.585	1.709
Attitude (AT)	←	Perceived Ease of Use (EU)	.665	1.503
Trust in cloud computing service the provider (TT)	←	SLA Verification-based Trust (VT)	.439	2.276
Trust in cloud computing service the provider (TT)	←	Reputation Based Trust (RT)	.412	2.427

Table 6: Coefficients for the proposed model

Dependent variable	Path direction	Independent variables (predictors)	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	Adjusted R^2	t	Sig.
Usage	←	Intention	.772	.027	.747	.557	28.765	.000
Intention	←	Attitude (AT)	.228	.046	.242	.636	4.922	.000
Intention	←	Perceived Usefulness (PU)	.552	.047	.577	.636	11.711	.000
Attitude (AT)	← ←	The cloud computing Technology Trust (TT)	.267	.057	.233	.781	4.655	.000
Attitude (AT)	←	Perceived Usefulness (PU)	.772	.032	.757	.781	23.807	.000
Attitude (AT)		Perceived Ease of Use (EU)	.097	.055	.085	.781	1.773	.000
Trust in cloud computing service provider (TT)	←	SLA verification-based trust (VT)	.180	.030	.174	.824	5.954	.000
Trust in cloud computing service provider (TT)	←	Reputation Based Trust (RT)	.818	.032	.758	.824	25.938	.000
Perceived usefulness (PU)	←	Perceived Ease of Use (EU)	.883		.792	.626	33.166	.000

p-values less than 0.05 were considered statistically significant

In order to ascertain whether there were any multicollinearity effects, we looked for any warning messages generated by the AMOS output that indicated a multicollinearity issue. The findings revealed that there was no evidence of multicollinearity. Moreover, regression analysis was used to provide a framework for a more rigorous investigation of the potential issue of multicollinearity. Table 5 shows that the tolerance values were between 0.938 and 0.400.

Using Variance Inflation Factors (VIF) is the best and only known technique to measure collinearity. Although a Variance Inflation Factor (VIF) of less than or equal to 10 (i.e., a tolerance of more than 0.1) is frequently recommended in this study, a Variance Inflation Factor (VIF) of more than 4 is taken as a sign of substantial multicollinearity issues. However, as the VIFs' values ranged from 1.066 to 2.502, as shown in Table 5, there were no VIF values exceeding 4 in the model. Therefore, there was no evidence of multicollinearity.

After confirming that all relevant requirements have been satisfactorily met, multiple regression analysis was used to assess the study's hypotheses.

The first regression involved "Intention" and "Usage". Figure 3, it was discovered that "Intention" ($\beta = 0.747$, Standardized path coefficient, $p<0.05$) is significantly and positively related to “Usage” (adjusted $R^2 = 0.56$) (Tables 6-7 and Fig. 3). Thus, H9 is supported.

Table 7: Standardized regression weights

Criterion variable	Path direction	Criterion variable predictors	Estimate	(Significance)
Usage	←	Intention	.747	Significant
Intention	←	Attitude (AT)	.242	Significant
Intention	←	Perceived usefulness (PU)	.577	Significant
Attitude (AT)	←	Trust in cloud computing service provider (TT)	.233	Significant
Attitude (AT)	←	Perceived Usefulness (PU)	.757	Significant
Attitude (AT)	←	Perceived Ease of Use (EU)	.085	Significant
Trust in cloud computing service provider (TT)	←	SLA Verification-Based Trust (VT)	.174	Significant
Trust in cloud computing service provider (TT)	←	Reputation Based Trust (RT)	.758	Significant
Perceived usefulness (PU)	←	Perceived Ease of Use (EU)	.792	Significant

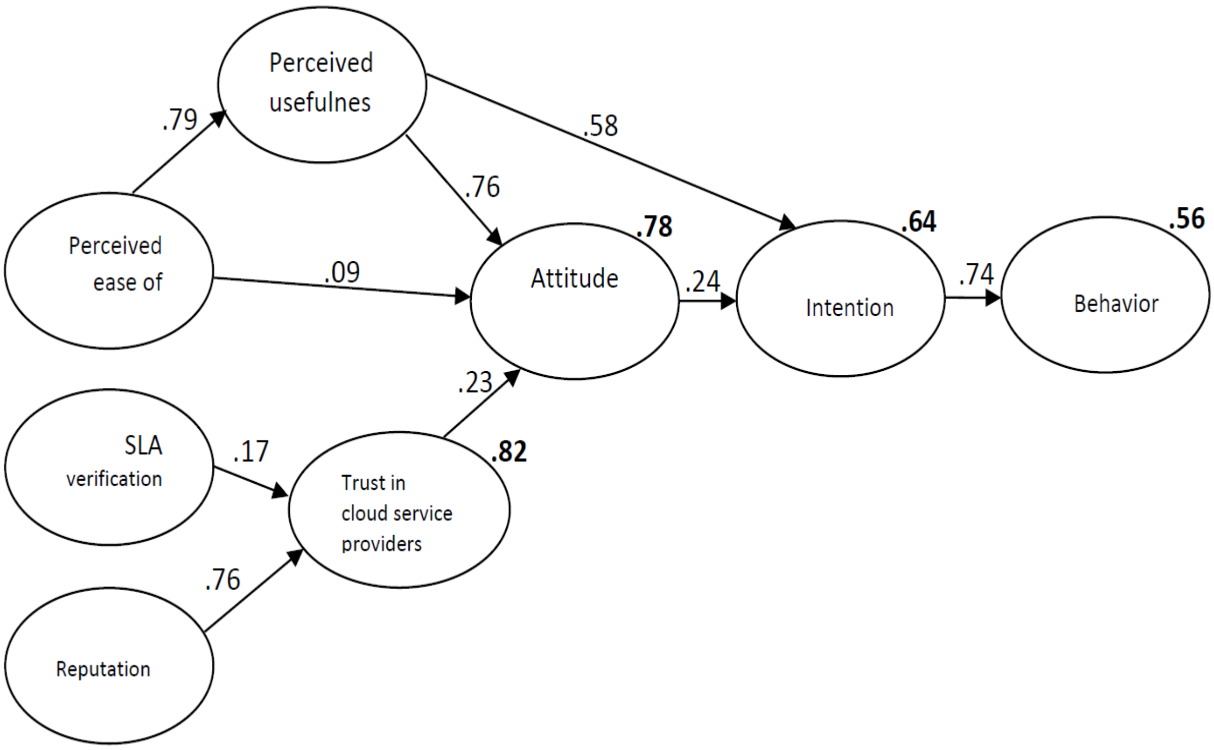

Fig. 3: The study model

Thereafter, the two independent variables (i.e., "attitude" and "perceived usefulness") were regressed on "behavioral intention". Results, as in Fig. 3, indicate that all two variables are significantly related to "behavioral intention" (adjusted $R^2 = 0.636$): "attitude" ($\beta = 0.242$, standardized path coefficient, $p<0.05$) and "perceived usefulness" ($\beta = 0.577$, standardized path coefficient, $p<0.05$) (Tables 6-7 and Fig. 3). Thus, H_5 and H_8 are supported.

Then, the three independent variables (i.e., "trust in cloud computing service provider", "perceived usefulness" and "perceived Ease of use") were regressed on "attitude". Results, as in Fig. 3, indicate that all three variables are significantly related to "Attitude" (adjusted $R^2 = 0.781$): "Trust in cloud computing service provider" ($\beta = 0.233$, Standardized path coefficient, $p<0.05$), "Perceived usefulness" ($\beta = 0.757$, Standardized path coefficient, $p<0.05$) and "Perceived Ease of Use" ($\beta = 0.085$, standardized path coefficient, $p<0.05$) (Tables 6-7 and Fig. 3). Thus, H_3, H_4 and H_7 are supported.

Next, the two independent variables (i.e., "SLA verification-based trust" and "Reputation Based Trust") were regressed on "Trust in cloud computing service provider". Results, as in Fig. 3, indicate that all two variables are significantly related to "Trust in cloud computing service provider" (adjusted $R^2 = 0.824$): "SLA verification-based trust" ($\beta = 0.174$, Standardized path coefficient, $p<0.05$) and "reputation based trust" ($\beta = 0.758$, Standardized path coefficient, $p<0.05$) (Tables 6-7 and Fig. 3). Thus, H_1 and H_2 are supported.

The last regression involved "perceived usefulness" and "perceived Ease of use". As seen in Fig. 3, it was found that "Perceived Ease of Use" ($\beta = 0.792$, standardized path coefficient, $p<0.05$) is significantly and positively related to "Perceived usefulness" (adjusted $R^2 = 0.626$) (Tables 6-7 and Fig. 3). Thus, H_6 is supported.

Discussion

One of the main objectives of this study was to identify the trust factors driving cloud computing adoption by using the theoretical TAM concept. The author extended TAM to investigate trust as a driver of cloud adoption in Saudi Arabia by placing SLA verification, reputation, and trust in cloud computing service providers as new constructs within Technology Acceptance Models (TAMs). The study model also investigated the factors affecting cloud adoption in Saudi Arabia. The study's findings demonstrate that the proposed model successfully explained a sizable portion of the variation in cloud adoption. All of the study hypotheses are supported. "Perceived usefulness" and Trust in cloud computing service provider variables were found to significantly affect cloud users' attitudes toward the cloud's adoption.

This suggests that the perceived usefulness of using cloud computing like the development and deployment of applications to the cloud using applications created by the provider and the ability to securely store and backup massive amounts of data offsite, which lessens the pressure on the business (Bagiwa *et al*., 2016) encourages people and businesses to use cloud computing to get their work done.

Moreover, trust in cloud computing service providers was also found to significantly affect cloud users' attitudes toward the cloud's adoption. According to Ahmad *et al*., (2012), a number of companies are reluctant to make the transition to the cloud because of a lack of trust in the cloud service provider. The results also show that trust in the cloud service provider can be built by paying attention to the Service Level Agreement (SLA) and the reputation of service providers. A clear and well-written SLA does not allow for opportunistic conduct. Published SLAs might reassure prospective clients of the trustworthiness of the cloud computing provider before a relationship between the two parties has been established (Stankov *et al*., 2012).

Service Level Agreements (SLAs) alone are not sufficient to establish trust between cloud services. The best way to determine whether cloud services are reliable is to ask customers for feedback; this will enable them to make improvements in the future. This feedback also helps in assessing the quality of the individual transaction and the specific service provider and helps in making recommendations. Reputation is built by collecting those recommendations. Prior studies found that reputation also has a significant impact on trust (Dadhich *et al*., 2011; Govindaraj *et al*., 2021; Phoomvuthisarn, 2011).

The results also show that reputation and SLA verification are able to explain 82% of the trust in cloud service providers.

Table 8: Participation of trust's variables in its explanatory power

Antecedents	Trust %
SLA Verification-based Trust (VT)	15.31
Reputation-Based Trust (RT)	66.69
Total	82.00

Table 9: Participation of attitude variables in its explanatory power

Antecedents	Attitude %
Trust in cloud computing service provider (TT)	9.06
Perceived Usefulness (PU)	29.42
Perceived Ease of Use (EU)	3.30
SLA Verification-based Trust (VT)	6.76
Reputation-Based Trust (RT)	29.46
Total	78.00

The author, in a prior study, developed an equation to estimate the participation of each model's construct in the model's explanatory power (Al-Ghaith, 2015):

$$A_x = \frac{\beta_x^{\,2}}{\sum_{k=1}^{n} \beta_x^{\,2}} \times R_y^{\,2}$$

where,

A_x = Participation of variable A_x in a model' explanatory power
β_x^2 = Square of beta coefficients or standardized coefficients of the variable
R_y^2 = Model' explanatory power (y)
$\sum_{k=1}^{n} \beta_x^{\,2}$ = Total of causal effects for the model's constructs

The study uses the aforementioned equation to determine the explanatory power of each construct and its antecedents, as well as the rate at which each antecedent contributes to a construct's explanatory power. The equation was applied to the "trust" antecedents and Table 8 summarizes the findings. The findings indicate that "reputation-based trust" alone accounts for 66.69% of "trust", while "SLA verification-based trust" accounts for 15.31%.

Once more, the Al-Ghaith equation (Al-Ghaith, 2015) was employed to determine the contribution of the "Attitude's" antecedents to its explanatory power. The results are described in Table 9.

The findings demonstrate that Saudi citizens' attitudes toward using cloud computing are significantly influenced by perceived usefulness and reputation-based trust, which have the ability to explain their attitude by 29.42 and 29.46%, respectively.

The Al-Ghaith equation (Al-Ghaith, 2015) was employed again to calculate the participation of the antecedents of "behavioral intention" on its explanatory power and the results have been summarized in Table 10.

Table 10: Participation of behavioral intention's variables in its explanatory power

Antecedents	Behavioral intention %
Attitude (AT)	7.49
Perceived Usefulness (PU)	17.84
Trust in cloud computing service provider (TT)	7.21
Perceived Ease of Use (EU)	2.63
SLA Verification-based Trust (VT)	5.38
Reputation-Based Trust (RT)	23.45
Total	64.00

The result shows that "reputation-based trust" alone explains 23.45% of individuals' "behavioral intentions" towards using cloud computing, followed by "perceived usefulness," which explains around 17.84% of "behavioral intentions," and then "attitude," with 7.49%. Whereas attitudes, trust in the cloud provider, SLA verification-based trust, and perceived ease of use were explained, respectively, as 7.49, 7.21, 5.38, and 2.63% of the variance in BI.

The results show that "reputation-based trust" alone explains 29.46% of individuals' attitudes and 23.45% of their "behavioral intentions" towards using cloud computing. This effect on people's attitudes and intention towards adopting cloud computing was indirect and through trust construct.

Trust and reputation are seen as essential components in any social transaction, although they are slightly different from each other. Trust can be characterized in a particular situation as one entity's subjective expectation of another. Trust can happen among two individuals or entities however it requires effort and time to create and might be readily destroyed.

Reputation, on the other hand, is a community's belief or perception of an entity. This belief might be derived from an entity's earlier encounters. Or, in other words, entities' previous encounters can directly or indirectly construct experiences, which in turn derive or even form beliefs.

Direct experience refers to the trust that is built as a result of direct interaction between the customer and the provider, whereas indirect experience refers to the trust that is formed as a result of watching how different entities interact or through recommendations made by other entities.

It is believed that if an entity has a great reputation in a community, then it indicates that many people there trust that entity. Consequently, by utilizing an entity's reputation, one can determine its level of trust. As it will have an impact on cloud users, reputation is crucial in the field of cloud computing, thus providers must work to improve their reputation. This improvement can be done by determining the reputation through the use of a specific model that is able to calculate two metrics, the first of which is points or scores for collected feedback or opinions and the second is for performance.

Implications for Theory and Research

Theoretically, this study proposes and develops a theoretical model by adopting and extending TAM to include trust as a cognition, representing a person's perception of social influence to perform or not perform a behavior under consideration. The study model also identifies factors affecting cloud computing adoption by considering Reputation Based Trust and SLA verification-based trust variables which have been rarely examined before. The proposed model was able to explain 64% of the variance in behavioral intention and 78% of individuals' attitudes toward the adoption of cloud computing in Saudi Arabia.

From a researcher’s perspective, the study’s findings show that a significant amount of variance in cloud computing adoption was explained by the proposed model. It suggests that the model expansion by incorporating trust in cloud computing service providers, reputation based trust, and SLA verification-based trust factors were valuable explorations. Further, the results also show that "reputation-based trust" alone explains 29.46% of individuals' attitudes and 23.45% of their "behavioral intentions" towards using cloud computing. This effect on people's attitudes and intention towards adopting cloud computing was indirect and through trust construct Fig. 3.

Implications for Practitioners

The results of this study are multifold. This study identifies a number of novel factors along with the core TAM variables that affect individuals’ attitudes and their intention to adopt the cloud. The practical implications of this study can help enterprises' IT staff members and cloud service providers. The findings demonstrate that Saudi citizens' attitudes toward using cloud computing are significantly influenced by perceived usefulness and reputation-based trust, which have the ability to explain their attitude by 29.42 and 29.46%, respectively. Therefore, it is recommended that companies be encouraged to leverage this result by enhancing their reputation and emphasizing the cloud's usefulness in terms of its benefits to individuals and organizations. SLA verification-based trust also was shown to be one of the key predictors of the acceptance of cloud computing. A Service Level Agreement (SLA) is a critical contract between a cloud service provider and a cloud user that ensures the expected level of service. A service provider needs a framework that aids in decision-making for SLA development and enhances its monitoring to increase its trust value and prevent penalties. Thus, it is recommended that companies develop a mechanism or technique for alerting a service provider to take immediate action when there is a chance of a service violation. The study also found that consumer trust in cloud service providers was a key predictor of the acceptance of cloud computing. Thus, it is recommended that companies narrow their attention to trust-building activities.

Limitations and Future Research

Although this research has presented results that are statistically significant, this study is not without some limitations. Firstly, this study was conducted in the main provinces of Saudi Arabia and it therefore could not be an accurate representative of the country's full population. In order to generalize the results, further surveys would be needed to investigate user attitudes and intentions toward cloud computing in rural portions of Saudi Arabia, as this demography accounts for approximately twenty percent of the population. Secondly, respondents without preset backgrounds were targeted in this research; however, the majority of the responses were obtained from technical specialists, owing to information technology professionals' greater understanding of cloud technologies and applications than regular end users. It is worth noting that individuals were rapidly adopting cloud services and products, but sometimes explaining was required to align the cloud idea with the popular product, such as clarifying that google drive and Dropbox are cloud storage service products or, for younger respondents, explaining that cloud gaming platforms like Google Stadia and Microsoft cloud are cloud-based products that allow gamers to play high-quality games without needing expensive hardware or consoles. Thirdly, by reading the respondents' comments, it was also noteworthy that some of them show that the decision to adopt cloud technology is not always made independently; however, it refers to peer influences such as friends and relatives or superiors such as teachers or professors. It can be claimed, therefore, that all of the limitations encountered during this research have led to insightful recommendations for further research. Due to the third limitation, we believe that it is useful to integrate more than one model when studying people's adoption of cloud computing in Saudi Arabia. A decomposed version of the TPB that contains several constructs from the TAM and DOI could be a good choice. DTPB suggests that normative beliefs could be decomposed into relevant reference groups such as peers and superiors and that each may have differing views on the use of cloud computing.

Conclusion

Cloud computing has emerged as one of the most significant developments in the field of Information Technology (IT) in recent years, allowing others to leverage third-party services. Therefore, it is essential to identify and address trust in cloud service providers as one of the key predictors of the acceptance of cloud computing. Several prior studies covered the technological facets of cloud-based contexts, including cloud virtualization, scalability, and security. However, it is argued that the biggest barrier to cloud computing is not technical but rather cognitive or behavioral and in particular attitudinal. Thus, this research aims to study individuals' attitudes and perceptions toward cloud computing, with a particular concentration on the perception of trust and its constructs in the cloud computing environment, namely Service Level Agreements (SLA) verification and reputation, in order to investigate the factors influencing the adoption of cloud computing in Saudi Arabia. This study presents an extended Technology Acceptance Model (TAM) to include trust as a cognition, representing a person's perception of social influence to perform or not perform a behavior under consideration. The study model also identifies factors affecting cloud computing adoption by considering reputation-based trust and SLA verification-based trust variables, which have been rarely examined before. The proposed model was able to explain 64% of the variance in behavioral intention and 78% of individuals' attitudes toward the adoption of cloud computing in Saudi Arabia. The study's findings show that the proposed model explained a significant amount of variation in cloud computing adoption. It suggests that the model expansion by incorporating trust in cloud computing service providers, reputation-based trust, and SLA verification-based trust factors were valuable explorations. Further, the results also show that "reputation-based trust" alone explains 29.46% of individuals' attitudes and 23.45% of their "behavioral intentions" toward using cloud computing. This effect on people's attitudes and intentions towards adopting cloud computing was indirect and through the trust construct.

Acknowledgment

Thank you to the publisher and Al Imam Mohammad Ibn Saud Islamic University (IMSIU) for their support in the publication of this research article.

Funding Information

The authors have not received any financial support or funding to report.

Ethics

This article is original and contains unpublished material. The corresponding author confirms that all have read and approved the manuscript and no ethical issues involved.

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