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TECHNOLOGICAL, ORGANIZATIONAL, AND ENVIRONMENTAL FACTORS INFLUENCING THE ADOPTING OF CLOUD COMPUTING: A QUANTITATIVE STUDY

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Abstract. The aim of this study is to identify the factors influencing the adoption of cloud computing. The Technology-Organization-Environment (TOE) Framework was utilized to analyze the organizational-level adoption of cloud technology using three contexts that might influence decision-makers to use such technology. A quantitative research approach was employed to analyze the hypothesis. Data was collected via a questionnaire-based survey involving 110 participants comprising mid-level managers and IT specialists from a public health organization. The inferential statistical results show that among the three types of context, certain factors influenced decision makers to adopt cloud computing technology. These factors are relative advantage, compatibility of technology, management support, technological readiness, and competition pressure. This research provides fruitful insight and contributes to the existing body of knowledge in the field of technology management, specifically cloud computing technology, and has research and practical implications.

Keywords: Technology-Organization-Environment Framework, cloud computing, technology management.

JEL Classification: 032, M15.

Introduction

Cloud computing is defined as "an information technology service model where computing services both hardware and software are delivered on-demand to customers over a network in a self-service fashion, independent of device and location" (Marston et al., 2011, p. 177). The concept of cloud computing emerged when organizations began to facilitate their services, such as sharing resources, external storage, and auto-scalability, with their customers in a large-scale cloud. This innovation enables users from all over the world to save time and money and allows them to access the services easily anytime and anywhere instead of using their own product to gain access to their information. Thus, cloud computing is not a simple technology, rather it is a fundamental change to the way in which information technology is provided and used; therefore, organization-must make considerable investments in both IT infrastructure and human capital in terms of training and personal development to remain competitive. In developing countries, digital technology has become an important aspect of their strategic initiatives to secure e-services to provide both economic and social value (Vyshnevskyi et al., 2021).

The Saudi government's rapid expansion plans have already brought about a huge transformation in economic and social reform. Through its 2030 Vision, the government is seeking to provide effective and efficient services to its citizens to meet the economic objective of reducing public costs and at the same time moving away from its dependency on oil. According to a United Nations report (2020) Saudi Arabia has one of the highest levels of human capital and development and a well-developed infrastructure, ranking V2 in the e-government development index (EGDI). Adopting new technology such as cloud computing has generated many opportunities and brought fruitful benefits for countries, shifting government strategy to technological innovation and its implementations.

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The benefits and drawbacks of cloud computing

Increasing digital solutions forces decision-makers to evaluate the benefits of cloud computing such as cost saving, agility, and flexibility (Gutierrez et al., 2015). However, related studies of cloud computing indicate the benefits of cloud computing (Rogers, 2003; Pather & Abiodun, 2017; Saedi & Iahad, 2013; Hsu et al., 2014).

(1) Cost efficiency. Every government seeks to optimize the use of its resource pool and reduce the need for future cost expansion, thereby saving resources for coming generations. Moving government infrastructure to the cloud benefits governments by sharing huge data and offers cloud solutions including infrastructure, platforms, and software across a variety of applications that serve not only the government but also its people by improving services. Such benefits have been found in many previous studies including (Rogers, 2003) and (Pather & Abiodun, 2017). For instance, e-government is vital in public sector transformation as a tool to increase efficiency, as well as a source of competitive advantage and political stability (Centeno et al., 2005).

(2) Improving services and social image. With populations rapidly increasing, and living and working patterns facing many philosophical, social, and economic changes, e-government services must find ways to meet such changes and protect people's data from cyber-attacks. Cloud computing offers a better solution than traditional IT services which have limited capacity and provide less security. It would also meet future demand increases. Reports from the available literature support this argument (Low et al., 2011; Nasir & Niazi, 2011; Borgman et al., 2013; Morgen et al., 2013; Senarathna et al., 2018; Saedi & Iahad, 2013; Hsu et al., 2014).

(3) Speed and robust cyber security. While traditional IT provided good solutions in the past, it takes longer to develop and implement than cloud solutions, which involve fewer steps to integrate and implement with robust innovation and greater security. In addition, many governments have faced cyber-attacks by hackers, costing them massive loss of resources, whereas cloud services provide a high level of cyber security that is very difficult to attack. It is important for governments to deliver good, high-quality services to the public; thus, the government should use and transfer this innovation to the next level of business economy (Sallehudin et al., 2015).

(4) Transferable innovation. The Covid-19 pandemic has taught us how to shift almost everything online, including education, with students attending classes online via Zoom or Teams. Moreover, the cloud enables people to order food, taxis, clothes, etc., all online anywhere and anytime. This innovation has also transferred to the government, with many government agents in Saudi Arabia having benefited from it. For example, e-services, start- up businesses, conferences, etc., have all enhanced the economy. The Covid-19 crisis has also encouraged the government of Saudi Arabia to increase its use of e-government services enabling a variety of its agencies to offer greater quality and efficiency in public services.

Although the advantages of cloud computing are clear to organizations, decision makers have to take great care when deciding to adopt it. Cloud computing, akin to any other technology is not without risks, which can include system performance like internet problems, server issues, and network reliability (Vyshnevskyi et al., 2021). Security and confidentiality risks are a big concern especially to large organizations which place their security and important data with a third party (Gutierrez et al., 2015; Rastogi et al., 2018) Loss of IT competencies may result from outsourcing IT support, and there may be control limitations due to inability of total function of the system (Duan et al., 2013). One issue faced by decision makers is implicit dependency on the provider (Gutierrez et al., 2015). This risk was also found in (Porter & Millar, 1985) five-forces model as a cost barrier to switching. The cost of switching to another provider is high and can be difficult since the bargaining power of the provider is high, due to the huge cost and time it can take to change or move data to another supplier.

While research on cloud computing has increased in recent years, and as mentioned above KSA ranked V2 in the e-government development index. the existing literature does not specifically address Saudi Arabia. Little attention has been paid to e-government and its use of cloud computing in the country. As such, there is a need to fill the gap by identifying the key factors influencing the adoption of cloud computing in public organizations in Saudi Arabia and their implications.

The aim of this study is to identify the factors influencing the adoption of cloud computing in a public organization in Saudi Arabia through an empirical model providing both theoretical understandings and practical implications. Therefore, the research questions are addressed:

1) What are the factors influencing the adoption of cloud computing in a public organization in Saudi Arabia?
2) What are the research and practical implications?

Thus, this research will contribute to the body of literature by providing empirical evidence of the relationship between factors leading to the adoption of cloud technology. In practical terms, it will offer insights to both suppliers in terms of creating successful strategies in the competitive nature of the market, and to end-users in terms of evaluating their development technology.

The following sections highlight several key findings of the existing literature, followed by the chosen theoretical framework and the formulated hypotheses along with methodological justifications and data collecting procedures; Then, the findings are presented and discussed, followed by the implications and conclusion.

1. Literature review

The Technology-Organization Environment (TOE) Framework created by (Tornatzky & Fleisher, 1990) explains that a firm which adopts and implements

technological innovations is influenced by three types of context: technological, organizational, and environmental. Within its broad contexts, it paved the way for studies to identify various factors that may influence the adopting of cloud computing by different types of organization, in both the private and the public sectors. Factors including competitive pressure, complexity, technology readiness and trading partner pressure have a significant influence on the adopting of cloud computing (Gutierrez et al., 2015). Oliveira et al. (2019) highlight the importance of the three contexts of the TOE framework in influencing the adoption of new technology such as cloud computing According to (Zhu & Kraemer, 2005) the three aspects of TOE, technology, organization, and environment, are influenced by factors such as firm size, firm scope, management support, competition. Key factors found to have a significant influence on the adoption decision of cloud computing services in the UK include competitive pressure, complexity, technology readiness and trading partner pressure (Gutierrez et al., 2015). A qualitative study conducted by Alanezi (2018) revealed two categories, namely a) negative impact, which includes security and privacy, government policy, lack of knowledge, and loss of control, and b) positive impact, which includes reducing expenses, improving IT performance, and promoting scalability and flexibility. However, factors identified within the three contexts included in the positive impact category vary in different studies and industries. For instance, the TOE has been examined by a number of empirical studies in various industries such as retail in Taiwan (Fu & Su, 2014), e-government services in the public sector (Nguyen, 2016), private organizations (Rastogi et al., 2018), district government (Ali et al., 2015, 2016), as well as from a managerial point of view using control variables such as size of farms, organizational structure, and type of industry in private companies (Tripathi & Mishra, 2019), among micro-enterprises (Pather & Abiodun, 2017).

1.1. Conceptual framework and hypotheses developed

A number of technological adoption theories and models have identified various factors associated with adopting of cloud computing. These include Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB), Unified Theory of Acceptance and Use of Technology (UTAUT), Technology-Organization-Environment framework (TOE), and Diffusion of Innovation Theory (DOI). Some studies integrated the DOI theory with personal characteristics (Sallehudin et al., 2015), TOE theory with Hofstede's cultural dimensions (Nguyen, 2016), or the TOE model with the resource-based view of firms (RBV) and contingency theories. These works aimed to provide an in-depth insight into the technology-adopting process using TOE model and expanding its implications.

As similar related studies evaluated the adoption of cloud computing using the TOE model which incorporates the three main contexts and their predicted factors, TOE was considered an appropriate conceptual framework for this paper which studies the adopting of cloud computing by a public organization in Saudi Arabia.

The existing literature discussed above commonly reveals nine factors across the three main contexts: relative advantage, complexity of technology, compatibility, management support, organization size, technology readiness, government regulations, competition pressure, and trading partners. The following section will discuss these factors.

1.2. Technology context

Relative advantage is considered an important factor in the adoption of CC innovation as it provides greater benefits for organizations (Rogers, 2003). It is associated with performance expectancy in which the implementation of such technology will enhance expectation, with the adopter expecting benefits such as data storage, sharing and cost benefits (Pather & Abiodun, 2017; Tripathi, 2019). Rogers defines it as the degree to which an innovation is perceived better than its current tools, and he includes social status or image to be a benefit of relative advantage. Such technology should provide or improve an organization's situation both economically, in terms of profitability and cost efficiency, and socially (Tornatzky & Klein, 1982). A study involving high-tech industry conducted by Low et al. (2011), using a questionnaire-based survey, found that relative advantage has a significant effect on the adoption of cloud computing by increasing communication inside and outside an organization. In order for the benefits of cloud computing to be realized, an organization has to develop several areas such as a high-speed network, green IT, and low-cost access computing devices (Dwivedi & Mustafee, 2010). Hence, the following hypothe-sis was developed:

H1. Relative Advantage Influences the Adoption of Cloud Computing Technology.

Complexity of technology refers to the degree to which an innovation is easy to use or learn for users within the organization and outside users (Rogers, 2003). If complexity exists in the technology or its process, it will be more difficult to adopt and even worse may be found difficult to use after the new technology is implemented. Many studies found that complexity negatively affects the adopting of cloud computing and therefore problems may be encountered by both adopters and users due to limited knowledge of the new technology (Low et al., 2011; Borgman et al., 2013; Morgan & Conboy, 2013; Gangwar et al., 2015). Ease of use and reliability are critical factors for public organizations to accept cloud computing (Shin, 2013; Tahir & Mehwish, 2015). Dwivedi and Mustafee (2010) highlighted that complexity occurs when an organization lacks confidence or system enablers for the new technology such as a high-speed network. While complexity exists in the adopted

tools, people tend to resist learning about it due to lack or limited knowledge of the new system. Therefore, the following hypothesis was developed:

H2. Complexity of Technology Negatively Affects the Adoption of Cloud Computing Technology.

Compatibility of technology is extensively reviewed in Rogers (2003) and is identified as a factor in enhancing the adoption of cloud computing. He describes it as the degree to which an innovation is perceived as being consistent with the adopter's values, needs, and experience. Many studies have identified compatibility as a factor affecting the adoption of cloud technology (Sallehudin et al., 2015; Makena, 2013; Rogers, 2003; Low et al., 2011). To ensure compatibility takes place and the development of the technology is sustained, whole-government approaches in different systems are essential to integrated system policies, taking into account the economic, social, and environmental dimensions (United Nations Survey, 2016). The Saudi Government would have to establish a good and consistent system that supports the new technology of cloud computing. Thus:

H3. Compatibility Influences the Adoption of Cloud Computing Technology.

1.3. Organizational context

Organizational context in general has multiple perspectives and its factors which might lead to significant outcomes have been the objective of numerous studies from a variety of fields including business, government, politics etc. It concerns all kinds of activities in organizations including strategy, structure, culture, organizational size, technology, and management support. The link between management support and new technology innovation has been emphasized by many scholars (Morgan & Conboy, 2013; Low et al., 2011; Rogers, 2003). The managerial role is critical in implementing, developing, deploying, and protecting strategic innovation such as adopting cloud computing. Top management support has a great impact on new technology outcomes by facilitating the process with appropriately allocated resources and defining authority, roles, and responsibilities. It is important for senior managers to realize the benefits of adopting cloud technology and through organizational change they can lead all employees to this goal by promoting a positive attitude (Low et al., 2011). In addition, the value of supporting the innovation of new technology has to come from top managers and their style of business, and they should be the first in the organization to realize this value. Hence:

H4. Management Support Influences the Adoption of Cloud Computing Technology.

The bigger the organization the more resources, in terms of finance and human resources, will be available to develop the technology infrastructure. In the case of public organizations in the Saudi government, their capabilities to support the process, provide fast services and networks, and upgrade their IT requirements efficiency have become strongly visible. In small organizations, however, their capabilities and limited financial resources are a barrier to developing the tools required for adopting cloud computing.

Several previous studies involving different sized firms found this factor to be vital in predicting the impact on adoption. For instance, an empirical survey by Low et al. (2011) of 111 senior middle managers in high-tech firms found that organizational size is a significant predictor for the adoption of cloud computing. With their strong capabilities, government owned organizations can share their vision and knowledge to encourage regional enterprises and small businesses to participate in developing their innovative technology. The perceived benefits can be limited in small business due to underutilizations and lack of integration (Iacovou et al., 1995). There is still a need to test this factor regarding adoption among organizations of different sizes. Hence:

H5. Organization Size Influences the Adoption of Cloud Computing Technology.

Technology readiness (TR) is defined as "People's propensity to embrace and use new technology for accomplishing goals in home life and at work". It represents a gestalt of mental motivators and inhibitors which determine the tendency for an individual to use new technology (Parasuraman, 2000). The influence of TR is widely used in research studies and in different frameworks and models such as DOI theory by the work of Hsu et al. (2006), EDI framework by Lacovou et al. (1995), and the TOE framework by Tornatzky and Fleischer (1990). In a contemporary competitive business environment, TR has become a vital factor in economic and social development (Radivojević et al., 2018). Therefore, Saudi's public agencies are more likely to adopt cloud computing if they are aware of technology readiness:

H6. Technology Readiness Influences the Adoption of Cloud Computing Technology.

1.4. Environmental context

The environmental context of a firm relates to the specific industry, its competitors, and the arena in which it conducts its business and dealings with the government (Tornatzky & Fleischer, 1990). It therefore concerns competition intensity, trading partners, technology infrastructure, government rules, and economics at a macro-level. Government regulations are the rules and policies that, by law, force agencies to follow requirements and legislative regulations and are found to be significant predictors of the propensity to adopt cloud computing. Government pressure, whether formal or informal, is shaped by the condition of the market structure, and the government's requirements (Wang et al., 2019). On the other hand, legislative regulations can be complex, subject to interpretation, and too general. According

to an e-government survey carried out in 2020 by the United Nations, governments should consider a standard ecosystem, which would incorporate laws, policies, and guidelines that address issues like accessing information, security, and data protection. Therefore:

H7. Government Regulations Influence the Adoption of Cloud Computing Technology.

Now the Saudi Government with its new 2030 vision is in the process of privatizing, and most of its own-state agency are strategizing their strategic business weapon including health institutions. In operational term, the government allows the market rules or games to take place and therefore force their managers and leaders to generate better quality and lower cost products and services. On other words, competition enables innovation solutions, thus, members of the health institution have perceived that they are operating under the competitive environment which necessity them to accept the need for innovation.

According to Porter (1990) A nation's competitiveness depends on the capacity of its industry to innovate and upgrade. Intense competition in a global economic environment has increased dramatically with countries seeking efficiency and sustained competitive advantage over their rivals. Knowledge in information technology has become an intangible asset that requires identifying, developing, and deploying by management and managing these assets needs managerial and leadership efforts that are vital in achieving sustained competitive advantage (Porter & Miller, 1985). To achieve this goal through cloud computing, governments, with their legislative power and capacity, gain operational efficiency and cost reduction; for example, data collection on a larger scale allows them to offer new products and services at a lower rate (Low et al., 2011). Thus:

H8. Competition Pressure Influences the Adoption of Cloud Computing Technology.

Trading partners work with service providers and adopters in a collaborative and supportive environment. The trading partner's role is not just to store and maintain the data, thus choosing the right provider is paramount for top management since this decision requires sophisticated security, availability of data for both adopter and users, strong capabilities of the trading partner, and well-trained staff (Gangwar et al., 2015).

Accordingly, service providers are expected to offer high levels of commitment during the implementation of cloud computing and are likely to influence the propensity of adopting the new technology as previous literature illustrates. Moreover, governments' data are so valuable, huge, and sensitive that regulations and policies must be followed to ensure data control and privacy. So, the following hypothesis was formed:

H9. Trading Partners Influence the Adoption of Cloud Computing Technology.

From the above discussion, the conceptual framework is presented, as seen in Figure 1 below, which shows the proposed association between the study variables.

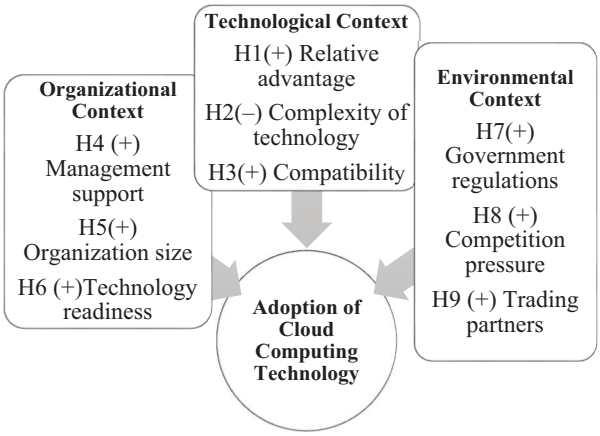

Figure 1. TOE conceptual framework

2. Research methodology

2.1. Measurements and questionnaire design

The questionnaire design was adopted in this study with two target groups, mid-level management and IT professionals in the Ministry of Health in Saudi Arabia, who were required to respond to and identify concerns surrounding adopting cloud technology.

A review of existing robust studies related to cloud computing and its associated variables resulted in the initial form of a questionnaire being developed, comprising 42 items divided into three dimensions. The dimensions used in this study were checked and verified to be valid and reliable measures in the empirical studies. The validity of the entire questionnaire was established further by presenting it to four experts in cloud computing from two Saudi universities, both male and female, for revision and to identify any potential misunderstandings or ambiguities. The result was that their feedback was considered for minor modifications before the survey was finalized. In addition, reliability was confirmed through analysis with statistical software, until its final form, consisting of 37 items was developed according to the specific research background. After the questionnaire was finalized, the researcher sent it to two participants to complete it for test purposes. The survey was designed with two main sections. The first looked at participants' experience in technology-based knowledge and comprised four items: responsibility for passing decisions related to the adoption of technology, level of knowledge of cloud technology, types of service model used, and the choice of cloud technology form. The aim of these questions was to assess the technology base-knowledge of the participants and confirm the decision-making level between the targeted group. The second section looked at potential factors influencing the adopting of cloud computing and comprised 33 items, based on the TOE conceptual

framework utilized in this study. The constructed questionnaire was adapted from mature measurement scales using common variables measured in similar previous studies (Oliveira et al., 2014; Alshamaila et al., 2013; Low et al., 2011) with minor modifications or in few cases removal if there were found to be issues with regards to suitability to a specific organizational environment. A 5-point Likert scale was used (with 1 being strongly agree and 5 being strongly disagree). The second section consisted of three scales, technological, organizational, and environmental, each of which comprised three variables. To measure the technological scale, we used: relative advantage (5 items); complexity of technology (4 items); and compatibility of technology infrastructure (5 items). To measure the organizational scale, we used: management support (4 items); organizational size (3 items); and technological readiness (3 items). To measure the environmental scale, we used: government regulations (3 items); competitive pressure (3 items); and trading partner (3 items).

2.2. Participants and data collecting

The study involved two groups (mid-level management and IT professionals) from one public organization in the Ministry of Health. The target was cloud computing end-users from the adopting side. The selected sampling frame for this study consisted of 430 managers and IT professionals, for which a selective non-random sampling method was used. The Ministry of Health was chosen as its development and progress in adopting innovation technology has been remarkable, especially during the Covid-19 pandemic. Service providers, physicians, pharmacists, nurses, and personal health assistants were not included in the target population. An online survey questionnaire using Google form was distributed to participants via the Public Relations Department of the Ministry of Health between May–June 2021. The number of responses received was 158, from which only 110 were fully completed and usable. Those which were incomplete, chose not to complete, or did not meet the study criteria, were excluded. This yielded a response rate of 25.6%. A cover page was included at the beginning of the survey which included the research objectives and a polite request for the recipient to participate in the study.

2.3. Statistical analysis

Data were analyzed using SPSS version 22.0 (IBM Inc., USA) statistical software, including a description of each participant's experiences. Multiple regression analysis was also used to determine the relationship between the independent variables and the dependent variable. F-tests and *t*-tests were used to test hypotheses, and stepwise regression multiple analysis was used to find the independent variables which most influenced the dependent variable. The regression equation is Prediction $(Y) = a + bx$ where a is constant b is the R^2 Coeff. and x is the independent variable; $Y = a + b_1x_1 + b_2x_2$.

3. Results

A total of 110 responses were received from middle managers and IT specialists and the data are described in Table 1. It should be mentioned, however, that the questionnaire initially contained other questions such as age, income, status, and other demographic information that might have helped to characterize the participants. These items were rejected by the respondents, despite the researcher assuring them that the information would remain confidential and only be used for research purposes. In addition, the absence of this demographic information would have no impact on what this study intended to achieve. Therefore, the decision was made to remove theses variables to avoid participants' concerns that their identity could be revealed by cross-referencing answers. Hence, only more generic questions were left. Regarding the decision-making role, half of the participants stated that it is the responsibility of management as managers make decisions related to adopting technology, followed by 27.2% who believed it to be the responsibility of the IT department and 22.7% who considered it to be a shared responsibility between the two groups.

Table 1. Description of participants' experience

Question	Title	Frequency	Percentage
Respondents' responsibility for passing decisions related to adopting technology	Management	55	50
	IT Dep	30	27.2
	Both Management and IT Dep	25	22.7
Level of knowledge about cloud technology	Limited	12	11
	Some knowledge	34	31
	Expert	64	58
	No Knowledge	–	0
Service model most suited to your organizational need	SAS	7	6.3
	PASS	78	78
	LAAS	25	25
	Not sure	–	0
Using any form of cloud technology by you organization.	Increasing dependency of cloud Tech	87	79
	Do not have plan	–	0
	Evaluating cloud Tech and studying their need	23	21
	Not Interested in cloud Tech	–	0
N = 110	100%		

The participants were predominantly experts or had some knowledge about cloud technology (58% and 31% respectively). The majority of the employees seemed to recognize which service model mainly suited their organization needs, with 71% identifying the Platform as Service (Pass) as best suiting their organization, while 22.7% preferred Infrastructure as a Service (IaaS). This could be due to the fact that the platform service identified by the participants is characterized by its scalability, speed, and flexibility in terms of developing and organizing different applications, particularly huge projects in governmental bases. Furthermore, 79% of the participants noted that their organization is increasingly dependent on cloud computing.

3.1. Reliability and validity

Table 2 shows that the Cronbach Alpha coefficient has been extracted for the internal consistency of all fields of the study, under the same theoretical dimension in the survey question. As for the total Cronbach Alpha coefficient for all fields of study, it reached (87%), which is an acceptable percentage for its application in this study.

Table 2. Reliability coefficients for the questionnaire and dimensions

Contexts	Dimension	Internal consistency
Technology Context	Relative Advantage	0.89
	Complexity of Technology	0.81
	Compatibility of Technology	0.77
Organizational Context	Management Support	0.92
	Organization Size	0.80
	Technological Readiness	0.88
Environmental Context	Technological Readiness	0.76
	Government Restrictions	0.84
	Trading Partners Pressure	0.81
Total Consistency		0.87

3.2. Factors influencing the adoption of cloud computing

The following section details the statistical analysis used to determine whether there is a relationship between the independent and dependent variables, to verify the generated hypotheses. Stepwise multiple regression analysis was used to determine the most influential independent variables.

3.3. The first main hypothesis

There is a statistically significant correlation between the technology context and the adoption of cloud technology (at 0.00 significant level which is below the general accepted cut off point of 0.05). To verify this hypothesis, regression covariance was used to determine the relationship between the independent variables as shown in Table 3. Table 3 indicates that there is a relatively strong and statistically acceptable correlation between the technology context and adopting cloud technology.

(H1) Relative Advantage Influences the Adoption of Cloud Technology.

Table 3 indicates that there is a strong and statistically acceptable correlation between relative advantage and adopting cloud technology. The *F*-value was 699.02 at level of significance 0.01 and freedom degree 109, which means acceptance of the first sub hypothesis.

(H2) Complexity of Technology Affects the Adoption of Cloud Technology.

Table 3 indicates that there is a relatively moderate relationship and statistically acceptable correlation between the complexity of technology and adopting cloud technology. The *F*-value was 126.59 at level of significance 0.01 and freedom degree 109, which means acceptance of the second sub hypothesis.

(H3) Compatibility of Technology Infrastructure Influences the Adoption of Cloud Technology.

Table 3 indicates that there is a strong and statistically acceptable correlation between the compatibility of technology and adopting cloud technology. The *F*-value was 301.86 at level of significance 0.01 and freedom degree 109, which means acceptance of the third sub hypothesis.

Table 3. Regression covariance

Independent variable	Source	Freedom	Sum square	Avera square	Calculated *F*	Sig	*R* value	R^2
Relative Adv	Regression SD	1 109	126.64 0.18	126.64 0.43	669.02	*0.000	0.84	0.71
Complexity of Technology	Regression SD	1 109	56.73 0.66	126.59	126.59	*0.000	0.57	0.31
Compatibility of Technology	Regression SD	1 109	93.82 0.55	301.86	301.86	*0.000	0.73	0.53
Technology Context	Regression SD	1 109	112.59 65.15	466.52	466.52	*0.000	0.79	0.63

Note: * Statistically significant at level 0.05.

Stepwise multiple regression analysis was used to arrange entry of the independent variables into the regression equation. The results showed that the independent variable (relative advantage) was the first variable to be entered, followed by compatibility of technology (Table 4). Complexity of technology was removed from the stepwise multiple regression equation Its correlation with the dependent variable was relatively moderate and the ratios of its interpretation of the common variance with the dependent variable were relatively small, as the determination coefficients for the same variables was 31%. Therefore, the regression equation was: $Y = 3.221 + 73.9$ (relative advantage) + 71.3 (compatibility of technology) where 3.221 was the constant of the equation.

Table 4. Stepwise multiple regression

Independent variable	Correlation Coeff	R^2 Coeff.	Calculated F	Sig. level
Relative advantage	86%	73.9%	382.25	*0.0000
Compatibility of technology	84%	71.3%	699.02	*0.0000

3.4. The second main hypothesis

There is a statistically significant correlation between organizational context and the adoption of cloud technology (at 0.00 significant level which is below the general accepted cut off point of 0.05). To verify this hypothesis, the current study used regression covariance to determine the relationship between the variables, as shown in Table 5.

Table 5 indicates that there is a relatively moderate correlation between organizational context and adopting cloud technology. The F-value was 357.23 at level of significance 0.01 and freedom degree 109, which means acceptance of the second hypothesis.

(H4) Management Support Positively Influences the Adoption of Cloud Technology.

Table 5 indicates that there is a relatively strong correlation between management support and adopting cloud technology. The F-value was 427.60 at level of significance 0.01 and freedom degree 109, which means acceptance of the first sub hypothesis.

(H5) Organization Size Influences the Adoption of Cloud Technology.

Table 5 indicates that there is a relatively weak correlation between organization size and adopting cloud technology. The F-value was 46.40 at level of significance 0.01 and freedom degree 109, which means rejection of the second sub hypothesis.

(H6) Technological Readiness Influences the Adoption of Cloud Technology.

Table 5 indicates that there is a strong and statistically acceptable correlation between technological readiness and adopting cloud technology. The F-value was 201.75 at level of significance 0.01 and freedom degree 109, which means acceptance of the third sub hypothesis.

Stepwise multiple regression analysis was used to arrange entry of the independent variables into the regression equation. The results showed that the independent variable (management support) was the first variable to be entered, followed by technological readiness (Table 6). Organization size was removed from the stepwise multiple regression equation. Its correlation with the dependent variable was relatively weak and the ratios of its interpretation of the common variance with the dependent variable were relatively small, as the determination coefficients for the same variables was 14%. So, the regression equation was: $Y = 3.221 + 61.3$ (management support) + 66.3 (technological readiness) where 3.221 is a constant of the equation.

Table 6. Stepwise multiple regression

Independent variable	Correlation Coeff	R^2 Coeff.	Calculated F	Sig. level
Management Support	84%	61.3%	427.60	*0.0000
Technological readiness	81%	66.3%	265.03	*0.0000

3.5. The third main hypothesis

There is a statistically significant correlation between the environmental context and the adoption of cloud

Table 5. Regression covariance

Independent variable	Source	Freedom	Sum square	Avera square	Calculated F	Sig.	R value	R^2
Management support	Regression SD	1 109	108.95 68.89	108.95 0.25	427.60	*.0.000	0.78	0.61
Organizational size	Regression SD	1 109	26.07 151.58	26.07 0.56	46.40	*.0.000	0.38	0.14
Technological Readiness	Regression SD	1 109	76.01 101.73	76.01 0.37	201.75	*.0.000	0.65	0.42
Organizational context	Regression SD	1 109	101.24 0.28	101.24 0.28	357.23	*.0.000	0.75	0.56

Note: * Statistically significant at level 0.05.

technology (at 0.00 significant level which is below the general accepted cut off point of 0.05). To verify this hypothesis, the current study used regression covariance to determine the relationship between the independent variables and the dependent variable as shown in Table 7.

Table 7 indicates that there is a relatively moderate correlation between environmental context and adopting cloud technology. This means that the environmental context explains 52% of the power of the independent variable on the dependent variable (adopting cloud technology). The *F*-value was 354.66 at level of significance 0.01 and freedom degree 109, which means acceptance of the third hypothesis.

(H7) Government Regulations Influence the Adoption of Cloud Technology.

Table 7 indicates that there is a moderate correlation between government regulations and adopting cloud technology. The *F*-value was 164.51 at level of significance 0.01 and freedom degree 109, which means acceptance of the first sub hypothesis.

(H8) Competitive Pressure Influences the Adoption of Cloud Technology.

Table 7 indicates that there is a relatively moderate correlation between competitive pressure and adopting cloud technology. The *F*-value was 192.27 at level of significance 0.01 and freedom degree 109, which means the second sub hypothesis is rejected.

(H9) Trading-Partner Pressure Influences the Adoption of Cloud Technology.

Table 7 indicates that there is a very weak correlation between trading partner pressure and adopting cloud technology. The *F*-value was 151.17 at level of significance 0.01 and freedom degree 109, which means the third sub hypothesis is rejected.

Stepwise multiple regression analysis was used to arrange entry of the independent variables into the regression equation. Results showed that the independent variable (competition pressure) was the only variable entered (Table 8). Government regulations and trading partner pressure were removed from the stepwise multiple regression equation. Their correlation with the dependent variable were relatively weak and the ratios of their interpretation of the common variance with the dependent variable were relatively small, as the determination coefficients for the same variables were 38% and 36%. So, the regression equation was $Y = 3.221 + 67$ (competition pressure) where 3.221 is the constant of the equation.

Table 8. Stepwise multiple regression

Independent variable	Correlation Coeff	R^2 Coeff.	Calculated *F*	Sig. level
Competition Pressure	82.4%	67%	189.42	*0.0000

4. Discussion

In this research, technology factors were found to be the most significant as both relative advantage and compatibility of technology were the most significant drivers for Saudi public organizations to adopt cloud technology. Both of these hypotheses were supported, consistent with the literature, which indicates that relative advantage can be perceived as a major driver in improving profitability, cost efficiency, and social image (Tornatzky & Klein, 1982), increasing the level of communication inside and outside organizations (Low et al., 2011). The second hypothesis was also supported in this study. Compatibility of technology was found to be a driver for decision makers to adopt the cloud technology where senior managers and IT professionals establish consistent systems and software applications compatible with cloud computing.

Although complexity of technology was found in previous literature to be an obstacle to adopting any new technology such as cloud computing (Sallehudin et al., 2015; Makena, 2013; Rogers, 2003; Low et al., 2011). This hypothesis was not supported due to its correlation with adopting cloud computing being relatively moderate, and the ratios of its interpretation of the common variance with the dependent variable being relatively small, as the determination coefficients for the same variables was 31%. In addition, as competition pressure in the marketplace increases, complexity is no longer a barrier to adopting new technology. This is possibly because adopters realize the risk to businesses and users associated with complexity, and in turn providers offer great services and free risk systems to ensure that adopters sign a contract with them and ensure they stay in business in return.

Organizational context was also a major significance as both management support and technological

Table 7. Regression covariance

Independent variable	Source	Freedom	Sum square	Avera square	Calculated *F*	Sig.	*R* value	R^2
Management support	Regression SD	1 109	67.29 110.45	67.25 0.40	164.5	*.0.000	0.61	0.38
Organizational size	Regression SD	1 109	73.93 103.81	73.93 0.38	192.27	*0.000	0.64	0.41
Technological Readiness	Regression SD	1 109	63.80 0.65	63.80 0.42	151.17	*0.000	0.60	0.36
Organizational context	Regression SD	1 109	102.28 76.50	102.28 0.28	354.66	*0.000	0.71	0.52

Note: * Statistically significant at 0.05.

readiness were drivers for organizations to adopt cloud technology. Management support is a central factor not only to adopting issues, but also as a major driver for all organizational activities at any level and size including government projects. Technological readiness was found to be a significant factor to the adopter's propensity to accept cloud computing. Organizational services at government level are gradually increasing their level of internet capacity and IT infrastructure, both for local agencies and end-users, in order to embrace new technology. The findings of the current study are consistent with similar previous studies (Alharbi et al., 2016; AlTwaijiry, 2020; AlQahtani, 2016; AlQarni & Barnawi, 2019), and indicated that business technology in terms of relative advantages, environmental factors including government-support, and competitive pressure and organizational factors in terms of the size and capability perspectives were found to be important factors for public and healthcare organizations in Saudi Arabia to adopt cloud Computing.

A Wide use of online services at governmental level must be compatible with IT system applications. An example of such an application is "Tawakkalna and Tabaud" which were created to protect people from the risk of novel Coronavirus, and which has gradually become people's first choice for storing their data and securing their information, using the latest IT technology system. In the environmental context, only competition pressure was found to be a significant factor for organizations wishing to adopt cloud computing. Competition pressure was found to be a major driver for new technology in numerous studies (Porter, 1990; Low et al., 2011). Also, (Trawnih et al., 2021) found that environmental contexts have a significant influence. For instance, (Lovelace, 2020) predicted that competition in the health care sector will be based on new technology innovation, therefore firms and governments should initiate their strategic planning (e.g., research and development) in response to technological environment changes. Finally, government regulations and trading partner pressure have no impact on the tendency to adopt new cloud computing, as their correlation with the dependent variable were relatively weak, and the ratios of their interpretation of the common variance with the dependent variable were relatively small. These two factors have no support from the results of the current study, contrary to previous studies (Wang et al., 2019; AlQarni & Barnawi, 2019). However, the findings of this research were expected and identified from previous studies and were employed in the current study of a public health organization in Saudi Arabia.

5. Implications and suggestion for future research

This study contributes to the field of technology management by identifying the factors influencing the adoption of cloud computing in the public sector from participants' perspectives. Empirically, certain factors were found to be the most significant drivers in the propensity of middle-level managers and IT professionals to adopt cloud computing. There is no evidence that complexity of technology is perceived as a barrier by adopters or users. This can be explained by the government's capabilities and knowledge in providing good and compatible system enablers for new technology, or the increased level of competition between third parties which means they offer the most remarkable services with well-trained staff, thus limiting the risk of this factor being a barrier. This study has shown that a combination of factors from different contexts impacts upon the decision to adopt the technology and eventually implement it. Thus, the decision-making mechanism works better when all the combined factors are evaluated allowing synergies to be built. One possible implication is that the interrelations between factors themselves would increase or decrease the tendency to adopt. For example, if managers fully recognized the benefits of cloud computing they would have to provide a compatible system in response in order to capture the potential benefits. In addition, government regulations and policies would pave the way to implementing the new technology. This interactive mechanism was previously highlighted by Bijker and Law (1992), who found that in relation to technological development, the influence of each factor cannot easily be differentiated from the others. The findings also reveal the importance of competition pressure in encouraging organizations to increase productivity, create a competitive edge, and look for technological innovations to remain competitive. In the case of Saudi's Vision 2030, in relation to cost efficiency and reducing the country's dependency on oil income, the government started to adopt cloud computing to achieve more efficient and agile IT resources to support the vision. The importance of agile technology to reduce government spending and deliver value for public has been stressed by (Aleinikova et al., 2020) Thus, it has allowed the government to efficiently fund different projects in the country. Another practical managerial implication raised by top management support was that, in addition to capturing the relative benefits of the technology, top managers in organizations need to develop, protect, and deploy IT resources to remain agile and competitive. This includes allocating finances, IT, and human resources, building strategic partnerships with providers, and most importantly providing effective leadership to support cloud services. Before implementation of new technology takes place, top managers must consider all possible factors that could benefit or harm their organization during the implementation stage. As with all studies, there were some limitations associated with this research, therefore further investigations would be beneficial. For example, the sample of 110 usable responses to the questionnaire was not sufficient and did not represent a large enough proportion of the population of cloud computing end-users in the Saudi organizational context. It is therefore suggested that the study should be extended with a larger population sample across public organizations. This would require a greater

timeframe and a high level of communication with state organizations who are described as conservative in disclosing such data. Further investigation could be carried out with specific organizational type services or specific organization sizes. Further research is suggested to better understand the interaction issues in the key drivers of adopting cloud computing and how these interrelationships could be impacted. A mixed methods approach is strongly recommended to gain robust results.

Conclusions

This study aimed to explore the key factors influencing the adoption of cloud computing by a public organization in Saudi Arabia. The Technology-Organization-Environment (TOE) Framework was utilized to analyze the organizational-level adoption of cloud technology using three types of context that might influence decision-makers to use such technology: technological, organizational, and environmental. Within these three contexts, specific factors were revealed from past studies: relative advantage, compatibility, complexity, management support, technological readiness, organizational size, competition pressure, trading partners, and government regulations. This research found that relative advantage, compatibility of technology, management support, technological readiness, and competition pressure are most significant. It is difficult to arrive at any conclusion regarding the factors influencing adopting cloud computing as the situation seems to be complicated because the effect of each factor varies between different organizational size, capabilities, and industry context. However, this research fulfilled its intended aim with its theoretical and empirical findings.

As the knowledge and sample data were gathered from a single organization in one country, the results of this research cannot be generalized; rather this should be treated as an introduction for further research. It should also be acknowledged that it has contributed to the existing body of knowledge in the field of technology management, specifically cloud computing technology, by identifying the key factors influencing the adoption of cloud computing and providing fruitful insights into the literature and implications for service providers.

Conflict of interest

The author declares no conflict of interest.

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References

Alanezi, M. (2018). Factors influencing cloud computing adoption in Saudi Arabia's private and public organizations: A qualitative evaluation. *International Journal of Advanced Computer Science and Applications*, *9*(4), 121–129. https://doi.org/10.14569/IJACSA.2018.090421

Aleinikova, O., Kravchenko, S., Hurochkina, V., Zvonar, V., Brechko, O., & Buryk, Z. (2020). Project management technologies in public administration. *Journal of Management Information and Decision Sciences*, *23*(5), 564–576. https://doi.org/10.32838/2663-6468/2020.2/23

Alharbi, F., Atkins, A., & Stanier, C. (2016). Understanding the determinants of cloud computing adoption in Saudi healthcare organizations. *Complex & Intelligent Systems*, *2*, 155–171. https://doi.org/10.1007/s40747-016-0021-9

Ali, O., Soar, J., & Yong, J. (2015). An investigation of the challenges and issues influencing the adoption of cloud computing in Australian regional municipal governments. *Journal of Information Security and Applications*, *27–28*, 19–34. https://doi.org/10.1016/j.jisa.2015.11.006

Ali, O., Soar, J., Yong, J., & Tao, X. (2016). Factors to be considered in cloud computing adoption. *Web Intelligence*, *14*(4), 309–323. https://doi.org/10.3233/WEB-160347

AlQahtani, F. (2016). *Identifying the critical factors that impact on the development of electronic government using TOE Framework in Saudi e-government context: A thematic analysis* [PhD thesis]. De Montfort University, Leicester, United Kingdom.

AlQarni, T., & Barnawi, A. (2019). A cloud adoption framework: Assessing the factors and determinants of adoption cloud computing technology. *Multi-Knowledge Electronic Comprehensive Journal for Education and Science Publications*, (26), 1–30.

Alshamaila, Y., Papagiannidis, S., & Li, F. (2013). Cloud Computing adoption by SMEs in the Northeast of England: A multi-perspective framework. *Journal of Enterprise Information Management*, *26*(3), 250–275. https://doi.org/10.1108/17410391311325225

AlTwaijiry, A. (2020). The determinants of cloud computing adoption in healthcare. *Research Berg Review of Science and Technology*, *1*(1), 9–20. https://doi.org/10.31219/osf.io/56d7b

Bijker, W. E., & Law, J. (Eds.). (1992). *Shaping technology, building society*. MIT Press. https://doi.org/10.1177/027046769401400468

Borgman, H., Bahli, B., Heier, H., & Schewski, F. (2013). Cloudrise: Exploring cloud computing adoption and governance with the TOE framework. In *46th Hawaii International Conference on System Sciences* (pp. 4425–4435). https://doi.org/10.1109/HICSS.2013.132

Centeno, C., van Bavel, R., & Burgelman, J. C. (2005). A prospective view of E-government in the European Union. *The Electronic Journal of e-Government*, *3*(2), 59–66.

Duan, J., Faker, P., Fesak, A., & Stuart, T. (2013). Benefits and drawbacks of cloud-based versus traditional ERP systems. In *Proceedings of the 2012-13 course on Advanced Resource Planning*. Tilburg, The Netherlands.

Dwivedi, Y. K., & Mustafee, N. (2010). It's unwritten in the cloud: The technology enablers for realizing the promise of cloud computing. *Journal of Enterprise Information Management*, *23*(6), 673–679. https://doi.org/10.1108/17410391011088583

Fu, H.-P., & Su, H.-T. (2014). A framework for a technology-organization-environment implementation model in Taiwan's traditional retail supermarkets. *The International Journal of Organizational Innovation*, *6*(3), 121–129.

Gangwar, H., Date, H., & Ramaswamy, R. (2015). Understanding determinants of cloud computing adoption using an integrated TAM-TOE model. *Journal of Enterprise Information Management*, *28*(1), 107–130. https://doi.org/10.1108/JEIM-08-2013-0065

Gutierrez, A., Boukrami, E., & Lumsden, L. (2015). Technological, organizational and environmental factors influencing managers' decision to adopt cloud computing in the UK. *Journal of Enterprise Information Management*, *28*(6), 788–807. https://doi.org/10.1108/JEIM-01-2015-0001

Hsu, P.-F., Kraemer, K. L., & Dunkle, D. (2006). Determinants of e-business use in US firms. *International Journal of Electronic Commerce*, *10*(4), 9–45. https://doi.org/10.2753/JEC1086-4415100401

Hsu, P.-F., Soumya Ray, S., & Li-Hsieh, Y.-Y. (2014). Examining cloud computing adoption intention, pricing mechanism, and deployment model. *International Journal of Information Management*, *34*(4), 474–488. https://doi.org/10.1016/j.ijinfomgt.2014.04.006

Iacovou, C., Benbasat, I., & Dexter, A. (1995). Electronic data interchange and small organizations: Adoption and impact of technology. *MIS Quarterly*, *19*(4), 465–485. https://doi.org/10.2307/249629

Lovelace, R. (2020). *The world in 2030: 10 predictions for long-term investors*. Capital Group. https://www.capitalgroup.com/intermediaries/sg/en/insights/articles/the-world-in-2030-10-predictions-for-long-term-investors.html

Low, C., Chen, Y., & Wu, M. (2011). Understanding the determinants of cloud computing adoption. *Industrial Management and Data Systems*, *111*(7), 1006–1023. https://doi.org/10.1108/02635571111161262

Makena, J. N. (2013). Factors that affect cloud computing adoption by small and medium enterprises in Kenya. *International Journal of Computer Applications Technology and Research*, *2*(5), 517–521. https://doi.org/10.7753/IJCATR0205.1003

Marston, S., Li, Z., Bandyopadhyay, S., Zhang, J., & Ghalsasi, A. (2011). Cloud computing – The business perspective. *Decision Support Systems*, *51*(1), 176–189. https://doi.org/10.1016/j.dss.2010.12.006

Morgan, L., & Conboy, K. (2013). Key factors impacting cloud computing adoption. *Computer*, *46*(10), 97–99. https://doi.org/10.1109/MC.2013.362

Nasir, U., & Niazi, M. (2011, June). Cloud computing adoption assessment model (CAAM). In *Proceedings of the 12th International Conference on Product Focused Software Development and Process Improvement* (pp. 34–37). https://doi.org/10.1145/2181101.2181110

Nguyen, A. (2016). A cross-cultural study on e-Government services delivery. *The Electronic Journal Information Systems Evaluation*, *19*(2), 121 –134.

Oliveira, T., Martins, R., Sarker, S., Thomas, M., & Popovič, A. (2019). Understanding SaaS adoption: The moderating impact of the environment context. *International Journal of Information Management*, *49*, 1–12. https://doi.org/10.1016/j.ijinfomgt.2019.02.009

Oliveira, T., Thomas, M., & Espadanal, M. (2014). Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors. *Information and Management*, *51*(5), 497–510. https://doi.org/10.1016/j.im.2014.03.006

Parasuraman, A. (2000). Technology Readiness Index (Tri): A multiple-item scale to measure readiness to embrace new technologies. *Journal of Service Research*, *2*(4), 307–320. https://doi.org/10.1177/109467050024001

Pather, S., & Abiodun, O. P. (2017). The Adoption of cloud computing amongst micro-enterprises. In *Proceedings of the 11th European Conference on Information Systems Management* (pp. 262–271). Academic Conferences and Publishing International Limited.

Porter, M. E. (1990). The competitive advantage of nations. *Harvard Business Review*, *68*(2), 73–93. https://doi.org/10.1007/978-1-349-11336-1

Porter, M. E., & Millar, V. E. (1985). How information gives you competitive advantage. *Harvard Business Review*, *63*, 149–160.

Radivojević, V., Krstić, B., & Stanisic, T. (2018). The role of technological readiness in the global competitiveness of Serbian Economy. *Facta Universitatis Series Economics and Organization*, *15*(2), 111–123. https://doi.org/10.22190/FUEO1802111R

Rastogi, G., Verma, H., & Sushil, R. (2018). Determining factors influencing cloud services adoption in India. *Serbian Journal of Management*, *13*(2), 335–352. https://doi.org/10.5937/sjm13-13207

Rogers, E. (2003). *Diffusion of innovations* (5th ed.). Free Press.

Shin, D.-H. (2013). User centric cloud service model in public sectors: Policy implications of cloud services. *Government Information Quarterly*, *30*(2), 194–203. https://doi.org/10.1016/j.giq.2012.06.012

Saedi, A., & Iahad, N. A. (2013). An integrated theoretical framework for cloud computing adoption by small and medium-sized enterprises. *PACIS 2013 Proceedings* (Paper 48, pp. 1–12). https://doi.org/10.1109/ICRIIS.2013.6716757

Sallehudin, H., Che Razak, R., & Ismail, M. (2015). Factors influencing cloud computing adoption in the public sector: An empirical analysis. *Journal of Entrepreneurship and Business, 3(1), 30–45.* https://doi.org/10.17687/JEB.0301.03

Senarathna, I., Wilkin, C., Warren, M., Yeoh, W., & Salzman, S. (2018). Factors that influence adoption of cloud computing: An empirical study of Australian SMEs. *Australasian Journal of Information Systems*, *22*, 1–31. https://doi.org/10.3127/ajis.v22i0.1603

Tripathi, S. (2019). Determinants of cloud computing intentions to use: Role of firm's size, managerial structure and industrial sector. *Journal of International Technology and Information Management*, *28*(2), 3. https://scholarworks.lib.csusb.edu/jitim/vol28/iss2/3/

Tahir, A., & Mehwish, W. (2015). Cloud computing adoption issues and applications in developing countries: A qualitative approach. *International Arab Journal of e-Technology*, *4*(2), 84–93.

Tornatzky, L. G., & Fleischer, M. (1990). *The processes of technological innovation*. Lexington Books.

Tornatzky, L. G., & Klein, K. J. (1982). Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Transactions on Engineering Management*, *29*(1), 28–45. https://doi.org/10.1109/TEM.1982.6447463

Trawnih, A., Yaseen, H., Al-Adwan, A. S., Alsoud, A. R., & Jaber, O. A. (2021). Factors influencing social media adoption among SMEs during COVID-19 crisis. *Journal of Management Information and Decision Sciences*, *24*(6), 1–18.

Tripathi, S., & Mishra, V. (2019) Determinants of cloud computing adoption: A comparative study. *Pacific Asia Journal of the Association for Information Systems*, *11*(3), 3. https://doi.org/10.17705/1pais.11303

United Nations E-Government Survey. (2016). *E-Government for sustainable development*. Department of Economic and Social Affairs.

United Nations E-Government Survey. (2020). *Digital government in the decade of action for sustainable development*. Department of Economic and Social Affairs.

Vyshnevskyi, O. Stashkeyych, I., Shubna, O., & Barkova, S. (2021). Economic growth in the conditions of digitalization in the EU countries. *Estudios de Economia Aplicada*, *38*(4). https://doi.org/10.25115/eea.v38i4.4041

Wang, N., Xue, Y., Liang, H., Wang, Z., & Ge, S. (2019). The dual roles of the government in cloud computing assimilation: An empirical study in China. *Information Technology and People*, *32*(1), 147–170.
https://doi.org/10.1108/ITP-01-2018-0047

Zhu, K., & Kraemer, K. L. (2005). Post-adoption variations in usage and value of e-business by organizations: Cross-country evidence from the retail industry. *Information Systems Research*, *16*(1), 61–84.
https://doi.org/10.1287/isre.1050.0045