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Cloud computing usage by governmental organizations in Saudi Arabia based on Vision 2030

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ABSTRACT

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Cloud computing (CC) has been used in several industries and domains. However, the use of CC in governmental organization is still limited. The purpose of this study is to examine the CC usage among governmental organizations in Saudi Arabia. The population of this study are Information technology (IT) professionals working for governmental organizations in Saudi Arabia. Purposive sampling was used to collect the data from the respondents. The questionnaire was distributed, and 211 valid responses were collected. The analysis was conducted using SmartPLS 4.0. The findings showed that perceived usefulness (PU), perceived ease of use (PEOU), external influence, security but not privacy have significant effects on CC usage. The findings also showed that technological readiness moderated the effect of PU, external influence, and security on CC usage. Decision makers are recommended to enhance the perception of the benefit of CC and conduct more training courses to ease the usage of CC.

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1. Introduction

Using cloud computing (CC) has become essential for the growth of business and for the digital transformation. A paradigm change in Information Technology (IT) is taking place with cloud computing (CC). With its digital architecture and expanded information storage capabilities, CC is described as a dynamic innovation platform that covers a wide range of needs (Alhomdy et al., 2021). Even more advantageous is the fact that CC provides access to software or equipment without major capital expenditures, as well as quick access to applications and administrations that may be recognized with little service provider contact (Ireda et al., 2019). To cope with the massive amounts of data transmitted and saved through electronic applications, CC has been a technical innovation (Raut et al., 2018). Researchers indicate that attitudes and perceptions are more important than any technology limitations in CC (Kayali & Alaaraj, 2020). Accordingly, researchers have focused on the behavioural aspects that contribute to CC acceptance. In contrast, the vast majority of prior research focused on the organizational aspects of CC adoption in commercial enterprises and other domains (Algarni et al., 2021; Hadi et al., 2021). Scholars have paid little attention to the use of CC by governmental organizations (El-Attar et al., 2019; Khan & Salah, 2020). Access to all programs, packages, software, and databases may be gained by CC users from both within and outside the organizations. Additionally, CC is a popular storage and entertainment service among users (El-Attar et al., 2019; Fithri et al., 2020). However, the extent of CC use at governmental organization and the variables that influence user governmental usage of CC are still unknown (Ali et al., 2020; Jones et al., 2019). Many prior research on CC focused on nations with advanced technology, but the cloud is increasingly being utilized in developing countries (Kayali & Alaaraj, 2020; Sabi et al., 2018). In Saudi Arabia, CC has been existed since 2009 however, recently in June 2022, the Saudi Cloud Computing Company (SCCC), which were founded by Alibaba Cloud was launched. This introduction of Alibaba Cloud in Saudi Arabia is in line with the vision of 2030 for digital transformation of the country and to reduce the dependence on oil in the country (Al-Mamary & Alraja, 2022). Alibaba cloud in Saudi Arabia will provide advantage of the leading global cloud capabilities with high availability, flexibility, security and sustainability, the company also offers a wide range of reliable and secure cloud computing solutions such as elastic computing, storage and network to meet the increasing demand from some sectors such as retail, financial technology, Internet, etc. throughout its digital transformation.

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Nevertheless, the usage of CC usage by governmental organizations is still limited worldwide and there is a need to identify the factors that might lead these organizations to deploy the CC. Existing theories in the literature such as TAM by (Davis, 1989) or UTAUT by (Venkatesh et al., 2003) suggested that variables such as perceived ease of use (PEOU) which is equal to effort expectancy or perceived usefulness (PU) which is equal to performance expectancy are critical for the use of technology. Additional factors such as the social influence as well as the facilitating condition were not included in TAM but in UTAUT (Venkatesh et al., 2003). Researchers criticized TAM and UTAUT for ignoring the technological factors such as security and privacy (Shachak et al., 2019). The technological readiness which includes the readiness of technical staff who are able to deploy the technology as well as the readiness of the governmental organization' infrastructure in term of network, software, hardware, and other technological tools has been examined by limited number of studies (Kim & Kim, 2022; Okuonghae et al., 2022). Therefore, this study investigates the usage of CC by governmental organizations in developing countries such as Saudi Arabia. The study examines the effect of PU, PEOU, external influence, security, and privacy on CC usage by governmental organizations. In addition, it investigates the moderating role of technological readiness of governmental organizations that might help in the transformation to digital economy and enable the use of CC by governmental organizations. The literature, research approach, results, debate, and conclusion are presented below.

2. Literature review

2.1 Use of CC by Organizations

CC is a relatively new technology that has been deployed in several industries such as education, healthcare, services, and large and small companies. CC provides convenient, on-demand network access to a centralized pool of customized computer resources without management or service provider contact (Mell & Grance, 2011). The researchers have divided CC into three layers. These layers are SaaS, PaaS, and IaaS. In all of the layers, the CC services include the services for the provided software and hardware as well as the services of the operating system (Khurana & Verma, 2013). When the users intend to adopt the CC technology, they have to take various CC deployments into consideration. These deployments are categorized into four main deployments that are public cloud, private cloud, hybrid cloud and community cloud (Lian, 2015). The four deployment models have advantages and disadvantages. The public cloud is cost effective but less secure while the private cloud has a cost disadvantage, but it is highly secure and trusted. In addition, the hybrid is costly in terms of the data sensitivity while the community cloud is not totally secure due to the involvement of several stakeholders (Flint, 2017; Yang et al., 2017). For these reasons, the researchers believe that the choice of the deployment of cloud should be based only on the requirement of the organization that intends to deploy CC technology (Al-Dhuraibi et al., 2018; Zhang et al., 2010). Because it keeps the company's infrastructure, software, hardware, and electronic services up to date and running smoothly, as well as accommodating individual users' needs for customization and convenience, CC has been suggested as a solution to lower the operational costs of organizations. This is a result of the CC technology's promises to clients of improved IT, availability, and dependability of these services at any time and from any location with the benefit of pay-per-use pricing (Singh & Chand, 2014). The CC technology has simplified services, accelerated operations, and improved the integrity of IT services offered to users and organizations. Nevertheless, despite the benefits that CC offers, the use of CC is not widely researched in some sectors, such as governmental organizations, because of the sector's conservatism and concern about security and privacy problems. Decision makers are still hesitant to start employing the technology of CC (Jones et al., 2019; Ali et al., 2020). Therefore, this study is examining the CC usage by governmental organizations in Saudi Arabia. The digital transformation in the country is encouraging as the government has launched several consequent plans to transform the country into the digital economy and the focus was on transforming the governmental organization into the digitalization. The administration of Saudi Arabia has changed over time in response to globalization and technological progress. It has shifted away from manual procedures in favour of digital ones, and it has set up a five-year strategy for improving productivity and quality. Its ultimate goal is to improve access to government services through technological advancements. The International Telecommunications Union has presented the Government Leadership Award to Saudi Arabia for enacting the most progressive policies and laws to advance the digital economy, encourage investment and innovation, and help achieve the goal of sustainable development (AlGhamdi et al., 2022; Almarhabi et al., 2022). This study includes five independent variables and one moderator. Table 1 shows a critical analysis of the variables that have been used in this study.

Table 1
Critical Analysis

Factor	(Park & Ryo, 2013)	(Lim et al., 2015)	(Burda & Teutberg, 2014)	(E. Park & Kim, 2014)	(Apraci et al., 2015)	(Aharony, 2015)	(Al-Gahani, 2014)	(Sarrifa, J. & Mohd Sulki, 2015)	(Low et al., 2011a)	(Lian et al., 2014)	(Gupta et al., 2013)
External influence	✓										
Security		✓		✓	✓					✓	✓
Privacy		✓			✓						✓
PEOU			✓			✓		✓			✓
PU			✓	✓			✓	✓			✓
technology readiness								✓	✓		

2.2 Theoretical Framework

Several theories can help in explaining the CC usage. However, TAM is designed for predicting the organizational level usage of technology while UTAUT is designed for individual usage. This study is using TAM which includes the variables of PEOU and PU. Additional factors from UTAUT such as the external influence, which is the influence of citizens, businesses and need to stay ahead in terms of using the technology. Further, since TAM was criticized for not including technology-related factors such as privacy and security, this study includes these two variables. Nevertheless, the usage of technology should be associated with high technological readiness by organizations. The role of technology readiness has been examined in a limited number of studies. Accordingly, this study deploys technological readiness as a moderating variable.

2.3 Conceptual Framework

This study claims, on the basis of TAM, that the PEOU and PU has a considerable beneficial influence on the usage of CC by governmental organizations. In addition, the research suggested that factors like external influence, security, and privacy will have a substantial impact on CC usage. In addition, the research suggests that technology readiness will moderate the effect of PU, PEOU, external influence, security, and privacy on CC usage. The conceptual core elements of this investigation are depicted in Fig. 1.

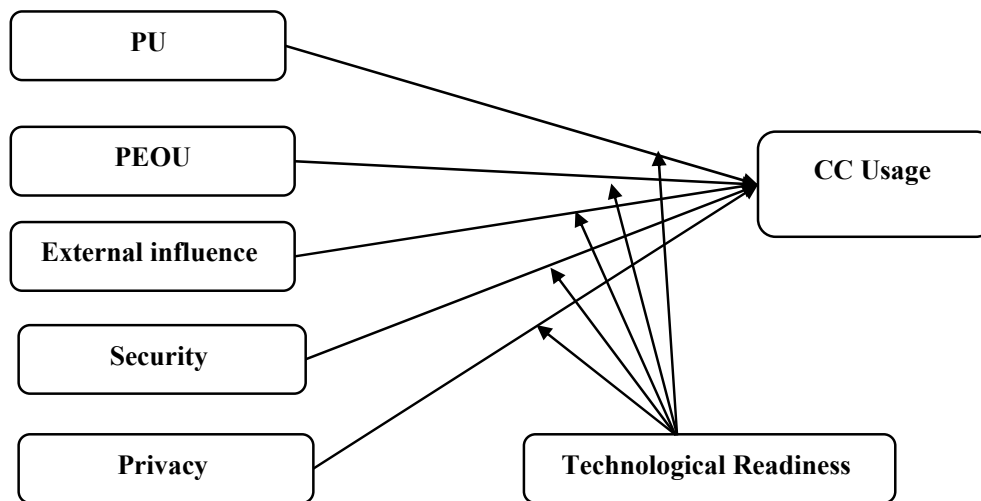


Fig. 1. Conceptual Framework

2.4 Hypotheses Development

Based on the conceptual framework, the hypotheses of this study are discussed as follows:

2.4.1 PU and CC Usage

PU is similar to performance expectancy (PE). Several researchers investigate the effect of PU on CC usage. Nguyen et al. (2014) investigated the effect of PU on CC usage and found this effect is positive and significant. Burda and Teuteberg (2014), Park and Kim (2014) and Alassafi (2021) found that PU is an essential variable for the usage of CC in Germany, Korea, and Saudi Arabia respectively. In this study, it is anticipated that PU will have a favourable and considerable impact on CC usage. As a result, it is postulated:

H₁: *PU has a significant effect on CC usage.*

2.4.2 PEOU and CC Usage

Researchers who deployed the model of TAM found that PEOU has a significant positive effect on the CC usage. Burda and Teuteberg (2014) found that PEOU positively affected cloud archiving. Aharony (2015) found that usage of CC by librarians and information specialists is affected by PEOU. Gupta et al. (2013) discovered PEOU to be the most critical reason for SMEs in Malaysia to use CC. The following hypotheses are derived from this research:

H₂: *PEOU has a significant effect on CC usage.*

2.4.3 External Influence and CC Usage

External influence is defined in this study as the pressure of citizens, business organizations, and other governmental organizations to use the CC. Several studies examined the pressure of customers, competitors, business partners in the context of business organizations while few examined this variable in the context of governmental organization. External influence

has a significant effect on the diffusion of a technology (Myers et al., 2012). Similarly, the effect of external influence on the marketing innovation was found significant (Radas, 2005). Therefore, the following is postulated.

H₃: *External influence has a significant effect on CC usage.*

2.4.4 Security and CC Usage

Several studies found significant effects of security on the CC usage. For instance, Arpaci (2016) found that security is critical for CC usage. Senyo, Effah and Addae (2016) also found that security concerns of the IT professional is one of the main reasons when adopting CC. Alkharusi and Al-badi (2016) found that security has a significant effect on the adoption of CC in the public sector. Alkhater et al. (2018) found that security is a significant factor for the adoption of CC by IT staff. Accordingly, it is hypothesized:

H₄: *Security has a significant effect on the CC usage.*

2.4.5 Privacy and CC Usage

Researchers have considered privacy as one of the essential factors for CC usage. For example, Arpaci (2016) investigated the effect of privacy on the adoption of mobile cloud usage and found that privacy has a significant effect on the usage. Other researchers also found a significant effect of privacy on CC usage (Arpaci et al., 2015; Gupta et al., 2013). Nevertheless, privacy was also found to have an insignificant effect on CC usage (Ermakova et al., 2014). In this study, privacy is anticipated to have a significant effect on CC usage. Thus, the following is hypothesized:

H₅: *Privacy has a significant effect on CC usage.*

2.4.6 Technological Readiness as A moderator

Technology readiness refers to the human and technological related readiness factors in term of technicians and the ability of organization to provide educated and knowledgeable staff who are able to manage the CC technology (Abuaddous et al., 2022; Enaizan et al., 2020; Eneizan et al., 2020; Rawwash et al., 2020; Saleh et al., 2021). In addition, it also includes the infrastructure and networks. When technological readiness is low, it is more likely that organizations will not adopt the technology (De Prieëlle et al., 2020). Readiness is critical for the successful utilization of technology (Asadi et al., 2021). Having a high level of readiness is important (Shin & Park, 2017). Geng et al. (2019) indicated that it is important to examine the role of technological readiness. Other studies also tested and empirically found that technology readiness is critical for adopting a new technology such as CC (Ghaleb et al., 2021; Low et al., 2011b). Technology readiness was found to moderate the effect of variables such as PU and electronic word of mouth on the technology usage (Kim et al., 2020; Kim et al., 2020; Kim & Chiu, 2018; Tsourela & Roumeliotis, 2015). Therefore, in this study, it is expected that organizational readiness moderates the effect of PU, PEOU, external influence, security and privacy on CC usage.

H₆: *TR moderates the impact of PU on CCU.*

H₇: *TR moderates the impact of PEOU on CCU.*

H₈: *TR moderates the impact of EI on CCU.*

H₉: *TR moderates the impact of SE on CCU.*

H₁₀: *TR moderates the impact of PV on CCU.*

3. Research Methodology

This study follows a quantitative approach in which the population is the governmental organizations in Saudi Arabia. The capital Riyadh is chosen because most governmental organizations exist in the city. Due to the notion that some of the employees might not have knowledge about CC, the study used a purposive sampling in which only IT professionals in governmental organizations were asked to participate in the study. The contact information of the respondents were obtained from websites of the governmental organizations. A questionnaire was used throughout this research endeavour to obtain the necessary information. The questionnaire was adopted from prior literature. Table 2 shows the source of the questionnaire.

Table 2
Measurement of Variables

Variables	Number of items	Source of measurement
PU	5	(Lian, 2015)
PEOU	5	(Lian, 2015)
External influence	5	(Lian, 2015)
Security	5	(E. Park & Kim, 2014)
Privacy	5	(Kayali & Alaaraj, 2020)
Technological readiness	6	Self-developed.
CC usage	6	(Venkatesh & Davis, 2000)

The questionnaire was first validated then translated into Arabic and validated again by three experts who understand both languages. A reliability analysis was conducted by examining the Cronbach's Alpha (CA) of 32 responses for pilot testing. The CA for all the variables are acceptable. The questionnaire was sent using a link to the respondents. This has resulted in 229 responses. The responses were checked for missing values and a total of 11 responses were removed. In addition, the outliers and normality were checked. The response has 7 outliers. The skewness and kurtosis showed that the data is normally distributed. The multicollinearity analysis showed that VIF is less than 5 and tolerance is larger than 0.20, suggesting that no multicollinearity exists. The valid responses for this study is 211.

4. Findings

The data was analysed using Smart PLS 4.0. According to the provided demographic data, the vast majority of responders (81% to be exact) are men with bachelor's degrees in computer science or a similar discipline like management information technology. The majority of responders (92%) were within the age bracket of 25 to 45. These respondents have experience of more than 7 years in CC and related technologies (89%).

4.1 Measurement Model

Factor loading (FL), reliability, and validity were used to assess the measurement model. Reliabilities and validity were improved by eliminating items from PU, PEOU, and TR. All variables in Table 3 have FLs higher than 0.70. Both the composite reliability (CR) and the CA were met. Higher than 0.50 is the AVE. Upon the recommendation of, these standards are adopted. (Hair et al., 2017).

Table 3
Measurement Model

Variable	Items	FL >0.70	CA >0.70	CR >0.70	AVE >0.50
PU	PU1	0.907	0.936	0.951	0.795
	PU2	0.877			
	PU3	0.884			
	PU4	0.894			
PEOU	PEOU1	0.922	0.937	0.955	0.841
	PEOU 2	0.896			
	PEOU 3	0.918			
	PEOU 4	0.931			
EI	EI1	0.854	0.907	0.931	0.729
	EI2	0.816			
	EI3	0.846			
	EI4	0.879			
	EI5	0.874			
SE	SE1	0.834	0.914	0.935	0.744
	SE2	0.875			
	SE3	0.861			
	SE4	0.872			
	SE5	0.869			
PV	PV1	0.902	0.940	0.954	0.807
	PV2	0.889			
	PV3	0.893			
	PV4	0.897			
	PV5	0.910			
TR	TR1	0.926	0.947	0.959	0.825
	TR2	0.897			
	TR3	0.908			
	TR4	0.913			
	TR5	0.899			
CCU	CCU1	0.910	0.928	0.944	0.737
	CCU2	0.871			
	CCU3	0.876			
	CCU4	0.885			
	CCU5	0.853			
	CCU6	0.747			

Discriminant validity is reached as well due to the fact that the values shown in bold are higher than the cross loading on other indicators. The discriminant validity test's outcome is tabulated in Table 4.

Table 4

Result of Discriminant validity

	PEOU	TR	PU	PV	SE	EI	CCU
PEOU	0.917						
TR	0.171	0.908					
PU	0.608	0.173	0.892				
PV	0.402	0.137	0.294	0.898			
SE	0.343	0.102	0.302	0.513	0.862		
EI	0.587	0.222	0.586	0.445	0.442	0.854	
CCU	0.363	0.148	0.283	0.349	0.406	0.372	0.859

4.2 Structural Model

The structural model of this paper is shown in Fig. 2. It shows a direct effect of the variables as well as the moderating effect of technological readiness.

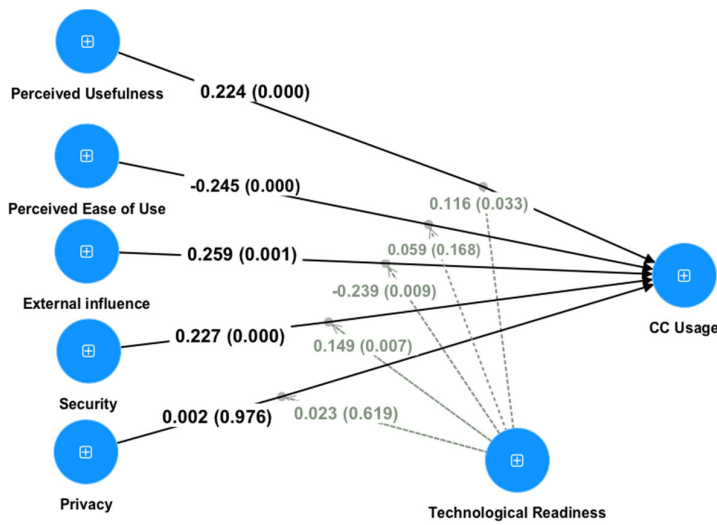


Fig. 2. Structural Model

In Table 6, the results of testing the hypotheses are shown. The value of R-square (R²) increased from 0.564 in the direct effect model to 0.686 in the moderating effect model indicating that the independent variables as well as the moderator can explain 68.6% of the variation in CCU. The value of F-square (F²) for all paths is greater than 0.02 except for paths that have weak or no effect such as PV → CCU, TR × PV → CCU, and TR × PEOU → CCU.

Table 6

Result of Hypotheses Testing

H	Path	R ²	F ²	B	STDEV	T	P	Result
H1	PU → CCU	0.564	0.122	0.224	0.060	3.736	0.000	Sig
H2	PEOU → CCU		0.129	-0.245	0.058	4.257	0.000	Sig
H3	EI → CCU		0.131	0.259	0.075	3.445	0.001	Sig
H4	SE → CCU		0.091	0.227	0.059	3.882	0.000	Sig
H5	PV → CCU		0.001	0.002	0.057	0.031	0.976	Not sig
	TR → CCU		0.083	0.131	0.043	3.022	0.003	Sig
H6	TR × PU → CCU	0.686	0.079	0.116	0.055	2.133	0.033	Sig
H7	TR × PEOU → CCU		0.001	0.059	0.042	1.379	0.168	Not sig
H8	TR × EI → CCU		0.142	-0.239	0.091	2.626	0.009	Sig
H9	TR × SE → CCU		0.078	0.149	0.056	2.675	0.007	Sig
H10	TR × PV → CCU		0.001	0.023	0.046	0.498	0.619	Not sig

The study's first assumption turned out to be correct. A P-value of less than 0.05 indicates a statistically significant beneficial effect of PU on CCU. As a result, we accept H1. As can be shown in Table 6, the p-value of the path between PEOU and CCU is less than 0.05, therefore we may accept H2. A negative indicator suggests that implementing CC might be difficult, but this is only a guess. With a p-value lower than 0.05, H3 is accepted. This suggests that CCU performance is favourably

impacted by technological preparedness. The CCU was favourably impacted by the security measures, which lends credence to the validity of H4. Since the P-value for privacy's impact on the CCU is more than 0.05, the effect is statistically negligible. In light of this evidence, hypothesis 5 cannot be supported.

Moderating impact of TR was generated using SmartPLS 4, which generates the new variable by multiplying the independent variable by the moderator. According to Table 6, TR moderated the impact of both PU and security on CCU. Both PU and security had beneficial effects on CCU, suggesting that a higher TR level would have an even greater positive effect on CCU, while TR reduced the negative effect of external influence on CCU, suggesting that a higher TR level would have had the opposite effect. The results indicated that hypotheses 6, 8, and 9 should be accepted, whereas hypotheses 7, and 10 should be rejected due to a P-value larger than 0.05.

5. Discussion

The findings of this study showed that the effect of external influence, PEOU, security, and PU are important factors and it has a significant effect on CC usage. This finding could be due to the fact that governmental organizations in Saudi Arabia considered CC as useful in accomplishing their tasks quickly and more efficiently. The use of CC is in line with the digital transformation plan of the government and the vision of 2030. Therefore, organizations are eager to use the CC to facilitate the transformation. Several other researchers have found similar results, including Burda and Teuteberg (2014), Park and Kim (2014) and Alassafi (2021).

The findings also showed that there is a negative effect of PEOU which might be interpreted as the increase in the complexity of the CC usage might discourage those in top management of the organization to use the CC. The finding could be related to the nature of the governmental organization and the required regulation and act to use a new technology. The findings also agreed with TAM which indicated that difficult and complex technology might be slow by users. These results are consistent with those of other studies, including (Aharony, 2015; Burda & Teuteberg, 2014; Gupta et al., 2013)

External influence was found to have a positive effect on the CC usage. This could be due to the existing plan of the government to move into digital organization and to transform the transaction into an online environment. The finding agrees with the existing studies which indicated that the higher external influence might affect the decision of an organization to use a new technology (Myers et al., 2012; Radas, 2005). Security was found as a critical factor for the usage of CC. High security is an encouraging factor for the organizations in Saudi Arabia to use the CC. The findings are in line with prior literature (Alkharusi & Al-badi, 2016; Alkhatir et al., 2018; Arpaci, 2016; Senyo, P. K., Effah, J., & Addae, 2016).

Surprisingly, privacy was found to have an insignificant effect on the CC usage. This could be due to the notion that having transactions with governmental organizations is perceived to be confidential and those who deal with the governmental organization believe that the organization will protect his or her privacy at all times. The findings contradict with the findings of other researchers such (Arpaci, 2016; Arpaci et al., 2015; Gupta et al., 2013). However, it is in agreement with the finding of (Ermakova et al., 2014) who found that privacy has insignificant effect on CC usage.

Technology readiness moderated the effect of PU, security and external influence on CC usage. This indicates that when TR increases, the positive effect of PU and security on CC usage will increase. TR will reduce the effect of external influence on the CC usage. These findings are in agreement with the findings of other researchers such as (Kim et al., 2020; Kim et al., 2020; Kim & Chiu, 2018; Tsourela & Roumeliotis, 2015).

This research adds to the existing body of knowledge by broadening the scope of TAM-related variables to include security and privacy considerations and external influences. Examining how government agencies use CC was another important part of the study's contribution to the literature. It is crucial that policymakers have access to this research in order to better grasp the significance of the chosen variables in enhancing CC usage. Leaders are urged to emphasize CC's value to the business and simplify its adoption by providing users with training on its features, processes, and procedures. The most secure environment for deploying CC technology is a private cloud, which decision-makers are urged to utilize.

6. Conclusion

This paper has contributed to the literature in terms of identifying the factors that lead to CC usage. The study found that PU, PEOU, EI, and SE are critical for the CC usage among governmental organizations in Saudi Arabia. The study also found that TR worked as a moderator between PU-CCU, PEOU-CCU, and EI-CCU. The limitation of this study includes the usage of purposive sampling. It also includes governmental organization. To overcome these limitations in future work, it is recommended to use the random sampling technique by identifying the target population and distributing the questionnaire. The future work might also extend the findings of this study by examining other variables such as trust, gender, and age of the decision makers as moderators. Future work can also deploy a qualitative approach to understand the factor that leads to more CC usage among governmental organizations. Having good perception about the benefit and easy process to use the CC will lead to more usage.

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