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Investigating the Determinants of Cloud Computing-Software as a Service Adoption in Pakistani SMEs from the Perspective of SME Managers

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ABSTRACT

Pakistan's small and medium enterprises (SMEs) sector oppose many challenges, encompassing resource mismanagement, infrastructural deficiencies, a burgeoning volume of data and impediments hindering organizational growth. These challenges include financial constraints from corruption and insecurity and limited IT resources and infrastructure access. Consequently, adopting Cloud Computing Software as a Service (CC-SaaS) presents a potentially advantageous solution. It offers SMEs an avenue to enhance operational efficiency through cost-effective technological integration, facilitating improved e-services for citizens and promoting knowledge sharing for increased benefits. However, the adoption of CC-SaaS remains relatively limited within the Pakistani SME landscape, beset by numerous obstacles, like data privacy, legal compliance and security concerns. Despite the extensive literature on factors influencing cloud computing (CC) adoption, most of these studies emanate from developed nations. More attention has been devoted to examining the adoption of CC-SaaS. Indeed, within countries marred by conflict and instability, the adoption landscape of CC-SaaS remains largely uncharted. This study addresses this knowledge gap by investigating the determinants influencing organizational intentions regarding adopting CC-SaaS among Pakistani SMEs operating in an environment fraught with conflict. It necessitates examining how the prevailing conflict dynamics in Pakistan might impact CC-SaaS adoption within the country. Ultimately, this research aspires to benefit SME organizations in Pakistan and contribute to validating measurement frameworks for future studies. The study's conceptual model draws upon the Technology-Organization-Environment theory and the Organization Support Theory. Expert opinions informed the identification of moderating effects. Data was collected from a sample of 368 SME managers operating in Pakistan. Subsequently, the collected data underwent analysis employing the Partial Least Squares Structural Equation Modelling (PLS-SEM) approach. The study findings indicate that the impacts of technology organization, environment and Organization Support Theory on CC-SaaS adoption are statistically significant.

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1. Introduction

CC has become a pivotal computing paradigm for the next generation [1]. It has garnered significant attention from researchers and stakeholders in recent years, encompassing academic and economic domains. The National Institute of Standards and Technology (NIST) has offered a comprehensive definition of CC, describing it as a model that facilitates convenient and on-demand network access to a shared pool of configurable computing resources [2]. Within the realm of CC, three primary service models exist. Firstly, infrastructure as a Service (IaaS) allows for outsourcing data processing and storage infrastructure. In this model organizations can access and utilize computing resources hosted in the cloud [3]. The second model is Platform as a Service (PaaS), which empowers inventors by providing a cloud-based platform to create services and applications [4]. CC enables developers to focus on software development without the need to manage the underlying infrastructure. Lastly, Software as a Service (SaaS) offers users a unique approach to accessing applications [5] as an alternative to installing software packages on their local computer operators' adamites applications via a web browser. SaaS services are highly centralized, facilitating automatic updates and relieving users from the burden of software installation and maintenance. Users can conveniently access these applications over the Internet [6]. SaaS is frequently associated with more favourable initial cost considerations than IaaS and PaaS. This advantage becomes particularly pertinent for SMEs in emerging economies where access to substantial capital for infrastructure and platform investments is constrained, rendering SaaS an appealing and pragmatic alternative [7]. In essence, CC-SaaS simplifies the user experience by offering accessible, web-based access to software applications and centralizes configuration and hosting, thus streamlining the process of software maintenance and updates [8].

CC-SaaS presents several advantages to organizations, such as the minimal initial investment costs, the ability to scale services and, notably, on-demand resource availability [9]. This capability allows users to achieve cost savings in their operational expenditures [10], simplifies the use of cloud-based solutions [11], streamlines service provisioning, facilitates budget management and enhances service delivery efficiency [12]. Furthermore, CC-SaaS helps reduce capital expenditure and lowers IT operations and maintenance costs, thereby freeing up resources for other strategic initiatives [13]. However, despite these benefits, the literature reveals challenges and obstacles organizations face when adopting SaaS [14]. These challenges include the need to align with the rapid pace of technological advancements while ensuring information security and protection against unauthorized access, insufficient awareness about service providers' capabilities related to privacy [15], disagreements between cloud providers and organizations concerning the scope of service and its implementation modalities [15], financial constraints, technical barriers and inadequate technical expertise [16].

In light of these assistances and contests, this research aims to investigate the variables impacting CC-SaaS implementation [17]. Although CC has been the subject of numerous studies in several domains, tackling technical concerns like data administration and infrastructure security productivity, interoperability and quality of service assessment standards [18], this research concentrates specifically on business management elements, including CC's potential, hazards and expenses [19]. In addition, it is layered with CC [19]. However, the ensuing section of this discussion will reveal a significant gap in research, particularly the need for adoption in the framework of small businesses and SMEs, particularly those operating in underdeveloped nations [20]. Accordingly, making decisions about these services involves complex, intricate and multifaceted issues. Organizations frequently consider numerous factors before concluding [21]. Enterprises, including SMEs, allocate substantial resources towards implementing CC-SaaS solutions. However, failing to address user

adoption effectively can result in these investments failing to generate the anticipated returns, leading to misallocating time and financial assets [22].

Therefore, the current study seeks to fill this void by developing a comprehensive research model [23]. This model draws upon the existing literature on CC adoption, combining carefully selected variables from two well-established theoretical models, all of which have demonstrated their relevance in prior research. The subsequent sections of this paper are organized into appropriate sections and subsections. Following this introductory section, the second section offers an overview of previous research on CC-SaaS. The third section delves into the theoretical foundations of information systems (IS) models employed in examining CC adoption. Section four explores the technological dimension of the proposed model, while section five outlines the study methodology and presents data sources. The ensuing section, section six, contains the discussion and the paper concludes in the final section.

2. Related Studies on CC-SaaS Adoption

Despite the abundant literature addressing contemporary cloud service development trends, more studies need to focus on CC-SaaS adoption [24]. The majority of existing literature within the realm of CC-SaaS tends to emphasize outsourcing [25] or the Application Service Provider (ASP) model [26]. Within the limited body of studies focusing on CC-SaaS adoption, several theories and models from the Information Systems (IS) domain have been employed to assess its determinants' importance or lack thereof. For example, Nathan *et al.,* [27] used a PEST analysis (political, economic, social and technological) and found economic factors to be the primary drivers behind CC-SaaS adoption. Nonetheless, it is essential to acknowledge that the PEST analysis framework may need to address the organization's internal environment comprehensively. In a study by Wong *et al.,* [28], the Technology Acceptance Model (TAM) was extended to include considerations of security and trust. The results of this study revealed that perceived usefulness, social influence, confidence and security played pivotal roles as determinants influencing the adoption of CC-SaaS.

It is important to note that the study by Wong *et al.,* [28] primarily centred on the individual user's acceptance of CC-SaaS. In another research endeavour, a case study conducted by Meri *et al.,* [29], an examination was undertaken to assess the influence of perceptions concerning the risks and benefits of adopting CC-SaaS. The study employed the Decision-Making Trial and Evaluation Laboratory (DEMATEL) approach. The findings of this investigation indicated that the strategic benefits linked to CC-SaaS adoption surpassed the associated risks. However, this study did not investigate crucial factors within technology organization and the broader environmental context that could influence CC-SaaS adoption.

Furthermore, the exploration of CC-SaaS adoption and the grade of its factors have been addressed in various studies. For instance, Kurtessis *et al.,* [31] investigated to gain insights into CC-SaaS adoption within enterprises. This study developed a model integrating the TOE framework and OST to identify the influential aspects upsetting CC-SaaS adoption. Prasanna *et al.,* [32] also utilized TOE and OST to examine the factors influencing CC-SaaS adoption within the SME industrial industry in the UK. Simultaneously, van de Weerd *et al.,* [30] conducted a study to uncover the impact of technological organizational and environmental features on CC-SaaS adoption among Indonesian corporations. In the industrial and services sectors, CC-SaaS adoption factors have been assessed by incorporating OST and TOE, albeit focusing primarily on technological readiness as a contributing aspect [31]. Furthermore, an online commercial study centred on SaaS adoption was carried out in Sri Lanka, targeting managerial and ICT professionals possessing technical expertise relevant to SaaS adoption [32].

However, in all of these studies, there appears to be a noticeable absence of specific consideration for human factors in the context of SaaS adoption. Therefore, exploring CC-SaaS adoption as the perception of particular attributes [34], particularly those related to the technological and organizational aspects, holds substantial significance in understanding the determinants of SaaS adoption. Furthermore, Kim *et al.,* [33] analysed the features influencing the CC-SaaS intention to adopt from the user's perspective, focusing on the associated risks and benefits. They examined how these factors influenced the intention to adopt CC-SaaS among small companies in Korea, considering the mediating roles of perceived risks and benefits. Similarly, a study delving into the opportunities and risks associated with CC-SaaS adoption was conducted among German companies [35]. However, despite the relevance of these studies in uncovering influential elements for CC-SaaS adoption purposes, there appears to be a gap in the examination of moderating effects on these crucial aspects. As Mohtaramzadeh *et al.,* [36] have emphasized, there is a pressing need for a more comprehensive understanding of moderating effects within IT acceptance research. CC entails examining the moderator's impact on the direct association between elements and the intention to adopt CC-SaaS, a fact that should be considered [37].

Moreover, the extant literature highlights that organizations often need help considering adopting or unfluctuating the intention to espouse CC-SaaS. These challenges predominantly revolve around concerns related to information security and privacy, particularly concerning unauthorized access [39]. Additionally, the lack of technical insight into the privacy capabilities offered by CC-SaaS providers, a deficiency in mutual consideration amongst CC-SaaS benefactors and organizations regarding provision scope and operation levels [38] and various methodological blocks containers significantly impede the adoption of SaaS-CC [40]. Although CC-SaaS has the potential to offer substantial advantages to organizations by enhancing their IT competencies at a condensed charge and with fewer managing apprehensions [3], the adoption of CC-SaaS remains a formidable challenge for many organizations. This challenge is particularly pronounced in cases where no precise characteristics exist for director decision-making regarding the evolution to CC-SaaS.

Furthermore, it is worth noting that the studies reviewed above have yet to comprehensively investigate the factors influencing CC-SaaS adoption from the organization's perspective. Additionally, the intuitions offered through earlier studies regarding CC-SaaS adoption are incomplete and need a holistic view. As Kayali *et al.,* [44] and Skafi *et al.,* [11] recommended, the examination of CC-SaaS must be context-specific since different contexts may harbour distinct determinants. Therefore, an in-depth study into the influences impacting CC-SaaS adoption is essential. Organizations are currently grappling with prioritizing critical factors when considering the move to CC-SaaS [41]. This underscores the imperative for further research into the features that can wield substantial effect on the adoption of CC-SaaS. Such research endeavours can potentially assist organizations in reaping considerable benefits from this technology. In conclusion, these factors align with the present literature on CC-SaaS adoption.

A literature review disclosed that the widely held previous studies investigating CC-SaaS adoption have predominantly relied on a single theoretical perspective [42]. However, more than this singular approach may be required to achieve the current study's objectives. It has become apparent that the absence of amalgamation among theories adoption has impeded our comprehension of the key influencing aspects [43]. While technical factors undoubtedly play a pivotal role, it is crucial to recognize that other factors, encompassing organizational, environmental and human elements, can significantly influence the decision-making process. Regrettably, these factors have not been adequately integrated into most adoption theories [44].

Consequently, it has been recommended that a more holistic perspective be adopted when considering CC-SaaS adoption. These considerations should encompass aspects related to the

organization and its broader operational context and technical attributes specific to CC-SaaS [45]. Additionally, the supervisory procedure necessitates the exploration of diverse perspectives [46]. Furthermore, El-Gazzar [47], in a systematic literature review, underscores several vital points: There is a need for additional empirical studies in this domain, recognizing that CC-SaaS adoption is a multifaceted phenomenon requires the application of multiple theoretical perspectives, the investigation of theories that elucidate how organizations respond contrarily to identical internal and external factors.

Hence, a multifaceted theoretical framework emerges as a viable approach for examining the intention to adopt CC-SaaS within the context of small enterprises situated in politically unbalanced nations such as Pakistan. Notably, the prevailing prose on CC-SaaS adoption has predominantly concentrated on its adoption in technologically advanced countries without encompassing any studies exploring CC-SaaS adoption within uneven emerging nations like Pakistan, particularly at the SME organizational side by side. Notably, the private sector in Pakistan holds a pivotal role in the nation's development. However, our literature review has revealed a need for more research addressing CC-SaaS adoption within this sector. Furthermore, it is imperative to acknowledge that the significant aspects influencing the adoption of CC-SaaS in Pakistan's small and medium organizations have yet to be empirically investigated from a comprehensive perspective, including technological organizational and environmental [48].

Consequently, this study endeavours to inspect the impact of these factors within the context of Pakistan SMEs. The present paper has developed a research model integrating the TOE and OST to bridge this research gap. The model has been meticulously crafted based on a severe review of applicable significant elements gleaned on or after prior literature about CC-SaaS adoption.

3. Research Model and Hypothesis Development

This study aims to develop a model concerning the intention to adopt CC-SaaS within Pakistani SMEs. The focal points of this model are the technological organizational and environmental perspectives [49]. The overarching objective of this model is to identify the factors that influence the intention to adopt CC-SaaS among Pakistani SMEs. The model in question has been meticulously crafted utilizing the TOE framework and the Organizational Support Theory (OST), as postulated by Eisenberger *et al.,* [50] and Tornatzky *et al.,* [51]. This comprehensive model delineates the interplay of the TOE and OST factors. For clarity and organization, the proposed model is categorized into three dimensions: Technology organization and Environment. Each of these dimensions plays a pivotal role in shaping the intention to adopt CC-SaaS among Pakistani SMEs. Hypothetical model, this study has forged an understanding of the associations between the study constructs. In the subsequent subdivisions, these aspects are defined, their relevance to the context of this research is expounded upon and hypotheses are proposed for each of these relationships.

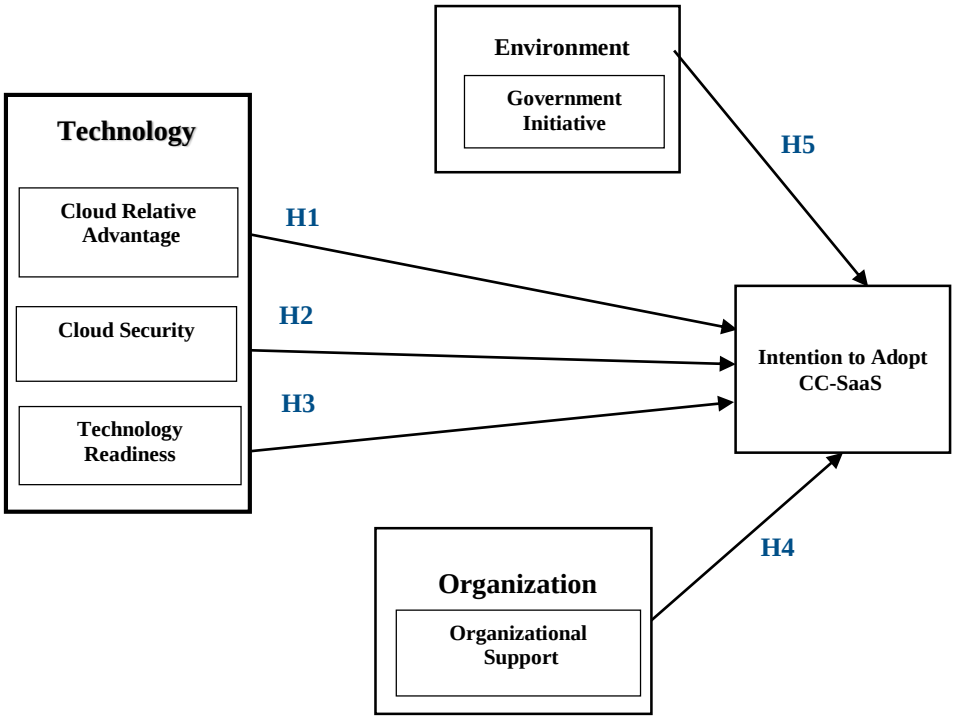

Fig. 1. The proposed model of CC-SaaS intention to adopt

3.1 The Technology Dimensions

In this study, the Technological Dimensions (TD) encompass technological factors influencing an organization's intention to adopt CC-SaaS technology [52]. Three (3) technological features have been identified and categorized within this purview as technological dimensions. These extents will be employed to gauge their impact on the intention to adopt CC-SaaS. These dimensions encompass the Cloud Relative Advantage factor, which measures the degree to which CC-SaaS technology is perceived as an improvement over its predecessors. The Cloud Security determinant dimension is concerned with the security aspects of CC-SaaS, including data and system protection. Technology Readiness factor pertains to the organization's preparedness regarding information technology infrastructure and the readiness of its professionals to embrace new technologies. The objective is to explore the effect of proposed technological dimensions on CC-SaaS adoption, particularly within an unbalanced situation such as Pakistan.

3.2 Cloud Relative Advantage

The Technology perspective includes equally inside and outside technologies associated with the organization, encircling the technologies currently in use and those willingly available in the market, as elucidated by Gupta *et al*., [53]. Within this context, the concept of Cloud Relative Advantage assumes significance. Cloud Relative Advantage is the degree to which an innovation is perceived as superior to its predecessors [33]. Consequently, the greater the perceived Cloud Relative Advantage, the more expeditious the organization's adoption of cloud technologies is likely to be, as affirmed by Tom *et al.,* [54]. Thus, Cloud Relative Advantage is a pivotal indicator in adopting new IS innovation, following Bhuiyan *et al*., [55]. The magnetism of CC-SaaS lies in its potential to offer myriad benefits to startup organizations, including small enterprises and SMEs, thereby facilitating adoption decisions, as noted by Jawad *et al.,* [56].

Furthermore, CC-SaaS can bestow significant advantages upon SMEs, ranging from cost savings to enhanced operational efficiency, as posited by Wulf *et al*., [3]. Therefore, it is evident that the Cloud Relative Advantage of CC-SaaS, particularly from the perspective of emerging countries, is substantial, even though the adoption rates may still be relatively modest, as indicated by Ayoobkhan *et al.,* [16]. In light of these insights, we propose the following:

Hypothesis H1: A positive relationship exists between Cloud Relative Advantage and the intention to adopt CC-SaaS.

3.3 Cloud Security

The concept of cloud security and accessibility has been extensively examined within IT, as evidenced by Zhang *et al.,* [57]. Cloud security pertains to safeguarding both data and systems, encompassing a blend of elements such as information security, software security, network security, identity security and infrastructure security, in line with the findings of Kim *et al.,* [33], Zulfiqar *et al.,* [58] and Chong *et al.,* [59]. Conversely, accessibility alludes to the ease with which data and systems can be reached. It is a pivotal determinant in the adoption of CC-SaaS by SMEs, as highlighted by Zhang *et al.,* [57]. Users expect their data to remain secure and private while readily accessible as and when required. Additionally, the limited internet capacity and reliance on less robust devices for accessing cloud services may significantly impact the adoption of such services, underscoring the paramount importance of accessibility, as noted by Oliveira *et al.,* [60].

Hypothesis 2: There is a positive relationship between Cloud Security and the intention to adopt CC-SaaS.

3.4 Technology Readiness

Technology readiness pertains to the enthusiasm of an organization's IT substructure and its professionals to effectively embrace and integrate new technologies, as elucidated by Bhuiyan *et al.,* [55]. This factor is pivotal in shaping an organization's willingness to adopt CC-SaaS, an observation supported by Ming *et al.,* [61]. Oyemike [62] contends that the successful implementation of CC-SaaS can yield numerous benefits, contingent upon the technological preparedness of businesses. Previous research within the domain of IS underscores the profound impact of technology readiness on an organization's intention to adopt CC-SaaS practices [63]. For instance, a comprehensive analysis conducted by scholars Modisane *et al.,* [64] revealed that technology readiness exerts a significant influence on enhancing the operational structure of organizations. This perspective aligns with the assertion made by Bharany *et al.,* [65], who highlight that the structural components encompass the technological Platform or infrastructure, including elements such as connected grid pieces of knowledge and enterprise systems. Within an organization, CC services can complement or substitute these existing technologies [66]. For instance, an organization might implement a cloud-based storage solution for collaborative document sharing, as articulated by Majid *et al.,* [67].

Moreover, within small organizations, CC-SaaS services can complement or even substitute existing technologies, as exemplified by implementing a cloud-based storage solution for collaborative document sharing, as highlighted by Alhammadi *et al.,* [71]. Furthermore, the study directed by Kumar *et al.,* [68,69] substantiates that an advanced level of knowledge and familiarity with technological innovations positively influences the likelihood of their adoption by organizations. Adequate foundational Information and Communication Technology (ICT) infrastructure and

technical proficiency assume paramount importance for organizations to effectively embrace CC-SaaS, as elucidated by Molinillo *et al.,* [70]. Consequently, organizations possessing a high degree of technological readiness are better poised for successful CC-SaaS adoption, particularly within SMEs. In light of these insights, we propose the following hypothesis:

Hypothesis 3: There exists a significant and positive relationship between technology readiness and the intention to adopt CC-SaaS.

3.5 The Organizational Dimensions

The second dimension elucidated in the model pertains to the Organizational Dimensions (OD). This dimension can be defined as resource management provisions, goal specification and decision-maker commitments [71]. These aspects collectively impact the adoption of SaaS-based CC-SaaS. The organizational dimension has been further described with one variable to gauge their impact on CC-SaaS intention adaptation. CC included Organizational Support. This category pertains to the degree of support the organization offers in adopting CC-SaaS, particularly within a developing country such as Pakistan.

3.6 Organization Support

The Organizational perspective is intricately linked with the resources and characteristics of SMEs, including factors such as size and managerial and operational structure [72]. Consequently, the organization's existing technologies are pivotal in the adoption process. These technologies delineate the broad boundaries that dictate the extent and pace at which enterprises can embrace technological changes [31]. Organizational support, on the other hand, pertains to the extent to which management is willing to provide resources and aid to employees in achieving the goals and objectives of the organization [73]. Extensive research has established a correlation between organizational support and the utilization of computer systems, particularly concerning attitudes and behaviours [73].

Conversely, lacking organizational support can yield adverse consequences [31]. Upper-level management support plays a pivotal role in encouraging employees [66]' use of advanced computer technology in their work roles [50]. Kurtessis *et al.,* [31] conducted a study that analysed the impact of organizational support on the adoption of CC-SaaS, with results indicating its significance. Based on the preceding literature, the following hypothesis is proposed:

Hypothesis H4: Organizational support positively and significantly affects the intention to adopt CC-SaaS in the relationship.

3.7 The Environmental Dimensions

The third dimension, the Environmental Dimension (ED), signifies the external factors influencing the intention to adopt CC-SaaS technology [71]. In this study, one significant factor is identified within the environmental dimension, which will be used to assess its impact on the intention to adopt CC-SaaS.

3.8 Government Initiative

The implementation of government initiatives (GI) is crucial for supporting small and medium-sized enterprises (SMEs) and startups in their technology investments, aiming to enhance their performance and reduce costs [74]. It is equally vital for governments to enact and enforce laws ensuring data security, privacy and confidentiality [11]. Research conducted in Denmark and Australia highlights the pivotal role played by government initiatives in facilitating CC-SaaS adoption by SMEs in developed nations [75]. However, in developing countries, robust IT infrastructure can be necessary to adopt technologies, especially internet-based ones like CC-SaaS [81]. This study explores the experiences of companies in such environments that have grappled with these challenges over an extended period. The following hypothesis is proposed:

Hypothesis H5: Government Initiatives positively and significantly affect the relationship intentions to adopt CC-SaaS.

4. Methodology

This study emphasizes demonstrating the relationships among the essential aspects persuading the intention of Pakistani SMEs to adopt CC-SaaS. According to Bougie *et al.,* [76], selecting an appropriate research approach and design is critical for addressing the primary research questions. Therefore, this study adopts a quantitative research approach, which allows for generalizing research findings to the entire population [77]. The quantitative approach enables researchers to examine the significance of relationships between various research variables [78]. Consequently, this study employs an empirical and correlational nature, as it tests specific hypotheses to assess the connections between the study's variables. This research uses a quantifiable examination methodology to investigate the determinants of CC-SaaS adoption in Pakistani SMEs, focusing on the perspective of SME managers—the research design involved collecting primary data through structured surveys among SME managers from SME sectors in Pakistan. The research instrument was developed based on an extensive review of the remaining literature and was designed to elicit responses regarding factors influencing the adoption of CC-SaaS solutions. A systematic random sampling technique was used to select a representative sample of SMEs from our target population. The data collected through the survey was subjected to rigorous quantitative analysis using statistical software SPSS and Smart-PLS 4, enabling meaningful conclusions regarding the determinants of CC-SaaS adoption. The methodology intended to provide an inclusive understanding of the factors that impact CC-SaaS adoption within the Pakistani SME context, facilitating valuable insights for both academics and practitioners in the field of cloud computing adoption and technology management.

4.1 Instrument Development

This research aims to discern the factors impacting the adoption of Cloud CC-SaaS within SMEs in Pakistan. This investigation seeks to achieve this objective by integrating the Technology-Organization-Environment (TOE) and Organizational Support Theory (OST) frameworks. A self-administered questionnaire was meticulously devised to pursue this goal and data were gathered from operational SMEs in Pakistan. The questionnaire included items utilized for variable measurement, which were adapted from prior scholarly studies, as outlined in Table 1. Respondents were instructed to assess these items on a five-point Likert Scale, with response options ranging from 1 ("strongly disagree") to 5 ("strongly agree") [27]. A two-step pre-testing process was undertaken to

ascertain the validity of the measurements. In the initial phase, the questionnaire was scrutinized by seasoned academic researchers skilled in questionnaire design. Subsequently, in the second round, the questionnaire was pilot-tested with a cohort of Small and Medium Enterprise (SME) managers to ensure that respondents could comprehensively grasp and respond to the items.

Table 1
Questionnaire based factor selection

Variable	References
Cloud Relative Advantage	Skafi *et al.,* [11]; Oliveira *et al.,* [60]
Cloud Security	Skafi *et al.,* [11]; Pathan *et al.,* [48]; Gupta *et al.,* [53]; Oliveira *et al.,* [60]
Technology Readiness	Oliveira *et al.,* [60]
Organization Support	Skafi *et al.,* [11]; Neves *et al.,* [73]
Government Initiative	Eisenberger *et al.,* [50]

4.2 Data Collection and Analysis

Empirical data for this study was gathered by administering a questionnaire survey. The questionnaires were distributed through online survey methods. Responses were collected from SME managers within the Pakistani SMEs. Two control measures were applied to ensure the quality and relevance of reactions. Firstly, participants were screened to confirm their involvement in IT decisions within their respective organizations. Secondly, participants were required to have experience with CC-SaaS, excluding those without such knowledge. Four hundred fifty survey questionnaires were distributed to Small and Medium Enterprises (SMEs) affiliated with SAMEDA. Impressively, 368 questionnaires were returned, resulting in a robust response rate of approximately 81.8%. Among these responses, 301 were deemed valid for subsequent data analysis. Various data analysis techniques were applied, following the customary practices for empirical research. The collected responses were analysed using the Partial Least Squares Structural Equation Modelling (PLS-SEM) technique. The Smart-PLS statistical software package, version 4.0, was employed to execute the analysis and validate the structural model after ensuring the appropriateness of the measurement model.

5. Result and Analysis

5.1 Demographic Characteristics

The demographic analysis of the study's respondents revealed a diverse composition in terms of gender. Of the 367 participants, 101 were female, constituting 27.50% of the total, while 266 were male, representing 72.50%. The respondents had an average age of 40 years. This distribution is acceptable, as in many Pakistani SMEs, especially in the IT field, male staff typically outnumber their female counterparts. It is worth noting that while the fraction of males is more sophisticated than that of females, this proportion aligns with statistical study norms, which do not assume equal sample sizes for males and females [79].

Additionally, an in-depth analysis of the participants' demographic characteristics, including their ages, job experiences and educational backgrounds, was conducted in this study. The analysis of demographic characteristics within the scope of this research provides valuable insights into the study's subject matter and its broader implications. The demographic data collected from a diverse sample of participants is crucial in understanding the relationships, patterns and trends explored in this study.

5.2 Model Analysis

During the data analysis phase, this research utilized Partial Least Squares Structural Equation Modelling (PLS-SEM) to validate the proposed model. It is essential to highlight that Structural Equation Modelling (SEM) entails two fundamental models that researchers should adhere to during data analysis: the measurement and structural models. As such, this study rigorously adhered to the two-step process as per the recommended methodology by Hair *et al.,* [80] to conduct the analysis. The first step involves assessing the measurement model. In this phase, the focus is on evaluating the reliability and validity of the constructs used in the study. This step ensures that the measurement tools (e.g., questionnaires) effectively measure the intended constructs and that the constructs are reliable and valid for further analysis. The additional stage includes assessing the structural prototype. In this phase, the study aims to verify the hypotheses established in the research model. This step examines how the various constructs relate to one another and tests their proposed relationships. By following this comprehensive two-step approach, the study ensures the robustness of its research model and the rationality of its findings.

5.3 Measurement Model

Within this study, the measurement model was employed to evaluate the validity and reliability of the collected data using the methodology suggested by Hair *et al*., [80]. All items in the model were considered reflective indicators. To assess the reliability of the constructs under examination, internal consistency measures, such as Cronbach's Alpha (α) and composite reliability (CR), were utilized, adhering to the commonly accepted criterion of 0.70 [81]. As demonstrated in Table 2, the Composite Reliability (CR) values for the constructs under investigation in this study varied from 0.89 to 0.889. Significantly, it is noteworthy that all CR values for the constructs surpassed the established threshold of 0.70. CC underscores the effective alignment of each construct's indicators with its respective latent variable, consequently affirming the constructs' robust reliability Pratikto [82]; Hadi *et al.,* [37]; Hair *et al*., [81]. CC provides strong evidence of good internal consistency and reliability. Convergent validity was also assessed, which indicates the degree to which a concept's pointers measure the same underlying idea. It is typically achieved when the Average Variance Extracted (AVE) for a construct is equal to or exceeds 0.50, as suggested by Nathan *et al.,* [27]. The results imply that, on average, more than half of the variance in the construct's indicators is explained by the latent variable. In the current study, all AVE values, as presented in Table 2, exceeded the recommended threshold of 0.50, ranging from 0.695 to 0.711. These findings illustrate that the constructs have attained a satisfactory degree of convergent validity, signifying that, on average, more than half of the variance in the indicators is explained by the latent variable. In essence, the refined measurement model exhibits ample evidence of convergent validity.

Table 2
Analysis of internal consistency

Construct	Cronbach's Alpha	Composite Reliability	AVE
Cloud Relative Advantage	0.89	0.891	0.695
Cloud Security	0.894	0.895	0.703
Technology Readiness	0.889	0.889	0.693
Organization Support	0.884	0.886	0.684
Government Initiative	0.864	0.864	0.711

5.4 Structural Model

After confirming the reliability and validity of the measurement model, an evaluation of the structural model was carried out to assess the hypothesized relationships [83]. This assessment entailed the examination of path coefficients, which denote the magnitude of relationships between dependent and independent variables and the computation of the R2 value. The R2 value signifies the proportion of variance in the endogenous construct (dependent variable) elucidated by one or more exogenous constructs (independent variables) [84]. In this research, the R2 values were evaluated using the method recommended by Cunha *et al.,* [85]. The findings disclosed a substantial R2 value of 0.768, signifying a robust capacity to elucidate the intention to adopt CC-SaaS. Furthermore, the statistical significance of each path was assessed by estimating t-values through a PLS bootstrapping method involving 5,000 resamples. The results of the hypothesis testing are outlined in Table 3, demonstrating significant support for the proposed hypotheses.

Table 3
Hypotheses results

Hypothesis	Constructs	Path Coefficient	Std. Error	T-value	P-Value	Result
H1	Cloud Relative Advantage	0.226	0.062	3.602	0.000	Supported
H2	Cloud Security	0.359	0.072	5.011	0.000	Supported
H3	Technology Readiness	0.331	0.072	4.603	0.000	Supported
H4	Organization Support	0.322	0.067	4.767	0.000	Supported
H5	Government Initiative	0.213	0.084	2.537	0.006	Supported

6. Discussion

The TOE and OST models were employed in this study to inspect the determinants contributing to Pakistani SMEs' decision to adopt CC-SaaS. Based on the results of the established model, the decision to adopt CC-SaaS technology in slightly SME is influenced by the compatibility of the technology's features with the responsibilities to be approved, along with various external and internal factors related to technology organization and the environment. This research explored three dimensions and the analysis of the hypotheses found support for all of them. The study of the hypotheses reveals compelling support for all the proposed findings. Hypothesis H1 posited that Cloud Relative Advantage (CRA) significantly impacts the Intention to Adopt CC-SaaS among IT professionals. The results demonstrate a statistically significant relationship ($\beta = -0.226$, $t = 3.602$, $p < 0.000$), affirming the validity of H1. Correspondingly, the findings indicate a substantial influence of Cloud Security (CS) on Intention to Adopt (INTA) ($\beta = 0.359$, $t = 5.011$, $p < 0.000$), thereby substantiating H2. Furthermore, H3, which proposed that Technology Readiness (TR) significantly affects Intention to Adopt (INTA), is also corroborated by the data ($\beta = 0.331$, $t = 4.603$, $p < 0.000$). Additionally, in line with the postulation, the results of H4 demonstrate a significant relationship between Organization Support (OS) and Intention to Adopt (INA) ($\beta = 0.322$, $t = 4.767$, $p < 0.000$). In a similar vein, H5, which examined the relationship between Government Initiative (GI) and INTA, unveiled a significant positive association between these constructs ($\beta = 0.213$, $t = 2.537$, $p < 0.006$), lending support to this hypothesis. In summary, as predicted, all the technology constructs exert substantial possessions on the CC-SaaS intention to adopt.

7. Conclusions

The rapidly rising costs of IT and the exponential growth of data within SMEs have made the adoption of CC-SaaS a matter of strategic importance. It offers SMEs the potential for significant innovative benefits. Consequently, CC-SaaS adoption has become a paramount issue and a substantial contest that each SME must address, necessitating coordination within its IT departments. To ensure that SMEs derive optimal benefits from CC-SaaS utilization, they should enhance their capacity and readiness to identify and acquire external knowledge. This knowledge is abundant and continually evolving through CC-SaaS offerings, which provide extensive functionality. SMEs can integrate this acquaintance with their remaining internal familiarity, which pertains to their operations and planned innovations. This integration enables them to discover commercial-level opportunities consuming CC-SaaS. Adopting CC-SaaS can bring significant advantages to SMEs, including cost-effectiveness and increased operational efficiency. However, the adoption process should follow established rules and guidelines, considering various factors that can impact the adoption process, both positively and negatively. In the case of Pakistan small sector organizations like SMEs, several factors must be thoroughly investigated to assess the feasibility and applicability of CC-SaaS adoption. This study proposes a model for CC-SaaS adoption intention by combining the TOE and OST frameworks. This robust combined model encompasses essential factors for decision-makers to consider when transitioning to CC-SaaS. The empirical results of the model testing reveal several key findings. The study suggests that Pakistani SMEs can successfully adopt CC-SaaS with the support of moderating variables like OS and GI. CC implies these SMEs possess the internal capabilities and resources needed for adoption. In general, this research delivers valuable insights into manipulating CC-SaaS adoption in the Pakistani SME sector. It underscores the importance of considering the unique technological organizational and environmental factors when planning and executing CC-SaaS adoption initiatives. Additionally, it suggests that Pakistani SMEs may have the internal capacity to undertake CC-SaaS adoption without extensive external support. However, the absence of regulatory constraints in the Pakistani SME context also plays a role in this scenario.

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