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Enhancing Efficiency: The Impact of Cloud Computing Adoption on Small and Medium Enterprises Performance

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Abstract

This study investigated the factors influencing cloud computing adoption (CCA) and its impact on organizational performance (OP) among SMEs employees in Bahrain. The study used an online survey approach, which includes Likert scale questions to assess attitudes and views, multiple-choice questions for categorical data, and open-ended questions to obtain qualitative insights. The target audience comprises 300-350 small and medium-sized enterprises (SMEs) in Bahrain currently utilizing cloud computing technology, and 314 useful responses were received. A mixed two-step sampling technique was initiated by convenience sampling. Then, snowball sampling was used to guarantee the inclusion of various SME categories, thus ensuring representativeness. The measurements are derived from validated instruments used in academic research, with the questionnaire incorporating elements adapted from the studies conducted. Participants' responses to the Likert scale are analyzed using SmartPLS 4 to understand their perspectives. Full collinearity was used to assess common method bias, and VIF values below 3.3 indicated no bias. The measuring model's validity and reliability were evaluated by loadings, AVE, CR, and discriminant validity tests (HTMT), which ensured all constructs fulfilled thresholds. Path coefficients, standard errors, t-values, and p-values were used to evaluate the structural model using 10,000-sample bootstrapping. The research findings indicate that both Perceived Ease of Use (PEU) and Perceived Usefulness (PU) have a substantial impact on Cloud Computing Adoption (CCA), which in turn improves the performance of Bahraini SMEs. PEU and PU directly impact CCA while indirectly improving Organizational Performance (OP) by increasing cloud computing usage. These findings emphasize the importance of user-friendly and beneficial cloud solutions in increasing cloud computing adoption and enhancing business outcomes for SMEs.

Keywords:
Cloud Computing Adoption;
Perceived Usefulness;
Perceived Ease of Use;
Organizational Performance;
SME's Performance:
Resource-Based View.

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1- Introduction

Small and Medium Enterprises (SMEs) are crucial in global economic development [1]. They make up the majority of businesses in most economies, accounting for over 90% of enterprises and contributing 55-70% of the GDP and

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employment in developed countries [2]. SMEs are essential in creating jobs, driving innovation, and reducing poverty. Governments are increasingly recognizing the importance of inclusive, sustainable economic growth [2, 3]. Small and medium-sized enterprises (SMEs) are vital to economic development, technological advancement, and employment creation in developing countries [3]. They also add value to agricultural products and drive economic growth in various communities [4]. SMEs help reduce unemployment, increase investment rates, boost foreign trade through exports, and contribute to tax revenue, making them essential for national and regional economic development [4].

The rapid advancement of technology puts pressure on Small and Medium-sized Enterprises (SMEs) to adapt and innovate. SMEs struggle to adopt new technologies because of the limited resources and complexity of technological transformation [5]. Technological advances, commonly referred to as "Industry 4.0," are changing business models across industries, making it necessary for SMEs to embrace modern technologies and compete globally [6]. Organizational agility, supported by digital technologies, relationships, and innovation capabilities, is crucial for SMEs to navigate volatile business environments and improve their performance [7]. To survive in the global market, SMEs must emphasize resilience and competitiveness, including new strategies and technologies [8]. Decision-making regarding technology adoption is complex and requires careful consideration of various operational factors [9].

Cloud computing is a revolutionary technology that enables users to access a shared pool of computing resources over the Internet on demand. This technology simplifies the complexities of the underlying infrastructure, allowing users to use computing resources without having to manage hardware or software components [10]. According to the National Institute of Standards and Technology (NIST), cloud services are defined as network connectivity that is both convenient and on-demand and that can be configured to share computing resources [11].

There is a plethora of literature on the adoption of cloud computing [12]. Relative benefit, service level, perceived hazards, supportive conditions, and upper management support are key factors that influence adoption decisions [11]. Cost reduction was identified as a powerful predictor [13]. Technological, organizational, and environmental factors also play a significant role [14]. Various research methodologies have been used, including systematic literature reviews [15], mixed-method approaches [16], and analytical techniques, such as SEM, ANN, and AHP [17, 18]. These studies covered different geographical contexts, with Asia having the highest number of research projects [15]. Despite the benefits of cloud computing for SMEs, its widespread adoption remains a challenge [17]. Managerial knowledge of cloud computing and perceived implementation costs are crucial factors influencing adoption among SMEs [19]. The Technological, Organizational, and Environmental (TOE) framework shows that SMEs are more inclined to adopt cloud technology when they see cost savings, scalability, and operational efficiency. The study also underscores the importance of gaining support from top management and having prior experience in successfully adopting cloud technologies. This indicates that these factors, combined with the perceived usefulness of the technologies, contribute to creating a favorable environment for cloud adoption [20].

Bahrain, a small island nation in the Arabian Gulf, is a hub for finance, trade, and technology-driven innovation [21]. Its diversified economy, which includes financial services, logistics, and tourism, supports business growth and technological advancement. Bahrain's robust ICT infrastructure, supported by fiber-optic networks and advanced telecommunications systems, is a testament to its commitment to developing a knowledge-based economy driven by digital innovation [21]. Bahrain has made significant strides in enhancing connectivity and internet penetration rates through initiatives such as the National Broadband Network (NBN) and the deployment of 5G networks [22]. These investments have laid the foundation for accelerating cloud computing adoption among businesses, particularly SMEs, by providing them with the necessary connectivity and bandwidth to leverage cloud-based services effectively.

Cloud computing offers several advantages for Small and Medium Enterprises (SMEs), including cost reduction, improved scalability, and enhanced operational efficiency [23-25]. This enables SMEs to access advanced technologies without significant hardware investments and facilitates easier software upgrades [25]. Despite these benefits, many SMEs remain hesitant to adopt cloud computing because of various barriers [13, 26]. The factors influencing adoption include technological, organizational, and environmental factors [13, 23]. To increase the adoption rates, it is crucial to understand these factors and develop tailored strategies [16, 17]. Cloud computing adoption varies across regions, with Asia generally being more advanced than Africa [24]**.** Overall, cloud computing provides a level playing field for SMEs, enabling them to compete more effectively in the global market [26-28]**.** Despite their many advantages, numerous barriers and challenges have been identified that impede SMEs' widespread adoption of cloud computing. Concerns over data privacy, security, and migration complexities have deterred some SMEs from embracing the cloud [29]. Furthermore, a lack of understanding and awareness of cloud computing offerings and their potential impacts has contributed to hesitancy among SME decision-makers [30].

This study is important because SMEs are crucial for global economic growth and job creation. Understanding how cloud computing adoption affects performance can provide valuable insights for SMEs and policymakers.

The current body of research on cloud computing adoption in SMEs has focused on general trends and barriers, with limited insights into industry-specific impacts, geographic variations, and long-term effects [15]. Most research has concentrated on the pre-adoption stages, with few studies examining the post-adoption impacts [31]. This research gap offers an opportunity to delve deeper into cloud computing adoption's intricacies and uncover the factors that drive or hinder its successful implementation within the SME landscape. By addressing this gap, researchers and practitioners can develop tailored and practical strategies to support SMEs on their cloud computing journeys, enabling them to fully leverage the potential of this transformative technology [32].

This study examines the effect of cloud computing adoption on the performance of Small and Medium Enterprises in Bahrain. While cloud computing offers SMEs potential benefits, such as enhanced operational efficiency, reduced costs, and increased agility, its actual impact on their performance requires further exploration.

2- Theoretical Background and Hypothesis Development

This study examines how cloud computing adoption affects the performance of small and medium enterprises. It specifically investigates the role of perceived usefulness and perceived ease of use using the Technology Acceptance Model in this relationship [33].

2-1- Technology Acceptance Model TAM

The Technology Acceptance Model (TAM) is a widely used framework for explaining and predicting user acceptance of technology [34, 35]. Developed by Davis (1989) [34], TAM posits that perceived usefulness and perceived ease of use have been consistently identified as key predictors of technology adoption [36, 37]. According to this concept, two important aspects influence an individual's attitude towards technology use: perceived usefulness and ease of use. These factors affect their intention to utilize the technology and their actual use [38]. This model has been extensively applied across various contexts and technologies, demonstrating its high validity and robustness [39]. Researchers have extended TAM by incorporating additional factors, such as computer self-efficacy, subjective norms, and system quality, to enhance its explanatory power [37]. Despite its popularity, some studies have noted limitations in the TAM's predictive capabilities, particularly in healthcare settings [40]. It posits that:

- ***Perceived Usefulness*:** The importance of a system's perceived usefulness, which refers to how much an individual believes the system enhances job performance, cannot be overstated when it comes to determining technology acceptance and usage [34]. The factors influencing perceived usefulness include subjective norms, self-efficacy, and system compatibility [41]. User training, computer skills, and self-efficacy also played significant roles in shaping the perceptions of usefulness [42]. The impact of perceived usefulness on performance can vary between voluntary and mandatory usage contexts, with mandatory contexts exhibiting more pronounced effects during system upgrades [43].
- ***Perceived Ease of Use***: The concept of Perceived Ease of Use (PEOU) revolves around users' perception of how effortless it is to use a specific system [44]. PEOU is influenced by factors such as self-efficacy, computer skills, and experience with the system [45, 46]. It plays a mediating role between various antecedents and behavioral intention to use [47]. PEOU significantly affects Perceived Usefulness and user satisfaction in e-learning and healthcare contexts [41]. However, its influence may vary across disciplines, as demonstrated in a study of accounting students' acceptance of e-books [48]. Understanding PEOU is crucial for improving the user experience and maximizing the effectiveness of technological systems.

2-2- Resource-Based View

Resource-Based View (RBV) theory suggests that companies can achieve long-term competitive advantage by utilizing valuable, rare, inimitable, and non-substitutable (VRIN) resources [49-51]. Cloud computing offers significant benefits for Small and Medium-sized Enterprises (SMEs) by providing access to scalable IT infrastructure and advanced software applications at reduced costs [52]. This enables SMEs to overcome resource constraints and improve their business performance through cost-effectiveness, flexibility, and security enhancement [53, 54]. Resource-Based View (RBV) theory has been applied to assess the impact of cloud computing on SME performance, considering factors such as cloud infrastructure capability and environmental turbulence [52, 55]. Cloud computing also facilitates value co-creation within business alliances, offering benefits such as global reach and innovation capabilities [56]. However, challenges remain in cloud adoption among SMEs, including the need for rigorous readiness assessment and management approaches [57]. SMEs can enhance their operational efficiency, agility, and overall performance by adopting and utilizing cloud computing effectively.

2-3- Hypothesis Development

Based on TAM and RBV, this research proposes the following hypotheses:

2-3-1- Cloud Computing and its Relevance for SMEs in Bahrain

Small and Medium-sized Enterprises (SMEs) are crucial to Bahrain's economy, providing numerous opportunities to improve their competitiveness and efficiency. It offers cost savings, simplified scaling, increased flexibility, real-time data analytics, and enhanced security [58]. Using cloud services, SMEs can access computing resources as needed, expand their operations rapidly, analyze data effectively, and benefit from solid security measures without substantial upfront investment in hardware and infrastructure. Adopting cloud computing among SMEs in Bahrain is not just a trend but a strategic move to access scalable, flexible, and cost-effective IT resources [59]. Cloud services enable Bahraini SMEs to focus on their core business activities without the hassle of managing complex IT infrastructure, leading to better resource allocation and increased productivity. Furthermore, cloud computing allows SMEs to access advanced technologies and business applications that were previously only available to larger corporations, creating a

level playing field in the competitive market. The agility provided by cloud solutions enables these enterprises to quickly adapt to market changes and customer demands, which is crucial in Bahrain's fast-paced business environment. Cloud computing fosters innovation among SMEs by providing them with tools to develop new business models and services to enhance their market presence and drive their growth [59]. Therefore, the relevance of cloud computing to SMEs in Bahrain extends beyond technology adoption. This transformative force can redefine business strategies and contribute to broader economic development.

2-3-2- Perceived Ease of Use and Perceived Usefulness

Several studies have examined the relationships among perceived ease of use (PEU), perceived usefulness (PU), and other factors in technology acceptance. While some research found that PEU significantly influences PU [60-62], in e-learning systems [41], e-government services [63], and electronic health records [46]. Others have reported no significant influence of PEU on PU [64, 65]. Understanding the antecedents of PEU and PU can help developers and managers implement more effective technological innovation and improve user adoption rates.

H1: Perceived Ease of Use (PEU) positively influences Perceived Usefulness (PU).

2-3-3- Perceived Usefulness and Perceived Ease of Use on Cloud Computing Adoption

Various research articles have explored the factors that impact the adoption of cloud computing. However, these studies produced conflicting results regarding the significance of perceived usefulness and perceived ease of use. Various studies have yielded different findings regarding the impact of perceived usefulness on adoption intentions. Some studies found no significant effect [66, 67], while others emphasized the importance of Perceived Ease of Use (PEU) and Perceived Usefulness (PU) as crucial factors in the adoption of cloud computing [68, 69]. A recent study on digital readiness and adoption among UK SMEs during the COVID-19 crisis underscored the significance of perceived usefulness in cloud computing adoption. Studies indicate that small and medium-sized enterprises (SMEs) are inclined to embrace cloud technologies when they perceive significant advantages, such as reduced costs, enhanced scalability, and improved operational efficiency. These findings highlight the importance of receiving support from top management and having prior experience in technology adoption. These factors, along with perceived usefulness, contribute to creating a favorable environment for cloud adoption [70]. Furthermore, a study conducted on Indian SMEs has validated the importance of cloud adoption by highlighting perceived usefulness as a critical factor. This study explored various factors that influence the adoption of cloud technology, encompassing technological, organizational, and environmental aspects. This study reveals the key factors that play a significant role in determining the adoption of cloud computing. These factors included perceived ease of use, technology readiness, top management support, and perceived usefulness [71].

When considering the adoption of cloud computing, IT managers and professionals value the perceived ease of use and the ability of technology to offer improved security and privacy measures. This finding supports the broader belief that the perceived usefulness of new technologies dramatically affects the decision to adopt them. When individuals view technology as valuable, they are more inclined to embrace it because they believe it will enhance their job performance and bring strategic advantages to the organization [14].

The impact of how easy it is to use cloud computing on its adoption has been researched extensively, while some studies found that PEU has no significant impact [66, 72]. Another study found that accounting students are significantly influenced by cloud computing if it is easy to use [67]. Additionally, different studies have demonstrated that ease of use significantly influences cloud computing adoption, which in turn positively affects academic performance [73, 74]. Others have emphasized the importance of perceived values such as availability, access, security, and reliability in shaping how easy and useful cloud services are perceived [75]. Finally,

H2: Perceived usefulness will have a positive effect on cloud computing adoption.

H3: Perceived ease of use will have a positive effect on cloud computing adoption.

2-3-4- Cloud Computing Adoption and SMEs' Performance

Several studies have examined the impact of cloud computing on firm performance. One study found that factors such as top management and regulatory support, personal innovativeness, and IT/IS competence positively influenced cloud computing adoption, leading to improved firm performance [76]. Another study highlighted the benefits of cloud computing for small and medium enterprises, citing improvements in performance, cost reduction, and increased profits [12, 71, 77]. In addition, efficient cloud monitoring systems are crucial for enhancing performance [78]. However, it was also pointed out that network interconnection in the cloud may present challenges for high-performance computing applications [79]. Finally, two studies underscored the importance of power and performance management strategies and performance evaluation techniques for optimizing cloud computing performance [80, 81]. Interestingly, while most studies suggest that cloud computing adoption positively impacts SME performance, one study found no significant effect [82].

H4: Cloud computing adoption will have a positive effect on the SMEs' performance.

2-3-5- Perceived usefulness and perceived ease of use on performance

Investigating the impact of perceived usefulness and perceived ease of use on various outcomes, studies have found that these factors do not significantly affect performance in mandatory e-learning or actual usage of e-learning, respectively [83, 84]. However, another study found a positive relationship between these factors and employee performance and customer loyalty [85-87]. Additionally, further support for this finding was found in another study, which concluded that they positively influenced consumers' intention to repurchase [88]. These findings suggest that while the impact of perceived usefulness and ease of use may vary across different contexts, they generally positively influence performance, loyalty, and satisfaction.

H5: Perceived Ease of Use (PEU) indirectly influences SME's performance (OP) through Cloud Computing Adoption (CCA).

H6: Perceived Usefulness (PU) indirectly influences Organizational Performance (OP) through Cloud Computing Adoption (CCA).

2-3-6- Mediation Effects of Perceived Usefulness and Cloud Computing Adoption (CCA)

The reviewed studies consistently support the influence of Perceived Ease of Use (PEU) on Cloud Computing Adoption (CCA) through Perceived Usefulness (PU). Multiple studies have found that PEU significantly affects PU, which in turn influences CCA intentions [68, 69, 89] . However, one study reported that PU did not affect CCA intentions [67].

H7: Perceived Ease of Use (PEU) indirectly influences Cloud Computing Adoption (CCA) through Perceived Usefulness (PU).

H8: Perceived Ease of Use (PEU) indirectly influences Organizational Performance (OP) through Perceived Usefulness (PU) and Cloud Computing Adoption (CCA)

The research model for the adoption of cloud computing and its effect on SME Performance is shown in Figure 1.

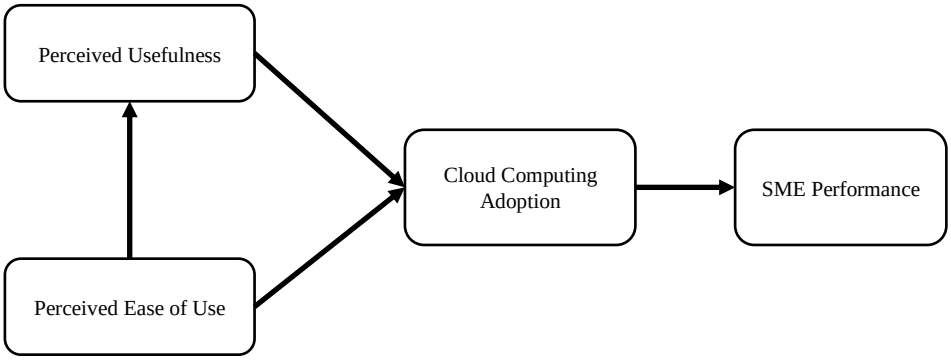

Figure 1. Research Model

3- Research Methodology

***Measurement*:** During the development of the research methodology, we focused on creating a comprehensive questionnaire that examined several variables relevant to the study. To ensure the validity and reliability of the measures, the questionnaire was carefully designed by combining items from instruments previously tested in scholarly literature.

***Questionnaire Development*:** The questionnaire included numerous components, each aimed at capturing different aspects of the impact of cloud computing on SME performance. Specifically, the concept of "Perceived Usefulness" is assessed using a collection of five questions, the Perceived Ease of Use construct, which consists of three questions and is adapted from the critical work of [73], which explores cloud computing solutions' perceived benefits and effectiveness in improving corporate operations. Similarly, the Cloud Computing Adoption (CCA) component, which includes three questions, is drawn again from [73] and focuses on how SMEs integrate cloud computing into their business processes and the variables that drive acceptance. In addition, the questionnaire tackles "Organizational Performance," which is tested using five questions inspired by Awa & Ojiabo [90], ensuring the relevance and validity of the questions in the context of Bahraini SMEs.

***Measurement Model Modification*:** Minor modifications were made to ensure the relevance and clarity of the items in the context of cloud computing adoption among Bahraini SMEs. These adjustments were validated through pilot testing and feedback from the field experts.

***Perceived Usefulness (PU) Modifications*:** The wording was changed from an academic context to a business context, emphasizing enterprise performance and work efficiency rather than academic performance and studies. This ensures that the items are relevant to SMEs and their operational reality.

Perceived Ease of Use (PEU): Modifications: The items remained unchanged, as they are generalizable to academic and business contexts. The focus on ease of use, clarity, and skill development applies to different settings.

Cloud Computing Adoption (CCA): Modifications: The items were revised to reflect the business environment, focusing on using cloud computing to manage work-related materials and access business data rather than educational purposes.

Organizational Performance (OP): Modifications: The wording was adjusted to reflect the past and future actions of organizations, focusing on the improvements already made and those planned. This ensures that the items are relevant to the current and ongoing use of cloud computing in Bahraini SMEs.

Data Collection: A comprehensive online survey was conducted, using a combination of a Likert scale and multiple-choice questions, to assess the attitudes and perceptions of individuals from Bahrain's SMEs who utilize cloud computing technology. The study used G*power software to calculate the necessary sample size [91]. The study had a maximum of two predictors. To test the hypothesis with a medium effect size of 0.15, a minimum of 66 observations were required [92]. However, this study purposely collected more data than was necessary.

Response Rate: A total of 329 questionnaires were submitted. After the data-cleaning process, 314 questionnaires were deemed appropriate for analysis.

Pre-testing: Instead of pilot testing, a comprehensive discussion was conducted with the vice president of the Bahrain SMEs Association. This consultation was instrumental in refining the questionnaire and ensuring its clarity and comprehensibility. Based on the feedback received, minor adjustments were made, including a briefing at the top of the survey on different common types of cloud computing. The prospective research participants received the final questions via email and social media. Within two months, 314 valuable responses were received.

Measures: The questionnaire prompt included a Likert scale response ranging from "1 (strongly disagree)" to "5 (strongly agree)". This allowed for a comprehensive examination of participants' perspectives and experiences.

Sampling Method: Convenience sampling was used by distributing the survey through their networks on all social media platforms and within the Bahrain SMEs' Association group. A message accompanying the survey encouraged the respondents to forward it to their networks after completion, thus implementing a snowball sampling technique to reach a wider audience. This method ensured a broad and diverse sample of SMEs in Bahrain.

Challenges during Data Collection: The challenges included ensuring participant engagement and completeness of responses. These challenges were addressed by sending reminder messages to participants and providing clear instructions throughout the survey. Additionally, including the Vice President of the Bahrain SMEs Association in the initial distribution helped boost credibility and encourage participation, further enhancing the response rates and data quality.

4- Results and Discussion

4-1- Results

The measurement and structural model were examined using SmartPLS version 4 [93], which is advantageous because it does not rely on the normality assumption, making it particularly useful for survey research that often has non-normal distributions [94].

4-1-1- Common Method Bias

The Full Collinearity Technique was chosen over Harman's Single-Factor Test to address the issue of common method bias (CMB). Recent research has shed light on the notable drawbacks of Harman's Single-Factor Test in identifying common method bias (CMB) in survey-based studies. A recent study [95, 96] found that this widely used technique has limited effectiveness in identifying CMB. These findings suggest that researchers may be misled by believing that they have accurate results when they do not. VIF ≤ 3. indicated the absence of bias [97, 98]. This analysis showed that VIF was <3.3, as shown in Table 1, indicating no bias was detected.

Table 1. Full Collinearity Testing

Construct	CCA	OP	PEU	PU
VIF	2.532	2.294	1.481	2.072

Note: CCA = cloud computing, adoption, OP= Organizational performance, PEU= Perceived usefulness, PEOU= Perceived ease of use.

We utilized the suggestions provided in Anderson & Gerbing [99] to analyze the model using a 2-step process. A thorough evaluation of the measurement model was first conducted to confirm the accuracy and consistency of the instruments [100, 101], followed by thorough analysis of the structural model to validate our hypotheses.

4-1-2- Assessment of the Measurement Model

To evaluate the measurement model, it is essential to analyze four different types of validity. The reliability of indicators can be assessed through loadings, whereas convergence validity can be evaluated using Average Variance Extracted (AVE). Internal consistency reliability can be measured using Composite Reliability (CR).

First, we examined the loadings, AVE, and CR. These numbers should be ≥ 0.708, ≥ 0.5, and ≥ 0.7, respectively [100]. evaluation criteria. Table 2 shows that all the indicators' outer loadings passed the necessary threshold value of 0.708, indicating convergent dependability at the indicator level. In addition, the results suggest that all constructions had AVE values greater than 0.5. Convergent validity is demonstrated at the construct level. Finally, all measurement models' indicators (CR) met the necessary composite reliability thresholds. The results showed that all constructions demonstrated internal consistency and reliability.

Next, we evaluated discriminant validity to assess the extent to which a construct is genuinely distinct from the other constructs in the model. Discriminant validity was assessed using [102] the modified HTMT criteria [103]. The stricter HTMT criterion was < 0.85, while the milder threshold was < 0.90, and the HTMT values were all below 0.85. As shown in Tables 2 and 3, the validity tests proved that the measurement items were valid and reliable.

Table 2. Measurement model assessment

Variable	Item	Loading	CR	AVE
Cloud Computing Adoption (CCA)	CCA1	0.916	0.949	0.862
	CCA2	0.941		
	CCA3	0.929		
Organization Performance (OP)	OP1	0.853	0.943	0.769
	OP2	0.863		
	OP3	0.844		
	OP4	0.723		
	OP5	0.857		
Perceived Ease of Use (PEU)	PEU1	0.888	0.918	0.788
	PEU2	0.899		
	PEU3	0.876		
Perceived Usefulness (PU)	PU1	0.885	0.917	0.688
	PU2	0.902		
	PU3	0.843		
	PU4	0.883		
	PU5	0.870		

Table 3. Discriminant Validity (HTMT)

Variables	1	2	3	4
1 Cloud Computing Adoption				
2 Organization performance	0.777			
3 Perceived Ease of Use	0.640	0.530		
4 Perceived Usefulness	0.779	0.756	0.552	

4-1-3- Assessment of the Structural Model

4-1-3-1- Path Coefficient

A large sample size for bootstrapping increased the stability and accuracy of the estimates, providing more reliable confidence intervals for the path coefficients. This approach is considered more robust than smaller sample sizes (e.g., 500 or 1,000), as it reduces the standard error and increases the precision of the estimates. Thus, a 10,000-sample bootstrapping method was used [100], and we presented path coefficients, standard errors, t-values, and p-values for the structural model in accordance with [100, 104]. Furthermore, based on criticisms leveled at p-values [105], it is recommended to combine p-values with confidence intervals and effect sizes as criteria for evaluating the relevance of the hypothesis. Table 4 shows the results of the hypothesis testing for both direct and indirect effects.

Direct Effects

First, we tested the effects of the predictors on Cloud Computing Adoption (CCA). The R^2 value was 0.581, which shows that the predictors explained 58.1% of the variance in the CCA. The hypothesis results were: H1: PEU → PU (β= 0.504, t= 9.493, p< 0.001) which indicates a strong influence of Perceived Ease of Use (PEU) on Perceived Usefulness (PU).

H2: PU → CCA (β= 0.578, t= 10.166, p< 0.001) indicates a strong influence of Perceived Usefulness (PU) on Cloud Computing Adoption (CCA). H3: PEU → CCA (β= 0.285, t= 5.374, p< 0.001) indicates a significant influence of Perceived Ease of Use (PEU) on Cloud Computing Adoption (CCA).

Next, we tested the effects of the predictors on Organizational Performance (OP). R^2 was 0.499, indicating that the predictors explained 49.9% of the variance in OP. The hypothesis result was H4: CCA → OP (β= 0.707, t= 19.474, p < 0.001), which indicates a powerful influence of Cloud Computing Adoption (CCA) on Organizational Performance (OP).

Indirect Effects (Testing Mediation Effects)

A multi-step mediation analysis was used to explore the indirect effects The indirect effect was calculated by multiplying the path coefficients along the indirect path; the indirect effect values were (H5) = 0.285 * 0.707 = 0.2015, (H6) = 0.578 * 0.707 = 0.4088, and (H7) = 0.504 * 0.578 = 0.2913**.** The bootstrapping method provided estimates for the indirect paths, including PEU → PU → CCA → OP: H5: PEU→CCA→OP (β= 0.202, t= 5.508, p< 0.001), indicating a significant indirect influence of Perceived Ease of Use (PEU) on Organizational Performance (OP) through Cloud Computing Adoption (CCA). H6: PU→CCA→OP (β= 0.408, t= 7.716, p < 0.001), indicating a significant indirect influence of Perceived Usefulness (PU) on Organizational Performance (OP) through Cloud Computing Adoption (CCA). H7: PEU→PU→CCA (β= 0.291, t= 7.874, p<0.001), indicating a significant indirect influence of Perceived Ease of Use (PEU) on Cloud Computing Adoption (CCA) through Perceived Usefulness (PU). H8: PEU→PU→CCA -> OP (β= 0.206, t= 6.466, p< 0.001) indicating a significant indirect influence of Perceived Ease of Use (PEU) on Organizational Performance (OP) through Perceived Usefulness (PU) and Cloud Computing Adoption (CCA) (See Table 5).

Table 4. Structural model assessment: Hypotheses testing (direct relationships)

Hypothesis	Relationship	β	Std Dev.	t-value	p-value	BCI [LL, UL]	f^2	Result
H1	PEU → PU	0.504	0.053	9.493	p<.001	[0.407, 0.582]	0.341	Supported
H2	PU → CCA	0.578	0.057	10.166	p<.001	[0.481, 0.666]	0.594	Supported
H3	PEU → CCA	0.285	0.053	5.374	p<.001	[0.198, 0.373]	0.145	Supported
H4	CCA → OP	0.707	0.036	19.474	p<.001	[0.641, 0.761]	0.998	Supported

Table 5. Structural model assessment: Hypotheses testing (indirect relationships)

Hypothesis	Relationship	β	Std Dev.	t-value	p-value	BCI [LL, UL]	f^2	Result
H5	PEU →CCA → OP	0.202	0.037	5.508	p<.001	[0.141, 0.261]	0.041	Supported
H6	PU → CCA → OP	0.408	0.053	7.716	p<.001	[0.320, 0.495]	0.166	Supported
H7	PEU →PU → CCA	0.291	0.037	7.874	p<.001	[0.233, 0.355]	0.085	Supported
H8	PEU → PU → CCA→ OP	0.206	0.032	6.466	p<.001	[0.155, 0.262]	0.042	Supported

4-1-3-2- Testing Coefficient of Determination, Effect Sizes, and Predictive Performance

We first examined the in-sample prediction to evaluate the model's predictive relevance and subsequently studied the out-of-sample prediction.

First, we analyzed the in-sample predictive power (coefficient of determination, R^2 for in-sample prediction explanatory power). [106] defined R^2 values as weak (above 0.25), moderate (above 0.50), and substantial (above 0.75). In our results, R^2 was moderate for CCA (0.581), which indicates that 58.1% of the variance in CCA is explained by its predictors PU and PEU. For OP, R^2 was weak (0.499), indicating that 49.9% of the variance in OP was explained by its predictors PU, PEU, and CCA. Lastly, R^2 was weak for PU with a value of 0.254, indicating that PEU's predictors explain 25.4% of the variance in PU.

Next, we calculated the f^2 effect size of the constructs. The effect sizes were categorized as weak (0.02), medium (0.15), or strong (0.35) [107, 108]. PU strongly affects CCA, whereas PEU has a medium impact on CCA.

PLS prediction was employed for out-of-sample prediction [109], Which utilizes a holdout sample-based approach, employing PLS-Predict and a 15-fold process to assess the predictive capability and generate predictions at the case-level for an item or construct If all the differences between the items (PLS-LM) are lower than LM, it indicates a significant level of predictive power. Confirmation of predictive relevance is not established when the values are higher, while moderate predictive power is observed when the majority of values are lower. If the minority is lower, then the predictive power is low [109]. Based on the findings presented in Table 6, it is evident that the model demonstrates a strong ability to make accurate predictions.

Table 6. PLSpredict

MV	Q^2predict	PLS-RMSE	LM-RMSE	PLS-LM RMSE
OP1	0.151	1.037	1.022	0.015
OP2	0.152	1.018	0.973	0.045
OP3	0.161	1.056	1.045	0.011
OP4	0.104	1.122	1.097	0.025
OP5	0.175	0.926	0.903	0.023

4-2- Discussion

This study highlights the importance of Perceived Ease of Use (PEU) and Perceived Usefulness (PU) in Cloud Computing Adoption (CCA) and their impact on the Organizational Performance (OP) of SMEs in Bahrain. This section analyses the findings in the existing literature by examining all the hypotheses.

The findings confirm that Perceived Ease of Use (PEU) positively influences Perceived Usefulness (PU), which is consistent with the core principles of the Technology Acceptance Model (TAM). The results showed a significant positive relationship between PEU and PU ($\beta = 0.504$, $t = 9.493$, $p < 0.001$), with an R^2 value of 0.254 for PU, indicating that PEU explained 25.4% of the variance in PU. Although this R^2 value is considered weak, it highlights the importance of ease of use in shaping user perceptions of a technology's usefulness. The moderate effect size of PEU on PU further emphasizes its relevance in influencing how users perceive the utility of cloud computing technologies[107]. These findings are in line with previous research [60-62] , suggesting that technologies perceived as easier to use are more likely to be seen as useful, particularly in environments where ease of interaction can significantly impact adoption decisions.

In addition, the results strongly support that Perceived Usefulness (PU) positively influences Cloud Computing Adoption (CCA). A path coefficient of $\beta = 0.578$, $t = 10.166$, $p < 0.001$, and an R^2 value of 0.581 for CCA indicate that 58.1% of the variance in CCA was explained by PU and PEU. The R^2 value was considered to be moderate, reflecting a substantial level of explanatory power. The strong effect size of PU on CCA suggests that perceived usefulness is a crucial determinant of cloud computing adoption. This finding aligns with the TAM framework and is consistent with the studies by [68-70], which emphasized the importance of perceived usefulness in driving technology adoption [110]. In the context of SMEs in Bahrain, where resources are often limited and operational efficiency is paramount, the perceived usefulness of cloud computing is particularly influential. The study shows that SMEs are inclined to adopt cloud computing solutions when they believe that these technologies will deliver tangible benefits, such as cost reduction, scalability, and improved performance. This is consistent with prior research that has highlighted the role of perceived usefulness in driving the adoption of new technologies across various sectors [20, 70, 71].

In addition, the results support the hypothesis that Perceived Ease of Use (PEU) positively influences Cloud Computing Adoption (CCA). The path coefficient for this relationship was $\beta = 0.285$, $t = 5.374$, and $p < 0.001$, with an R^2 value of 0.581 for CCA, indicating moderate predictive power. Although the effect size of PEU on CCA is medium, it underscores the significance of user-friendliness in the adoption process. This finding aligns with the TAM framework, which posits that technologies perceived as easy to use are more likely to be adopted. These results are consistent with those of previous studies [67, 73, 74]. found that ease of use is a critical factor influencing the adoption of cloud computing, particularly in environments where users may have limited IT resources or technical expertise. As SMEs integrate cloud computing into their operations, the user-friendliness of these technologies is crucial for their effective and sustained use [14, 68] . This ongoing ease of use ensures that cloud services remain accessible and beneficial to SMEs, allowing them to leverage these technologies fully.

The results confirm the hypothesis that Cloud Computing Adoption (CCA) positively influences Organizational Performance (OP), with a path coefficient of $\beta = 0.707$, $t = 19.474$, $p < 0.001$. However, the R^2 value for OP was 0.499, indicating that 49.9% of the variance in OP was explained by its predictors, including PU, PEU, and CCA. Although this R^2 value is categorized as weak, the strong effect size of CCA on OP highlights the significant impact of cloud computing adoption on organizational outcomes. These findings are consistent with the Resource-Based View (RBV)

theory, which posits that leveraging valuable resources, such as cloud computing, can lead to improved performance and competitive advantage [52, 55]. The results support the notion that cloud computing enables SMEs to enhance their operational efficiency, reduce costs, and increase agility, thereby contributing to improved organizational performance [12, 71, 76, 77, 78] . In the context of Bahraini SMEs, the adoption of cloud computing is particularly relevant given the challenges these enterprises face in maintaining competitiveness with limited resources. Cloud computing offers a way to overcome these challenges by providing access to advanced technologies without the need for significant upfront investments in hardware and infrastructure. This allows SMEs to focus on their core business activities while benefiting from enhanced operational capabilities and improved data management processes [25, 59]. Furthermore, the positive impact of CCA on OP can be attributed to the increased efficiency of inter-organizational data exchange, reduction in data duplication, and improvement in service delivery, all of which are critical for maintaining a competitive edge in the market. The ability to quickly adapt to changing market conditions and customer demands, facilitated by cloud computing, further reinforces the importance of CCA in driving organizational success [14, 32].

The study's results confirm that Perceived Ease of Use (PEU) indirectly influences Organizational Performance (OP) through Cloud Computing Adoption (CCA). The indirect effect path coefficient was $\beta = 0.202$, $t = 5.508$, and $p < 0.001$, indicating a significant mediating effect. The moderate R^2 value for CCA and the weak R^2 value for OP suggest that while the model's explanatory power is not substantial, the identified pathways are nonetheless important. The medium effect of PEU on CCA and the subsequent impact on OP highlights the role of ease of use in driving adoption and contributing to organizational success. These findings align with TAM and RBV frameworks, suggesting that user-friendly technologies are more likely to be adopted and enhance performance outcomes [85-87].

The hypothesis that Perceived Usefulness (PU) indirectly influences Organizational Performance (OP) through Cloud Computing Adoption (CCA) is supported by the study's results, with an indirect effect path coefficient of $\beta = 0.408$, $t = 7.716$, $p < 0.001$. The moderate R^2 value for CCA and the weak R^2 value for OP indicate that, while the predictive power is not strong, the pathways identified are critical in understanding the role of perceived usefulness in driving adoption and enhancing performance. The strong effect size of PU on CCA reinforces its importance as a key determinant of cloud computing adoption, which positively affects organizational performance. These findings are consistent with the TAM framework and prior research [71], emphasizing the importance of perceived usefulness in technology adoption and performance outcomes. For SMEs in Bahrain, the perceived usefulness of cloud computing, such as its potential to improve job performance, streamline operations, and reduce costs, is a major determinant of its adoption. The study's findings suggest that when SMEs perceive cloud computing as highly useful, they are more likely to adopt these technologies, which positively impacts their organizational performance. This includes improvements in operational efficiency, resource management, and the ability to respond quickly to market changes [70, 71]. Therefore, the indirect effect of PU on OP, mediated by CCA, illustrates the importance of demonstrating clear and tangible benefits to encourage the adoption of new technologies and achieve better business outcomes.

The study confirms that Perceived Ease of Use (PEU) indirectly influences Cloud Computing Adoption (CCA) through Perceived Usefulness (PU), with an indirect effect path coefficient of $\beta = 0.291$, $t = 7.874$, $p < 0.001$. The moderate R^2 value for CCA suggests that this pathway has a meaningful impact on adopting cloud computing technologies. The medium effect size of PEU on PU, coupled with the strong effect of PU on CCA, highlights the mediating role of perceived usefulness in the relationship between ease of use and adoption. This finding aligns with the TAM framework, suggesting that technologies perceived as easier to use are also more likely to be perceived as useful, which in turn drives adoption [68, 69, 89]. The mediating role of PU in this relationship is crucial, as it bridges the initial ease of use with the eventual adoption decision. When users perceive a system as easy to use, their belief in its usefulness increases, which directly influences their intention to adopt and use it continuously. This is particularly relevant for Small and Medium Enterprises (SMEs) in Bahrain, where the simplicity of technology integration can be a decisive factor in whether these enterprises adopt cloud computing solutions [20, 44].

The indirect influence of Perceived Ease of Use (PEU) on Organizational Performance (OP) through the mediation of Perceived Usefulness (PU) and Cloud Computing Adoption (CCA) is supported by the study's results, with a combined indirect path coefficient of $\beta = 0.206$, $t = 6.466$, $p < 0.001$. The moderate R^2 value for CCA and the weak R^2 value for OP indicate that, while the model's predictive power is not substantial, the pathways identified are significant in explaining how ease of use can ultimately enhance organizational performance through the mediation of perceived usefulness and cloud computing adoption. The findings underscore the interconnected nature of these constructs within the TAM framework and highlight the strategic importance of designing user-friendly and useful cloud computing solutions to drive adoption and improve performance outcomes [34, 52]. Once CCA is in place, its positive effects on OP become evident. Cloud computing enables SMEs to streamline their processes, access scalable resources, and benefit from real-time data analysis, all of which are essential for maintaining their competitiveness in Bahrain's dynamic market. The findings support the view that the combination of ease of use and perceived utility drives adoption, leading to tangible improvements in organizational performance [37, 73].

This indirect pathway from PEU to OP through PU and CCA highlights the importance of designing user-centric cloud computing solutions that are both easy to use and beneficial to the organization. By focusing on these aspects, developers and SMEs can ensure that adopting cloud technologies translates into significant performance gains, thereby reinforcing their strategic value in achieving long-term business success.

5- Conclusions

This study emphasizes the importance of perceived ease of use (PEU) and perceived usefulness (PU) in the adoption of cloud computing technology (CCA) adoption and organizational performance (OP) of Bahraini SMEs. According to the Technology Acceptance Model, PEU significantly affects PU, making user-friendly cloud computing solutions essential for adoption and organizational success. SMEs' adoption of cloud computing depends on their perceived usefulness, which improves operational efficiency and performance. The study also found that the ease of use of cloud platforms increases adoption, suggesting that simplifying user interfaces can boost cloud computing usage and organizational effectiveness. CCA was shown to be strongly correlated with OP, indicating that cloud computing adoption improves efficiency, lowers costs, and boosts the profitability of Bahraini SMEs. The indirect effects analysis showed that PEU and PU indirectly influenced OP via CCA, stressing the importance of early ease and usefulness perceptions in technology adoption and performance increases. Simplifying cloud technologies boosts perceived utility and uptake, thereby improving corporate outcomes. This multi-step mediation emphasizes the need for user-friendly and helpful cloud solutions to maximize Bahraini SMEs' performance. Specifically, our results demonstrate the following:

- **The Power of Perceived Usefulness:** PU is a powerful driver of CCA, aligning with TAM's emphasis on the importance of perceived usefulness in technology adoption decisions. SMEs in Bahrain are more likely to adopt cloud computing when they perceive it as beneficial for their operations, particularly in terms of cost reduction, scalability, and enhanced performance.
- **The Importance of User-Friendliness:** The positive influence of PEU on CCA indicates that user-friendliness is a significant driver of cloud adoption among SMEs. Prioritizing intuitive design and user-centric features can empower SMEs to overcome potential barriers to adoption and fully leverage the benefits of cloud computing.
- **The Tangible Benefits of Cloud Adoption:** Our findings strongly support the positive influence of CCA on OP, confirming that embracing cloud technology can significantly enhance organizational outcomes for SMEs. This aligns with the Resource-Based View, which emphasizes the strategic value of cloud computing as a valuable resource for enhancing efficiency, reducing costs, and increasing agility.
- **The Mediating Role of User Perceptions:** Both PEU and PU indirectly influence organizational performance through their impact on CCA. This highlights the critical role of user perceptions in driving technology adoption and, subsequently, organizational success.

5-1- Research Implications

Based on the findings of this study, we suggest the following recommendations:

- **Invest in User-Friendly Cloud Solutions:** Small and medium-sized enterprises (SMEs) should prioritize adopting simple cloud computing technology. Ensuring that employees can learn and use these systems will improve their perceived usability and enhance their overall adoption rates and organizational performance**.**
- **Highlight the advantages of cloud computing:** To boost perceived usefulness, SMEs should educate their staff on the real benefits of cloud computing, such as increased efficiency, cost savings, and better data management. Demonstrating these benefits can increase adoption rates and improve organizational performance.
- **Provide Training and assistance:** Comprehensive training programs and continuing assistance can help employees feel more at ease and competent when using cloud technologies. This can improve perceived ease of use and usefulness, resulting in smoother adoption and improved performance outcomes.
- **Leverage Cloud Adoption for Performance Gains:** SMEs should strategically use cloud computing to improve the different elements of their operations, including customer relationship management, supply chain efficiency, and data analytics. This can result in considerable gains in organizational performance.

5-2- Limitations and Suggestions for Future Studies

Although this study sheds light on the relationship between reported ease of use, perceived usefulness, cloud computing adoption, and organizational success among Bahraini SMEs, several limitations of this study should be acknowledged:

- **Sample Size and Generalizability:** The conclusions of this study are based on a sample of Bahraini small and medium enterprises. Although the sample contains valuable insights, the applicability of the results to SMEs in other nations or locations may be limited. Future studies should examine more diverse populations to improve the generalizability of our findings.

- **Cross-Sectional Design:** This study used a cross-sectional research design, with data collected at a single point in time. Consequently, we did not consider potential changes in the variables being investigated over time. Longitudinal studies are recommended to examine how the links among perceived ease of use, perceived usefulness, cloud computing adoption, and organizational performance change over time.
- **Self-Reported Data:** The data utilized in this study were self-reported by the participants, which may introduce biases such as social desirability or recollection bias. Future research could benefit from including objective metrics of cloud computing adoption and organizational performance to validate the findings.
- **Specific setting of Bahrain:** This study is limited to SMEs in Bahrain, which may have distinct economic, cultural, and technological characteristics. However, these findings may not be applicable to SMEs in other settings. Comparative research across countries and regions is required to understand the broad relevance of these findings.
- Focus on SMEs: This study focuses solely on SMEs, that may exhibit different adoption habits and performance outcomes than more prominent organizations. Future research could examine similar relationships among larger firms to determine whether these findings apply to different business sizes.
- **Limited Scope of Variables:** The study examined perceived ease of use, perceived utility, and cloud computing adoption as predictors of organizational performance. Other factors influencing cloud computing adoption and performance include organizational preparation, top-level management support, and external influences. Incorporating these variables into future studies could provide a more complete picture of the factors influencing cloud computing adoption and their impact on performance.

Further research could address the constraints of this study by employing longitudinal designs to track changes over time and enhance our understanding of the impact of cloud computing adoption on organizational performance in small and medium-sized enterprises. Examining samples from various nations can contribute to the broader applicability of the findings through cross-cultural comparisons. A more unbiased and precise assessment can be achieved by incorporating objective metrics with self-reported data. In addition, exploring a wider range of variables, including organizational preparation and external influences, would offer a more comprehensive understanding of the factors that impact cloud computing adoption. Studies should consider various firm sizes and industry contexts to uncover unique challenges and opportunities. Ultimately, incorporating cutting-edge technologies and qualitative research methods can provide small and medium-sized enterprises with a deeper understanding and actionable suggestions.

6- Declarations

6-1- Author Contributions

Conceptualization, R.A. and JPS.; methodology, R.A.; software, R.A.; validation, R.A., R.T., and J.P.S.; formal analysis, R.A.; investigation, R.T.; resources, L.A.; data curation, J.P.S.; writing—original draft preparation, R.A.; writing—review and editing, L.A.; visualization, J.P.S.; supervision, R.T.; project administration, L.A. All authors have read and agreed to the published version of the manuscript.

6-2- Data Availability Statement

The data presented in this study are available on request from the corresponding author.

6-3- Funding

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6-4- Acknowledgements

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6-5- Institutional Review Board Statement

Ethical approval was obtained from the ethical committee Research Center at the University of Technology Bahrain (UTB2024CAFSEC012 dated July 8). This study adhered to the ethical principles outlined in the IRB-HSBS informed consent guidelines of the university.

6-6- Informed Consent Statement

All participants provided informed consent at the beginning of the questionnaire. This study exclusively gathered information from SME personnel in Bahrain. All participants received detailed information regarding their research goals prior to participation. Participation in the survey was entirely voluntary, and respondents were requested to complete the questionnaire only after thoroughly reviewing the lengthy information clarifying any concerns, they may have had regarding Cloud computing, which was provided at the top of the form. Informed consent is critical for ensuring that the participants understand the study's objectives and voluntarily participate in the research.

6-7- Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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