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Current challenges of organizational learning and cloud adoption technology toward SMEs' performance

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Abstract

This study aims to examine the effect of cloud computing on the business performance of Small and Medium Enterprises (SMEs) in Indonesia post-adoption and highlights the mediating role of organizational learning. Based on the Technology–Organization–Environment (TOE) framework, the study investigates the relationship between internal and external drivers of cloud adoption and the subsequent impact of cloud adoption on the learning processes and business performance at organizations. The research uses a hypothesized model framework to develop a quantitative study using CB-SEM with survey data from 315 SMEs using cloud computing as an ICT for more than a year. This means high management support and competitive pressure are potential motivators, whereas external support, regulatory support, and technology readiness do not significantly influence the adoption of the cloud. Results reveal the positive effect of cloud adoption on both organizational learning and firm performance. Additionally, organizational learning only partially mediates the relationship between cloud computing adoption and performance, thereby indicating the role of internal knowledge processes in converting technological investments into performance. These results show that the effectiveness of the cloud is magnified in the presence of learning at the organizational level. The study provides important insights for practitioners and policymakers seeking to enhance digitization efforts in the SME context.

Keywords: Cloud computing adoption, organizational learning, firm performance, SMEs, TOE framework, structural equation modeling.

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Institutional Review Board Statement: This study has been conducted in compliance with ethical research guidelines. The research was carried out following ethical considerations, and all respondents provided informed consent before participating. Since the study does not involve experiments on humans or animals, formal ethical approval was not required. However, the authors affirm that all ethical research standards were maintained throughout the study.
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1. Introduction

The rapid advancement of information technology in the Fourth Industrial Revolution (Industry 4.0) era has significantly transformed business operations across various sectors, including Small and Medium Enterprises (SMEs). However, many SMEs continue to struggle with competitiveness due to their limited access to advanced technology. Cloud computing presents an innovative solution to this challenge, enabling SMEs to utilize computing resources such as storage, software, and application services without requiring substantial investment in hardware infrastructure [1-4]. This technology provides flexibility that was once exclusive to large corporations, now made accessible to SMEs through an affordable pay-as-you-go model tailored to their limited financial capacity. By adopting cloud computing services, SMEs can enhance their competitiveness and thrive in the evolving business landscape [2]. Cloud adoption offers technological advantages, but its impact on operational performance is significantly amplified when supported by a strong culture of organizational learning. This means that SMEs can leverage new technologies effectively but also transform and continuously enhance their operations to ensure sustained competitive advantage.

Research conducted by Tippins and Sohi [5] and Liu et al. [6] showed that there is no direct effect from using IT systems, like cloud technology to improve performance unless these efforts have been intervening with certain capabilities, one of which is organizational learning. According to Bratianu [7], organizational learning is an intuitive, interpretive and integrative process through which organizations institutionalize knowledge. A well-embedded organizational learning culture also constructs a competitive advantage for firms operating in the SMEs sector and facilitates enhanced adaptability to changing markets. While prior research has highlighted direct effects of cloud adoption [1, 8-10] [8]. It is essential to understand that the full potential of this technology can be unlocked only if we couple it with organizational learning. Thus, for SMEs to thrive in today's competitive environment, cloud adoption must be coupled with processes that encourage learning and knowledge-sharing across all levels of the organization. Cloud computing helps to smooth this process by streamlining the flow of information and enhancing collaboration within the organization.

Most previous research has concentrated on the intention to adopt cloud technology, and thus, less work has been done on the post-adoption effects related to firm performance arising from cloud adoption [9]. Furthermore, the mediating role of organizational learning in the relationship between cloud adoption and performance have not been thoroughly investigated [5]. Hence, this research aims to investigate the TOE framework on cloud adoption in SMEs located in Indonesia. This study also examines the mediating role of organizational learning between cloud adoption and SME performance.

2. Literature Review

NIST defines cloud computing as a model that facilitates widespread, convenient, and on-demand access to a shared pool of adjustable computing resources that can be swiftly provisioned and released with minimal management overhead [11]. Cloud computing offers big benefits to SMEs, which usually operate on limited resources. Hence, this business can leverage technology and also increase operational efficiency to become more competitive. Research indicates that cloud computing technology contributes to improved efficiency, productivity, and competitiveness for SMEs, aligning with claims that it serves as a crucial element in enhancing productivity [8, 12]. Furthermore, Zhang et al. [2] stated that SMEs can gain a competitive edge by moving to cloud-based services. Previous investigations have consistently demonstrated a positive correlation between organizational performance and cloud computing adoption [1, 13, 14]. Despite the wealth of research outlining the benefits of cloud computing technology [10, 14-17]. A significant number of SMEs in different countries have not yet adopted this technology. This hesitance is often attributed to a lack of awareness regarding its benefits or insufficient familiarity with the technology [17-20]. Moreover, previous studies investigating the theory of cloud computing adoption have mainly concentrated on the initial adoption phase and lack sufficient focus on the post-adoption stage [14]. This gap in existing literature shows the necessity for more research to investigate the factors determining the adoption and long-term use of cloud computing technology. It is extremely important to explore post-adoption behavior, which will help understand how SMEs can leverage their potential gains from cloud computing through its long-term performance and innovation.

The exploration of technology adoption has advanced considerably, integrating various established theories relevant to diverse contexts. Prominent models at the individual level encompass the Diffusion of Innovations Theory, the Theory of Reasoned Action, the Theory of Planned Behavior, the Technology Acceptance Model and the Unified Theory of Acceptance and Use of Technology [1, 21]. At the organizational level, research tends to rely on the Technology-Organization-Environment (TOE) framework, which has been extensively applied in previous research. This study will examine the factors influencing cloud computing adoption among SMEs in Indonesia, using the TOE framework as its theoretical basis. The Technology-Organization-Environment (TOE) framework, introduced by Tornatzky and Fleischer [22] consists of three interdependent aspects encouraging the organization to adopt technological innovations, namely, technological factors, organizational factors, and environmental factors. Based on Hameed et al. [21], the TOE framework explains the adoption, implementation, and dissemination of technology from a holistic perspective of the organization. In contrast to models that focus solely on people, the TOE framework captures a broader range of factors affecting technology adoption; these include technological readiness, organizational structure, and environmental pressures [23-25].

Previous studies have identified some key drivers and obstacles for SME cloud adoption clustered into the TOE framework with different results. Study Asiaei and Ab. Rahim [26] stated that the major influencing factors for cloud adoption consisted of technological readiness, regulatory support and competitive pressure. In contrast, Gui et al. [27] found no significant effects from these factors. While Alismaili et al. [28] highlighted the need for external support in the entire cloud computing adoption process, Skafi et al. [29] showed that this factor did not have a significant impact. Skafi et al. [29] also emphasized top management support as one of the most determining factors for cloud adoption, but Gui et al. [30] and

Alismaili et al. [28] could not detect supportive evidence for this. This variation emphasizes the necessity for further examination to better understand how these factors uniquely influence cloud adoption, particularly within the SME context.

2.1. Developing Hypotheses

SMEs are faced with numerous challenges in the rapidly changing environment of the digital era. Cloud computing provides a solution with several advantages for SMEs to leverage information technology innovations at lower costs, increasing scalability, collaboration, and business agility. Understanding the factors driving cloud computing adoption and its subsequent impact on SME performance is essential for formulating effective implementation strategies. Grounded in the TOE framework and insights from prior research, this study proposes a set of hypotheses to explore the relationships between various determinants of cloud computing adoption and their effects on SME performance.

The research framework, as shown in Figure 1, is designed to investigate the relationships between multiple influencing factors and the adoption of cloud computing. From the TOE framework, we examine the roles of technological readiness, top management support, competitive pressure, external support, and regulatory support in facilitating adoption. Furthermore, this framework explores the subsequent effects of cloud computing adoption on firm performance and organizational learning, while also considering how organizational learning mediates the relationship between the use of cloud computing and firm performance

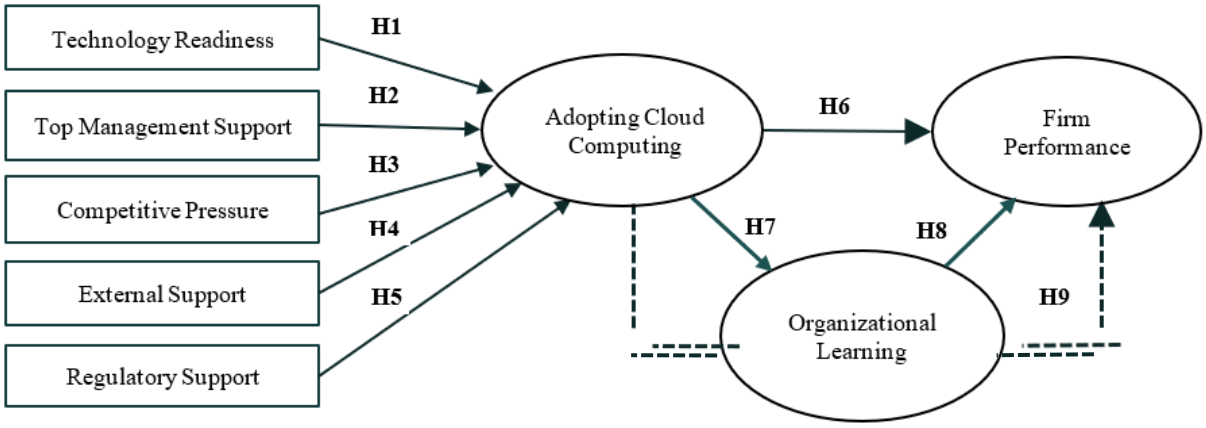

Figure 1.
Research Model.

2.1.1. Technology Readiness and Cloud Computing Adoption

Technology readiness refers to the extent to which an organization's technological infrastructure and human resources are prepared to adopt and integrate new technologies. Parasuraman [31] identifies four dimensions of technology readiness: optimism, innovation, discomfort, and insecurity. Optimism and innovation positively influence technology adoption, while discomfort and insecurity act as barriers. Research indicates that levels of technology readiness are linked to cloud computing adoption [26, 32]. In light of this information, we propose the following hypothesis:

H_1: Technology readiness positively influences cloud computing adoption by SMEs in Indonesia.

2.1.2. Top Management Support and Cloud Computing Adoption

In SMEs, the leadership typically comprises business owners who are crucial in overseeing the organization and making strategic, tactical, and operational decisions, particularly regarding technology adoption [9, 33]. Research indicates that when top management comprehends the advantages of cloud computing, they are more inclined to allocate essential resources and support organizational changes to facilitate its adoption [34]. As a result, the successful acceptance and implementation of cloud technology within SMEs significantly depend on the extent of support from top management.

Previous studies have shown varied outcomes concerning the impact of top management support on the adoption of cloud computing. A study in Portugal revealed a significant positive correlation between top management support and cloud adoption among SMEs [35]. Likewise, research conducted in various countries consistently demonstrated that top management support had a beneficial effect on cloud computing adoption [18, 26, 29, 34, 36, 37]. Evidence from Indonesia further corroborates this positive relationship, as shown by Gui et al. [27] and Gui et al. [30]. However, contrasting results have been reported in prior research, such as Hassan [38], which identified no significant influence of top management support on cloud computing adoption among SMEs in Malaysia. Similarly, research in Australia indicated that top management support did not significantly affect cloud adoption within SMEs [28]. This study seeks to address these inconsistencies by examining the influence of top management support on cloud computing adoption among SMEs in Indonesia. Hence, we propose:

H_2: Top management support positively influences cloud computing adoption by SMEs in Indonesia.

2.1.3. External Support and Cloud Computing Adoption

External support refers to the assistance provided by vendors, consultants, or cloud service providers before and after implementation, as well as training and technical advice [39]. This support is vital for SMEs, as it affects their willingness to

adopt cloud computing by mitigating potential challenges related to the technology [28]. Such assistance allows SMEs to reduce risks and uncertainties by providing access to expertise and resources that may not be available internally [39].

Research conducted in Australia has shown that external support plays a significant role in the adoption of cloud computing [28]. Other studies in Malaysia found that external support did not significantly influence cloud computing adoption [40]. Similarly, research in Lebanon reported no positive correlation between external support and cloud computing adoption [29]. These inconsistencies in prior research underscore the necessity for further investigation to understand the impact of external support in cloud computing adoption. In light of these findings, we propose the following hypothesis:

$H_{3:}$ External support positively influences cloud computing adoption by SMEs in Indonesia

2.1.4. Competitive Pressure and Cloud Computing Adoption

For small and medium-sized enterprises, embracing cloud computing offers a variety of competitive advantages, including improved customer service, increased flexibility in response to market changes, shorter time-to-market, and enhanced operational efficiency [41].

Empirical research further supports the impact of competitive pressure on the adoption of cloud computing. Studies in Iran, Malaysia, Pakistan, and Nigeria reveal that competitive pressure significantly influences SMEs to adopt cloud technologies [18, 36, 37, 39]. However, research conducted in Portugal, Lebanon, Bangladesh, and Indonesia indicates that competitive pressure does not significantly influence cloud computing adoption [23, 27, 29, 40]. Based on these insights, we propose the following hypothesis:

$H_{4:}$ Competitive pressure positively influences cloud computing adoption by SMEs in Indonesia.

2.1.5. Regulatory Support and Cloud Computing Adoption

Regulatory support is a critical factor in fostering the adoption of cloud computing, as it provides a foundational framework that addresses challenges and creates a secure environment for technology implementation. Since cloud computing relies heavily on proper internet infrastructure, the government must form policies that protect the various stakeholders and address emerging issues [15]. Research by Safari et al. [39] reveals that government support significantly influences cloud computing adoption, which emphasizes the crucial role that regulatory initiatives can play in promoting enterprise acceptance of cloud computing. Similarly, Pathan et al. [36] stated that support by regulation positively impacts adoption by reducing uncertainties and creating a favorable innovation environment. Likewise, Usman et al. [37] verified these findings and highlighted the impact of supporting policies in encouraging cloud adoption. In contrast, Oliveira et al. [23] stated that regulatory support was not a significant predictor of cloud computing adoption. This aligns with the findings of Asiaei and Ab. Rahim [26], Dinca [42], Gui et al. [27], and Khayer et al. [40] observed no positive relationship between regulatory support and cloud computing adoption. These differences underscore the necessity for further investigation thus, we propose the following hypothesis:

$H_{5:}$ Regulatory support positively influences cloud computing adoption by SMEs in Indonesia

2.1.6. Cloud Computing Adoption and Firm Performance

Integrating cloud computing enhances operational effectiveness, scalability, and responsiveness of the business, thereby improving overall business performance [1, 43]. Cloud computing in the SME sector has the potential to increase market share, improve the quality of services or products, and expand the business itself [1, 13]. Previous research shows that moving towards cloud services could provide SMEs with a competitive advantage in the market [2]. However, how exactly the adoption of cloud computing influences SME performance remains inconclusive, especially in the context of Indonesia. Research by Sari et al. [44] found no significant relationship between cloud computing adoption and SME performance in Karawang, Indonesia. Interestingly, Aligarh et al. [10] reported differing results, showing that cloud computing adoption significantly improved SME performance in Surakarta and Yogyakarta. These mixed findings underscore the need for further research, particularly within the context of Indonesia; thus, we propose the following hypothesis:

$H_{6:}$ Cloud computing adoption positively influences firm performance in SMEs in Indonesia

2.1.7. Cloud Computing Adoption and Organizational Learning

Organizational learning is the process by which organizations promote the sharing of knowledge and understanding of ideas to create and reinforce knowledge [10]. The application of information technology, particularly cloud computing, supports communication between people within an organization, which allows for the accessibility of information, comprising the interpretation and incorporation of new information along with existing knowledge [5]. It assesses an organization's ability to leverage learning into a competitive advantage in a market, with organizations that are high on learning being more likely to thrive in a competitive environment, achieving and sustaining advantages [45, 46]. However, limited studies to date have explored the relationship between cloud computing adoption and organizational learning, especially within the context of small and medium enterprises (SMEs). Thus, we propose the following hypothesis:

$H_{7:}$ The adoption of cloud computing has a positive effect on organizational learning in SMEs in Indonesia.

2.1.8. Organizational Learning and Firm Performance

Organizational learning at the corporate level is manifested in how businesses implement systems for knowledge collection and dissemination, empower their members, link the organization to its external context, and provide strategic leadership to facilitate learning endeavors. When effectively integrated, Industry 4.0 technologies can significantly improve operational efficiency by promoting learning and knowledge enhancement [47]. Organizational learning plays a crucial role

in interpreting scattered information throughout the organization, which aids in making informed decisions [37, 48]. Moreover, organizational learning is an evolving process where experiences gained from task execution are converted into practical knowledge, leading to a transformation in organizational practices and positively affecting overall business performance. The strategic use of technology becomes valuable when organizations utilize it to manage pertinent information databases, including customer insights, market trends, and other vital elements influencing sound decision-making, thus boosting organizational performance. Despite its importance, there is limited research exploring the direct relationship between organizational learning and firm performance; therefore, we propose the following hypothesis:

$H_{8:}$ Organizational learning has a positive impact on firm performance in SMEs located in Indonesia.

2.1.9. Mediating Role of Organizational Learning

The successful adoption of Information Technology (IT) occurs when technological innovations become integral to an organization's operations and processes, impacting organizational behavior and outcomes [5]. However, IT alone does not directly enhance firm performance. The integration of IT into organizational processes is mediated by capabilities such as organizational learning, which refines decision-making processes and strategic alignment [5, 47]. This aligns with the findings of Powell and Dent‐Micallef [49], who emphasized the mediating role of organizational learning in translating information technology competencies into improved firm performance. Organizational learning bridges IT adoption and improved firm performance by translating technological capabilities into actionable knowledge [47, 49]. While previous studies have examined in general contexts, this study extends the inquiry to the SME sector by hypothesizing:

$H_{9:}$ Organizational learning mediates the relationship between cloud computing adoption and firm performance in SMEs in Indonesia

3. Research Methodology

This study adopts a quantitative method to examine the influence of Technology-Organization-Environment (TOE) factors upon the utilization of cloud computing and, in turn, its effect on the performance of small and medium enterprises (SMEs) in Indonesia. Data collection was performed through purposive sampling, focusing on SMEs employing cloud computing for at least one year to assess the technology's impact on operational performance. Sampling covered only SMEs that had adopted a Software as a Service (SaaS) model, from basic applications to more advanced systems. Thus, the sample consisted of 315 SMEs' owners and managers in Indonesia who had adopted cloud computing for at least one year.

A questionnaire using a 5-point Likert scale was designed to collect data on different variables. The analysis was conducted based on Covariance-Based Structural Equation Modeling (CB-SEM) through AMOS software. Measurement model testing using confirmatory factor analysis (CFA) and validation of constructs with path analysis to test all hypothesized relationships. Model fit was evaluated by goodness-of-fit indices, including CMIN/DF < 3, RMSEA < 0.08, RMR < 0.05, AGFI, TLI, CFI, and IFI > 0.90 [50]. To evaluate reliability and validity, CR (Composite Reliability) and AVE (Average Variance Extracted) were used, where CR values greater than 0.70 and AVE greater than 0.50 were indicative of convergent validity [51]. The Fornell-Larcker criterion was employed to establish discriminant validity, which facilitates the evidentiary requirements indicating that the square root of AVE was larger than the relationship between the other constructs. These results corroborated the reliability and validity of the two models. Next, mediation hypotheses were tested using a bootstrapping method (2000 resamples, 95% bias-corrected confidence interval), providing potentially less biased estimates of indirect effects and their statistical significance [52].

4. Data Analysis and Interpretation

The table below illustrates how the duration of cloud computing usage varies among various small and medium-sized enterprise (SME) sectors. Table 1 reveals that a significant proportion of Indonesian SMEs have been utilizing cloud computing for 1 to 3 years, with the small business sector representing the largest group of users in this timeframe. This suggests that a considerable number of SMEs, particularly small businesses, have embraced cloud computing in the relatively recent past.

Table 1.
Cloud Computing Usage Duration by Business Sector.

Cloud Use Duration	Micro	Small	Medium	Total	Percentage
1–3 years	27	114	27	168	53.34%
4–6 years	4	49	46	99	31.43%
7–10 years	5	11	32	48	15.23%
Total	36	174	105	315	100%

This indicating that cloud computing adoption in different sectors may not yet be mature. The majority of SMEs (53,34%) have utilized cloud computing for 1–3 years, reflecting a relatively early adoption stage influenced by the COVID-19 pandemic.

To test the estimated relationships between constructs, data were analyzed using Covariance-Based Structural Equation Modeling (CB-SEM) in two main stages. The first stage focused on evaluating the measurement model, specifically the reliability and validity of the latent constructs. The next step comprised an examination of the structural model, where the hypothesized relationships between constructs were assessed. This two-stage approach ensures that the structural model is

based on a stable and robust measurement model, which helps to enhance the accuracy and validity of the findings obtained from testing the hypotheses.

4.1. Measurement Model Test

Confirmatory Factor Analysis (CFA) was applied to evaluate the measurement model, to assess construct reliability, convergent validity, and discriminant validity. Composite Reliability (CR) was used for assessing construct reliability, with all values found to be above 0.70 (indicative of internal consistency). Confirmatory Factor Analysis confirmed convergent validity, as standardized factor loadings and Average Variance Extracted (AVE) values were higher than 0.50. These results indicate that the observed variables reliably represent their underlying constructs. Discriminant validity was assessed using the Fornell-Larcker criterion, which compares the square root of each construct's AVE with its correlations with other constructs. The results showed that all constructs met this criterion, indicating satisfactory distinctiveness among the latent variables. These findings confirm that the measurement model is statistically sound and suitable for further structural model analysis. The detailed results of the CFA are presented in Table 2 (Convergent Validity and Reliability) and Table 3 (Discriminant Validity).

Table 2.
Assessment of Reliability and Validity

Construct	Item	Factor Loading	AVE	CR
Technology Readiness	TR4	0.666	0.56	0.86
	TR5	0.570		
	TR6	0.621		
	TR7	0.594		
	TR9	0.523		
Top Management Support	TM1	0.504	0.70	0.87
	TM5	0.711		
	TM6	0.600		
Regulatory Support	RS2	0.707	0.70	0.82
	RS3	0.681		
Competitive Pressure	CP3	0.698	0.68	0.86
	CP4	0.659		
	CP5	0.556		
External Support	EX2	0.696	0.76	0.87
	EX3	0.815		
Adoption Cloud Computing	ACC1	0.582	0.69	0.87
	ACC4	0.618		
	ACC6	0.611		
Organization Learning	OL2	0.590	0.74	0.93
	OL4	0.747		
	OL5	0.606		
	OL6	0.603		
	OL7	0.537		
Firm Performance	FP2	0.587	0.72	0.93
	FP4	0.637		
	FP5	0.701		
	FP7	0.643		
	FP9	0.522		

Results of discriminant validity are described in Table 3 using the Fornell-Larcker criterion, from which the square root of the Average Variance Extracted (AVE) for each construct (the diagonal in bold) should be greater than the correlations of the constructs. The table shows that the square root of the AVE is greater than the inter-construct correlations. The above results indicate that each construct is empirically distinctive from the other constructs, which indicates sufficient evidence of discriminant validity of the measurement model.

Table 3.
Discriminant Validity.

	TR	TM	EX	CP	RS
TR	0.747				
TM	0.592	0.831			
EX	0.822	0.116	0.874		
CP	0.523	0.163	0.603	0.823	
RS	0.686	0.004	0.798	0.630	0.836

To further evaluate the model's adequacy, seven (7) goodness-of-fit indices were analyzed as shown in Table 4. The findings indicate that the model meets all suggested thresholds, reflecting a robust overall fit. The CMIN/DF value stands at 1.199, significantly lower than the recommended cutoff of less than 3.0, suggesting an acceptable level of model parsimony. The Root Mean Square Error of Approximation (RMSEA) is 0.025, and the Root Mean Square Residual (RMR) is 0.012, both below their respective thresholds of less than 0.08 and 0.05, demonstrating minimal approximation and residual error. Regarding incremental and comparative fit indices, the Adjusted Goodness-of-Fit Index (AGFI) is recorded at 0.901, the Tucker-Lewis Index (TLI) at 0.970, the Comparative Fit Index (CFI) at 0.975, and the Incremental Fit Index (IFI) at 0.976; all surpassing the widely accepted threshold of 0.90. Collectively, these results suggest that the model aligns well with the data.

Table 4.
Goodness of Fit**.**

No	Goodness of Fit	Criteria	Result	Remark
1.	CMIN/DF	$\leq$ 2	1.199	Good Fit
2.	RMSEA	< 0.08	0.025	Good Fit
3.	RMR	$\leq$ 0.05	0.012	Good Fit
4.	AGFI	$\geq$ 0.90	0.901	Good Fit
5.	TLI	$\geq$ 0.90	0.970	Good Fit
6.	CFI	$\geq$ 0.90	0.975	Good Fit
7.	IFI	$\geq$ 0.90	0.976	Good Fit

4.2. Structural Model Test

The model in this study explained 78.0% of the variance in cloud computing adoption, 60.9% in organizational learning, and 76.9% in firm performance. The path analysis results, as presented in Table 5, indicate that top management support (β = 0.695, p-value < 0.001) and competitive pressure (β = 0.708, p-value < 0.001) have significant influences on cloud computing adoption; therefore, H2 and H4 are accepted. However, external support (β = -0.843, p-value = 0.051), regulatory support (β = -0.287, p-value = 0.306), and technology readiness (β = 0.856, p-value = 0.057) are not statistically significant, so hypotheses H1, H3, and H5 were rejected.

Cloud Computing Adoption has had a positive impact on Organizational Learning (β = 0.780, p-value < 0.001) and Firm Performance (β = 0.570, p-value < 0.001), respectively supporting hypotheses H6 and H7. Additionally, Organizational Learning significantly influences Firm Performance (β = 0.357, p-value = 0.005), verifying Hypothesis H8. Moreover, Table 6 presents the testing of the mediating role of Organizational Learning, revealing a significant indirect effect (β = 0.278, p-value = 0.036), thereby supporting Hypothesis 9.

Since the direct effect (β = 0.570, p-value = 0.004) is significant when the indirect effect is also significant, then Organizational Learning is a partial mediator in the relationship between cloud computing adoption and firm performance. Therefore, the total impact of cloud computing on performance is 0.278 + 0.570 = 0.848. Assessing each mediation effect individually confirms how Organizational Learning, as a mediating variable, strengthens the total effect of cloud computing adoption on organizational performance from 0.278 up to 0.848.

Table 5.
Path Analysis Result

Hypotheses			R^2	β	C.R.	P-Value	Result
Adoption_Cloud Computing			0.780				
H1 = Technology_Readiness	--->	Adoption_CC		0.856	1.905	0.057	Reject
H2 = Top_Management Support	--->	Adoption_CC		0.695	3.611	***	Support
H3 = Competitive Pressure	--->	Adoption_CC		0.708	3.937	***	Support
H4 =External_Support	--->	Adoption_CC		-0.843	-1.954	0.051	Reject
H5 = Regulatory Support	--->	Adoption_CC		-0.287	-1.023	0.306	Reject
Org_Learning			0.609				
H7 = Adoption_CC	--->	Org_Learning		0.780	6.637	***	Support
Firm_Performance			0.769				
H8 = Org_Learning	--->	Firm_Performance		0.357	2.784	0.005	Support
H9 = Adoption_CC	--->	Firm_Performance		0.570	4.003	***	Support

Note: β = Standardized Path Coefficients, R^2 = Coefficients of Determination, *** = < 0.001.

Table 6.
Output of the mediating role.

Path	Direct Effect		Indirect Effect		Result
	β	P_Value	β	P_Value	
ACC → OL → FP	0.570	0.004	0.278	0.036	Partial Mediator

Note: ACC =Adoption Cloud Computing, OL =Organization Learning, FP =Firm performance.

The final structural model based on these results was created using AMOS which is presented in Figure 2 along with significant and non-significant paths. This provides a visual depiction of the empirical validation of the suggested hypotheses, as well as emphasizing the role of organizational learning as a mediator.

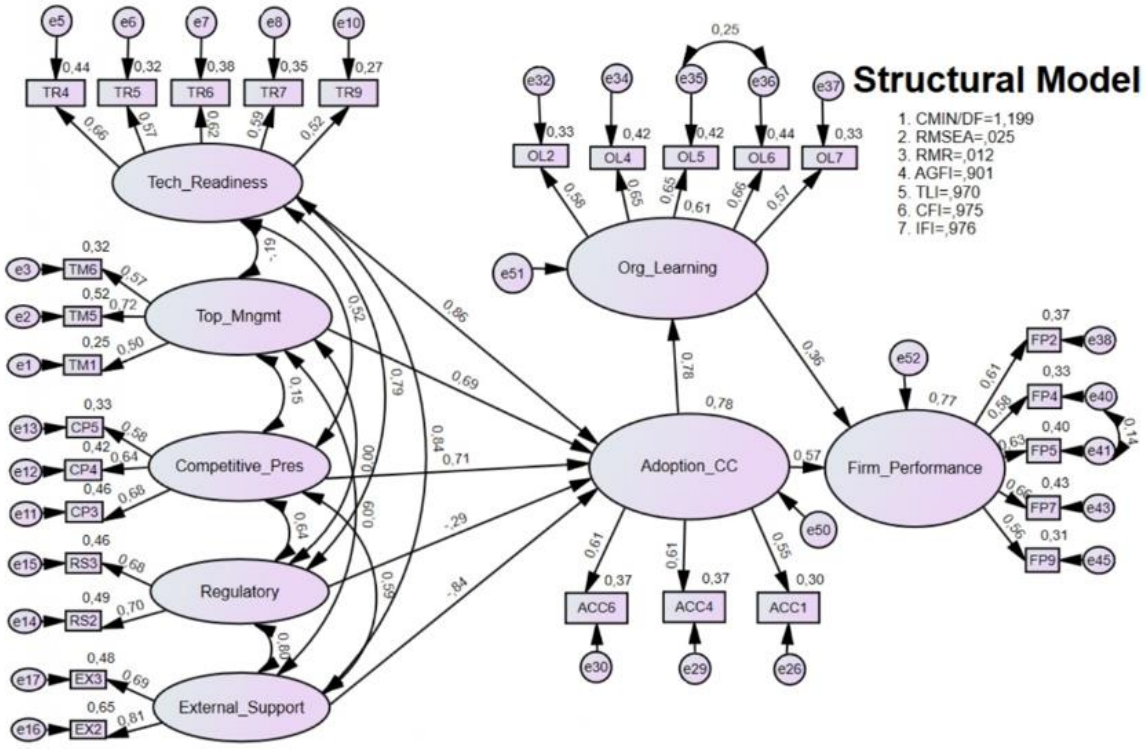

Figure 2.
Structural Model.

5. Findings and Discussion

The purpose of this study is to investigate the effect of cloud computing adoption on SMEs' firm performance and the mediating role of organizational learning. Using CB-SEM analysis, a quantitative test of the proposed hypotheses was conducted, and the analysis framework was based on the Technology Organization Environment (TOE) model.

As per the results of the structural model, top management support and competitive pressure positively influence cloud adoption (H2 and H4 supported). These findings align with existing literature that top management

commitment shapes organizational readiness, resource prioritization, and digital orientation [23, 29, 34, 53]. Whereas competitive environments exert pressure that compels SMEs to adopt technological innovation to remain relevant and efficient [26, 37, 54]. In contrast, external support, regulatory support, and technology readiness have no significant influence on cloud adoption. This lends weight to SME priorities that external infrastructure and government incentives may not support or even have the capacity to drive adoption in emerging economies [27, 29, 40, 42].

This study also suggested that cloud usage is positively associated with both organizational learning and firm performance. These results underscore the emerging notion that cloud technologies offer flexible and scalable tools that enhance communication and collaboration, access to information and operational efficiency that lead to better knowledge sharing and learning throughout organizations [5, 47]. The findings underscore the reality that simply adopting technologies does not guarantee sustained business performance. The real impact of digital investments comes from how an organization absorbs, shares and applies new knowledge with one another. This research highlights the relevance of organizational and environmental factors in cloud computing adoption, yet also emphasizes the integral importance of the experience-based internal learning processes in the quest for cloud to deliver its potential.

6. Conclusion

This study offers empirical evidence supporting the argument that cloud computing adoption positively impacts SMEs' organizational learning and firm performance, particularly when the organizational environment fosters knowledge development and dissemination. The TOE framework provides a robust foundation to assess the determinants of cloud computing adoption. Not all dimensions prove equally significant, suggesting that internal leadership and market pressures are more impactful than external policy or support systems in the Indonesian SME context.

The mediating role of organizational learning revealed a layered mechanism: technology adoption alone is insufficient to drive performance unless paired with learning processes that embed that technology into organizational routines and strategic decision-making. The findings reinforce the importance of building adaptive learning cultures to realize the full potential of digital transformation.

6.1. Future Avenues of Research

Future research can explore several paths to expand this study's contributions. First, this research focused exclusively on Indonesian SMEs, thus limiting the generalizability of findings. Comparative studies across different countries would further elaborate on this understanding of cloud adoption and organizational learning. Second, longitudinal studies could investigate how cloud adoption and learning progress over time, especially regarding performance metrics. Additionally, future studies may distinguish between types of cloud services to determine if certain varieties have more extensive effects on learning or performance. Moreover, this paper was limited by not including other dynamic capabilities, such as sensing and reconfiguration; thus, future research may also include these dynamic capabilities. These additional dimensions could provide a richer view of the interplay between firm capabilities and technological innovation. Finally, qualitative studies could provide more insights into the behavioral and cultural forces that may promote or inhibit organizational learning in SMEs, complementing the statistical findings in this research.

6.2. Implications of the Study

This study provides practical and theoretical implications for researchers, managers, and policymakers. From a theoretical perspective, the study extends the TOE framework by integrating organizational learning as a mediating mechanism, offering a more holistic model of cloud computing adoption and its outcomes. The confirmed partial mediation effect supports resource-based and learning theories, which argue that firm performance is shaped not only by resources (like IT) but also by capabilities (like learning) to deploy them effectively.

For practitioners, the results highlight the importance of not only investing in technology but also cultivating a learning-oriented culture. SMEs must actively build systems that encourage knowledge sharing, reflection, and adaptation to ensure that technological tools translate into tangible performance benefits.

From a policy standpoint, findings suggest that regulatory and external support systems may currently be underutilized or misaligned with SME needs. Governments and cloud service providers should design support mechanisms that are context-sensitive, accessible, and focused on building internal capabilities alongside external infrastructure.

Therefore, the successful adoption of cloud technology for micro-small businesses is not primarily about access to technology; rather, it is about the organizational capacity to learn, innovate, and adapt through digital technology.

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