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The Role of Cloud-Based Accounting in Enhancing Operational Efficiency of MSMEs

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Abstract. *In the era of digital transformation, the adoption of cloud-based accounting has emerged as a strategic solution to enhance the operational efficiency of Micro, Small, and Medium Enterprises (MSMEs). This study aims to examine the role of cloud-based accounting in improving operational efficiency and to identify the mediating and moderating factors that influence this relationship. Using a quantitative approach, data were collected from 220 MSME respondents across various sectors in Indonesia. The data were analyzed using Partial Least Squares–Structural Equation Modeling (PLS-SEM) through SmartPLS 4.0. The results reveal that cloud-based accounting adoption significantly and positively affects operational efficiency by reducing processing time, minimizing costs, and increasing accuracy in financial management. Furthermore, digital literacy and organizational readiness are found to be strong predictors of adoption, while perceived usefulness and ease of use mediate the impact of adoption on efficiency. The study integrates the Technology Acceptance Model (TAM) and Technology–Organization–Environment (TOE) frameworks, providing both theoretical and practical insights. These findings suggest that MSMEs should strengthen their digital competencies and infrastructure readiness, while policymakers and software providers should promote inclusive digital transformation programs to maximize the benefits of cloud accounting for MSME sustainability.*

Keywords: *Cloud-Based Accounting, Digital Literacy, MSMEs, Operational Efficiency, Organizational Readiness.*

1. INTRODUCTION

MSMEs often rely on traditional manual bookkeeping methods or locally installed desktop accounting systems, both of which suffer from significant limitations in terms of real-time access, flexibility, and scalability. In several case studies conducted in Indonesia, the use of simple digital accounting applications has proven effective in reducing operational costs, accelerating transaction processing, and improving service quality for customers. However, despite these advantages, the penetration of cloud accounting adoption among MSMEs remains relatively low due to barriers such as limited digital literacy, inadequate technological readiness, financial constraints, and concerns over data security.

According to Musyaffi, Johari, Hendrayati, Wolor, and colleagues (2024), factors such as digital literacy and system compatibility significantly influence both the perceived ease of use (PE) and perceived usefulness (PU) of cloud accounting technology. Similarly, a study by Napitupulu and Siahaan (2025) demonstrated that the adoption of cloud accounting among

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small and medium enterprises in the retail sector led to notable improvements in operational efficiency, including an average reduction of 17.3% in operating costs and a considerable increase in return on investment (ROI). Furthermore, research conducted in Solo Raya found that MSME readiness to adopt cloud accounting is shaped by managerial support, organizational competence, system service quality, perceived usefulness, and perceived ease of use.

The digitalization of accounting has become increasingly vital, particularly in the post-pandemic era, where operational efficiency, business continuity, and adaptability are crucial for survival. A study conducted in Ambon revealed that the use of digital accounting tools among MSMEs after the COVID-19 pandemic had a positive effect on financial performance, liquidity, and overall operational efficiency. International research also supports these findings, showing that the application of cloud-based technology in accounting information systems positively contributes to firm performance, mediated by the effectiveness of the Accounting Information System (AIS) and the quality of decision-making processes.

Although various studies have explored related topics—such as cloud accounting adoption, reporting effectiveness, and its impact on financial or operational performance—several critical research gaps remain. First, there is a lack of empirical evidence specifically examining the direct effect of cloud-based accounting on operational efficiency within local MSME contexts, as most studies focus solely on financial performance or reporting accuracy. Second, there is inconsistency in moderating and mediating variables, such as digital literacy, organizational readiness, firm size, management support, and technological infrastructure, which have not been examined comprehensively within a unified model. Third, many prior studies have utilized frameworks such as TAM (Technology Acceptance Model), TOE (Technology–Organization–Environment), or UTAUT (Unified Theory of Acceptance and Use of Technology) to analyze adoption intention, but very few have explored post-adoption effects—specifically, how active use of cloud accounting impacts daily operational efficiency among MSMEs. Lastly, longitudinal or comparative studies remain scarce, particularly those that compare MSMEs already using cloud accounting with those that have not adopted it. Such studies are necessary to identify tangible differences in operational processes, such as cycle time, bookkeeping errors, administrative overhead costs, and decision-making speed.

Based on these identified gaps, the objectives of this study are as follows: To examine the extent to which the adoption of cloud-based accounting among MSMEs influences operational efficiency, focusing on cost reduction, financial process speed, reporting accuracy, and data-driven decision-making capabilities. To identify the factors that moderate or mediate

the relationship between cloud accounting adoption and operational efficiency, such as digital literacy, organizational readiness (infrastructure and human resources), perceived usefulness and ease of use, and firm size. To provide practical recommendations for MSME owners, cloud software providers, and policymakers on how cloud accounting systems can be effectively implemented to enhance operational efficiency and competitiveness.

This study is expected to make several significant contributions. Theoretical contribution: It fills existing gaps in the literature by developing an empirical model that integrates adoption, usage, and moderating/mediating factors within a single framework. Practical contribution: It offers actionable insights for MSMEs regarding the effective implementation of cloud-based accounting systems and identifies critical success factors that influence operational improvement. Policy contribution: It provides a foundation for governments and MSME-supporting institutions to design targeted training programs, financial incentives, and regulatory frameworks—particularly concerning data security and digital infrastructure—to increase the accessibility and sustainability of cloud accounting systems.

Based on the above discussion, the research questions of this study can be summarized as follows: To what extent does the use of cloud-based accounting affect the operational efficiency of MSMEs?. What factors moderate or mediate this relationship?. How does operational efficiency differ between MSMEs that have adopted cloud accounting and those that have not?.

2. THEORETICAL REVIEW

Resource-Based View (RBV)

The Resource-Based View (RBV) serves as the grand theoretical foundation for this study. This theory, originally proposed by Barney (1991), posits that a firm's competitive advantage is derived from its unique and inimitable resources and capabilities. These resources can be tangible (e.g., technology, infrastructure) or intangible (e.g., knowledge, skills, organizational culture).

In the context of cloud-based accounting, RBV explains how the technological resources (cloud systems, data infrastructure) and human capabilities (digital literacy, accounting competence) jointly contribute to enhancing operational efficiency. Cloud-based systems enable MSMEs to integrate financial information, reduce transaction costs, and improve data accuracy—transforming accounting systems into strategic assets rather than administrative tools (Grant, 2019; Wernerfelt, 2021).

According to Al-Shammari & Rasheed (2023), firms that effectively utilize cloud technologies tend to outperform competitors due to improved information flow and decision-making agility. These digital resources, when aligned with managerial capabilities, create sustainable operational advantages. Similarly, Opute & Madichie (2022) argue that cloud-based systems transform traditional accounting into a strategic capability, improving organizational responsiveness and cost efficiency.

In MSME settings, the RBV framework suggests that cloud accounting adoption becomes a form of technological resource acquisition that enhances process efficiency, accuracy, and coordination, which in turn strengthens the enterprise's competitive positioning (Nguyen et al., 2024).

Technology–Organization–Environment (TOE) Framework

The Technology–Organization–Environment (TOE) framework (Tornatzky & Fleischer, 1990) provides a middle-level theoretical lens to analyze the determinants influencing the adoption of cloud accounting systems. It posits that three key contextual dimensions—technological, organizational, and environmental—shape the adoption and implementation of technological innovations.

Technological context refers to perceived benefits, compatibility, and complexity of cloud accounting systems. Studies show that perceived ease of use and perceived usefulness (from TAM theory) significantly drive MSME adoption (Musyaffi et al., 2024) Organizational context involves management support, digital readiness, and firm size, which influence implementation success (Alsharari, 2021). Environmental context encompasses competitive pressure, regulatory support, and industry standards that affect technology acceptance (Yadav et al., 2022).

Within this study, TOE helps explain why MSMEs adopt or delay cloud accounting technologies. Firms with higher technological readiness and stronger managerial support are more likely to achieve higher operational efficiency through cloud-based accounting tools. Conversely, limited digital literacy or resource constraints may hinder their ability to leverage such systems effectively (Rahayu & Day, 2023).

Technology Acceptance Model (TAM)

At the applied level, this study draws upon the Technology Acceptance Model (TAM) (Davis, 1989) and its extensions (Venkatesh & Bala, 2020) to explain user behavior and system usage intensity. TAM posits that Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) are key determinants of technology acceptance and continued use.

In the context of cloud-based accounting for MSMEs: Perceived Usefulness (PU) refers to the belief that using cloud accounting enhances performance and decision-making efficiency. Perceived Ease of Use (PEOU) refers to the extent to which users believe the system is free of effort and user-friendly.

Several empirical studies confirm TAM's applicability in accounting contexts. Musyaffi et al. (2024) found that digital literacy and compatibility positively influence PU and PEOU, thereby increasing cloud accounting adoption. Similarly, Nguyen & Nguyen (2023) found that perceived security and trust are significant extensions of TAM in predicting cloud adoption among SMEs in Southeast Asia.

Integrating TAM into this study allows examination not only of adoption intention but also of post-adoption behavior, particularly the extent of usage and its impact on operational efficiency—a research area still underexplored (Ariyanti et al., 2025).

Cloud-Based Accounting (CBA)

Cloud-based accounting refers to accounting systems hosted on remote servers that allow users to access financial data via the internet in real-time. CBA provides scalability, cost-efficiency, and real-time data synchronization across devices and users (Zhang et al., 2023). For MSMEs, this system eliminates the need for physical servers and manual backups, reducing operational costs (Napitupulu & Siahaan, 2025).

CBA systems improve decision-making by enabling timely financial analysis, reducing human error, and integrating financial data with other operational systems such as sales, inventory, and HR (Adebayo & Ojo, 2022). Furthermore, the integration of AI-driven analytics in cloud platforms enhances predictive capabilities and risk management (Singh & Dwivedi, 2024).

Operational Efficiency

Operational efficiency refers to the optimal utilization of resources to achieve maximum output with minimal cost and waste (Hitt et al., 2021). In MSMEs, efficiency involves timely financial reporting, faster transaction processing, cost reduction, and better workflow automation (Opute & Madichie, 2022). Cloud accounting contributes to operational efficiency by: Automating repetitive accounting tasks (e.g., reconciliation, reporting). Reducing paper-based transactions and administrative costs. Providing real-time financial insights that enhance decision-making. Improving collaboration among employees and with external stakeholders (Bhardwaj et al., 2023).

Digital Literacy and Organizational Readiness

Digital literacy significantly influences how effectively MSMEs can utilize cloud systems. Firms with higher digital competence are more likely to optimize cloud functionalities for operational improvements (Yadav et al., 2022). Organizational readiness—comprising infrastructure, employee skills, and managerial support—also moderates the relationship between cloud adoption and operational efficiency (Alsharari, 2021).

The Mediating Role of Cloud Usage Intensity

The degree of cloud accounting usage mediates the relationship between system adoption and operational efficiency. Merely adopting technology is insufficient; it must be actively and strategically used to deliver measurable efficiency gains (Nguyen et al., 2024).

Based on the theoretical integration of RBV, TOE, and TAM, this study proposes a conceptual model linking Cloud-Based Accounting (CBA) adoption with Operational Efficiency (OE), moderated by Digital Literacy (DL) and Organizational Readiness (OR), and mediated by Usage Intensity (UI). Conceptual Propositions: Cloud-Based Accounting adoption positively influences Operational Efficiency. Digital Literacy and Organizational Readiness strengthen this relationship. Usage Intensity mediates the relationship between CBA adoption and Operational Efficiency. Theoretical Integration:

RBV → Explains efficiency as an outcome of resource utilization (CBA as digital resource). TOE → Explains determinants of adoption (technological, organizational, environmental contexts). TAM → Explains user acceptance and continuous usage behavior.

3. RESEARCH METHODOLOGY

This study adopts a quantitative research design using a cross-sectional survey approach to empirically investigate the role of cloud-based accounting in enhancing the operational efficiency of Micro, Small, and Medium Enterprises (MSMEs). The study focuses on measuring both the direct and indirect relationships among key constructs such as Cloud-Based Accounting Adoption, Digital Literacy, Organizational Readiness, and Operational Efficiency.

The research framework is grounded in the Technology–Organization–Environment (TOE) framework and the Technology Acceptance Model (TAM), which together explain the adoption and utilization of technological innovations within organizations.

The population of this research comprises MSMEs operating in Indonesia that have at least one year of experience using digital financial management tools or are in the process of adopting cloud-based accounting systems. The sampling technique used is purposive sampling, targeting MSME owners, managers, or accounting staff familiar with the company's financial and operational processes. A total of 220 valid responses were collected from distributed

questionnaires through online and offline channels between March and June 2025. This sample size meets the minimum requirement for multivariate analysis, specifically Structural Equation Modeling (SEM) using SmartPLS, as suggested by Hair et al. (2021), which recommends a minimum sample of 5–10 times the number of observed indicators.

Primary data were obtained through structured questionnaires distributed electronically via Google Forms and in-person surveys. Each construct was measured using multiple-item scales adapted from prior validated studies. Respondents were asked to rate their agreement on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Before full-scale data collection, a pilot test involving 30 MSME respondents was conducted to ensure the clarity, reliability, and validity of the questionnaire items. Feedback was incorporated to refine the wording of several indicators.

Data analysis was performed using SmartPLS 4.0 software for Partial Least Squares Structural Equation Modeling (PLS-SEM). The analysis process involved: Measurement Model Assessment — to evaluate indicator reliability, internal consistency, convergent validity (using AVE), and discriminant validity (using Fornell-Larcker criterion). Structural Model Assessment — to test hypotheses through path coefficients, R^2, f^2, and predictive relevance (Q^2). Mediation and Moderation Tests — to identify indirect and conditional relationships among variables. Descriptive statistics were also used to summarize respondent profiles and provide contextual insights into MSME characteristics, such as business size, sector, and technology usage duration.

The following table presents the operationalization of research variables, their definitions, measurement indicators, and supporting references.

Table 1: Operationalization of Variables.

Variable	Dimension	Indicator	Measurement
Cloud-Based Accounting Adoption (CAA)	The extent to which MSMEs utilize cloud technology for financial recording, reporting, and decision-making.	CAA1: Real-time financial access CAA2: Data integration & automation CAA3: Cost savings & efficiency CAA4: Decision-making support	Likert Scale (1-5)

Digital Literacy (DL)	The ability of MSME personnel to use digital tools effectively for accounting and business operations.	DL1: Basic computer skills DL2: Understanding of digital platforms DL3: Cybersecurity awareness DL4: Proficiency in accounting software	Likert Scale (1-5)
Organizational Readiness (OR)	The preparedness of an organization in terms of infrastructure, skills, and management support to adopt new digital technologies.	OR1: IT infrastructure adequacy OR2: Managerial support OR3: Employee competence OR4: Financial resources for digitalization	Likert Scale (1-5)
Perceived Usefulness (PU)	The degree to which an MSME believes that using cloud accounting improves its performance and productivity.	PU1: Improves task efficiency PU2: Enhances accuracy PU3: Facilitates better decisions PU4: Reduces workload	Likert Scale (1-5)
Perceived Ease of Use (PEOU)	The extent to which MSME users find cloud accounting systems easy to use and learn.	PEOU1: Easy to learn PEOU2: Easy to navigate PEOU3: Clear interface PEOU4: Compatible with existing systems	Likert Scale (1-5)
Operational Efficiency (OE)	The ability of MSMEs to optimize their operational processes with minimal cost, time, and error.	OE1: Reduction in processing time OE2: Cost efficiency OE3: Error minimization OE4: Timeliness of reports	Likert Scale (1-5)

	OE5: Productivity improvement

To ensure the robustness of measurement, the following thresholds were applied: Indicator reliability: factor loading ≥ 0.70. Composite reliability (CR): ≥ 0.70. Average Variance Extracted (AVE): ≥ 0.50. Cronbach's Alpha: ≥ 0.70. All constructs met these criteria during preliminary analysis, indicating adequate internal consistency and convergent validity. Discriminant validity was confirmed through the Fornell-Larcker and HTMT ratio criteria, ensuring that constructs were empirically distinct.

All respondents participated voluntarily, and their data were treated confidentially. Informed consent was obtained prior to questionnaire distribution. The study adhered to the principles of research ethics and data protection, aligning with the ethical standards of social science research as outlined by Creswell & Creswell (2023).

4. RESULTS AND DISCUSSION

A total of 220 valid responses were collected from MSMEs located across various provinces in Indonesia, including West Java, Central Java, East Java, and North Sumatra. The distribution shows that 43% of respondents operate in the retail and trade sectors, 28% in food and beverage production, 17% in creative industries, and 12% in services. Regarding firm size, 61% are classified as micro enterprises (less than 10 employees), 27% as small enterprises, and 12% as medium-sized firms.

From a technological perspective, approximately 58% of respondents have already implemented some form of digital accounting tool, while 42% remain in the early adoption or evaluation stage. Most MSMEs (67%) have less than three years of experience using digital financial platforms. These descriptive findings indicate that while digital transformation has begun to take root among Indonesian MSMEs, the adoption of cloud-based accounting is still in its growth phase — providing a relevant empirical foundation for this study.

Before testing the structural model, the reliability and validity of all constructs were evaluated. All factor loadings exceeded the recommended threshold of 0.70, indicating strong indicator reliability. Composite reliability (CR) values ranged between 0.86 and 0.93, and Cronbach's alpha values were between 0.80 and 0.91, suggesting high internal consistency.

The Average Variance Extracted (AVE) values for all constructs were above 0.50, confirming convergent validity. In terms of discriminant validity, both the Fornell–Larcker

criterion and Heterotrait-Monotrait (HTMT) ratio (< 0.85) demonstrated that each construct was empirically distinct.

These results confirm that the measurement instruments are statistically sound, allowing for reliable testing of the structural relationships among variables. The evaluation of the inner model involved analyzing path coefficients, t-statistics (via bootstrapping with 5,000 resamples), and the coefficient of determination (R^2) for each endogenous variable. The R^2 value for Operational Efficiency (OE) was 0.62, indicating that approximately 62% of the variance in operational efficiency can be explained by cloud-based accounting adoption, perceived usefulness, perceived ease of use, digital literacy, and organizational readiness. This level of explanatory power is considered moderate to strong in behavioral research (Hair et al., 2021).

The R^2 for Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) were 0.55 and 0.48, respectively, showing that cloud-based accounting adoption and digital literacy jointly account for a substantial portion of the variance in user perceptions toward technology. In addition, Q^2 predictive relevance values exceeded zero for all dependent variables, confirming that the model possesses predictive capability and is not overfitted.

Table 2: Hypothesis Testing Results (Path Coefficients, t-value, p-value).

Path	β (Coefficient)	t-value	p-value	Result
Cloud-Based Accounting → Operational Efficiency	0.421	6.37	0.000	Supported
Digital Literacy → Cloud-Based Accounting Adoption	0.332	5.91	0.000	Supported
Organizational Readiness → Cloud-Based Accounting Adoption	0.298	4.85	0.000	Supported
Cloud-Based Accounting Adoption → Perceived Usefulness	0.357	5.67	0.000	Supported
Perceived Usefulness → Operational Efficiency	0.263	4.24	0.000	Supported
Perceived Ease of Use → Perceived Usefulness	0.279	3.97	0.000	Supported

Digital Literacy → Operational Efficiency (indirect via PU)	0.148	3.12	0.002	Supported
Organizational Readiness → Operational Efficiency (indirect via CAA)	0.112	2.74	0.006	Supported

Direct Influence of Cloud-Based Accounting on Operational Efficiency

The results show a significant positive relationship between Cloud-Based Accounting Adoption (CAA) and Operational Efficiency (OE) ($\beta = 0.421$, $p < 0.001$). This finding aligns with Napitupulu & Siahaan (2025), who found that the integration of cloud accounting systems reduced average operational costs by 17.3% in Indonesian MSMEs. The real-time accessibility of financial data, automation of bookkeeping tasks, and synchronization across departments contribute to faster decision-making and reduced administrative errors. Moreover, these results corroborate previous studies by Nguyen et al. (2023) and Musyaffi et al. (2024), which emphasized that the automation and real-time reporting enabled by cloud accounting platforms increase transparency and accountability — key factors in improving MSMEs' operational workflows.

Role of Digital Literacy and Organizational Readiness

The results indicate that Digital Literacy (DL) ($\beta = 0.332$) and Organizational Readiness (OR) ($\beta = 0.298$) are significant predictors of Cloud-Based Accounting Adoption. These findings confirm the argument by Gangwar et al. (2021) and the OECD (2023) that the success of digital transformation initiatives in MSMEs depends heavily on the technological competence of employees and institutional preparedness in terms of resources and leadership support. In low-resource environments, such as micro-enterprises, the lack of skilled personnel and digital awareness often acts as a barrier to adoption (Marjanovic et al., 2022). However, the presence of managerial encouragement and training programs significantly mitigates these barriers, suggesting that organizational learning culture is a crucial determinant of technology assimilation.

Mediating Role of Perceived Usefulness and Ease of Use

The study found that both Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) serve as mediators linking cloud-based accounting adoption with operational efficiency. This result is consistent with the Technology Acceptance Model (TAM) proposed by Davis (1989), which postulates that user perceptions of utility and ease of technology drive behavioral intention and subsequent performance outcomes.

In MSME contexts, when users perceive that cloud accounting systems are both beneficial and simple to operate, they are more likely to utilize them consistently, leading to operational improvements. The significant path from PEOU to PU ($\beta = 0.279$, $p < 0.001$) further reinforces the idea that system design simplicity enhances users' belief in its usefulness (Musyaffi et al., 2024; EconJournals, 2024).

Indirect Effects via Perceived Usefulness

The results also demonstrate that Digital Literacy and Organizational Readiness indirectly influence Operational Efficiency through Cloud-Based Accounting Adoption and Perceived Usefulness. These mediation effects suggest that digital competencies and organizational preparedness foster not only adoption but also effective utilization of cloud systems.

This supports findings from Susanto & Meiryani (2019) who emphasized that technology adoption without adequate human capital and organizational support seldom yields meaningful efficiency gains. Hence, it is not the adoption per se, but rather the depth of use and integration into daily operations, that leads to measurable improvements in productivity.

Comparative and Contextual Interpretation

Comparatively, the results align with international evidence (Alshurafat et al., 2023), yet they extend the discussion by focusing on post-adoption effects rather than mere adoption intention. Many prior studies using TAM or TOE models (e.g., Rahman et al., 2023; Ali et al., 2022) stopped at the stage of intention to adopt; this study moves forward by empirically showing that sustained use of cloud accounting leads to tangible operational efficiency gains among MSMEs.

From a contextual standpoint, the Indonesian MSME ecosystem presents a unique challenge: while digital infrastructure and software availability have improved, digital literacy and data security concerns remain major bottlenecks. The findings imply that national and local government programs should not only provide access to technology but also foster continuous digital education and trust-building measures regarding data privacy and cyber risk management.

From a theoretical perspective, this research enriches the integration of TAM and TOE frameworks by demonstrating how technological, organizational, and behavioral dimensions jointly explain operational outcomes beyond mere adoption. From a practical standpoint, the results suggest that MSME owners and managers should: Invest in employee training to enhance digital literacy and software competency. Ensure organizational readiness by

allocating sufficient budget and leadership support for cloud integration. Select cloud accounting platforms that emphasize usability, data security, and customer support to sustain engagement. For policymakers, initiatives such as tax incentives for digital adoption, public-private training collaborations, and strengthened cybersecurity frameworks can help accelerate cloud accounting diffusion among MSMEs — ultimately boosting national productivity and competitiveness.

5. CONCLUSION AND IMPLICATIONS

This study concludes that the adoption of cloud-based accounting significantly enhances the operational efficiency of MSMEs by improving cost control, data accuracy, and decision-making speed. Empirical results demonstrate that digital literacy and organizational readiness play crucial roles in facilitating successful adoption, while perceived usefulness and ease of use mediate the effectiveness of cloud accounting in improving daily operations. The integration of TAM and TOE frameworks provides a comprehensive understanding that operational efficiency is not merely a technological outcome but also a function of human capability and organizational preparedness. Practically, these findings suggest that MSMEs should strengthen their internal digital competencies, allocate adequate resources for technological readiness, and choose user-friendly, secure accounting platforms to ensure sustainable efficiency gains. Policymakers and technology providers are encouraged to collaborate in offering digital training programs, financial incentives, and data security assurances to accelerate cloud adoption. By doing so, MSMEs can better leverage cloud technology to enhance productivity, competitiveness, and long-term business sustainability in the evolving digital economy.

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