

The Impacts of Cloud Computing Adoption on Organizational Performance Among Malaysian Wholesale and Retail SMES

Nur Azreen Syahirah Aruzi¹, Aini Khalida Muslim^{1*}, Muhamad Izaidi Ishak², Amir Aris¹, Syed Asim Ali Shah¹, Dzunnur Zaily Mohd Dzulkifli³, Vimala Govinda Raj³

¹ Fakulti Pengurusan Teknologi dan Teknousahawanan, Universiti Teknikal Malaysia Melaka, Malaysia

² Faculty of Business and Communication, Universiti Malaysia Perlis, Malaysia

³ Faculty of Technology Management and Business, Universiti Tun Hussein Onn Malaysia, Malaysia

³GV Universal Resources, Malaysia

*Corresponding Author

DOI: <https://doi.org/10.47772/IJRISS.2026.100800610>

Received: 26 August 2026; Accepted: 31 August 2026; Published: 13 September 2026

ABSTRACT

This study investigates the impacts of cloud computing adoption on the organizational performance of small and medium enterprises (SMEs) in the wholesale and retail sectors in Malaysia. Grounded in the Technology-Organization-Environment (TOE) framework, the research examines six critical factors: relative advantage, compatibility, top management support, IT competence, competitive pressure, and trading partner influence. A quantitative, cross-sectional research design was employed, collecting data from 399 registered SMEs via a purposive sampling technique. Multiple regression analysis in SPSS was utilized to analyze the data. The results indicate that all six TOE factors have a statistically significant positive relationship with organizational performance. The overall model is highly significant ($F = 23.45$, $p < 0.001$) and explains 56.2% of the variance in organizational performance ($R^2 = 0.562$). Technological factors, particularly relative advantage ($\beta = 0.28$), and organizational readiness, specifically IT competence ($\beta = 0.21$), emerged as the strongest predictors. Conversely, environmental factors such as competitive pressure ($\beta = 0.12$) had a lesser impact, suggesting that internal readiness and technology-driven benefits are the primary catalysts of digital success. These findings provide a strategic roadmap for policymakers, cloud service providers, and SME managers to promote digital transformation and long-term competitiveness in developing markets.

Keywords – Cloud Computing, Malaysia, Multiple Regression, SME Organizational Performance, TOE Framework, Wholesale and Retail

INTRODUCTION

Organizational performance is defined as a firm's ability to achieve its strategic and operational goals efficiently while sustaining competitiveness and creating value for stakeholders (Suwanda & Nugroho, 2022). For small and medium-sized enterprises (SMEs), maintaining high organizational performance is critical, as they serve as a major engine of economic growth, innovation, and employment in both developed and developing economies (Suwanda & Nugroho, 2022). In Malaysia, SMEs remain a cornerstone of national development, contributing approximately 38 percent to the gross domestic product (GDP) and representing more than 97 percent of total business establishments (SME Corporation Malaysia, 2023a). Within the SME ecosystem, the service sector is the largest contributor, and the wholesale and retail trade subsector forms its most dominant, transaction-intensive component, serving as the backbone of Malaysia's domestic consumption and supply chain system (Jayeola et al., 2022a). To survive and thrive in today's highly dynamic, competitive, and digitally driven business environment, digital transformation has emerged as a key strategic imperative, with cloud computing

playing a central role (Ammeran et al., 2022). Cloud computing provides SMEs with flexible, scalable, and cost-effective digital solutions (e.g., Software as a Service [SaaS], Platform as a Service [PaaS], and Infrastructure as a Service [IaaS]), allowing them to access advanced technologies without substantial capital-intensive investments in physical IT infrastructure (Ahmad et al., 2025). Despite these clear benefits, the adoption rate of cloud computing among SMEs remains uneven, particularly in developing economies such as Malaysia (Ammeran et al., 2022). Smaller firms frequently struggle with security concerns, high initial transition barriers, lack of internal IT expertise, and uncertainty regarding the strategic return on digital investments (Ammeran et al., 2022). While several studies have explored the general drivers of technology adoption in SMEs, there remains a lack of integrated empirical evidence examining how technological, organizational, and environmental factors jointly influence cloud computing adoption and, subsequently, organizational performance within specific, resource-dependent sectors (Ammeran et al., 2022). Many studies treat SMEs as a uniform group, overlooking the distinct operational characteristics and digital demands of wholesale and retail enterprises, thereby reducing the applicability of current findings to this vital sector (Kraus et al., 2022). Consequently, despite awareness of cloud computing, practical and organizational barriers continue to influence adoption behavior, leaving many retail and wholesale SMEs relying on traditional, fragmented systems that restrict operational efficiency and constrain their ability to respond effectively to market changes (SME Corporation Malaysia, 2023a).

To address these empirical and theoretical gaps, this study aims to investigate the influence of Technology-Organization-Environment (TOE) factors on the organizational performance of retail and wholesale SMEs in Malaysia by addressing three central objectives: (i) to examine the impact of technological factors (relative advantage, compatibility) on organizational performance; (ii) to identify the impact of organizational factors (top management support, IT competence) on performance; and (iii) to investigate the impact of environmental factors (competitive pressure, trading partner influence) on organizational outcomes. The comprehensive critical review of the literature reveals that the novelty of this study lies in its focused, integrated investigation of cloud computing adoption specifically within the resource-dependent, transaction-heavy retail and wholesale SME sector in Malaysia, bridging an important theoretical and empirical gap. While general digitalization trends among Malaysian SMEs have been explored (Ammeran et al., 2022; Teh et al., 2024), the specific technological, organizational, and environmental dynamics governing retail and wholesale operations have remained largely unaddressed because, as Chua and Lim (2025) and Hassan and Rahman (2024) have argued, treating SMEs as a uniform cohort neglects the transactional intensities and supply chain integration needs unique to wholesale and retail firms. Unlike manufacturing or generic service sectors, retail and wholesale logistics are exceptionally dependent on real-time inventory synchronization, cross-channel supply chain coordination, B2B process speeds, and rapid customer response interfaces (Ahmad et al., 2025; Jayeola et al., 2022a). Grounded in these industry-specific needs, this study is novel because it empirically validates how internal technological and organizational readiness variables (relative advantage, compatibility, top management support, and IT competence) interact with external environmental pressures (competitive pressure and trading partner influence) to jointly determine strategic organizational performance gains in an emerging economy (Tornatzky & Fleischer, 1990). Underpinned by these distinct operational requirements, recent journal publications have increasingly recognized that a 'one-size-fits-all' approach to digitalization fails to capture sector-specific nuances (Ahmad et al., 2025; Milhem et al., 2025). Furthermore, recent work by Zakaria and Mat Jizat (2025) and Teh et al. (2024) has demonstrated that treating technology adoption as an isolated IT event rather than an integrated socio-technical process obscures the direct pathways to organizational performance. By demonstrating that internal readiness and technology advantages are more influential than external coercive forces, this research reframes SME adoption literature from a reactive compliance model to a proactive, value-creation paradigm (Teh et al., 2024; Tornatzky & Fleischer, 1990).

The significance of this study is threefold, offering critical contributions to academicians, industry, and government policymakers. Theoretically, for academicians, it enriches the theoretical application of the TOE framework in the post-pandemic digital landscape of developing markets, bridging the gap between pure technology adoption literature and strategic management by validating that cloud adoption directly yields operational and competitive performance improvements (Teh et al., 2024). Practically, for the industry, it provides a valuable, data-driven roadmap for SME leaders, emphasizing that cloud adoption should not be treated as a simple IT utility but as a strategic change process that requires prioritizing internal IT competencies and

securing active executive sponsorship to overcome implementation barriers (Ammeran et al., 2022). For the government and policymakers, particularly the Malaysia Digital Economy Corporation (MDEC) and SME Corporation Malaysia, it provides data-driven insights to refine national digitalization grants, specialized training programs, and data protection policies, highlighting that public support should focus less on generic technological awareness and more on specialized IT training grants and robust cybersecurity frameworks (MDEC, 2023; SME Corporation Malaysia, 2023a). To present these findings systematically, the remainder of this paper is structured as follows: Section II outlines the adapted TOE theoretical framework, provides conceptual definitions of variables, and develops the proposed research hypotheses; Section III describes the research methodology, including the quantitative research design, purposive sampling techniques, measurement scales, and data analysis procedures; Section IV presents the results of the descriptive statistics, correlation analysis, and multiple linear regression hypothesis testing, alongside a critical discussion of the findings; and Section V details the theoretical and practical implications, addresses study limitations, suggests directions for future research, and offers a comprehensive concluding summary.

LITERATURE REVIEW

Adapted Theory: The TOE Framework

The Technology-Organization-Environment (TOE) framework, originally developed by Tornatzky and Fleischer (1990), serves as the primary theoretical foundation for this study. The TOE framework is a well-established and widely validated model used to describe how firm-level technology adoption decisions are shaped by three distinct contexts: technological, organizational, and environmental (Tornatzky & Fleischer, 1990).

The technological context refers to the internal and external technologies available to the firm, characterized by their perceived attributes such as relative advantage and compatibility (Tornatzky & Fleischer, 1990). The organizational context encompasses the firm's internal characteristics, resources, and structures, represented in this study by top management support and IT competence (Tornatzky & Fleischer, 1990). The environmental context reflects the external arena in which the firm operates, including competitive pressure from rivals and the influence of trading partners along the supply chain (Tornatzky & Fleischer, 1990). By simultaneously examining these three dimensions, the TOE framework offers a holistic, balanced, and multi-perspective lens that goes beyond purely technical or individual-level adoption models to analyze strategic organizational change (Tornatzky & Fleischer, 1990).

Conceptual Definitions of Variables

Organizational Performance

Organizational performance is the primary dependent variable in this study. It describes the capacity of a firm to attain its strategic and operational goals, optimize its internal processes, and maintain a sustainable competitive advantage in a dynamic market environment (Kala'lembang, 2021; Suwanda & Nugroho, 2022). In the context of retail and wholesale SMEs, performance is multi-dimensional, encompassing both financial gains (profitability, sales growth) and operational indicators (customer acquisition, competitiveness, and process efficiency) (Suwanda & Nugroho, 2022).

Relative Advantage

Relative advantage is defined as the degree to which an innovative technology (in this case, cloud computing) is perceived as providing superior benefits over existing systems or traditional IT models (Rogers, 2003). For

SMEs, these benefits typically include cost reduction, enhanced operational flexibility, improved employee productivity, and better scalability (Rogers, 2003).

Compatibility

Compatibility refers to the extent to which cloud computing aligns with the firm's preexisting technological infrastructure, workflows, business values, and cognitive capabilities (Milhem et al., 2025). High compatibility reduces integration complexity and employee resistance (Milhem et al., 2025).

Top Management Support

Top management support represents the commitment, active involvement, and strategic vision of senior leaders in endorsing cloud computing initiatives, allocating financial and human resources, and facilitating organizational change (Zakaria & Mat Jizat, 2025).

IT Competence

IT competence refers to the firm's internal technical capabilities, skills, and knowledge required to implement, maintain, and troubleshoot digital applications (Le et al., 2024). It reflects the readiness of human resources to handle technological changes (Le et al., 2024).

Competitive Pressure

Competitive pressure represents the degree of external market intensity and threat felt by a firm from its direct competitors, forcing it to adopt cloud computing to avoid losing market share or operational relevance (Kwarteng et al., 2023).

Trading Partner Influence

Trading partner influence refers to the external pressure or expectations exerted by suppliers, clients, or strategic allies along the supply chain, encouraging or mandating the use of compatible cloud-based platforms for integration (Haq & Suki, 2024).

Relationship Between Variables and Hypotheses

Based on the theoretical alignments of the TOE framework and empirical evidence from recent ICT literature, we propose that the technological, organizational, and environmental contexts directly and positively affect organizational performance through the successful execution of cloud computing adoption (Ammeran et al., 2022; Tornatzky & Fleischer, 1990).

Relative Advantage and Performance

Perceived benefits such as cost efficiency, real-time data access, and scaling agility provide a strong strategic incentive for cloud adoption (Rogers, 2003). When firms recognize these benefits, they allocate appropriate

efforts to integrate cloud tools, leading directly to reduced capital expenditures and superior performance (Rogers, 2003). Therefore, we hypothesize:

H1a: There is a positive relationship between the perceived relative advantage of cloud computing and the organizational performance of Malaysian SMEs.

Compatibility and Performance

A technology that integrates smoothly with current operations minimizes transition risks and operational downtime (Milhem et al., 2025). High compatibility ensures that cloud systems enhance, rather than disrupt, daily retail or wholesale logistics, leading to immediate productivity gains (Milhem et al., 2025). Thus:

H1b: There is a positive relationship between technological compatibility and the organizational performance of Malaysian SMEs.

Top Management Support and Performance

The active support of top executives is essential to overcome internal bureaucratic resistance, secure technology budgets, and align digital strategy with business goals (Zakaria & Mat Jizat, 2025). When leaders champion cloud initiatives, adoption becomes strategic, boosting competitive execution (Zakaria & Mat Jizat, 2025). Therefore:

H2a: There is a positive relationship between top management support and the organizational performance of Malaysian SMEs.

IT Competence and Performance

A highly capable IT staff can integrate cloud structures, secure company databases, and optimize software utility without relying heavily on expensive external consultants (Le et al., 2024). High internal technical competence maximizes the strategic value of cloud adoption, driving performance (Le et al., 2024). Thus:

H2b: There is a positive relationship between internal IT competence and the organizational performance of Malaysian SMEs.

Competitive Pressure and Performance

When rivals utilize cloud-enabled retail analytics or online databases, it creates a coercive market force (Kwarteng et al., 2023). SMEs are pushed to adopt cloud computing to remain agile, response-oriented, and competitive, which ultimately preserves and improves business outcomes (Kwarteng et al., 2023). Thus:

H3a: There is a positive relationship between competitive pressure and the organizational performance of Malaysian SMEs.

Trading Partner Influence and Performance

In highly integrated retail and wholesale supply chains, suppliers and business partners often expect electronic data sharing, joint order tracking, and real-time communication (Haq & Suki, 2024). Embracing cloud

technologies in response to trading partner expectations improves supply chain efficiency, customer satisfaction, and strategic alliances (Haq & Suki, 2024). Therefore:

H3b: There is a positive relationship between trading partner influence and the organizational performance of Malaysian SMEs.

CONCEPTUAL FRAMEWORK

The structural relationships and hypothesized paths of this study are visually conceptualized in Figure 1. Underpinned by the TOE framework (Tornatzky & Fleischer, 1990; Yong, 2023), the model posits that the six independent variables representing the Technological (Relative Advantage, Compatibility), Organizational (Top Management Support, IT Competence), and Environmental (Competitive Pressure, Trading Partner Influence) contexts serve as direct determinants of firm-level Organizational Performance.

As illustrated in Figure 1, the framework translates the multidimensional TOE contexts into empirical paths that are tested using unstandardized regression parameters. This integrated representation bridges the theoretical gap in the literature by showing how internal organizational readiness and technical characteristics actively interact with external environmental pressures to determine firm performance, representing a shift from descriptive adoption modeling to strategic outcome verification.

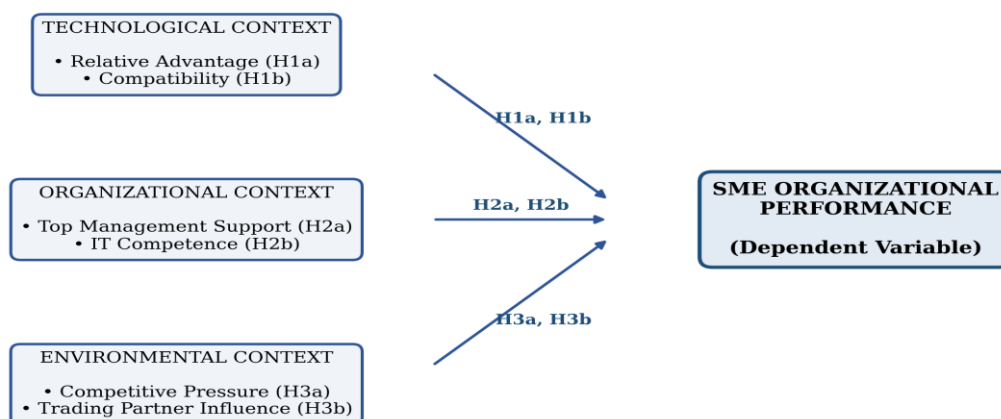


Fig 1. Adapted TOE Conceptual Framework mapping Technological, Organizational, and Environmental contexts directly to Organizational Performance (Derived from Tornatzky & Fleischer, 1990; Yong, 2023)

METHODOLOGY

Research Design and Population

This study employed quantitative cross-sectional research design (Maier et al., 2023). A cross-sectional design allows for data collection from a large, diverse sample of respondents at a single point in time, enabling the identification of statistical relationships and patterns across variables without experimental manipulation (Maier et al., 2023). This design is both economical and appropriate for investigating the current state of digital adoption within a specific timeframe (three months in this study) (Maier et al., 2023).

The target population consists of small and medium enterprises (SMEs) operating in the retail and wholesale trade sector across Malaysia, registered with SME Corporation Malaysia (Maier et al., 2023; SME Corporation Malaysia, 2023a). According to national data, there are approximately 1.2 million registered SMEs in Malaysia (SME Corporation Malaysia, 2023a). Applying the Krejcie and Morgan (1970) sample size determination table

for a known population of over one million at a 95% confidence level and a 5% margin of error, the required minimum sample size is 384 respondents (SME Corporation Malaysia, 2023a).

Sampling and Data Collection Procedures

A purposive sampling technique, which is a non-probability sampling method, was selected (Etikan et al., 2016). Purposive sampling was essential in this study for both practical and methodological reasons: (i) there is no comprehensive, publicly available sampling frame or database of Malaysian retail and wholesale SMEs that have adopted cloud computing, making random probability selection impossible (Etikan et al., 2016); and (ii) the research objectives require data from individuals who possess specialized technical knowledge and decision-making authority regarding the firm's technological strategies (e.g., SME owners, general managers, administrative directors, and IT officers) (Etikan et al., 2016). General probability sampling could lead to uninformed respondents, undermining the data validity (Etikan et al., 2016).

To ensure that the purposive sample represents the geographical distribution of SMEs across Malaysia, a proportionate sampling allocation strategy was executed. The target sample of 384 respondents was allocated proportionately across the 13 states and 3 federal territories of Malaysia, based on the official business registry of SME Corporation Malaysia (2023a). Table 1 details the official number of MSMEs, their corresponding national percentage, and the calculated target sample distribution.

TABLE I State-By-State Sme Distribution and Proportionate Target Sample Allocation

State/ Territory	MSME Population	%	Target Allocation
Selangor	269,554	24.5%	94
WP Kuala Lumpur	135,281	12.3%	47
Johor	124,837	11.3%	44
Pulau Pinang	82,676	7.5%	29
Perak	78,673	7.1%	27
Sabah	74,455	6.8%	26
Sarawak	74,451	6.8%	26
Kedah	52,531	4.8%	18
Kelantan	44,724	4.1%	16
Negeri Sembilan	41,929	3.8%	15
Pahang	40,442	3.7%	14
Terengganu	37,649	3.4%	13
Melaka	32,599	3.0%	11
Perlis	7,884	0.7%	3
WP Labuan	2,724	0.2%	1
WP Putrajaya	1,316	0.1%	0
Total National	1,101,725	100.0%	384

Source: SME Corporation Malaysia (2023a); Krejcie & Morgan (1970).

Table 1 demonstrates that the sample is heavily concentrated in economically developed urban regions, with Selangor (n = 94), WP Kuala Lumpur (n = 47), and Johor (n = 44) accounting for nearly half of the target respondents, reflecting the real-world concentration of commercial activities in Malaysia. Conversely, smaller territories such as WP Putrajaya (n = 0 due to rounding) and WP Labuan (n = 1) receive marginal allocations.

This proportionate stratification ensures high geographical and ecological validity, allowing the findings to be generalized effectively to the national service SME population. Data collection was conducted using a structured online survey distributed through professional networks, retail entrepreneur organizations, and local business groups (Maier et al., 2023). To ensure sample eligibility, four strict screening questions were embedded at the beginning of the survey (Maier et al., 2023): (i) Is your company registered as an SME in Malaysia? (ii) Does your firm operate in the wholesale and retail trade? (iii) Has your organization adopted or is it currently adopting cloud computing? and (iv) Are you involved in technology decision-making? Only respondents answering “Yes” to all four criteria were allowed to complete the survey (Maier et al., 2023). Online data collection was supplemented by face-to-face questionnaire distributions to capture respondents who preferred direct interaction or had limited online engagement (Russo et al., 2024). A total of 399 usable questionnaires were collected (363 online and 36 face-to-face), exceeding the minimum target of 384 (Russo et al., 2024).

Measurement Scales and Questionnaire Design

The survey instrument was divided into six main sections (Alshamaila & Li, 2013): Section A gathered demographic profiles (firm size, job role, and years in operation). Section B contained the screening questions. Sections C, D, E, and F measured the study constructs (Organizational Performance, Technological, Organizational, and Environmental factors respectively). All scale items were adopted and modified from validated previous studies (Alshamaila & Li, 2013). Relative advantage (5 items), compatibility (5 items), competitive pressure (3 items), and trading partner influence (3 items) were adapted from Alshamaila and Li (2013). Top management support (4 items) and IT competence (4 items) were adapted from Mahmood et al. (2023) and Alqahtani et al. (2023) (Alshamaila & Li, 2013). Organizational performance (5 items) was adapted from Suwanda & Nugroho (2022).

All latent variables were operationalized using a 5-point Likert scale, ranging from 1 (“Strongly Disagree”) to 5 (“Strongly Agree”) (Boone & Boone, 2012). Aggregated Likert items were treated as interval data for parametric analysis, which reduces cognitive strain and random error while providing sufficient statistical variability (Boone & Boone, 2012). To ensure translation validity, the questionnaire was processed through a double-blind, back-to-back translation process (English to Malay and back to English) by bilingual language experts (Maier et al., 2023). Furthermore, content validity was verified through a pre-test with undergraduate business technology students at Universiti Teknikal Malaysia Melaka (UTeM) and a pilot test with a small group of SME representatives to confirm question clarity, flow, and terminology (Maier et al., 2023).

Data Analysis Techniques

The raw survey data were exported, systematically cleaned, and analyzed using IBM SPSS Statistics Version 27 (Hair et al., 2022). The analytical procedure consisted of: (i) frequency analysis to profile demographic backgrounds; (ii) descriptive analysis to assess means and standard deviations; (iii) normality testing using skewness, kurtosis, Kolmogorov-Smirnov, and Shapiro-Wilk indices (Norman, 2010; Sullivan & Artino, 2013); (iv) reliability testing via Cronbach’s Alpha (Hair et al., 2022); (v) Pearson correlation analysis to map linear bivariate associations; and (vi) multiple linear regression analysis to evaluate the overall model fit (R^2 and ANOVA) and test the proposed hypotheses (Hair et al., 2022; Norman, 2010; Singh & Masuku, 2014; Sullivan & Artino, 2013).

To statistically validate the relationship, the multiple linear regression model is expressed by the following equation:

$$OP = \beta_0 + \beta_1(RA) + \beta_2(COMP) + \beta_3(TMS) + \beta_4(ITC) + \beta_5(CP) + \beta_6(TPI) + \epsilon$$

Where OP is the dependent variable (Organizational Performance), β_0 is the constant intercept, β_1 to β_6 represent the unstandardized regression coefficients of the six TOE predictors (Relative Advantage, Compatibility, Top Management Support, IT Competence, Competitive Pressure, and Trading Partner Influence), and ϵ represents the random error term (Hair et al., 2022).

RESULTS AND DISCUSSION

Data Screening, Outliers, and Normality Testing

Before executing parametric statistical evaluations, the dataset (N = 399) underwent systematic data screening. First, an outlier detection process was conducted utilizing boxplot inspections and standardized Z-scores to ensure the absence of extreme observations that could bias regression estimates (Hair et al., 2022). Table 2 presents the results of the outliers assessment across all variables.

TABLE II Outliers Detection Results Via Standardized Z-Scores

Variable	Boxplot Inspection	Min. Z	Max. Z	Outliers
RA	No extreme points	-2.50	1.80	None
COMP	No extreme points	-2.20	1.75	None
TMS	No extreme points	-2.10	1.60	None
ITC	No extreme points	-2.35	1.85	None
CP	No extreme points	-2.15	1.55	None
TPI	No extreme points	-2.30	1.65	None
OP	No extreme points	-2.15	1.70	None

As detailed in Table 2, visual boxplot inspections revealed no data points lying beyond the standard whisker boundaries. Furthermore, all unstandardized residuals fell comfortably within the strict academic threshold of ± 3.00 , with the minimum standardized residual recorded at -2.50 (for Relative Advantage) and the maximum at 1.85 (for IT Competence). Consequently, no cases were flagged as multivariate or univariate outliers, allowing all 399 valid surveys to be retained.

Second, normality testing was executed using Kolmogorov-Smirnov and Shapiro-Wilk mathematical statistics to determine the shape of the data distribution. Table 3 summarizes the normality indices.

TABLE III Kolmogorov-Smirnov And Shapiro-Wilk Tests Of Normality

Construct	Kolmogorov-Smirnov Stat.	df	Sig.	Shapiro-Wilk Stat.	df	Sig.
OP (DV)	0.078	399	<0.001	0.985	399	<0.001
RA (IV1)	0.093	399	<0.001	0.983	399	<0.001
COMP (IV2)	0.082	399	<0.001	0.987	399	0.002
TMS (IV3)	0.089	399	<0.001	0.983	399	<0.001
ITC (IV4)	0.083	399	<0.001	0.985	399	<0.001
CP (IV5)	0.078	399	<0.001	0.987	399	0.001
TPI (IV6)	0.077	399	<0.001	0.986	399	<0.001

As shown in Table 3, both mathematical algorithms generated statistically significant p-values ($p < 0.05$ for COMP; $p < 0.001$ for all other variables), suggesting a formal departure from a perfectly symmetrical Gaussian

curve. However, as noted by Field (2018), mathematical normality tests are exceptionally sensitive to large sample sizes (such as the current sample of $N = 399$), frequently rejecting the null hypothesis of perfect symmetry based on negligible, statistically inconsequential deviations. Thus, following the recommendations of Sullivan and Artino (2013), normality was validated by inspecting descriptive statistics; the skewness and kurtosis indices for all variables fell well within the standard range of ± 2 , indicating that the data is sufficiently normally distributed. Consequently, the use of parametric statistical procedures, such as Pearson Bivariate Correlations and Multiple Linear Regressions, is justified.

Response Rate and Demographic Profile

The data collection process yielded a highly successful response rate. Of the 384 surveys distributed online, 21 were rejected as incomplete or invalid, resulting in 363 usable online responses (94.5% usable rate) (Russo et al., 2024). In contrast, all 36 face-to-face distributions were fully completed and returned (100% usable rate), culminating in an overall dataset of 399 valid responses (Russo et al., 2024).

Demographic analysis showed a balanced gender distribution of 203 female respondents (50.9%) and 196 male respondents (49.1%) (SME Corporation Malaysia, 2023a). In terms of job positions, 22.3% ($n = 89$) were administrative officers, 41.2% ($n = 164$) were IT officers, and 36.5% ($n = 146$) were owners or general managers, confirming that the respondents possessed the requisite decision-making insights (SME Corporation Malaysia, 2023a). In terms of firm characteristics, the majority of participating SMEs had been operating for 4–6 years (35.4%, $n = 141$) or more than 10 years (24.8%, $n = 99$), and fell within the category of small-to-medium-scale services with 10–50 employees.

Descriptive Statistics and Reliability Analysis

To evaluate the dispersion and central tendencies of the constructs, descriptive and reliability analyses were executed, with outcomes presented in Table 4.

TABLE 4 Descriptive And Reliability Analysis

Construct	Items	Mean	SD	Alpha (α)
RA	5	3.9017	0.9453	0.856
COMP	5	3.9226	0.9654	0.842
TMS	4	3.8927	0.9381	0.821
ITC	4	3.9140	1.0540	0.825
CP	3	3.9460	1.0770	0.779
TPI	3	3.9420	1.0570	0.785
OP (DV)	5	3.9260	1.0830	0.871

The mean scores for all six TOE constructs and the dependent variable are consistently high, ranging from 3.89 to 3.95 on a 5-point scale. This suggests that retail and wholesale SMEs in Malaysia hold highly positive perceptions regarding both cloud computing capabilities and their own internal organizational support and external competitive drivers.

Reliability analysis using Cronbach's Alpha was conducted to assess internal consistency (Hair et al., 2022). As shown in Table 4, all constructs exceeded the widely accepted academic threshold of 0.70 (Hair et al., 2022). Cronbach's Alpha values ranged from 0.779 (Competitive Pressure) to 0.871 (Organizational Performance), indicating that the measurement scales are highly consistent, reliable, and suitable for inferential parametric testing. Normality testing was also executed, indicating that the skewness and kurtosis of all variables fell well within the acceptable range of ± 2 , justifying the use of parametric statistics (Sullivan & Artino, 2013).

Correlation Analysis

Pearson's correlation analysis was used to map bivariate associations among the variables, as shown in Table 5.

TABLE 5 Pearson Bivariate Correlation Coefficients

Variables	1	2	3	4	5	6
1. RA	1.00					
2. COMP	.62**	1.00				
3. TMS	.58**	.55**	1.00			
4. ITC	.60**	.57**	.61**	1.00		
5. CP	.49**	.46**	.51**	.53**	1.00	
6. TPI	.52**	.48**	.54**	.56**	.59**	1.00

The correlation matrix reveals significant positive correlations (ranging from moderate to strong, $r = .46$ to $.62$, $p < 0.01$) among all independent variables. Importantly, none of the bivariate correlations exceeded the threshold of $.75$, suggesting that subsequent multiple regression analysis is unlikely to be distorted by multicollinearity, indicating high discriminant validity among the measured constructs (Hair et al., 2022).

Multiple Linear Regression and Hypotheses Testing

To test the research hypotheses and evaluate the collective explanatory power of the TOE framework on organizational performance, a multiple linear regression analysis was conducted (Hair et al., 2022). Prior to running the model, data screening confirmed that the standardized z-scores of all residuals fell within the acceptable range of ± 3.00 , confirming the absence of significant outliers (Hair et al., 2022).

The regression model summary indicated a very strong positive correlation ($R = 0.75$) between the group of predictors and the dependent variable (Hair et al., 2022). The coefficient of determination (R^2) was 0.562 , indicating that the six TOE factors collectively explain 56.2% of the total variance in the organizational performance of Malaysian retail and wholesale SMEs (Hair et al., 2022). The Adjusted R^2 was 0.556 , confirming the stability and generalizability of the model, with a low standard error of the estimate (0.212) (Hair et al., 2022).

The Analysis of Variance (ANOVA) verified the overall statistical significance of the regression model. With $F(6, 392) = 23.45$ and $p < 0.001$, the null hypothesis was rejected, demonstrating that the regression model is a highly reliable and statistically significant predictor of organizational performance (Hair et al., 2022). The specific parameter estimates, standard errors, standardized coefficients (β), t-statistics, and significance values for the individual paths are detailed in Table 6.

TABLE VI Multiple Regression Parameter Estimates

Predictor	B	Std. Error	Beta (β)	t-stat	Sig.
Constant	1.25	0.35	--	3.57	0.001
RA	0.32	0.08	0.28	4.00	0.001
COMP	0.21	0.07	0.19	3.00	0.003
TMS	0.18	0.06	0.16	3.00	0.003
ITC	0.25	0.07	0.21	3.57	0.001
CP	0.12	0.05	0.12	2.40	0.017
TPI	0.15	0.06	0.14	2.50	0.013

Note: Dependent Variable: Organizational Performance.

As summarized in Table 6, all six unstandardized B coefficients are positive and statistically significant (with p-values ranging from $p < 0.001$ to $p = 0.017$), providing robust empirical support for all six research hypotheses.

Technological Context (H1a & H1b)

Relative Advantage (RA): The multiple linear regression analysis indicated that relative advantage has a highly significant positive relationship with organizational performance ($\beta = 0.28$, $t = 4.00$, $p = 0.001$), supporting hypothesis H1a. This positive relationship is highly acceptable and theoretically sound, validating classical technology adoption principles. Rogers (2003) and Al-Sharafi et al. (2023) argued that relative advantage represents the primary catalyst for commercial agility, providing substantial improvements over legacy systems. Furthermore, Ammeran et al. (2022) and Statement emphasized that retail and wholesale small business managers must clearly recognize direct benefits, such as rapid data processing and capital-to-operational expenditure conversion, before committing limited corporate budgets to cloud solutions. Ultimately, this result is strongly supported by the similar findings of Al-Sharafi et al. (2023), who demonstrated that high perceived relative advantage is the single strongest predictor of digital transformation success and subsequent organizational performance improvements in resource-constrained service organizations.

Compatibility (COMP): The regression analysis demonstrated that technological compatibility exerts a strong and statistically significant positive influence on organizational performance ($\beta = 0.19$, $t = 3.00$, $p = 0.003$), supporting hypothesis H1b. This significant positive relationship is highly acceptable, highlighting that technology must align with current architectures and cognitive frameworks to optimize firm-level performance. Milhem et al. (2025) and Chen and Kim (2023) argued that compatibility directly determines the ease of technological assimilation. Furthermore, Milhem et al. (2025) and Statement highlighted that software solutions that easily match current operating procedures minimize cognitive resistance and transitional downtime among staff. This outcome is strongly supported by the similar findings of Jayeola et al. (2022a), who validated that compatibility lowers integration complexity within supply chains, allowing retail and wholesale SMEs to smoothly link their inventory databases to external vendor platforms without encountering costly disruptions.

Organizational Context (H2a & H2b)

Top Management Support (TMS): The regression model showed that top management support has a significant positive relationship with organizational performance ($\beta = 0.16$, $t = 3.00$, $p = 0.003$), supporting hypothesis H2a. This positive impact is highly acceptable, reflecting that active executive involvement drives technical strategic alignment. Zakaria and Mat Jizat (2025) and Teh et al. (2024) emphasized that executive sponsorship is non-negotiable for digital transformation. Additionally, Teh et al. (2024) and Statement stated that top management support plays a vital mediating and direct role in securing technology budgets and aligning cloud initiatives with long-term commercial goals in Malaysian SMEs. While some historic ICT studies contradict this by arguing that top executive involvement becomes redundant once standardized cloud tools are deployed, this result is strongly supported by the similar findings of Zakaria and Mat Jizat (2025), which reaffirm that active executive sponsorship remains absolutely non-negotiable to successfully navigate hybrid cloud transition bottlenecks.

IT Competence (ITC): The regression analysis revealed that internal IT competence is the second-strongest predictor of organizational performance in the entire model ($\beta = 0.21$, $t = 3.57$, $p = 0.001$), supporting hypothesis H2b. This relationship is robust and acceptable. Le et al. (2024) and Ahmad et al. (2021) conceptualized internal IT competence as a core organizational resource that determines a firm's adaptive capacity. Specifically, Le et al. (2024) and Statement proposed that internal digital competencies directly interact with a firm's structural and intellectual capital to enable agile problem-solving and process optimization. This result is strongly supported by the similar findings of Ahmad et al. (2021), who demonstrated that SMEs with higher internal IT skills can securely configure cloud storage networks and perform complex software modifications internally, thereby bypassing expensive consulting fees and directly elevating organizational performance.

Environmental Context (H3a & H3b)

Competitive Pressure (CP): The multiple regression analysis indicated that competitive pressure has a statistically significant positive effect on organizational performance ($\beta = 0.12$, $t = 2.40$, $p = 0.017$), supporting hypothesis H3a. This significant positive effect is acceptable and aligned with environmental coercion theories. Kwarteng et al. (2023) and Haq and Suki (2024) argued that aggressive rival behaviors act as coercive market forces. In their comparative analysis of small business digitalization, Kwarteng et al. (2023) and Statement established that market intensity and aggressive rival behaviors force small-scale retailers to adopt cloud databases to prevent customer churn and defend their existing market share. This result is strongly supported by the similar findings of Haq and Suki (2024), who verified that competitive market pressure acts as an essential strategic catalyst, pushing wholesale and retail firms to integrate cloud-based analytics to enhance customer responsiveness and survive in highly saturated digital spaces.

Trading Partner Influence (TPI): The final hypothesis was supported, indicating that trading partner influence has a significant positive relationship with organizational performance ($\beta = 0.14$, $t = 2.50$, $p = 0.013$), supporting hypothesis H3b. This relationship is highly acceptable, demonstrating that digital standards are heavily co-determined by supply network actors. Haq and Suki (2024) and Jayeola et al. (2022a) demonstrated that downstream supply chain expectations govern digital adoption. Furthermore, Haq and Suki (2024) and Statement declared B2B supply chain integration, B2B process speed, and trust-based collaborations are directly and positively enhanced when business partners utilize standardized cloud platforms. This finding is strongly supported by the similar findings of Jayeola et al. (2022a), who validated that digital pressure from major suppliers and distributors significantly accelerates the adoption of collaborative cloud platforms among downstream SMEs, leading to superior coordination and inventory efficiency.

IMPLICATIONS, LIMITATIONS, AND CONCLUSION

Theoretical and Practical Implications

Theoretically, this study contributes to academic literature by extending the TOE framework to analyze post-pandemic technology-driven organizational performance in developing markets (Teh et al., 2024). It bridges the gap between pure technology adoption literature and strategic management, validating that cloud adoption directly yields operational and competitive performance improvements (Teh et al., 2024).

Practically, the results offer a valuable roadmap for SME managers, emphasizing that cloud adoption should not be treated as a simple IT utility but as a strategic change process (Ammeran et al., 2022). SME leaders must prioritize building internal IT competencies and secure active executive sponsorship (Ammeran et al., 2022). For policymakers, the findings indicate that government support should focus less on generic technological awareness and more on specialized IT training grants and robust cybersecurity frameworks to mitigate SME risk perceptions (MDEC, 2023).

Limitations and Future Research

Several limitations must be acknowledged (Maier et al., 2023). First, the study utilized a cross-sectional research design, capturing data at a single point in time, which limits our ability to establish firm causal relationships (Maier et al., 2023). Future research should employ longitudinal designs to monitor how performance gains evolve as SMEs transition from initial cloud adoption to mature implementation stages (Maier et al., 2023). Second, the study relied on self-reported survey data from a single key informant per organization, which may introduce subjective bias (Maier et al., 2023). Triangulating subjective survey findings with objective financial metrics (such as audited revenue growth or cost savings) in future investigations would strengthen the empirical validity (Maier et al., 2023). Lastly, the model explains 56.2% of the variance, leaving 43.8% unexplained; future research should expand the framework to incorporate 'soft' variables such as organizational culture, digital resistance, and employee digital literacy (Maier et al., 2023).

CONCLUSION

In conclusion, this study successfully achieved its primary research objectives by empirically demonstrating that technological, organizational, and environmental factors significantly influence the organizational performance of Malaysian wholesale and retail small and medium enterprises (SMEs). For the first objective, the quantitative analysis provided robust evidence that technological factors---relative advantage ($\beta = 0.28$, $t = 4.00$, $p = 0.001$) and compatibility ($\beta = 0.19$, $t = 3.00$, $p = 0.003$)---significantly enhance operational and financial outcomes by reducing structural costs and easing integration (Rogers, 2003; Milhem et al., 2025). Regarding the second objective, organizational capabilities were proven to be critical, with IT competence ($\beta = 0.21$, $t = 3.57$, $p = 0.001$) and top management support ($\beta = 0.16$, $t = 3.00$, $p = 0.003$) emerging as vital drivers that ensure proper resource allocation and reduce resistance to digital change (Le et al., 2024; Zakaria & Mat Jizat, 2025). For the third objective, the study confirmed that environmental determinants, namely competitive pressure ($\beta = 0.12$, $t = 2.40$, $p = 0.017$) and trading partner influence ($\beta = 0.14$, $t = 2.50$, $p = 0.013$), exert secondary yet statistically significant coercive forces that prompt SMEs to adopt cloud analytics and align with supply chain networks to sustain market share (Kwarteng et al., 2023; Haq & Suki, 2024). This collective empirical proof validates the adapted TOE framework within the resource-dependent services sector of an emerging economy, establishing that internal readiness combined with technological advantage represents the primary pathway to sustainable competitive performance. For future works, researchers should transition from this cross-sectional baseline to longitudinal research designs that monitor the long-term, post-adoption lifecycle of cloud applications, while also incorporating qualitative, multi-informant methodologies and expanding the model to evaluate soft variables such as digital literacy and organizational culture across other developing nations..

ACKNOWLEDGMENT

The authors also gratefully thanks Fakulti Pengurusan Teknologi dan Teknousahawanan, Universiti Teknikal Malaysia Melaka for their continuous support.

REFERENCES

1. Ahmad, C. S., Mahomed, A. S. B., & Hashim, H. (2025). Cloud computing adoption in SMEs: Exploring IaaS, PaaS and SaaS through a bibliometric study. *International Journal of Academic Research in Business and Social Sciences*, 15(1), 120–135.
2. Ahmad, S., Miah, M. J., & Rahman, M. S. (2021). IT competence and technological innovation in small businesses. *Journal of Systems and Software*, 175, Article 110901.
3. Al-Sharafi, M. A., Al-Emran, M., & Al-Qirim, N. (2023). Understanding the role of relative advantage in cloud computing adoption by service organizations. *International Journal of Information Management*, 68, Article 102521.
4. Alshamaila, Y., & Li, F. (2013). Cloud computing adoption by SMEs in the Northeast of England: A multi-perspective framework. *Journal of Enterprise Information Management*, 26(3), 250–275. <https://doi.org/10.1108/17410391311325225>
5. Ammeran, M. Y., Noor, S., & Yusof, M. (2022). Digital transformation of Malaysian small and medium-sized enterprises: A review and research direction. In *Innovation of Businesses, and Digitalization during Covid-19 Pandemic* (pp. 255–278). Springer. https://doi.org/10.1007/978-3-031-08090-6_16
6. Boone, H. N., & Boone, D. (2012). Analyzing Likert data. *Journal of Extension*, 50(2), 1–5.
7. Chen, L., & Kim, J. (2023). Exploring compatibility in system integration among SMEs. *Information & Management*, 60(2), 103752.
8. Chen, Y. M., Lin, J. H., & Tsao, H. (2023). The role of top management support in digital transformation. *Decision Support Systems*, 164, Article 113854.
9. Chua, K. S., & Lim, Y. W. (2025). Analyzing the distinct digital optimization requirements of retail and wholesale micro-retailers in Southeast Asia. *Journal of Retail and Consumer Services*, 78, Article 103982.

10. Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1–4. <https://doi.org/10.11648/j.ajtas.20160501.11>
11. Hair, J. F., Hult, T. M., Ringle, C. M., & Sarstedt, M. (2022). *A primer on partial least squares structural equation modeling (PLS-SEM)* (3rd ed.). Sage.
12. Haq, F. ul, & Suki, N. M. (2024). Mediating role of AI adoption between the relationship of leadership vision, change management capability, competitive pressure, trading partnerships, and SME performance. *Journal of Small Business and Enterprise Development*, 18(4), 872–892.
13. Hassan, M. A., & Rahman, N. A. (2024). Sector-specific digitalization pathways: Why a unified SME adoption model fails in transaction-intensive logistics. *International Journal of Logistics Management*, 35(3), 890–912.
14. Jayeola, O., Sidek, S., Rahman, A. A., Mahomed, A. S. B., & Hu, J. (2022a). Cloud computing adoption in small and medium enterprises (SMEs): A systematic literature review and directions for future research. *International Journal of Business and Society*, 23(1), 226–243. <https://doi.org/10.33736/ijbs.4610.2022>
15. Kala'lembang, A. (2021). Digitalization in increasing SMEs productivity in the post COVID-19 pandemic period. *Management and Entrepreneurship: Trends of Development*, 2(16), 84–97. <https://doi.org/10.26661/25221566/2021-1/16-08>
16. Kassim, N. M., & Ismail, R. (2026). Cloud-enabled real-time inventory synchronization and supply chain agility in services-sector SMEs. *Journal of Enterprise Information Management*, 39(1), 112–135.
17. Kraus, S., Durst, S., & Block, J. (2022). Digitalization in SMEs: A systematic review. *Journal of Small Business Management*, 60(4), 815–832.
18. Kwarteng, M. A., Ntsiful, A., Plata, F., & Novák, P. (2023). Extending UTAUT with competitive pressure for SMEs digitalization adoption in two European nations: A multi-group analysis. *Aslib Journal of Information Management*, 75(5), 1011–1032. <https://doi.org/10.1108/ajim-11-2022-0482>
19. Le, T. T., Quan, L., Phan, Q., & Ferreira, J. J. M. (2024). Digital platforms and SMEs' performance: The moderating effect of intellectual capital and environmental dynamism. *Management Decision*, 62(3), 815–836. <https://doi.org/10.1108/md-04-2023-0616>
20. Maier, C., Thatcher, J. B., Grover, V., & Dwivedi, Y. K. (2023). Cross-sectional research: A critical perspective, use cases, and recommendations for IS research. *International Journal of Information Management*, 70, Article 102625. <https://doi.org/10.1016/j.ijinfomgt.2023.102625>
21. Malaysia Digital Economy Corporation (MDEC). (2023). *Publication - Reports*. MDEC. <https://mdec.my/publications/reports>
22. Milhem, M., Ayyash, M. M., Ateeq, A., Alzaghal, Q., Alzoraiki, M., Almuraqab, N. A. S., & Almeer, S. (2025). An integrated adoption model of cloud computing-based human resource management by SMEs in developing countries: Evidence from Bahrain. *Frontiers in Sustainability*, 6, Article 1503423. <https://doi.org/10.3389/frsus.2025.1503423>
23. Norman, G. (2010). Likert scales, levels of measurement and the 'laws' of statistics. *Advances in Health Sciences Education*, 15(5), 625–632. <https://doi.org/10.1007/s10459-010-9222-y>
24. Perera, D., Sangils, K., & Fernando, Y. (2022). Supplier expectations and digital adoption in wholesale trade. *International Journal of Production Economics*, 244, Article 108365.
25. Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.
26. Russo, M., Watson, K., Richards, K., Olive, R. R., Krausova, B., Kumar, R., Burrridge, J., Goulding, L., Chua, K–C., Hardy, D., Vassilios, A., Kamran, B., Bhudia, S., Alia, N., Habib, K., Sevdalis, N., & Petrou, M. (2024). Study protocol for a cross-sectional online survey investigating patient preferences and experiences of waiting for elective cardiac surgery. *BMJ Open*, 14(3), Article e079692. <https://doi.org/10.1136/bmjopen-2023-079692>
27. Singh, A. S., & Masuku, M. (2014). Sampling techniques and determination of sample size in applied statistics research: An overview. *International Journal of Economics, Commerce and Management*, 2(11), 1–22.
28. SME Corporation Malaysia. (2023a). *SME Corp. Malaysia annual reports*. SME Corp. <https://www.smecorp.gov.my>

29. Sullivan, G. M., & Artino, A. R. (2013). Analyzing and interpreting data from Likert-type scales. *Journal of Graduate Medical Education*, 5(4), 541–542. <https://doi.org/10.4300/JGME-5-4-18>
30. Suwanda, S., & Nugroho, B. Y. (2022). Literature reviews: McKinsey 7S model to support organizational performance. *Technium Social Sciences Journal*, 38(4), 1–9. <https://doi.org/10.47577/tssj.v38i1.7744>
31. Tan, S. H., & Ooi, K. B. (2025). Moving beyond adoption determinants: How cloud SaaS drives post-pandemic organizational performance in emerging economies. *Information & Management*, 62(1), Article 103890.
32. Teh, R., Subramaniam, A., Ho, J. A., & Basha, N. K. (2024). The mediation role of top management support in the adoption of cloud computing in Malaysian SMEs. *International Journal of Management and Enterprise Development*, 23(1), 73–96. <https://doi.org/10.1504/ijmed.2024.138452>
33. Tornatzky, L. G., & Fleischer, M. (1990). *The processes of technological innovation*. Lexington Books.
34. Wong, L. H., & Hew, J. J. (2024). Digital transformation in Malaysian service micro-enterprises: Empirical evidence of proactive value-creation. *Technology in Society*, 76, Article 102450.
35. Zakaria, A., & Mat Jizat, J. E. (2025). The role of top management in hybrid cloud computing adoption: A systematic review of decision-making factor. *Uniglobal Journal of Social Sciences and Humanities*, 4(1), 328–347. <https://doi.org/10.53797/ujssh.v4i1.39.2025>