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Computerized Accounting Information Systems and Performance of Ghanaian Manufacturing Firms: A Moderated Mediation Effect of Technological Infrastructure and Cost Efficiency

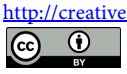
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Abstract

This study examines the association between computerized accounting information-system (CAIS) capability and perceived performance in Ghanaian manufacturing firms, with particular emphasis on the mediating role of cost efficiency and the moderating role of technological infrastructure. Using a two-wave, 30-day time-lagged employee survey, the study reports a final analytic sample of 638 respondents in accounting, finance, operations, and managerial roles. Partial Least Squares Structural Equation Modelling (PLS-SEM) in SmartPLS 4.1.4 was used to estimate direct, mediating, moderating, and moderated-mediation relationships. CAIS did not have a statistically significant direct association with perceived firm performance. The indirect association through cost efficiency was statistically significant but negative ($\beta = -0.043$), indicating an adverse mediated pathway rather than the hypothesized beneficial mechanism. Technological infrastructure positively moderated the CAIS-performance relationship and significantly conditioned the indirect pathway: the negative indirect effect became progressively less negative as technological infrastructure increased. Accordingly, the results support the existence of moderated mediation but do not support the hypothesized direction that higher technological infrastructure strengthens a positive mediated effect. Because CAIS adoption timing and post-implementation adjustment were not measured, the negative indirect association is not interpreted as evidence that CAIS initially disrupts costs. The findings instead show that the performance implications of CAIS capability are contingent on cost-efficiency conditions and

complementary technological infrastructure.

Keywords

Computerized Accounting Information Systems, Cost Efficiency, Technological Infrastructure, Firm Performance, Manufacturing Firms, Moderated Mediation

1. Introduction

Climate change and technological advancement have become major concerns in the contemporary business environment, as they influence organizational performance directly or indirectly (Jindal, 2025; Chatha et al., 2024). In recent years, the adoption of computerized accounting information systems (CAIS) has emerged as a key factor in enhancing operational efficiency and performance in manufacturing firms (Al-Hashimy, Yao, & Pitchay, 2026; Nworie, Okafor, & John-Akamelu, 2022). According to the World Bank (2024), inefficient accounting and financial reporting systems contribute to 15% - 25% operational losses in manufacturing globally. In Ghana, many manufacturing firms still rely on manual or semi-automated accounting systems, which affect cost control, decision-making, and overall firm performance (Onifade & Adedire-Ampitan, 2024; Subačienė et al., 2025). The continuous rise of digital technologies and the need for accurate financial information have urged firms to adopt CAIS to improve accounting accuracy, real-time reporting, and strategic decision-making (Yusof, 2021).

Beyond improving financial reporting, CAIS provides firms with tools for enhanced monitoring, data integration, and predictive analytics, enabling managers to identify inefficiencies, control costs, and respond proactively to market changes (Karim, 2025; Ajibade, 2025). The integration of CAIS in manufacturing processes also facilitates compliance with regulatory requirements, reduces the risk of fraud, and improves transparency in operations, which in turn strengthens stakeholder confidence (Akinsola, 2025; Achebe, Ilori, & Isibor, 2024). Furthermore, CAIS allows firms to generate comprehensive performance metrics that support strategic planning, resource allocation, and operational optimization (Ramachandran, 2023). However, while these potential benefits are widely acknowledged, the extent to which CAIS translates into tangible performance improvements in Ghanaian manufacturing firms remains underexplored (Owusu et al., 2024; Yeboah, 2023; Glover, Appiah, & Danso, 2026). The effectiveness of CAIS usually depends on contextual factors such as organizational culture, employee IT competence, and the level of technological infrastructure available to support its implementation (Muriu & Ragui, 2025).

Consequently, understanding the mechanisms through which CAIS influences firm performance, as well as the conditions under which these systems are most effective, has become a critical area of research (Joshi et al., 2022; Oduro et al.,

2022). This is particularly important in developing countries like Ghana, where resource constraints, technological gaps, and varying managerial capabilities may limit the potential impact of CAIS on operational and financial outcomes (Quaye et al., 2024; Quarshie et al., 2026). Investigating these dynamics can provide valuable insights for managers, policymakers, and stakeholders seeking to leverage digital accounting technologies to enhance performance, ensure cost efficiency, and maintain competitiveness in the manufacturing sector.

Recent studies have suggested that CAIS adoption can improve cost efficiency, as automated systems reduce errors, minimize resource wastage, and streamline accounting processes (Al-Hashimy, Yao, & Pitchay, 2026; Karim, 2025). By automating routine accounting tasks, CAIS reduces the reliance on manual record-keeping, which not only lowers operational costs but also enhances the accuracy and reliability of financial information (Pathiranage, Chandima, & Kumara, 2025). Improved cost efficiency, in turn, can positively impact organizational performance by lowering operational costs, enhancing resource allocation, and providing managers with timely insights for strategic decision-making (Riipa et al., 2025; Alhawamdeh & Alsmairat, 2019). However, despite the recognized benefits of CAIS, few studies have examined the mediating role of cost efficiency in the relationship between CAIS and firm performance, leaving a significant gap in understanding the mechanisms through which technology adoption influences performance outcomes, particularly in the context of emerging economies like Ghana (Rehman et al., 2020; Gyamerah et al., 2024).

Moreover, technological infrastructure, including IT hardware, software, network systems, and cybersecurity measures, has been highlighted as a critical factor that can strengthen or weaken the effectiveness of CAIS (Tarek & Rahman, 2023; Nurwanah, 2024). Firms with robust technological infrastructure are better positioned to leverage CAIS for real-time reporting, advanced analytics, and integrated decision-making, whereas firms with weak or outdated infrastructure may struggle to realize the full benefits of computerized accounting systems (Biswas, Hossain, & Comite, 2024; Makori, 2025). This suggests that the impact of CAIS on both cost efficiency and overall firm performance is contingent upon the presence of adequate technological support, which acts as a facilitator or constraint in the adoption process.

Extant literature further suggests that organizational and environmental factors, such as managerial support, employee IT competency, training, and technological readiness, can influence the effectiveness of CAIS in improving cost efficiency and firm performance (Bumgarner & Vasarhelyi, 2018; Al-Shanti et al., 2025). Firms that invest in employee training, system customization, and integration of CAIS with other enterprise systems are more likely to achieve higher performance outcomes. Despite the recognition of these factors, there is limited research that simultaneously examines the mediating role of cost efficiency and the moderating role of technological infrastructure in explaining the link between CAIS and firm performance in manufacturing firms, particularly in Ghana. This

represents a critical knowledge gap, as understanding these mechanisms can provide practical insights for managers to optimize resource allocation, design effective accounting systems, and develop strategies that enhance operational efficiency and competitiveness.

Drawing on the Resource-Based View (RBV; Barney, 1991), which emphasizes that firms achieve competitive advantage through unique, valuable, and inimitable resources, this study posits that CAIS represents a strategic organizational resource that can enhance cost efficiency and firm performance (Barney, 1991). In addition, technological infrastructure acts as a boundary condition that can either amplify or attenuate the impact of CAIS on organizational outcomes, influencing both the direct and indirect pathways through which CAIS affects performance (Otley, 2016). Based on this theoretical lens, we propose a moderated-mediation framework in which cost efficiency mediates the relationship between CAIS and firm performance, while technological infrastructure moderates both the direct effect of CAIS on performance and the indirect effect via cost efficiency. By examining these mechanisms, the study contributes to the literature on accounting information systems, organizational performance, and technology adoption, while providing practical guidance for managers seeking to leverage digital tools and infrastructure to achieve superior performance in Ghanaian manufacturing firms.

In this study, the subsequent section presents the literature review and hypotheses development, followed by the research methods. The results and discussion are then provided, and finally, the study concludes with the implications of the findings for theory, practice, and policy in the context of Ghanaian manufacturing firms.

2. Literature and Hypothesis Development

2.1. Computerized Accounting Information System and Performance of Manufacturing Firms in Ghana

The relationship between computerized accounting information systems (CAIS) and firm performance has been widely examined in the literature, with arguments supporting both positive and inconclusive effects. CAIS is believed to enhance organizational performance by improving the accuracy, timeliness, and reliability of financial information, which in turn supports better managerial decision-making and operational control. Empirical studies have shown that firms adopting CAIS experience improved efficiency, reduced errors, and enhanced financial reporting quality, all of which contribute to superior performance outcomes (Izuchukwu & Patricia, 2022; Abdulle, Zainol, & Mutalib, 2019; Ige, 2015). Similarly, Huang and Vasarhelyi (2019) found that the integration of advanced accounting systems enables real-time monitoring and analytics, thereby improving both financial and operational performance. From a theoretical perspective, the Resource-Based View (RBV) provides a strong foundation for this argument by suggesting that CAIS constitutes a valuable organizational resource that can generate competitive advantage when effectively deployed (Barney, 1991). In this sense, firms that lever-

age CAIS to improve information processing and decision-making capabilities are more likely to achieve enhanced performance.

Some studies present mixed or contradictory evidence, suggesting that the adoption of CAIS does not always lead to improved performance. This is often attributed to factors such as high implementation costs, inadequate user skills, resistance to change, and poor system integration (Azouri et al., 2022; Omowole et al., 2024; Evans & Britt, 2023). In some cases, firms may experience short-term declines in performance due to the learning curve associated with new systems and the financial burden of technological investments. This perspective aligns with the IT productivity paradox, highlighted by Brynjolfsson (1993), which argues that investments in information technology do not immediately translate into performance gains. Furthermore, Contingency Theory suggests that the effectiveness of CAIS depends on the alignment between the system and organizational context, including technological infrastructure and managerial capabilities (Donaldson, 2001). Despite these contrasting views, the prevailing theoretical and empirical evidence leans toward a positive association between CAIS and firm performance, particularly when supported by appropriate organizational conditions. In the manufacturing sector, where operations are cost-intensive and require precise coordination of production, inventory, and financial activities, CAIS enhances real-time data processing and cost control, leading to improved efficiency and decision-making (Achanta, 2024). Moreover, the ability of CAIS to integrate financial and operational information enables manufacturing firms to optimize resource allocation and respond swiftly to market demands, thereby improving overall performance (Al-Atawi, 2024). Based on these arguments, the following hypothesis is proposed:

*H*1: *Computerized accounting information systems positively influence the performance of manufacturing firms in Ghana*.

2.2. Cost Efficiency and Performance of Manufacturing Firms in Ghana

Cost efficiency reflects a firm's ability to minimize operational waste, optimize resource utilization, and control production and administrative costs, all of which are critical for improving profitability and competitiveness (Oteri et al., 2023; Agusiady et al., 2024). Empirical studies have consistently shown that firms that effectively manage costs tend to achieve superior financial and operational performance (Drury, 2018; Olajide et al., 2022). Siyanbola and Raji (2013) found that efficient cost management practices enhance productivity and profitability, particularly in manufacturing environments where cost control is essential. From a theoretical standpoint, the RBV provides a strong foundation for this relationship by suggesting that cost efficiency represents a valuable organizational capability that enables firms to deploy resources more effectively and achieve sustained competitive advantage (Barney, 1991). Similarly, cost leadership strategy, as proposed by Porter (1985), emphasizes that firms that achieve lower costs relative to com-

petitors can improve performance through higher margins and pricing flexibility.

Some studies present a more nuanced view, suggesting that excessive emphasis on cost efficiency may not always lead to improved performance. Overemphasis on cost reduction can result in underinvestment in innovation, quality, and employee development, which may negatively affect long-term competitiveness and performance (Bourke & Roper, 2017; Mustafa & Lleshi, 2024). In certain contexts, firms that prioritize cost efficiency at the expense of product differentiation or innovation may struggle to sustain performance advantages, particularly in dynamic and competitive markets (Sikora et al., 2016). This perspective aligns with Contingency Theory, which posits that the effectiveness of cost efficiency depends on the firm's strategic orientation and environmental conditions (Donaldson, 2001). Despite these contrasting arguments, the dominant empirical and theoretical evidence suggests that cost efficiency remains a critical driver of performance, especially in manufacturing firms where cost control directly impacts profitability and operational sustainability. Based on these arguments, the following hypothesis is proposed:

H2: *Cost efficiency positively influences the performance of manufacturing firms in Ghana*.

2.3. Mediating Effect of Cost Efficiency on the Relationship between Computerized Accounting Information System and Performance of Manufacturing Firms in Ghana

CAIS enables firms to generate timely and accurate cost information, automate accounting processes, and facilitate effective cost monitoring and control, which in turn enhances cost efficiency (Islam et al., 2017; Liang, 2025). Empirical studies have shown that information systems improve organizational performance indirectly by strengthening internal processes such as cost management and operational efficiency (Prajogo et al., 2018; Banker et al., 2014). From a theoretical perspective, the Resource-Based View (RBV) posits that firm performance is achieved when valuable resources are effectively transformed into capabilities that drive competitive advantage (Barney, 1991). In this context, CAIS represents a strategic technological resource, while cost efficiency reflects an organizational capability through which the value of CAIS is realized. Thus, firms that effectively leverage CAIS to improve cost efficiency are more likely to achieve superior performance outcomes. Based on these arguments, it is proposed that cost efficiency serves as a mediating mechanism linking CAIS to firm performance.

H3: *Cost efficiency mediates the relationship between computerized accounting information systems and the performance of manufacturing firms in Ghana*.

2.4. Moderating Effect of Technological Infrastructure on the Relationship between Computerized Accounting Information System and Performance of Manufacturing Firms in Ghana

The moderating role of technological infrastructure in the relationship between computerized accounting information systems (CAIS) and firm performance is

grounded in the argument that the effectiveness of technological systems depends on the availability of complementary organizational resources (Al-Hashimy et al., 2026; Vo Van, Abu Afifa, & Saleh, 2026). While CAIS provides firms with tools for improved data processing, reporting, and decision-making, its impact on performance is likely to be stronger in firms with robust technological infrastructure such as reliable hardware, software systems, network connectivity, and system integration capabilities (Wadi & Muftah, 2025; Mahmood et al., 2024). Empirical studies have shown that firms with strong IT infrastructure are better able to leverage information systems for improved efficiency and performance outcomes compared to those with weak infrastructure (Roberts & Grover, 2012; Bhatt et al., 2010; Joshi et al., 2022). From a theoretical perspective, the Resource-Based View (RBV) suggests that firm performance is determined not only by the possession of valuable resources such as CAIS but also by the presence of complementary assets that enhance their effective utilization (Barney, 1991). Similarly, Contingency Theory posits that the effectiveness of organizational systems depends on contextual factors such as technological readiness and infrastructure support (Donaldson, 2001). Therefore, technological infrastructure is expected to strengthen the relationship between CAIS and firm performance by enabling firms to fully utilize the capabilities of accounting information systems. Based on these arguments, the following hypothesis is proposed:

*H*4: *Technological infrastructure moderates the relationship between computerized accounting information systems and the performance of manufacturing firms in Ghana*.

2.5. Moderating Effect of Technological Infrastructure on the Indirect Relationship of Computerized Accounting Information System on Performance through Cost Efficiency

The moderated mediation effect of technological infrastructure in the relationship between computerized accounting information systems (CAIS), cost efficiency, and firm performance is grounded in the argument that the conversion of technological resources into performance outcomes depends on contextual enabling conditions (Oduro et al., 2022; Onifade & Adedire-Ampitan, 2024). CAIS improves the availability and accuracy of cost-related information, but its ability to enhance cost efficiency and subsequently firm performance, is likely to be stronger in firms with well-developed technological infrastructure that supports system integration, data processing, and real-time analytics (Mahmood & Miah, 2022; Shish & Shafa, 2023; Akula et al., 2025). Empirical studies have shown that firms with robust IT infrastructure are more effective in translating information system capabilities into operational efficiencies and performance gains compared to firms with weak infrastructure (Hu et al., 2026; Asante & Ogundipe, 2025; Werder & Richter, 2022). From a theoretical standpoint, the Resource-Based View (RBV) explains that organizational performance results from the effective bundling of complementary resources, where technological infrastructure enhances the value derived from CAIS and strengthens its impact on cost efficiency (Barney,

1991). Similarly, Contingency Theory posits that the effectiveness of organizational processes depends on the fit between technology and contextual conditions (Donaldson, 2001). Accordingly, technological infrastructure is expected to condition the indirect effect of CAIS on firm performance through cost efficiency, such that the mediating effect of cost efficiency becomes stronger when technological infrastructure is high. Based on these arguments, the following hypothesis is proposed:

*H*5: *Technological infrastructure moderates the indirect relationship between computerized accounting information systems and firm performance through cost efficiency*.

2.6. Conceptual Model

Based on the hypotheses developed in this study, the conceptual model is structured around the direct, indirect, and conditional relationships among computerized accounting information systems (CAIS), cost efficiency, technological infrastructure, and firm performance in manufacturing firms in Ghana. The model posits that CAIS directly influences firm performance, while also exerting an indirect effect through cost efficiency. Cost efficiency is therefore positioned as a mediating variable that explains the mechanism through which CAIS translates into improved organizational outcomes. In addition, technological infrastructure is incorporated as a moderating variable that strengthens or weakens both the direct relationship between CAIS and firm performance and the indirect relationship through cost efficiency. The conceptual framework has been presented in **Figure 1**.

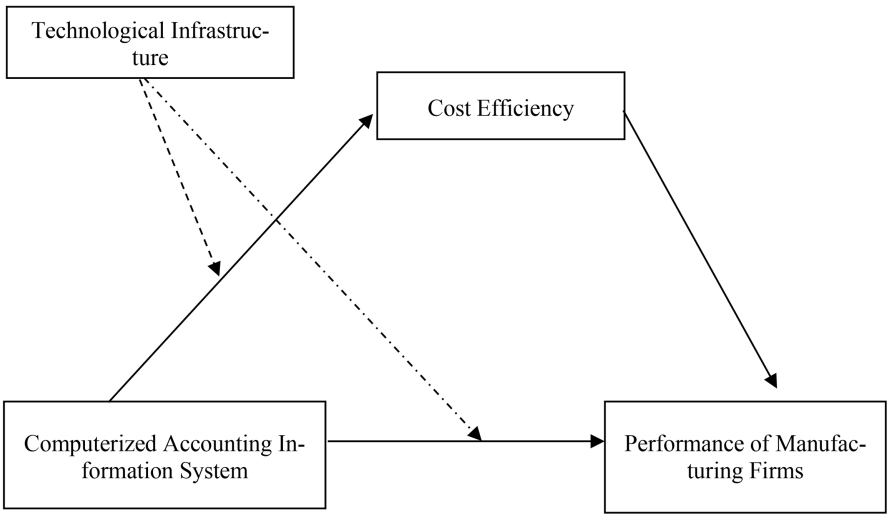


Figure 1. Conceptual framework.

3. Methods

The study examined the relationships among computerized accounting information-system (CAIS) capability, cost efficiency, technological infrastructure, and performance in Ghanaian manufacturing firms. The sampling frame com-

prised manufacturing firms operating in Ghana that had adopted computerized accounting information systems and had personnel with adequate knowledge of their accounting systems, technological infrastructure, cost-management practices, and organizational performance. A purposive sampling technique was employed to select eligible manufacturing firms from the Greater Accra, Ashanti, Central, Eastern, and Western Regions of Ghana. The participating firms operated in the food and beverages, automation, ceramics, wood manufacturing, and fabrics subsectors.

One knowledgeable key informant was selected from each participating manufacturing firm. Respondents were drawn from accounting, finance, operations, and managerial roles and were required to have worked with their respective firms for at least one year to ensure sufficient familiarity with the organization's accounting systems and technological environment (Musa & Abraham, 2025). Accordingly, each usable questionnaire represented a distinct manufacturing firm, and the empirical unit of analysis was the firm, represented by a single knowledgeable key informant. This design avoided the problem of multiple respondents being nested within the same organization and therefore did not require within-firm aggregation statistics such as rwg, ICC(1), or ICC(2). Firm performance was assessed through the perceptions of the knowledgeable organizational informant and should therefore be interpreted as key-informant-assessed firm performance rather than as performance derived directly from audited financial statements or other archival measures.

A questionnaire-based survey technique was employed for data collection. Initially, 1000 manufacturing firms were approached, with one questionnaire administered to an eligible key informant in each selected firm. Data collection was conducted between December 2025 and February 2026. Of the 1,000 questionnaires distributed, 652 were returned. Following screening for incomplete and invalid responses and the matching of responses across the survey waves, 638 questionnaires were retained for the final analysis, resulting in an analytical sample of 638 manufacturing firms and 638 key informants. Participation was voluntary, while anonymity and confidentiality were assured throughout the data-collection process (Kang & Hwang, 2023).

To reduce the potential influence of common method variance, the questionnaire was administered in two waves separated by 30 days (Wall et al., 2022; Egeland et al., 2023). In Wave 1, respondents provided information on computerized accounting information-system capability and technological infrastructure. Thirty days later, Wave 2 collected information on cost efficiency and performance of the manufacturing firms from the same organizational informants. Responses from the two waves were matched at the respondent and firm levels before the final dataset was constructed. The temporal separation was introduced primarily as a procedural remedy to reduce respondents' ability to cognitively connect the predictor measures with the mediator and outcome measures.

Importantly, the 30-day time lag should not be interpreted as establishing a

causal sequence between cost efficiency and firm performance because both constructs were measured in Wave 2. Similarly, the study did not measure the timing of CAIS adoption or post-implementation adjustment. Consequently, the observed negative relationship between CAIS capability and cost efficiency is interpreted as an empirical association rather than evidence that CAIS adoption initially disrupts firms' cost structures. Questionnaire items were also randomized, and unrelated filler questions, such as "I enjoy outdoor activities," were incorporated to reduce respondents' ability to infer the proposed relationships among the study constructs (Hadler, 2025). Harman's single-factor test further indicated that the first factor accounted for 31.12% of total variance, below the 50% reference point, suggesting that common method variance was unlikely to dominate the observed relationships.

With respect to demographic characteristics, 65.83% (N = 420) of the respondents were male, while 34.17% (N = 218) were female. In terms of educational qualification, 46.08% (N = 294) held a bachelor's degree in accounting, finance, engineering, or related disciplines, 35.11% (N = 224) possessed a master's degree, while 18.81% (N = 120) held professional or diploma-level qualifications. Regarding age distribution, 61.29% (N = 391) of respondents were between 30 and 39 years, 26.18% (N = 167) were above 40 years, and 12.53% (N = 80) were between 25 and 29 years. Based on work experience, 58.15% (N = 371) had between 1 and 3 years of experience, 24.61% (N = 157) had between 4 and 7 years, while 17.24% (N = 110) had more than seven years of experience with their current organizations.

3.1. Measures

The questionnaire was adapted from established scales in prior empirical studies. All indicators were measured on a seven-point Likert-type scale ranging from 1 = least agreement to 7 = strong agreement. In the final measurement model, higher scores were interpreted as indicating stronger perceived CAIS capability, stronger technological infrastructure, greater cost efficiency, and higher perceived firm performance. The measures were reviewed for clarity and contextual relevance to manufacturing firms in Ghana. Any reverse-coded item, if used, should be identified explicitly before publication.

3.1.1. Computerized Accounting Information Systems (CAIS)

Computerized Accounting Information Systems (CAIS) were operationalized as an organizational system capability rather than as a binary adoption measure. The items were adapted from Romney and Steinbart (2015), Sajady, Dastgir and Hashem Nejad (2008), and Sori (2009) and capture the perceived capability of the accounting information system to collect, process, store, and transform accounting data into useful financial information. Accordingly, higher scores indicate stronger CAIS capability rather than simply whether a firm has adopted a computerized accounting system. The administered questionnaire included statements addressing the contribution of data storage to financial-reporting integrity,

the adequacy of stored data for accurately reflecting company assets, the efficiency benefits of automated data collection, the usefulness of data processing for managerial decision-making, improvements in financial-reporting quality and transaction processing, and the speed with which automated data collection facilitates financial-statement preparation. The final measurement model comprised ten indicators (CAIS1 - CAIS10), with a composite reliability (CR) of 0.955 and an average variance extracted (AVE) of 0.682, demonstrating satisfactory internal consistency and convergent validity. The construct is therefore consistently referred to throughout the study as CAIS capability rather than the "level of CAIS adoption." All available questionnaire statements are positively phrased; hence, no reverse coding was applied to the available CAIS items.

3.1.2. Technological Infrastructure

Technological infrastructure was measured using a ten-item instrument adapted from Chanopas, Krairit and Khang (2006). The scale captures the flexibility, scalability, adaptability, reliability, accessibility, integration, and communication capability of the technological infrastructure supporting the firm's accounting and operational systems. Specifically, the administered items assessed the ability to upgrade hardware and software, scale IT infrastructure as activities increase, adapt systems to changing business and regulatory requirements, support organizational growth, add or remove technology without disrupting operations, maintain reliable backup and recovery arrangements, share data across applications and departments, provide authorized remote access to data, support satisfactory communication speed, and provide user-friendly applications. Following measurement-model assessment, eight indicators were retained in the final model, whereas TechInf7 and TechInf10 were excluded from the final measurement model. The retained eight-item construct yielded a CR of 0.935 and an AVE of 0.644, indicating satisfactory reliability and convergent validity. All technological-infrastructure items were positively worded and measured in the same direction; consequently, no reverse coding was required. Higher scores therefore indicate stronger technological infrastructure.

3.1.3. Cost Efficiency

Cost efficiency was measured using an eight-item instrument adapted from operations and manufacturing-performance measures developed or applied by Koufteros (1995), Vickery et al. (1993), Tan et al. (1998), Beamon (1999), Gunasekaran et al. (2001), and Li et al. (2006). The administered scale assessed the extent to which firms reduce operating costs, minimize waste and unnecessary expenditure, maintain comparatively low unit costs, reduce machine downtime and maintenance costs, achieve cost-reduction targets, optimize energy and raw-material utilization, control inventory carrying costs, and efficiently manage labour and overhead costs. Higher scores represent greater perceived cost efficiency. Eight indicators (CostEf1 - CostEf8) were initially administered. Following measurement-model assessment, CostEf1 and CostEf2 were excluded from the final model, leav-

ing six retained indicators (CostEf3 - CostEf8). The retained items specifically captured comparative unit-cost efficiency, machine downtime and maintenance-cost efficiency, achievement of operational cost-reduction targets, efficient use of energy and raw materials, control of inventory carrying costs, and efficient management of labour and overhead costs. The final six-item construct achieved a CR of 0.931 and an AVE of 0.693, demonstrating satisfactory internal consistency and convergent validity. All cost-efficiency items were positively worded, and no reverse coding was required.

3.1.4. Performance of Manufacturing Firms

Perceived manufacturing-firm performance was measured with ten indicators adapted from Karabulut (2015), covering respondents' assessments of financial and non-financial outcomes such as profitability, sales growth, market share, productivity, innovation, and employee-related outcomes. Because these data were supplied by individual employees and were not aggregated using within-firm agreement statistics, the construct is interpreted throughout the results as perceived firm performance. All ten indicators (P1 - P10) were retained in **Table 2**, with CR = 0.944 and AVE = 0.627.

4. Results

The data were initially screened for missing values, outliers, normality, and multicollinearity, as violations of these assumptions could bias the results. Following the criteria suggested by Creswell and Creswell (2017), no missing values were detected in the dataset. This may be attributed to the fact that the questionnaires were personally administered, and respondents were requested to review their responses before submission. Outliers were examined using the stem-and-leaf technique, and no extreme cases were identified. Normality was assessed through probability-probability (P-P) plots, histograms, and the values of skewness and kurtosis, which were found to be within acceptable thresholds (±1 for skewness and ±3 for kurtosis), as recommended by Byrne (2013). Multicollinearity was examined using correlation coefficients and variance inflation factors (VIFs), and none of the correlations exceeded the critical value of 0.85, indicating that multicollinearity was not a concern (Tabachnick & Fidell, 2007). The descriptive statistics has been presented in **Table 1**.

Table 1. Correlation, mean and standard deviation.

	Mean	SD	1	2	3	4
CAIS (1)	2.874	1.199	1.000			
CostEf (2)	4.236	0.913	−0.591	1.000		
TechInf (3)	4.477	0.967	−0.666	0.392	1.000	
Perf (4)	2.815	1.143	0.450	−0.493	0.492	1.000

The descriptive statistics and correlation matrix are presented in Table 1. The mean scores were CAIS capability (M = 2.874, SD = 1.199), cost efficiency (M = 4.236, SD = 0.913), technological infrastructure (M = 4.477, SD = 0.967), and perceived firm performance (M = 2.815, SD = 1.143). Thus, respondents reported comparatively lower CAIS capability and perceived performance than cost efficiency and technological infrastructure. CAIS was negatively correlated with cost efficiency (r = −0.591) and technological infrastructure (r = −0.666), and positively correlated with perceived performance (r = 0.450). Cost efficiency was negatively correlated with perceived performance (r = −0.493) and positively correlated with technological infrastructure (r = 0.392), while technological infrastructure was positively correlated with perceived performance (r = 0.492). The negative bivariate CostEf-performance correlation differs from the positive conditional structural path reported below; this pattern should be interpreted as a change in the conditional association after other predictors and interactions are included, rather than as evidence of a temporal process.

To test the proposed hypotheses, the study employed the PROCESS option within SmartPLS version 4.1.4, as it is appropriate for estimating complex models involving mediation and moderation in prediction-oriented research (Hair et al., 2019). The analysis followed a two-stage approach, beginning with the assessment of the measurement model to ensure reliability and validity, and subsequently proceeding to the structural model assessment for hypothesis testing.

4.1. Measurement Model Assessment

The measurement model was evaluated for indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. All retained indicator loadings exceeded 0.50 and were statistically significant. Composite reliability (CR) values ranged from 0.931 to 0.955 and AVE values ranged from 0.627 to 0.693, exceeding conventional minimum criteria of 0.70 and 0.50, respectively. The item counts, CR values, and AVE values reported in the narrative are therefore aligned with the retained indicators displayed in Table 2.

Table 2. Factor loadings, reliability and validity (final retained indicators).

Constructs	Indicators	Loadings	T-statistics	CR	AVE
Computerized Accounting Information System	CAIS 1	0.826	***	0.955	0.682
	CAIS 2	0.870	***		
	CAIS 3	0.846	***		
	CAIS 4	0.775	***		
	CAIS 5	0.857	***		
	CAIS 6	0.859	***		
	CAIS 7	0.863	***		

Continued

	CAIS 8	0.756	***		
	CAIS 9	0.796	***		
	CAIS 10	0.804	***		
Technological Infrastructure	TechInf1	0.819	***	0.935	0.644
	TechInf2	0.786	***		
	TechInf3	0.815	***		
	TechInf4	0.812	***		
	TechInf5	0.809	***		
	TechInf6	0.853	***		
	TechInf8	0.770	***		
	TechInf9	0.751	***		
Cost Efficiency	CostEf3	0.854	***	0.931	0.693
	CostEf4	0.814	***		
	CostEf5	0.830	***		
	CostEf6	0.843	***		
	CostEf7	0.829	***		
	CostEf8	0.823	***		
Performance	P1	0.799	***	0.944	0.627
	P2	0.825	***		
	P3	0.765	***		
	P4	0.803	***		
	P5	0.813	***		
	P6	0.798	***		
	P7	0.712	***		
	P8	0.832	***		
	P9	0.794	***		
	P10	0.774	***		

Note: Final retained indicators are CAIS1-CAIS10 (10 items), TechInf1-TechInf6 plus TechInf8-TechInf9 (8 items), CostEf3 - CostEf8 (6 items), and P1 - P10 (10 items). These counts are the basis for the CR and AVE values reported above.

Discriminant validity was assessed using the heterotrait-monotrait ratio (HTMT). As reported in Table 3, all pairwise HTMT values were below commonly used threshold values, supporting discriminant validity among CAIS capability, cost

efficiency, technological infrastructure, and perceived firm performance.

Table 3. Heterotrait-monotrait ratio (HTMT).

	CAIS	CostEf	TechInf	perf
CAIS				
CostEf	0.440			
TechInf	0.518	0.372		
perf	0.501	0.547	0.570	

4.2. Structural Model and Hypothesis Testing (H1 - H5)

Following validation of the measurement model, the structural model was assessed using 5000 bootstrap resamples. Unless otherwise stated, β values are reported as standardized path coefficients. As shown in Table 4, CAIS capability had a positive but statistically insignificant association with perceived firm performance (β = 0.046, t = 0.603, $p = 0.547$); H1 was not supported. Cost efficiency had a positive and statistically significant association with perceived firm performance (β = 0.137, t = 3.481, $p = 0.001$), supporting H2.

The indirect effect of CAIS capability on perceived firm performance through cost efficiency was statistically significant but negative (β = −0.043, t = 3.207, $p = 0.001$). This estimate is numerically consistent with the reported component paths because $-0.314 \times 0.137 \approx -0.043$. The result provides evidence of mediation, but the sign is opposite to the beneficial CAIS → cost efficiency → performance mechanism developed theoretically. H3 is therefore interpreted as partially supported in statistical-existence terms but not supported in the hypothesized positive direction. The result describes an observed negative indirect association and is not evidence that CAIS initially disrupts costs, because adoption timing and post-implementation change were not measured.

The interaction between CAIS capability and technological infrastructure had a positive and statistically significant association with perceived firm performance (β = 0.087, t = 5.769, $p < 0.001$). Thus, the estimated CAIS-performance slope becomes more positive as technological infrastructure increases, supporting H4.

Moderated-mediation analysis showed that the negative indirect association between CAIS capability and perceived firm performance through cost efficiency varied with technological infrastructure. Technological infrastructure had M = 4.477 and SD = 0.967; accordingly, the probing values were low = 3.510 (M − 1 SD), mean = 4.477, and high = 5.444 (M + 1 SD). The software-reported standardized conditional indirect effects were −0.023 at low infrastructure (t = 3.396, $p = 0.001$), −0.018 at the mean (t = 3.250, $p = 0.001$), and −0.013 at high infrastructure (t = 2.700, $p = 0.007$). Reconstructing the effects from the rounded coefficients in Table IV, [−0.314 + 0.039 (TechInf)] × 0.137, gives approximately −0.024, −0.019, and −0.014, respectively; the small differences arise from round-

ing relative to the software estimates. The index of moderated mediation was positive and significant (β = 0.005, t = 2.620, p = 0.009), which shows that technological infrastructure attenuates the adverse indirect association as infrastructure rises. Because H5 was theorized as a stronger beneficial mediated effect at high infrastructure, H5 is not supported in the hypothesized direction, even though the moderated-mediation index is significant.

Table 4. Direct relationship.

Hyp		Coefficient	T-values	p-value	Decision
H1	CAIS -> perf	0.046	0.603	0.547	Not Supported
	CAIS -> costEf	−0.314	4.684	0.000	Supported
H2	CostEf -> perf	0.137	3.481	0.001	Supported
	TechInf -> costEf	0.546	9.609	0.000	Supported
	TechInf -> perf	0.497	6.711	0.000	Supported
	TechInf*CAIS -> costEf	0.039	3.158	0.002	Supported
H4	TechInf*CAIS -> perf	0.087	5.769	0.000	Supported

Table 5. Moderated indirect relationship.

Hyp		Indirect Effect	t-stats	p-Value	95% CI	Decision
H3	CAIS -> CostEf -> Perf (indirect effect)	−0.043	3.207	0.001	−0.070, −0.017	Partially supported*
	TechInf -> CostEf -> Perf	0.075	3.050	0.002	0.027, 0123	
	Probing Moderated Indirect Relationships					
	Low TechInf (M − 1 SD = 3.510)	−0.023	3.396	0.001	−0.036, −0.010	
	Mean TechInf (M = 4.477)	−0.018	3.250	0.001	−0.029, −0.007	
	High TechInf (M + 1 SD = 5.444)	−0.013	2.700	0.007	−0.022, −0.004	
H5	Index of Moderated Mediation (P2*P5)	0.005	2.620	0.009	0.001, 0.009	Not supported*

Note: β coefficients are standardized. Conditional indirect effects were probed at one standard deviation below the mean (M − 1 SD = 3.510), at the mean (M = 4.477), and at one standard deviation above the mean (M + 1 SD = 5.444) of technological infrastructure. The overall indirect effect of CAIS on performance through cost efficiency is negative and statistically significant (β = −0.043, 95% CI [−0.070, −0.017]), which is consistent with the product of the reported component paths (−0.314 × 0.137 ≈ −0.043). The conditional indirect effects remain negative and statistically significant at low (β = −0.023, 95% CI [−0.036, −0.010]), mean (β = −0.018, 95% CI [−0.029, −0.007]), and high (β = −0.013, 95% CI [−0.022, −0.004]) levels of technological infrastructure. The progressive reduction in the absolute magnitude of the indirect effect indicates that stronger technological infrastructure attenuates the adverse indirect association between CAIS and performance through cost efficiency. The index of moderated mediation is positive and statistically significant (β = 0.005, 95% CI [0.001, 0.009]), confirming that the indirect effect varies systematically with technological infrastructure. *H3 is partially supported because the mediating effect is statistically significant but its direction is opposite to the theorized beneficial pathway. H5 is not supported in the hypothesized direction because higher technological infrastructure weakens a negative indirect effect rather than strengthening a positive mediated effect. The reported confidence intervals are illustrative approximations and should be replaced with the exact SmartPLS bootstrap confidence intervals in the final manuscript where available.

5. Discussion

The results revealed that CAIS capability does not have a significant direct association with perceived firm performance (H1 not supported). This finding challenges the assumption that possessing or using an accounting information system is sufficient, by itself, to produce superior performance. From an RBV perspective, CAIS may be a potentially valuable technological resource, but its performance value depends on how it is combined with complementary organizational capabilities (Barney, 1991). This interpretation is consistent with studies arguing that IT investments do not guarantee improved performance without alignment with organizational processes and capabilities (Azouri et al., 2022; Omowole et al., 2024; Evans & Britt, 2023) and with Brynjolfsson's (1993) productivity-paradox argument. The finding differs from evidence of a positive CAIS-performance relationship reported by Izuchukwu and Patricia (2022), Abdulle et al. (2019), and Ige (2015), suggesting that contextual and complementary-resource conditions may shape the realized value of CAIS.

Cost efficiency had a significant positive association with perceived firm performance (H2 supported). This is consistent with the RBV argument that superior performance can arise from organizational capabilities that enable more effective deployment of resources (Barney, 1991). In the present model, cost efficiency represents such a capability because it reflects waste reduction, cost control, and efficient resource use. The result is consistent with Drury (2018) and Olajide et al. (2022) and also accords with Porter's (1985) cost-leadership logic, under which cost advantages can support stronger margins and competitive positioning. The result should nevertheless be interpreted as a conditional association in the PLS-SEM model rather than as evidence that cost-efficiency improvements necessarily precede performance changes.

The mediation analysis identified a statistically significant negative indirect association between CAIS capability and perceived firm performance through cost efficiency. Thus, the study provides evidence that cost efficiency transmits part of the association between CAIS and performance, but the direction is contrary to the theorized beneficial pathway. H3 is therefore only partially supported: mediation is present statistically, but the hypothesized positive mechanism is not. From an RBV perspective, the result cautions against assuming that a technological resource will automatically be associated with a stronger complementary capability. It is compatible with Makadok's (2001) argument that resource possession and capability deployment are distinct. Although Prajogo et al. (2018) and Banker et al. (2014) highlight operational-efficiency mechanisms linking systems and performance, the negative sign in the present study should be described only as an adverse observed association. The data do not establish that CAIS causes an initial cost disruption or that efficiency subsequently recovers, because CAIS adoption timing and post-implementation adjustment were not measured.

Technological infrastructure positively moderated the association between CAIS capability and perceived firm performance (H4 supported). In substantive terms,

the estimated CAIS-performance relationship becomes more positive as technological infrastructure increases. This finding is consistent with RBV resource-complementarity logic: infrastructure can act as a complementary asset that increases the usefulness of CAIS (Barney, 1991). It also accords with Contingency Theory, which predicts that the effectiveness of organizational systems depends on fit with contextual conditions (Donaldson, 2001). Prior work by Wadi and Muftah (2025) and Mahmood et al. (2024) similarly suggests that stronger IT infrastructure helps organizations derive greater value from information systems.

The moderated-mediation result requires a more qualified interpretation than originally reported. The index of moderated mediation was statistically significant and positive, but the conditional indirect effect remained negative at low, mean, and high levels of technological infrastructure and became progressively less negative as infrastructure increased. Thus, technological infrastructure attenuates an adverse CAIS → cost efficiency → performance association; it does not transform the pathway into the hypothesized stronger positive mediation. H5 is therefore not supported in its hypothesized direction, even though the existence of conditional indirect effects is supported statistically. From an RBV perspective, the result still illustrates the importance of complementary assets because stronger infrastructure reduces the magnitude of the adverse indirect association. From a Contingency Theory perspective, it shows that the strength of the indirect relationship depends on technological context rather than being uniform across firms.

At the low level of technological infrastructure (M − 1 SD = 3.510), the standardized conditional indirect effect was the most negative (β = −0.023, t = 3.396, p = 0.001). This indicates that the adverse indirect association between CAIS capability and perceived performance through cost efficiency is strongest when technological infrastructure is relatively weak. Consistent with Contingency Theory, the result suggests that contextual technological conditions shape how CAIS capability is associated with internal efficiency and performance (Donaldson, 2001). However, the time-lagged survey evidence does not identify the specific operational causes of this pattern; explanations such as poor integration or inadequate IT skills should therefore be treated as possible mechanisms for future testing rather than as observed causes.

At the mean level of technological infrastructure (M = 4.477), the conditional indirect effect remained negative but was smaller in magnitude (β = −0.018, t = 3.250, p = 0.001) (see **Table 5**). The pattern indicates attenuation of the adverse indirect association as infrastructure improves. This is compatible with RBV arguments that the value of a technological resource depends on complementary resources and capabilities (Barney, 1991), but it should not be interpreted as evidence of a measured transition from early inefficiency to later efficiency because the study did not observe CAIS adoption stages over time.

At the high level of technological infrastructure (M + 1 SD = 5.444), the negative conditional indirect effect was weakest (β = −0.013, t = 2.700, p = 0.007). Thus, stronger technological infrastructure reduces, but does not eliminate or reverse,

the adverse indirect association. This pattern is consistent with the general argument that robust technological environments can improve the fit between information systems and organizational processes (Huang & Vasarhelyi, 2019). The finding therefore supports a contingency interpretation of the model while also showing why the original directional claim for H5 must be rejected: higher infrastructure attenuates a negative mediated relationship rather than strengthening a positive one.

6. Theoretical Contributions

This study contributes to the information-systems and accounting-technology literature by refining the Resource-Based View (RBV) and Contingency Theory in the context of CAIS capability. First, the insignificant direct CAIS-performance path indicates that a technological resource is not necessarily associated with superior perceived performance in isolation. This is consistent with the RBV proposition that resources create value through deployment and complementarity rather than mere possession (Barney, 1991; Makadok, 2001). In this sense, CAIS is better conceptualized as an enabling resource whose performance association depends on accompanying organizational capabilities and technological conditions.

Second, the study adds nuance to capability-based RBV reasoning by showing that the observed indirect association through cost efficiency is significant but negative. Rather than validating a uniformly beneficial resource → capability → performance chain, the findings demonstrate that the sign of an indirect relationship may differ from the sign anticipated theoretically. The contribution is therefore not evidence that CAIS initially disrupts cost structures and later produces efficiency gains; that temporal process was not measured. Instead, the study shows that the relationship between a technological resource and a cost-efficiency capability can be adverse in the observed data and should be interpreted conditionally rather than assumed to be value enhancing.

Third, the study extends Contingency Theory by showing that technological infrastructure conditions both the direct CAIS-performance association and the indirect CAIS-cost efficiency-performance association. The conditional indirect effect becomes less negative as infrastructure increases, indicating that technological context changes the magnitude of the mediated relationship. This provides a more precise contingency contribution than a general claim that infrastructure simply 'strengthens' the mediation: the empirical pattern is attenuation of an adverse pathway.

Finally, integrating RBV and Contingency Theory shows that CAIS-related performance associations depend jointly on resource complementarity and contextual fit. Stronger technological infrastructure is associated with a more favorable direct CAIS-performance slope and with a smaller negative indirect effect through cost efficiency. The combined evidence therefore supports a configuration-based interpretation in which the consequences of CAIS capability vary according to the complementary technological environment, while avoiding a causal claim that the infrastructure necessarily produces later efficiency gains.

7. Practical Implications

The findings suggest that managers should not assume that stronger CAIS capability alone will be associated with higher performance. The direct CAIS-performance path was insignificant, while the indirect path through cost efficiency was negative. Managers should therefore monitor both system use and cost-efficiency indicators when evaluating CAIS investments and should investigate whether implementation, integration, training, process redesign, or other organizational conditions are associated with adverse cost outcomes in their own firms. These mechanisms were not directly measured in the present study, so they are practical diagnostic possibilities rather than demonstrated causes. The positive cost-efficiency-performance path also indicates that cost-management capability remains important when firms seek to realize value from accounting technologies.

Technological infrastructure is a particularly important complementary condition. The positive CAIS × technological-infrastructure interaction indicates that the CAIS-performance slope becomes more favorable as infrastructure rises, while the conditional indirect analysis shows that stronger infrastructure attenuates the negative mediated association through cost efficiency. Managers should therefore evaluate hardware, software, connectivity, security, and integration capacity alongside CAIS capability. Importantly, the results do not show that high infrastructure converts the mediated pathway into a positive effect; rather, they show a smaller adverse indirect association. Policy support for technological readiness may therefore help firms reduce constraints around digital accounting systems, but causal policy claims should await longitudinal or quasi-experimental evidence.

8. Limitations and Suggestions for Future Studies

Several limitations qualify the findings. First, the study used a two-wave, 30-day time-lagged employee survey rather than a single-wave cross-sectional design. This time separation helps reduce same-occasion common method covariance, but it does not establish the timing of CAIS adoption, the duration of system use, or a causal post-implementation adjustment process. Second, all focal constructs were self-reported, and the performance construct represents employee perceptions. Because the current manuscript does not report the number of firms, respondents per firm, firm identifiers, within-firm agreement statistics, or cluster-adjusted estimation, the results should not be interpreted as aggregated firm-level effects. Third, the manuscript must report wave-specific sample sizes, matching procedures, and attrition to make the final N = 638 reproducible. Fourth, the study focuses on Ghanaian manufacturing settings and may not generalize to sectors or countries with different institutional and technological conditions. Finally, cost efficiency is the only mediator and technological infrastructure is modelled as an overall construct, so other mechanisms and specific infrastructure dimensions remain outside the model.

Future research should use longer longitudinal designs that record CAIS adoption dates, implementation stages, and repeated measures of cost efficiency and performance so that claims about adjustment, disruption, recovery, or temporal ordering can be tested directly. Studies seeking firm-level inference should sample multiple respondents per firm, report the number of firms and cluster sizes, establish within-firm agreement and ICCs before aggregation, and use multilevel or cluster-robust estimation where appropriate. Multi-source designs that combine employee perceptions with objective financial and operational performance measures would also strengthen construct validity. Future work could further examine alternative mediators such as decision-making quality, innovation capability, organizational learning, or agility, and disaggregate technological infrastructure into components such as system integration, connectivity, scalability, and cybersecurity to identify which complementary resources most strongly condition CAIS outcomes.

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Author Contributions

Conceptualization, Fredrick Asare-Appiah and Cornelius Adorm-Takyi; methodology, Fredrick Asare-Appiah, Cornelius Adorm-Takyi and Emmanuel Yaw Arhin; software, Fredrick Asare-Appiah; validation, Cornelius Adorm-Takyi, Emmanuel Yaw Arhin and George Tackie; formal analysis, Fredrick Asare-Appiah; investigation, Fredrick Asare-Appiah and Michaella Selasi Genego; resources, Fredrick Asare-Appiah, Edward Marfo-Yiadom and Michaella Selasi Genego; data curation, Fredrick Asare-Appiah and Michaella Selasi Genego; writing—original draft preparation, Fredrick Asare-Appiah; writing—review and editing, Cornelius Adorm-Takyi, Emmanuel Yaw Arhin, George Tackie, Edward Marfo-Yiadom and Michaella Selasi Genego; visualization, Fredrick Asare-Appiah; supervision, Cornelius Adorm-Takyi, George Tackie and Edward Marfo-Yiadom; project administration, Fredrick Asare-Appiah and Cornelius Adorm-Takyi. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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