Analyzing the Impact of Computerized Accounting Information System on Iraqi Construction Companies' Performance

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The construction industry is presently confronted with a myriad of issues which has necessitated the adoption of new technologies like the computerized accounting information system (CAIS) to keep up with the ever-changing construction environment. This research is aimed at empirically investigating the effect of CAIS contexts on construction companies' performance (CCP), and the mediating effect of innovation on the relationship between CAIS and CCP. The data for this study were collected via a survey carried out using structured questionnaires. The questionnaires were self-administered. Non-probability sampling technique was used in this study for a population of 208 projects, and 152 usable responses were collected accounting for a 73% response rate. The collected data were analyzed using descriptive statistics (mean score) and the partial least squares-structural equation modelling (PLS-SEM) method. The result of the study indicates that all the three CAIS contexts had insignificant effect on CCP, while the relationship between CAIS contexts and CCP is fully mediated by innovation. The findings of this study support the deduction that investing in CAIS processes while giving due attention to innovation within the organization improves CCP. This study also makes important recommendations for future research, alongside some practical and theoretical contributions.

Povzetek: Analiziran je vpliv informacijskega sistema na gradbena podjetja v Iraku.

1 Introduction

The construction industry is among the most unpredictable and complex industrial environments. In many developing countries like Iraq, the construction industry contributes in no small measure to the country's economy. In spite of its huge contribution to the economy, the construction industry has consistently shown low degrees of efficiency in comparison with other sectors like the oil and manufacturing industry [1]. Moreover, the construction industry has a negative image for having unacceptable levels of productivity and poor performance resulting from its inefficiencies [2, 3].

It is generally recognized that globalization is of utmost importance when it comes to the issue of performance [4]. In the current global market, the construction industry is been confronted with a myriad of issues, such as economic instability, new emerging markets, rising competition, the influence of technology, characteristically novel and growing demands from clients, customer, and society, and the necessity to engage highly-skilled labor force across all strata of the company [5]. The increasing competition globally influences construction organizations to reorganize their construction efforts towards enhancing productivity, quality, and efficiency [6]. This has resulted in the introduction of novel and improved means of carrying out their activities through the adoption of the Computerized Accounting Information System (CAIS). As Al-Bataineh and Gallagher [1] asserted, productivity is the real basis for adopting CAIS, and the advantage offered by CAIS can result in high performance.

Public projects as well as university projects in Iraq have adopted CAIS [7]. However, regardless of the existence of well-established CAIS, cases of delays in reporting, mis-postings of transactions, and inefficiency in report writing have continued to be a common occurrence [8]. Additionally, there have been reported cases of high volume of paperwork, slow data processing and eventual delays in the production of managements accounts in these projects [9], which could impact negatively on company performance. These were ordinarily not expected to happen since these projects employed CAIS, therefore it has become necessary to undertake an assessment of the efficacy of this system in financial reporting as it relates to their effects on construction company performance in Iraq.

The role of CAIS adoption factors, and innovation to achieve construction companies' performance has been reported in extant literature. With the growing significance of computerizing in the contemporary and global era, construction companies have begun focusing on managing CAIS as an aspect of their organizational performance criteria and an organizational asset as well as a source of wealth [10, 11].

Generally, the degree of adoption of CAIS in Iraq is moderate, and the cause for this moderate adoption level

is because CAIS is currently at an infancy stage in the country [12]. Although CAIS is vital for the construction sector due to its functions in achieving company's performance [13], CAIS practices can be deemed as somewhat new in the Iraqi setting since most organizations are at the early stage of formal CAIS adoption [14]. Given that the level of CAIS practice in construction companies in Iraq is currently in its early adoption stage [15], it is essential to assess the effect of CAIS adoption factors on construction companies' performance in Iraq to enable construction stakeholders have the required understanding of its merits. Thus, the first research question of this research is; what is the effect of CAIS adoption factors (technology context, organization context and environment context) on construction companies' performance?

In order to successfully adopt CAIS, construction companies need to appropriately adjust to the dynamic demands within the construction industry [16]. The key challenge remains in understanding human-related influences where attitudes and preferences are the most difficult factors to change [17]. One probable reason why CAIS adoption in Iraqi construction companies is currently at a moderate level is due to innovation culture which varies between organizations have not been adequately harnessed by Iraqi construction companies [18, 19], however, this has not been empirically tested in past related studies [20]. Moreover, most of organizational innovation research treated innovation as an independent construct impacting companies' performance, or as dependent construct influenced by some antecedent constructs [21, 22]. Also, a strong reliance on human capital suggests that innovation will likely mediate in the link between CAIS adoption factors and CCP [23, 24]. Despite some theoretical agreement regarding the mediation role of innovation [16], to the best of our knowledge, there is a dearth of research that have tested the mediating role of innovation on the relationship between CAIS and construction companies' performance. Hence the need to introduce innovation as a mediator in this study to examine the relationship between CAIS factors and CP. This gives rise to the next research question; does innovation mediate the relationship between CAIS and company's performance?

Hence, this study is aimed at evaluating the effect of CAIS implementation factors such as the technological context, environmental context, and organizational context on construction companies' performance in Iraq while considering innovation as a mediator. The findings of this study have some significance to different stakeholders in the Iraqi construction industry and has wide implications globally. First, the findings would help construction organizations evaluate if the prospects of adoption of CAIS initiatives will be successful or could improve the organization's performance in association with the existing organizational innovation capacity. Secondly, an improved knowledge of the relationship between CAIS and innovation culture may help owners and top management of construction companies enhance organizational competence and make informed choices concerning how these resources will be managed to realize organizational performance targets. Furthermore, an understanding of the inter-relationships between CAIS, innovation culture, firm size and companies' performance can assist managers in implementing CAIS within the current innovation culture type to achieve high company performance.

2 Literature review

2.1 Computerized accounting information system

A CAIS involves software developed to monitor an entire company's accounting dealings, with the objective of generating monetary output for monthly reports, yearly financial statements, tax return data and other report configurations used to examine a company's operations, its proficiency and cost-effectiveness [25]. Whereas, Abdulle, et al. [26] describes CAIS to be an account information system which means computer systems used for writing and handling business information, alongside generating reports to aid management in planning and controlling business activities. While a computerized accounting software deals with the software that employed in processing the work of accounting information systems which are created with the intent of making the decision-making process seamless. CAIS is considered as a process that assists organizations to create, capture, organize, store, spread and use valuable information and skills required for actions such as problem solving, dynamic learning, strategic planning and decision making, to accomplish constructions companies' performance goals [27]. The definition offered by Lanlan, et al. [25] is adopted as the working definition in this research. CAIS has three contexts which are the technological context, organizational context, and the environmental context.

2.2 Relationship between CAIS contexts and construction company's performance

The context of CAIS implementation factors and construction companies' performance relationship has been subjected to comprehensive empirical examination. This cumulative work introduces a somewhat clear picture [28, 29], with the efforts of previous works that revealed a consistent result. Previous studies revealed that the higher usage of CAIS implementation factors lead to higher companies' performance [30-33]. Specifically, earlier research has shown a positive relationship between CAIS technology context on companies' performance. For examples, evidence from [16] supports the positive link between Perceived benefit of CAIS financial statement and companies' performance.

Also, it is obvious from the result obtained by [20] who admitted the positive relationship between reports preparation decision making and companies' performance. Same findings were found the relationship between organizational context and companies' performance. For example, organizational context represented by financial

capability was found to positively influence companies 'performance, Other previous studies were in the same result in investigating the relation between organizational context represented by technology capability and companies' performance. For example, a study done by Katsaros et al., (2020) showed that there exists a positive relationship between technology capability and companies' performance. Similarly, some studies documented a positive relationship between external pressure and companies' performance as mentioned by Majid, et al. [34].

From the perspective of the present study, it is essential matter to recognize the importance and the quality of CAIS implementation factors and their elements in introducing important strategic information which impossible to be gathered via using the traditional AIS. Such perspectives have participated in motiving the present study to suggest the hypotheses as shown below.

H1: There is a positive and significant relationship between CAIS implementation factors and construction companies' performance.

H1a: There is a positive and significant relationship between technology context of CAIS and constructions companies' performance

H1b: There is a positive and significant relationship between organizational context of CAIS and constructions companies' performance.

H1c: There is a positive and significant relationship between environmental context and constructions companies' performance.

2.3 Nexus between innovation, CAIS factors, and construction company's performance

This current research seeks to explore the adoption of the direct relationship between CAIS implementation and companies' performance, and to reveal whether the direct relationship is fully mediated by the innovation culture. Whereas previous studies reviewed have emphasized the function of innovation in improving firm performance, the current research tries to test the ability of organization culture in achieving successful integration of CAIS implementation into companies' performance. Growingly, companies introduce or modify new products, policies, and procedures to treat and deal with stakeholder, worries; however, such responses might be considered as unimportant and insufficient to sustainably address business and social challenges [35-38]. Critics in the literature review argue that companies need to be extremely considered CAIS implementation to be linked to companies performance [39, 40] to the extent that CAIS is no longer considered optional in its link to the companies' performance. In this path, CAIS becomes an essential system that organizations strengthen their character and reputations, earn a competitive advantage [41, 42].

Nevertheless, CAIS also might cost stakeholders' money and confuses the managers from their duties and also responsibilities [43]. Such conflicting viewpoints have largely led to a several empirical studies in previous time [44, 45]. Yet, several works have tested the consequences or outcome of CAIS [46-48], or have constraint on the ethical matters of CAIS see, [49, 50] without focusing on its implications. Previous works assure that CAIS can be an important thing of companies' business performance e.g. [51, 52]. and the suitable alignment between performance and CAIS can assist companies enhance their long-term performance and value and make links with various groups of stakeholders to be improved [53]. Nevertheless, little awareness and attention are paid by the researchers to test the empirical relationship between the company's performance and the adoption of CAIS in the organizational context. The current research aims at filling this gap, revealing a substantial missing connection between companies' performance as an essential predictor of CAIS and the tendency of companies to adopt and engage with CAIS. Nevertheless, little awareness and attention are paid by the researchers to test the empirical relationship between the company's performance and the adoption of CAIS in the organizational context.

Taking a cue from the existing studies in the field, the current research argues that elements of CAIS implementation can exert an indirect impact on the companies' performance through innovation. In this regard, [52] found that companies pay more attention to innovation when there is a higher percentage of (financial readiness). Similarly, [54] show that there is a positive relationship between (organization readiness) and innovation in Jourdan companies. Tarba, et al. [55] report that (Return on Investment (ROI) linked positively with innovation. In Iraqi stock market, the findings of a study done by [56] show a positive link between external pressure and innovation.

Besides, some studies' and based on Agency theory, their findings were mixed. J Barthélemy (2011) find there is no significant relationship between decision making and innovation. However, a study by [53] show a positively significant in some countries and negatively significant in other countries. Based on organizational culture theory that suggested that the majority of management researchers accept that innovation increases construction performance by controlling organizational members' response repertoires in their working environments [57, 58]. Strong corporate cultures improve consistency in the behavior of employees in any organization. In recent times, the relationship between innovation and economic development has been reiterated in the research outputs of scholars such as Fukuyama (1995) and Harrison and Huntington (2000). The majority of these scholars have shown that innovation is a hindrance to economic growth and but not given any attention to the possible positive influence that innovation has on economic activities, even in poor countries. In this context, [53] found that organizational context is an important issue to determine innovation with regards to its impact on companies' performance. From the earlier discussions, the following research hypotheses are generated:

H2: Innovation mediates the relationship between CAIS implementation factors and constructions companies' performance.

H2a: Innovation mediates the relationship between technology context of CAIS and CCP.

H2b: The relationship between organizational context of CAIS and CCP is mediated by innovation.

H2c: The relationship between environmental context of CAIS and CCP is mediated by innovation.

The study's conceptual model illustrating the hypothesized relationships is presented in [59].

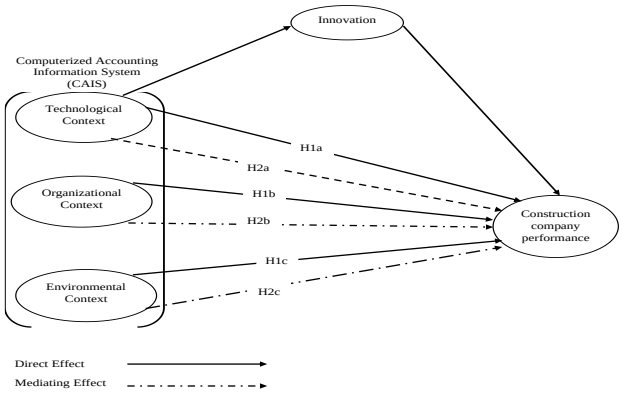

Figure 1. Conceptual model showing the hypothesised relationships

A summary of related works and their respective findings are presented in .

Table 1.

Table 1. Summary of related studies and their findings

Previous studies	Results
Asian, et al. [33]	Higher usage of CAIS implementation factors lead to higher companies' performance
Minaee, et al. [16]	Positive link between perceived benefit of CAIS financial statement and companies' performance.
Sahibzada, et al. [20]	Positive relationship between reports preparation decision making and companies' performance
Al-Bataineh and Gallagher [1]	The construction industry has a low degree of efficiency when compared to other industries.
Röck, et al. [3]	The construction industry has unacceptable levels of productivity and poor performance due to its inefficiencies
Majid, et al. [34]	There exists a positive relationship between technology capability and companies' performance.
Aljanabi [60]	Suitable alignment between performance and CAIS can assist companies enhance their long-term performance and value
Gangi, et al. [53]	Organizational context is an important issue to determine innovation with regards to its impact on companies' performance
Abusweilem and Abualoush [54]	There is a positive relationship between (organization readiness) and innovation in Jourdan companies
Alabdullah, et al. [56]	Positive link between external pressure and innovation
Pedras, et al. [57]	Culture increases construction performance by controlling organizational members' response repertoires in their working environments
Suarez and Montes [58]	Show a positively significant in some countries and negatively significant in other countries.

3 Methodology

3.1 Sample and data collection procedure

The non-probability sampling method was used for data collection from construction companies in Iraq. The sample of this research was taken from the directory of the Iraqi ministry of higher education and scientific research for contracting companies operating in the universities of southern Iraq. Contracting companies operating in the southern Iraq were chosen for this research because they are the most CAIS adopters in Iraq [61].

The ministry of higher education and scientific research's guide is published by the Iraqi ministry of planning in collaboration with the Iraqi academics' association. This directory gives a list of construction companies in Iraq. The guide is an official state publication. Information related to the construction companies' background, address, name of the chief executive officer (CEOs), year it was incorporated, alongside other useful information about the companies are contained in the database of the directory. Additionally, the guide offers information related to the annual work carried out, the number of employees, buildings completed and similar works, and the quality standards achieved.

The survey respondents were the managers, CEO or Senior Manager of contracting companies operating in the universities of Southern Iraq. This research focused only on large and medium contracting companies because the literature has revealed that large and medium organizations are more likely to adopt CAIS in contrast to smaller construction companies (Faccia et al., 2019). After identifying the construction companies eligible to take part in the survey, they were contacted via emails and phone calls, describing the aim of the research, and inviting them to participate. After obtaining the informed consent from the respondents, data collection started from June to November 2021, using a structured questionnaire.

Reminders were sent at intervals asking respondents to fill the questionnaires. The gamma exponential approach was adopted in establishing the sample size for this study Kock and Hadaya [62]. The gamma exponential method recommends a minimum sample of 146 at a power of 0.8 and the lowest absolute significant path coefficient of 0.197. In total, 208 survey questionnaires were administered, and 152 useable questionnaires were received, signifying an 73% response rate, thus satisfying the minimum sample size.

3.2 Questionnaire design and development

The constructs of this research were adapted from prior research and measured using a Likert scale with 5-points. Specifically, the three contexts of computerized accounting information system (CAIS) namely the technological context, organizational context, and the environmental contexts were adapted from Nguyen and Nguyen [63]. While the items measuring companies' performance were measured using 7 indicators measured as second order constructs on a 5-point Likert scale adapted from Ullah, et al. [64]. Specifics of the study constructs and the references from which they were adapted are presented in [65].

To ensure that the study's constructs are reliable, pilot test was conducted. The pilot tests helped in determining how easily the respondents understood the questionnaire items and the amount of time required to fill in their responses. The possibility of vagueness in the questionnaire questions was minimized by the pilot test conducted, thus guaranteeing its reliability. TC, OC, EC, and CP constructs has composite reliability estimates of 0.867, 0.825, 0.914, and 0.781, respectively. This shows that each of the constructs were highly reliable.

Table 2. Constructs measured and their respective sources

Constructs	Sources
Technological context (TC)	Nguyen and Nguyen [63]
Adopting CAIS enhances the efficiency to which my company records its financial dealings (TC1)	
The efficient preparation of reports and financial statements is one of the areas my company has benefitted from CAIS (TC2)	
The amount of time required to record financial transaction has been shortened significantly since the introduction of CAIS (TC3)	
The precision in the preparation of financial statements has increased significantly due to CAIS adoption (TC4)	
Decision making in my organization has improved significantly given the quality of information provided by the CAIS (TC5)	
Financial records are made readily available for the purpose of decision making by CAIS (TC6).	
My organization is availed the opportunity of having accurate and up to date information as at when needed by decision makers through the CAIS (TC7).	
Organizational context	Nguyen and Nguyen [63]
Financial resources are within my organizations disposal for the adoption of CAIS (OC1).	
My organization has budgeted funds for staff training programs as well as budgets aimed at increasing proficiency in adopting CAIS technologies (OC2).	
Budget for the regular upgrade of existing versions of CAIS is usually set aside (OC3).	
Our organization has the required hardware and software to fully adopt CAIS (OC4).	
The required skilled manpower is available within our organization for CAIS adoption (OC5).	
There are motivational programs within our organization that inspire staff to learn and make use of CAIS (OC6).	
Environmental context (EC)	Nguyen and Nguyen [63]
Our customers had an influence on our adoption of CAIS (EC1).	
Our organization's decision to adopt CAIS is influenced by our suppliers (EC2).	
Competition within the construction industry has made my organization strive to adopt CAIS (EC3).	
The pressure from government agencies has influenced our decision to adopt CAIS (EC4).	
Construction Company Performance (CP)	Ullah, et al. [64]
Performance factors related to owner resources	
Low level of experience of the owner (OR1)	
Difficulty in accessing the site (OR2)	
Mismatch between the project manager and job function (OR3)	
Level of client/owner interference is excessive (OR4)	
Owner orientation toward reducing cost (OR5)	

Dispute between project participants and owner exceeds tolerable limits (OR6)
Payments are not made as at when due (OR7)
Performance factors related to contractor
Inadequate consultant experiences (PRC1)
Incorrect designs and/or drawings (PRC2)
Inadequate specifications in the drawings (PRC3)
Weak response to alterations and variations (PRC4)
Lack of consultant monitoring in the course of project execution (PRC5)
Performance factors related to cost
Poor budget estimation (CR1)
Inappropriate financial analysis (CR2)
Bad cash flow of project (CR3)
Dearth of frequent budget update (CR4)
Absence of organization cash flow (CR5)
Constant increase in price of materials (CR6)
High cost of providing security (CR7)
Undue financial claims (CR8)
Small market stakes of company (CR9)
Too much rework (CR10)
Excessive rate of material waste generation (CR11)
Performance factors related to time
Poor scheduling plan (TR1)
High schedule overrun (TR2)
Delays in making critical decisions (TR3)
Long and bad routine (TR4)
Too many holidays (TR5)
Bad security conditions (TR6)
Excessive time spent on remedial and corrective actions (TR7)
Performance factors associated with quality
No interest of quality (QR1)
Lack of compliance with specification (QR2)
Inadequate quality control, assurance and monitoring mechanisms (QR3)
Lack of personnel with the required skill sets (QR4)
Absence of quality training programs (QR5)
Too much variation orders (QR6)
No interest of quality (QR7)
Performance factors related to internal resource
Large size of project (INTR1)
Project complexity (INTR2)
Low profit rate (INTR3)
Poor site management (INTR4)
Bad communication between project parties (INTR5)
Cultural and educational differences (INTR6)
Low motivation (INTR7)
Health and safety rules are not applied (INTR8)
Accident rate is high (INTR9)
Performance factors related to external resources
High level of competition (ER1)
Excessive legal constraints (ER2)
Inconsistencies in government laws and regulations (ER3)
Political uncertainty (ER4)
Corruption (ER5)
Number of been executed concurrently (ER6)
Location of project is remote (ER7)
Inclement weather conditions (ER8)
Unstable economic climate (ER9)

3.3 Methods of data analysis

The partial least squares structural equation modeling (PLS-SEM) technique was employed to analyze the data for this research using WarpPLS version 8 software. PLS-SEM method was adopted since it has the capability of testing theoretical links between variables [66]. Furthermore, the data collected for this study were asymmetrical in distribution, a pre-condition for adopting the PLS-SEM technique [67].

The "factor-based PLS algorithm" was used to assess the measurement model, while the "stable 3" method was adopted in estimating the P-values [68]. The structural model was evaluated making use of the warp 3 option. This produces values of the path coefficients and p-values considering non-linear relationships [69]. The selection of the factor-based PLS is due to its ability to generate values of both true composites and factors taking into account the measurement error [70].

In the mediator analysis, the transmittal approach proposed by Rungtusanatham, et al. [71] was used. This requires concentrating only on the mediating relationship. Additionally, Hayes and Rockwood [72] opined that the indirect effect should be the area of focus in the analysis of a mediator. As such, the study's hypothesis was developed as; "The relationship between computerized accounting information system (CAIS) and company performance is fully mediated by innovation", without

needing to hypothesize relationships involving the impact of CAIS on innovation and the effect of innovation on company performance as suggested by Rungtusanatham, et al. [71]. Similarly, Preacher and Hayes [73] suggests taking into account solely the indirect effect in mediation analysis. This is conducted using the stable 3 function in WarpPLS version 8 software.

4 Results

4.1 Respondents' demographics

One hundred and fifty respondents participated in this study. From of 153 firm representatives that took part in the survey, all their years of working experience varied from less than 5 to more than 20 years of working experience. A total of 7.8% had experience in the construction field for 5 and less than 10 years while 62.7 % of the respondents had experience of 10 and less than 15 years. However, 29.4% of the respondents had working experience of 15 and less than 20 years. Hence, it can be said that majority of the respondents have long working experience in the field with cumulative percentage of 92.7% of more than 10 years of experience.

The results obtained with respect to the respondents' highest educational qualification showed that 62.8% of the respondents had at least a bachelor's degree, with 36.2% of the respondents also holding a master's degree, while 1.1% had doctorate degree as their highest academic qualifications.

The results in the table show that 73 (47.7%) of the respondents are in accounting filed followed by 32 (34.0%) in Business Administration, Finance, and banking 16 (10.5%). A total of 12 of the respondents stated that they belong to other field.

4.2 Measurement model analysis

The reflective measurement model evaluation focuses on reliability analysis, convergent validity assessment (indicator reliability/outer loading and average variance extracted), and discriminant validity. The outcome of the analysis of the reflective measurement model is presented inRhemtulla, et al. [74].

Table 3. Measurement model evaluation

Construct	Items	Loadings	AVE	CR
Technological context	TC1	0.665	0.782	0.867
	TC2	0.665		
	TC3	0.559		
	TC4	0.773		
	TC5	0.928		
	TC6	0.740		
	TC7	0.949		
Organizational context	OC1	0.831	0.619	0.825
	OC2	0.889		
	OC3	0.743		
	OC4	0.870		
	OC5	0.776		
	OC6	0.633		
	OC7	0.551		
Environmental Context	EC1	0.633	0.842	0.914
	EC2	0.769		
	EC3	0.858		
	EC4	0.646		
Innovation	IN1	0.686	0.577	0.794
	IN2	0.543		
	IN3	0.748		
	IN4	0.522		
	IN5	0.792		
	IN6	0.672		
	IN7	0.750		
	IN8	0.807		
Owners' Resources	OR1	0.719	0.615	0.848
	OR2	0.826		
	OR3	0.747		
	OR4	0.800		
	OR5	0.770		
	OR6	0.807		
	OR7	0.654		
Performance factors related to Contractor	PRC1	0.655	0.592	0.761
	PRC2	0.599		
	PRC3	0.693		
	PRC4	0.665		
	PRC5	0.557		
	PRC6	0.690		
Performance factors related to Cost resources	CR1	0.641	0.871	0.781
	CR2	0.503		
	CR3	0.591		
	CR4	0.710		
	CR5	0.632		
	CR6	0.829		
	CR7	0.721		
	CR8	0.686		
	CR9	0.568		
	CR10	0.883		
	CR11	0.762		
Performance factors related to time resources	TR1	0.790	0.584	0.872
	TR2	0.703		
	TR3	0.703		
	TR4	0.686		
	TR5	0.711		
	TR6	0.562		
	TR7	0.586		
Performance factors related to Quality	QR1	0.631	0.787	0.718
	QR2	0.808		
	QR3	0.807		
	QR4	0.813		
	QR5	0.750		
	QR6	0.635		
Performance factors related to internal resources	INTR1	0.636	0.698	0.875
	INTR2	0.831		
	INTR3	0.726		
	INTR4	0.857		
	INTR5	0.917		
	INTR6	0.818		
	INTR7	0.928		
	INTR8	0.505		
	INTR9	0.063		
Performance factors related to external resources	ER1	0.880	0.571	0.721

ER2	0.846
ER3	0.687
ER4	0.787
ER5	0.805
ER6	0.859
ER7	0.843
ER8	0.741
ER9	0.841
ER10	0.838

The reliability of the constructs was calculated using the composite reliability (CR) coefficients. The results for the composite reliability (CR) calculated for each of the latent variables (constructs) as presented in[75]. are 0.867, 0.825, 0.914, 0.794, 0.848, 0.761, 0.781, 0.872, 0.718, 0.875, and 0.721 which were all greater than the 0.70 minimum value suggested by Hair, et al. [76]. Therefore, all the constructs in this study have sufficient composite reliability.

For convergent validity to be actualized, every single construct must account for a minimum of 50% of the allotted indicators' variance (AVE ≥0.50) [76]. As shown in [77], the Average Variance Extracted estimates for all the study's constructs are more than 0.5, thus all the constructs meet the threshold value for convergent validity. Discriminant validity can be defined as the extent to which the constructs been analyzed are actually different from each other [78]. In PLS-SEM analysis, there are three criteria for assessing discriminant validity. These are the cross loading criterion, and either of the Fornell and Larcker [79] measures, or the Heterotrait-Monotrait ratio of correlations (HTMT).

The results of the Fornell and Larcker criterion are shown in [80]. It shows that the constructs in the model exhibit adequate or suitable discriminant validity [79], where the square root of AVE (diagonal) is more than the correlations (off-diagonal) for all reflective constructs.

Table 4. Discriminant Validity using Fornell and Lacker Criterion

	TC	OC	EC	IN	CP
TC	**0.782**				
OC	0.347	**0.619**			
EC	0.359	0.475	**0.842**		
IN	0.524	0.392	0.433	**0.577**	
CP	0.234	0.499	0.481	0.215	**0.615**

Note: Diagonals signify the square root of the AVE and the off-diagonals denote the correlations.

Employing the cross loading to evaluate discriminant validity, it is required that every indicator load high on its own constructs but low on other constructs [81]. As indicated on Appendix I, all the indicators load high on their respective constructs but low on other constructs. This shows that discriminant validity is attained because the constructs are distinct from each other.

4.3 Structural model analysis

In the evaluation of the structural model using PLS-SEM, six tests are required [82]. These include; evaluation of structural model for collinearity issues, evaluation of the significance and relevance of model relationships, assessment of the level of R^2, assessment of the effect size (f^2), evaluation of predictive relevance Q^2, evaluation of Q^2 effect size.

Lateral collinearity is addressed in this study. This is important because lateral collinearity could lead to misleading findings due to its characteristics of reducing strong casual effect in a model [83].Variance inflation factor (VIF) is used in determining the level of collinearity in the model. The VIFs of all the constructs in this research are presented in[74]. All the VIFs values for the variables are less than 3.3, hence there is no collinearity issue among the study's constructs [84].

Table 5. Collinearity Assessment

Constructs	VIF
Technological context	1.128
Organizational context	1.288
Environmental Context	1.388
Innovation	1.846
Owner's resources	2.167
Performance factor related to contractor	2.122
Performance factor related to cost resources	1.961
Performance factors related to time resources	2.099
Performance factors related to Quality	1.489
Performance factors related to internal resources	1.469
Performance factors related to external resources	2.214

An R^2 value of 0.94 was obtained in this research[85], signifying that the model has substantial predictive accuracy [86]. Furthermore, the predictive relevance Q^2 value of 0.911 was obtained which implies that the exogenous constructs have predictive relevance for the dependent variable (company performance), since its value is substantially greater than zero [68].

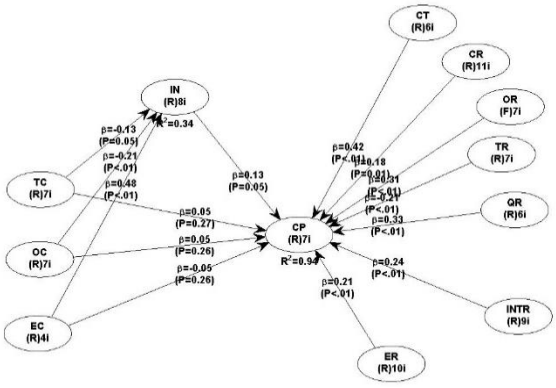

Figure 2: Structural model results

4.4 Hypothesis testing

Suprihartini, et al. [87] shows the various relationships between the endogenous and exogenous latent variables with their path coefficients and p-values. The outcome of the hypotheses testing are shown in [88]. The paths TC → CP, OC → CP, and EC → CP are all not significant (P > 0.05) which does not support H1, H2, and H3 respectively. This indicates that technological context (TC) does not have a significant effect on company performance (p=0.274, β=0.274) (H1), while organizational context (p=0.260, β=0.052) (H2) and environmental context (p=0.256, β=0.053) (H3) also had no significant effect on company performance. However, the mediating effect of innovation on the relationship

between technological context and company performance, the mediating effect of innovation on the relationship between organizational context and company performance, and the mediating effect of innovation on the relationship between environmental context and company performance are all statistically significant supporting H4, H5 and H6.

Cohen [89] interpretation of effect size is adopted in this study's interpretation of effect size (f^2). From Nguyen, et al. [90]it is observed that the effect size (f^2) of the mediating effect of innovation on the relationship between technological context and company performance (TC → IN→CP) is large (>0.35), while the effect sizes of the mediating effect of innovation on the relationship between organizational context and company performance (OC→ IN→CP), and that of mediating effect of innovation on the relationship between environmental context and company performance (EC→ IN→CP) are both medium (greater than 0.15 but less than 0.35). Similarly, the effect of environmental context on innovation (EC → IN) also has a medium effect size (greater than 0.15 but less than 0.35). On the other hand, the other relationships presented in [91] have effect sizes ranging from small (greater than 0.02 but less than 0.15) to very small ($f^2 < 0.02$).

Table 6. Results of hypotheses testing

Hypotheses	Construct Relations	P-values	Path Coefficient (β)	Effect Size (f^2)	T-ratio	Notes	Decision
	TC → IN	0.045	0.134	0.006	1.701	Significant	-
	IN → CP	0.049	0.130	0.026	1.713	Significant	-
	OC→ IN	< 0.004	0.208	0.026	2.689	Significant	-
	EC → IN	<0.001	0.458	0.371	6.670	Significant	-
H1a	TC → CP	0.274	0.048	0.014	0.602	Not significant	Not supported
H1b	OC → CP	0.260	0.052	0.059	0.646	Not Significant	Not supported
H1c	EC → CP	0.256	0.053	0.152	0.658	Not Significant	Not supported
H2a	TC → IN→CP	< 0.001	0.441	0.004	6.724	Significant	Supported
H2b	OC→ IN→CP	0.037	0.331	0.251	3.491	Significant	Supported
H2c	EC→ IN→CP	<0.001	0.41	0.176	5.573	Significant	Supported

Note: p < 0.05**, p < 0.01*** (2-tailed)

In determining the nature of the mediating effect, the Variance Accounted For (VAF) approach is adopted. A VAF estimate greater than 80% reveals that there is full mediation while values less than 20% signifies no mediation. However, VAF values between 20% and 80% is suggestive of partial mediation, and estimates larger than 80% signifies full mediation [92]. In this research, a VAF value of 87% was gotten for the TC → IN→CP relationship, a VAF value of 83.9% was obtained for the OC→ IN→CP relationship, while a VAF value of 88.2% was obtained for the EC→ IN→CP relationship which are all indicative of full mediation.

5 Discussion

This study is to determine the effect of CAIS implementation factors on construction companies' performance, and the mediating role of innovation on the relationship between CAIS factors and construction companies' performance in the Iraqi construction industry. Technological context, organizational context, and environmental context were considered as CAIS factors for this research. While company performance was measured as a second order construct comprising of owner's resources, performance factor linked to contractor, performance factors related to cost resources, performance factors related to time resources, performance factors related to quality, performance factors related to internal resources, and performance factors related to external resources. The findings of this research show that the hypothesized positive effects of technological context, organizational context, and environmental context on construction companies' performance were not statistically significant which does not support the study's hypotheses (H1a, H1b, H1c). However, the hypothesized mediating effect of innovation on the relationship between technological context and companies' performance (H2a), mediating effect of innovation on the relationship between organizational context and companies' performance (H2b), and the mediating effect of innovation on the relationship between environmental context and companies' performance (H2c) were all statistically significant, thus supporting the 4th, 5th, and 6th hypotheses respectively.

The findings of this study regarding the effect of technology context on construction company performance (H1a) is not significant and does not support the hypothesis. The finding of this study is contrary to that of Adamyk, et al. [93]. Adamyk, et al. [93] opined that technology context has the potential of providing benefits which could improve construction companies' performance stemming from other deliverables, such as greater innovative and competitive advantages of the adopting company [94]. Similarly, this current study's finding is conflicting with those of Mærøe, et al. [95] and Habiba, et al. [96] who reported a positive significant effect of technology context on construction company performance. However, they attributed their findings to the fact that technology provides many advantages to the company such as uncomplicated process of accounting information system, and a seamless management accounting system.

The likely reason for the no significant effect of technology context on company performance obtained in this study could be due to other factors such as the ease to which the adopted technologies can be put to use as opined by Raguseo [97]. Also, although the technology context of CAIS has been projected by previous studies such as Sun, et al. [98], Tu [99], Mærøe, et al. [95] and Habiba, et al. [96] to lead to better construction companies' performance, the lack of fit or inadequate fit between an organizational goal and capabilities could result in a negative, or a non-significant effect [100], which gives credence to the non-significant results obtained in this regard in the current study.

Another likely reason for the non-significant relationship between the technology context and company performance obtained in this study could be the lack of or inadequate innovative capacity of the construction companies within the study area [60, 101]. Inadequate or

lack of innovation in the use of new technologies could lead to a situation whereby an organization such as a construction company may not get the full benefits associated with the technologies adopted [102]. This is supported by the perception that construction companies are very slow adopters of technologies, and slow in embracing innovation [103]. All these could be the reason for the non-significant effect obtained for the technology context – company performance relationship.

The result obtained for the effect of organizational context on construction company performance (H1b) show that there is no significant effect between both constructs which does not support the hypothesized relationship. Previous studies such as Ganyam and Ivungu [104] and Abdelraheem, et al. [105] had findings which are contrary to that obtained in this study. Specifically, Ganyam and Ivungu [104] and Abdelraheem, et al. [105] reported that organizational context has a positive significant effect on company performance and further opined that organizational context is the most important factor determining construction company performance.

Additionally, Maroufkhani, et al. [106] and Lubis [107] opined that companies' financial capability which is an integral part of the organizational context of CAIS adoption is a vital resource for adopting new technologies such as CAIS, and leads to company performance, thereby contradicting the findings in this study. Also, the present study's findings differ from that of Fordham and Hamilton [108] who opined that an organization's experience in utilizing computerized systems appropriately within the construction company is the main criteria for achieving company performance. In a similar vein, the findings of this study are also at variance with that of Palomäki [109] who views the expertise of construction companies in leveraging and harnessing intangible assets to be a major trigger for construction company performance.

However, the likely reasons for the non-significant results obtained in this regard could be the fact that although organizational context could have some positive effect on company performance, its effect might not be visible enough due to the relative newness of this technology in the study area. Additionally, organizational resources required to cope with the complexities of CAIS may be in the technology acceptance and infancy stage, hence their effect on construction company performance will not be very obvious at this stage [110]. Therefore, it is pertinent to note that more capabilities are required to be developed and mastered before the effect of organizational factors inherent in CAIS adoption can have a positive significant effect on construction company performance.

In this study, the relationship between external factors and construction companies' performance (H1c) was observed to be non-significant ($P > 0.05$, $\beta = 0.053$), which is contrary to the positive significant relationship hypothesized. The non-significant relationship between environmental context of CAIS and construction company performance obtained in this study contradicts the findings of Li and Wang [111] and Kamble, et al. [112] who opined that external demands from the environment which the construction company operates has a positive effect on their overall performance. Likewise, studies by Muhammad, et al. [113] and Dieste, et al. [114] observed a positive significant relationship between environmental context of CAIS in the form of environmental pressure on construction companies' performance.

Muhammad, et al. [113] and Dieste, et al. [114] attributed their findings to the fact that external environmental pressures from the government, as well as other agencies of government for the adoption of CAIS gives rise to some sort of competition between construction companies. Therefore, construction companies would naturally want to outdo their contemporaries and gain competitive advantage [115], which will translate into greater construction company performance.

However, the non-significant relationship obtained in this study for the relationship between the environmental context of CAIS and company performance can be attributed to low or seemingly no pressures from regulatory agencies, or a lack of competition from other construction organizations on the adoption of CAIS in the study area. Also, another likely reason for the non-significant relationship could be that the demand for CAIS adoption from other relevant stakeholders such as customers and suppliers is minimal, or these stakeholders have not made its adoption a prerequisite for continued business with the construction companies. Additionally, since Iraq is a developing country, and the adoption of the CAIS technology is not very pronounced [116], its effect on construction company performance may have been downplayed by the respondents since they are not sufficiently put under pressure from external stakeholders to adopt it. This lends support for the non-significant effect obtained in this regard.

The result of the mediating effect of innovation on the relationship between technological context of CAIS and construction company performance (H2a) shows that there exists a significant positive mediating effect ($P < 0.001$, $\beta = 0.441$), which supports the study's hypothesis. Also, the type of mediation is full mediation since the direct effect of technological context of CAIS on company performance is not significant, but the indirect (mediating) relationship is statistically significant. This imply that the technological context of CAIS can only lead to company performance through innovation. This finding goes to show the important role of innovation in achieving construction company performance while adopting technologies such as CAIS.

The findings of this study corroborate that of Clohessy and Acton [117] who opined that organizations must be innovative in the use of technology for them to obtain the gains of adopting new technologies such as CAIS. Also, Ritz, et al. [118] opined that technology adoption is itself can be detrimental to company performance if employees are not innovative in its use. Therefore, construction companies who are technologically oriented through the use of CAIS would invariably engage in more innovative practices which makes them more competitive in the construction sector, thereby improving their performance. Similarly, the findings of this study are similar with that of Ahmad, et al.

[119] and Bodlaj, et al. [120]. Ahmad, et al. [119] and Bodlaj, et al. [120] opined that although many construction companies within the same geographical location adopt similar technologies, the companies with greater innovative capacity tend to achieve greater company performance with regards to more economic gains. Additionally, Yao, et al. [121] view innovation as the link that guarantees that technological advancements lead to company performance, thus lending support to this study's hypothesis (H2a). This imply that innovation mediates the relationship between technological context and company performance. The role of technology management in firms' innovation was emphasized by Mardani, et al. [122]. Mardani, et al. [122] views technology management as a tool for enhancing the innovative capacity of firms, which in turn improves the company's competitive advantage and company performance.

On the contrary, studies such as Cai and Li [123] and Khalil, et al. [124] show that technological innovativeness in CAIS adoption its own may not lead to company performance. They hinged their argument on the fact companies need to have matured to certain levels to be able to handle new technologies and the innovations that come along with it. In other words, they proposed a partial mediating effect of innovation on the technology – company performance relationship, stressing the fact that company performance while adopting CAIS technologies is contingent on other factors alongside innovation, and not solely on innovation. This conflicts with the full mediating effect findings obtained in this study.

The result obtained for the mediating effect of innovation on the relationship between organizational factors and construction companies' performance (H2b) shows that there exists a full mediating effect, which supports the study's hypothesis. The full mediating effect implies that organizational factors can only lead to construction company performance through innovation. Organizational factors involves both human and material resources available within the organization [125]. It also includes intellectual capital of its employees. It is also worth stating that the capability of a construction company to be innovative is largely dependent on the internal resources available within it. Therefore, it can be said that construction companies having the requisite resources required to adopt CAIS technologies would most likely be able to imbibe innovative approaches which will lead to better company performance.

The findings of this research corroborates that of Falahat, et al. [126] who opined that innovation is an outcome of organizational capabilities, and that innovation resulting from organizational resources contributes to the overall company performance. Similarly, the full mediating results obtained in this study are in tandem with those obtained by Salunke, et al. [127]. Salunke, et al. [127] opined that the knowledge base of an organization which is an aspect of the organizational context of CAIS is a pre-requisite for innovation, and that innovation is a panacea for construction company performance. Since it is already a given that construction companies' capabilities dictates their ability to be innovative, Rajapathirana and Hui [128] states that innovation facilitates a firms urge to introduce new products and adopt new systems, thereby making innovation an important factor for feeding competition which leads to improved company performance.

In addition to the foregoing, Saridakis, et al. [129] found that a firm's capacity to adopt radical innovations (such as CAIS) will improve its competitive position by presenting new qualities and distinctive gains for its customers which will result in company performance, thus corroborating the findings of full mediating effect obtained in this research. Additionally, the findings of this study are similar to that of Jia, et al. [130] who found that novel innovation contributes to a company's innovative capability, competitive advantages, and company's performance.

The sixth hypothesis of this research (H2c) states that innovation mediates the relationship between environmental factors and construction companies' performance. The findings of this study show that innovation fully mediates the relationship between environmental factors and construction companies' performance which supports the studies' hypothesis (H2c). As stated earlier by Cao and Chen [131], environmental context/factors of CAIS includes external pressures in the form of competitive pressures from other players in the construction industry. The results of this research are in tandem with those of Ferreira, et al. [132] and Ancarani, et al. [133] who found that when competition increases due to external pressures, the likelihood of innovation adoption also increases which leads to an increase in construction company performance.

Furthermore, previous studies such as Wang, et al. [134] and Guo, et al. [135] also alluded to the mediating role of innovation on the relationship between the environmental context of CAIS and company performance, which is in accordance with the outcomes of this present research. Precisely, Wang, et al. [134] opined that due to environmental factors through pressure from the government and other stakeholders, the companies develop intellectual and structural capital which fast tracks innovation speed and improves firms' performance. Also, Guo, et al. [135] opined that innovation performs a mediating role in the external environment – company performance relationship which lends support to the findings of this study.

6 Conclusion

The first research objective has been met with the results showing that there is no significant relationship between CAIS processes and construction company performance. CAIS process comprise of free dimensions of CAIS cycle, technology context, organizational context, and environment context. Organizations that are aware of their innovation capacity can plan strategically and make decisions on the type of CAIS initiatives to employ. This is very important since organizations make significant investments in terms of money, time, and personnel to embark on CAIS initiatives. The findings showed that the leaders of the company need to consider

their capacity to be innovative in the strategic planning of CAIS initiatives. If the leaders understand the innovative capacity of their company, they can consider the degree-of-fit required between their organization's CAIS initiatives and their innovation ability.

The second research objective has been met by the results showing that innovation fully mediates the relationship between CAIS processes and CCP. Research that examines the role of innovation in CAIS programs is important to help organizations understand how to improve their organizations' performance, as innovation has been proven to be the enabler for the success of CAIS initiatives. In this research, the empirical investigation on the mediating role of innovation on the relationship between CAIS processes, and construction companies' performance, has given a positive full mediation result. In other words, construction companies must be innovative to guarantee company performance while adopting CAIS.

Generally, to make CAIS program adoption more successful, it is essential to identify all probable factors that impact it. The total link between CAIS processes and construction companies' performance is significant since they are multifaceted by nature, comprising of several theoretical fields and practices. Before highlighting the individual and fragmented link between CAIS, innovation, and CCP, it is important to see the broader perspective, i.e., the essential components in the relationship between CAIS, innovation and CCP. Against this backdrop, this research measured CAIS processes, innovation and CCP in the diverse viewpoints and observed that they were positively related in the Iraqi construction companies. It is important that organizations establish whether the investment in a CAIS has paid-off with respect to verifiable performance improvement. This presents reliable proof in encouraging organizations to give attention to being innovative when planning to adopt and invest in CAIS, especially when CAIS initiatives are contending with other business endeavors for scarce resources.

Since CAIS and innovation are positively related, each capability considered in isolation might not yield success in the construction companies in Iraq in an effort to achieve competitive advantage. Additionally, this study suggests that innovation has a strong relationship with CAIS programs which can aid organizational change agents in creating, starting, and carrying out adjustments that encourage successful knowledge management programs. The results provide strong evidence to support that CAIS-related processes are restricted and cannot guarantee construction company performance if there is no supportive innovation culture.

7 Contributions of the study

This research makes theoretical, and practical contributions to the body of existing knowledge. Specifically, the theoretical implications are in the aspect of filling the gaps identified in previous studies with particular reference to the relationship between CAIS, innovation and construction companies' performance. The practical contributions are in terms of providing solutions and clarity for the problems faced by the industry. The theoretical, and practical implications of this research are presented next.

7.1 Theoretical contributions of the study

This study expands extant literature in strategic accounting, the construction industry, and CAIS by making several significant theoretical contributions. First, the study provides a detailed review of the existing literature on CAIS, innovation, and construction companies' performance, resulting to a comprehensive review of relevant studies, from which the research gaps were identified. As a result, a holistic theoretical model of CAIS-organizational culture- construction companies' performance was developed. This model represents one of the first attempts to combine the CAIS programme, focusing on CAIS processes, with Innovation, and their impacts on construction companies' performance.

The research by Chege, et al. [102] analyzed the effect of information technology on firm performance while Wijekoon and Ratnayake [136], and Anaeli [137] considered the influence of CAIS usage on organization performance in Sri Lanka and Tanzania respectively. This present research broadens the studies of Chege, et al. [102], Wijekoon and Ratnayake [136], and Anaeli [137] beyond mere analyzing the effect of CAIS on firm performance by also considering the mechanism through which CAIS can lead to construction company performance through innovation, hence contributing theoretically to the body of existing knowledge.

Additionally, this research considers the effect of the three individual components of CAIS such as the technological context, organizational context, and environmental context on construction company performance. This extends and provides more clarity to studies by Trabulsi [138] and Ganyam and Ivungu [104] who considered CAIS as a single unit, thereby contributing theoretically to existing literature.

There is insufficient empirical evidence in the existing literature on the interrelationship between CAIS, innovation, and CCP, particularly with respect to developing countries. This study filled this gap by carrying out a questionnaire survey of a cross-section of enterprises in Iraq to examine the theoretical links in the proposed model. The vital role played by innovation as a mediator in construction firm performance is the key theoretical contribution of this study.

7.2 Contributions to practice

First, the findings obtained in this study show that all three CAIS contexts considered in this study have no significant effect on company performance. Therefore, this research contributes to the practice of CAIS by revealing that adopting CAIS cannot guarantee construction company performance in isolation. Construction companies are encouraged to consider developing other capabilities to ensure they can fully benefit from the merits of adopting CAIS.

Secondly, this research's findings showed that innovation fully mediated the relationship between all

three CAIS contexts and CCP. This means that CAIS can only lead to construction company's performance through innovation. Therefore, in the practice of CAIS, it should be noted that the adoption of CAIS should not be done in isolation. Rather, the construction companies should develop their innovative capabilities while adopting CAIS to guarantee optimal company performance. Hence the level of innovation determines to a great extent how well the construction company will perform.

Successful CAIS programme adoption should require both CAIS processes and innovation attributes. Investing merely on CAIS is insufficient for the organization to achieve construction companies' performance. Additionally, it is challenging to adopt CAIS program with no attention given to innovation, which is supposed to be the facilitator of any knowledge management program. This forms a vital element to be taken into consideration for an organization that is willing to invest in CAIS initiatives.

8 Study limitations and probable future research directions

Although the purpose of this study was achieved, a number of limitations do exist that can be taken into consideration in future studies. First, this research was carried out in Iraq, a developing country in the west of the Asian continent. Therefore, its findings can only be generalized within this context. It is suggested that future research be conducted in other countries of the world, and the findings compared with those obtained in this research.

Furthermore, the quantitative technique employing a structured questionnaire was used in collecting data for this research, thereby restricting the respondents to the options provided therein. It is suggested that future studies be carried out using the qualitative method, perhaps a mixed method approach can be adopted in future research to obtain more in-depth findings.

Additionally, this study had an acceptable coefficient of determination value (R^2) of 94%, there are other factors such as size of the organization [139], technological complexity [140] and experience level of the organizational workforce which could have an effect on the construction company performance [141] but were not considered in this research. It is advised that future research consider these factors to obtain greater perspectives.

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