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# Management accounting practices and project cost control in Saudi construction firms

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**A B S T R A C T**

This study investigates the influence of Management Accounting Practices (MAPs) on Project Cost Control (PCC) within the context of the Saudi construction industry, a sector pivotal to the nation's economic diversification under Saudi Vision 2030. Employing a purposive sampling technique, data were collected from 222 industry professionals and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings reveal that budgetary control exerts the strongest positive effect on PCC, underscoring its foundational role in cost containment. Additionally, cost monitoring and reporting, cost variance analysis, and the effective utilization of accounting information emerged as significant positive predictors of PCC success. Collectively, these MAPs are instrumental in achieving robust project cost control. The results hold important implications for the Sustainable Development Goals (SDGs), particularly those related to industry, innovation, and infrastructure, by offering actionable insights for policymakers. Mandating robust budgetary control frameworks and integrated accounting systems can significantly reduce resource waste, enhance project efficiency, and contribute to the sustainable development of national infrastructure projects, thereby aligning with the long-term objectives of Saudi Vision 2030.

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## 1. Introduction

The construction industry may support the economic development of any economy. However, projects exceeding the approved budgets would be responsible for low profitability, ruining client-contractor relationships, and risking the economic viability of infrastructure, which can result in financial distress for the projects. This challenge of cost overrun is not only a technical failure of estimation but also a failure of control, which shows a disconnection between planning and execution. As per Vision 2030, the Saudi economy is targeting mega construction projects due to the transformation of the economy from the oil sector to tourism and other sectors. In this domain, Project Cost Control (PCC) is a very important phenomenon to deliver the construction projects within time limits and financial boundaries, as well as to serve the Kingdom's transformation objectives. In theory, Management Accounting Practices (MAPs) are the organizational nervous system to control the projects within the targeted cost (Theeuwes & Adriaansen, 1994).

MAPs are internal processes of budgeting, monitoring, analysis, and reporting, which could help managers to deliver construction projects in a timely manner with minimal cost. The construction firms should establish a robust budget and should check expenditures against budgeting, which could help in analyzing any deviations between planned and actual spending, and take corrective decisions. The volatile environment of the construction industry suggests that budgets can become obsolete documents, which can be filed away after tendering. Thus, cost reports might arrive too late for meaningful intervention. Here, Budgetary Control (BC), Cost Monitoring & Reporting (CMR), Cost Variance Analysis (CVA), and the Use of Accounting Information (UAI) can serve as meaningful tools. For instance, BC can compare actual costs with the budget to detect deviations regularly. Moreover, CMR continuously tracks costs and generates reports to inform stakeholders. In addition, UAI provides financial and accounting data to guide timely decision-making. Thus, these tools support project managers to manage costs instead of relying on static budgeting (Salim et al., 2024).

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The literature has intensively investigated the causes of cost intensification (Shane et al., 2009). However, the literature usually investigated specific techniques or case studies of technological adoption. Still, a holistic examination is missing to understand the collective functions of MAPs to control the cost in Saudi construction firms. Thus, construction managers in Saudi firms may adopt advanced accounting and budgeting systems. Without understanding the effective use of these functions, it would lead to inefficient use of financial information in Saudi construction firms. This present study tries to understand the PCC in Saudi construction projects by examining MAPs as an interdependent control system. For this purpose, the present study empirically investigates the influence of BC, CMR, CVA, and UAI on the PCC in Saudi construction projects to understand the adaptability of BC, the decision relevance of CMR, the analytical depth of CVA, and the critical role of UAI in strategic and operational decision-making. Thus, this research aims to assess the perceived effectiveness of key MAPs in Saudi construction firms to empirically test their effects on PCC. The results of the study would be helpful to empirically find the best practices of management accounting in Saudi firms and would inform managers and policymakers with evidence-based guidance for strengthening the MAPs infrastructure to deliver construction projects with cost control mechanisms as per Vision 2030.

## 2. Literature Review

The literature signifies that effective PCC is a comprehensive process, which can help a project to be completed within the approved budget. MAPs, such as BC, CMR, CVA, and UAI techniques, may support planning, performance evaluation, and decisions, which can achieve rigorous PCC. This section is divided into four subsections to develop the hypotheses in the relationship between PCC and BC, CMR, CVA, and UAI.

### *2.1. Budgetary Control and Project Cost Control*

In construction projects, BC is the foundational MAP technique, which begins with preliminary estimates and develops into a final project budget. It can be used as a standard to compare and control project expenses (Do et al., 2025; Herrmann & Spang, 2020). Similarly, Azman et al. (2013) linked the problem of cost overruns with flawed initial estimates. Moreover, Creedy et al. (2010) correlated cost overrun percentages with the reciprocal of project budget size, which highlighted economies of scale in estimation accuracy. These studies, however, treated the budget as a static and externally-imposed target instead of a dynamic PCC tool. In an advancement, Kim & Reinschmidt (2011) proposed a probabilistic view and suggested a Bayesian adaptive forecasting technique in the execution of the project, which assumed BC to be a dynamic and updating process.

The effectiveness of BC also depends on its integration with project planning. Perera & Kamardeen (2004) demonstrated that accessible software was found helpful to improve the feasibility of integrated time-cost management systems. The separation of cost and schedule data might undermine control. Chen et al. (2005) argued that traditional cost-schedule integration models were unable to handle complex payment conditions. Thus, the budget was meaningless without a realistic model of cash flow. The literature has also focused on the formulation of the function of BC. For instance, Baalousha & Çelik (2011) formulated inflation-adjusted systems to create accurate budgets. Moreover, Stoy et al. (2008) depended on regression models for early estimation. However, there is scant literature to examine the behavioral and organizational aspects of BC. Johnson et al. (2013) identified the principal-agent problems in the budgeting mechanism, which required sophisticated internal costing rules. Overall, the literature signifies that BC is not only a planning document but a dynamic control framework, and its effectiveness in enhancing PCC depends on its accuracy, adaptive integration, and implementation. Thus, we develop the following hypothesis:

**$H_1$:** *The dynamic BC positively influences PCC in Saudi construction firms.*

### *2.2. Cost Monitoring & Reporting and PCC*

CMR tracks actual costs and compares these with the budget, which could help transform the budget from a plan into a tool for action. The literature has been focused on the integration challenges of CMR systems. For instance, some seminal studies by Carr (1993) and Singh (1991) discussed the mechanism of integrating cost and schedule data. Moreover, the managerial challenges of implementing systems like the C/SCSC have also been explored in modern literature. For instance, Jaiswal & Kar (2025) proposed a decision support system, which combined BIM and scheduling software to optimize labor acquisition. Thus, it demonstrated a move from retrospective reporting to proactive and data-driven monitoring. Elghaish & Abrishami (2021) also proposed a Centralized Cost Management System (CCMS) for Integrated Project Delivery (IPD). The authors highlighted the need for transparency and shared information platforms for project stakeholders.

In the critical literature, Rowings (1991) critiqued the inefficiencies of multiple data entries and ineffective outputs. This critique leads us to future directions, like Artificial Intelligence (AI), to improve software integration. However, later literature showed that effective CMR needed well-structured processes using simulation and databases instead of advanced technologies (Perera & Kamardeen, 2004; AbouRizk & Dozzi, 1993). Moreover, the literature identified a gap in identifying direct costs (labor), focusing less on monitoring indirect costs (overheads), and the cost implications of risks and rework (Park et al., 2005; Kim & Kim, 2011). Moreover, the literature also signified that reporting was linked to clear accountability and a culture of continuous improvement instead of assuming reporting-led-control (Rounce, 1998; Ketabi & Heravi, 2022).

In the Saudi environment, reporting lines and decision-making authority can be complex. Thus, effective CMR is more important than data collection. Thus, CMR could help in generating timely, accurate, and actionable information, which could link to clear accountability structures at different managerial levels. Thus, the hypothesis is developed as follows:

**$H_2$:** *Robust CMR systems by providing timely, accurate, and actionable cost performance information positively influence PCC in Saudi construction firms.*

*2.3. Cost Variance Analysis and Project Cost Control*

CVA is the process of finding the variance between budgeted and actual costs. Thus, CVA can convert CMR data into managerial insight. Earlier studies by Anon (1985) and Singh (1991) explained this principle by comparing the budgeted and actual costs, which helped to derive cost and schedule variances. Moreover, Chang (2001) operationalized CVA to design projects and defined value ranges for performance indices. However, the literature has discussed the limitations of Earned Value Management (EVM). For instance, Naeni et al. (2011) argued that EVM remained weak in handling uncertainty. Thus, the authors suggested a fuzzy-based EVM model and argued that traditional variance analysis failed in the ambiguous reality of construction projects.

Other than EVM, the literature has also conducted variance analysis in specific contexts. For instance, Chen et al. (2011) improved cash flow forecasting by proposing cost-payment coordination mechanisms, which analyzed variances due to payment agreements. Moreover, AbouRizk & Dozzi (1993) proposed simulation methods, which analyzed the variance in a claim situation. Thus, it helped in dismembering the cost impact of changed conditions. Thus, CVA helped in routine control and also served as a dispute resolution and learning mechanism. However, the literature signified a limitation that most studies used variance analysis as a technical and backward-looking exercise. Thus, it was less directive on its feed-forward potential. For instance, variance root-cause analysis might improve future estimating, budgeting, and risk management processes in material flow cost accounting (Jasch, 2015; Ning et al., 2025).

On the whole, the literature suggests that CVA needs EVM and a fuzzy logic framework as per the suitability of project uncertainty to identify root causes with the support of an organizational culture of learning and improvement. Thus, the following hypothesis is developed:

**$H_3$:** *The CVA focusing on root-cause investigation and feed-forward learning has a positive effect on PCC in Saudi construction firms.*

*2.4. Use of Accounting Information and Project Cost Control*

The UAI enables managers to utilize cost and performance data from MAPs for strategic decision-making and performance evaluation. The literature has worked on both traditional and modern uses of accounting information. In traditional use, the techniques focus on cost control and financial compliance. However, modern literature emphasized the strategic and integrated use of UAI. For instance, Gupta & Galloway (2003) proposed an information system to support strategic operations decisions. Moreover, it linked cost data to product design, quality, and capacity management. Likewise, Elghaish & Abrishami (2021) integrated Activity-Based Costing (ABC) with EVM and BIM to create a CCMS for IPD. Thus, the authors showed that information raised the collaboration and fair risk/reward sharing behavior. Moreover, Al-Hashimy & Yao (2025) argued that Enterprise Accounting Information System (EAIS) effectiveness depended on organizational readiness and found the moderating role of technical infrastructure and staff competency in the adoption of EAIS.

The literature has also discussed the limitations of UAI. For instance, the implicit assumption of UAI explained that managers used information as effectively as it is generated, which is highlighted in the literature as the "if you build it, they will use it" mindset. For instance, Baalousha & Çelik (2011) suggested UAI systems, which were designed and deployed within organizations. However, the authors paid less attention to the behavioral and managerial dimensions of information use. Thus, the availability of accounting information was not guaranteed to be utilized in managerial decision processes. Walker (2000) proposed triple bottom line reporting, which facilitated the informational requirements of organizations to balance economic, environmental, and social performance. Similarly, Arya et al. (2000) proposed the design of UAI, which improved incentive alignment. By this, accounting information shaped managerial behavior and decision outcomes.

Heidari et al. (2020) investigated life-cycle costing, which suggested long-term cost efficiency and sustainability considerations in the entire life span of the project. Moreover, Jasch (2015) emphasized the need for the incorporation of environmental costs and resource efficiency into accounting systems, which could support environmentally responsible decision-making. Some studies worked on real options theory and strategic flexibility (Kamrad, 1995; Di Maddaloni et al., 2024), which supported the incorporation of uncertainty and flexibility into investment decisions. However, the literature failed to address how project-level cost information can be generated through routine PCC processes, which could be systematically aggregated and analyzed to support project portfolio optimization, sustainability performance, and long-term strategic investments. Thus, the present study addresses the gap between operational accounting practices and strategic decision-making. For instance, the impact of MAPs on PCC can be fully realized with the help of the generated accounting information to support decision-making. Thus, we hypothesize:

**H4:** *The strategic and integrated UAI for decision-making positively influences the relationship between MAPs and PCC.*

## 3. Methodology

This study is grounded on a well-developed questionnaire with five constructs to test the effects of BC, CMR, CVA, and UAI on the PCC in Saudi construction projects. The questionnaire is generated with a Likert scale and is pilot tested by taking data from 25 respondents. The pilot study assesses the clarity and logical flow of all items. Moreover, the average completion time was also noticed. In addition, Cronbach's Alpha coefficients were estimated on the initial collected data, which showed that all construct scales in the pilot exceeded the acceptable threshold of 0.70. Based on the pilot study, the items of the constructs were improved and refined in language to improve clarity, enhance respondents' understanding, and increase the overall response rate. Table 1 shows all items in their final shape.

**Table 1**
Constructs and Their Items

| Constructs | Items | Descriptions | Sources |
|---|---|---|---|
| PCC | PCC1 | Project costs are kept within the approved budget. | Azman et al., 2013; Creedy et al., 2010 |
| | PCC2 | Cost overruns are effectively controlled in our projects. | Singh, 1991; Carr, 1993 |
| | PCC3 | Unexpected project costs are minimized. | Stoy et al., 2008; Shahid et al., 2023 |
| | PCC4 | Cost control procedures improve overall project performance. | AbouRizk & Dozzi, 1993; Minchin et al., 2010 |
| | PCC5 | Our firm successfully manages project costs. | Elghaish & Abrishami, 2021; Rounce, 1998 |
| BC | BC1 | Detailed project budgets are systematically prepared and approved before the start of project execution. | Al-Hashimy & Yao, 2025; Azman et al., 2013 |
| | BC2 | Budget targets and cost limits are clearly communicated and understood by project managers and team members. | Norris, 1987; Sandahl & Sjögren, 2003 |
| | BC3 | Actual project expenditures are regularly monitored and compared with the approved project budgets. | Chang, 2001; Kim & Reinschmidt, 2011 |
| | BC4 | Budget variances are formally analyzed and reviewed by management to identify causes and necessary corrective actions. | Arya et al., 2000; Johnson et al., 2013 |
| | BC5 | Budgetary control procedures effectively guide project managers in minimizing unnecessary costs and maintaining cost discipline. | Gupta & Galloway, 2003; de Pena & Fisher, 1994 |
| CMR | CMR1 | Project costs are systematically monitored at regular intervals throughout the project lifecycle. | Carr, 1993; Kim & Kim, 2011 |
| | CMR2 | Cost performance reports are prepared and delivered promptly to support prompt managerial decisions. | Chen et al., 2005; Jaiswal & Kar, 2025 |
| | CMR3 | Cost reports are presented in a clear and understandable format that enables project managers to interpret cost performance easily. | Perera & Kamardeen, 2004; Baalousha & Çelik, 2011 |
| | CMR4 | The cost information provided in reports is reliable, accurate, and reflects the actual financial status of the project. | Liu & Zhu, 2007; Chen et al., 2011 |
| | CMR5 | Cost monitoring and reporting systems provide actionable information that supports effective project cost control and corrective actions. | Elghaish & Abrishami, 2021; Minchin et al., 2010 |
| CVA | CVA1 | Cost variances are identified and reported at an early stage during project execution. | Anon, 1985; Naeni et al., 2011 |
| | CVA2 | The underlying causes of cost variances are systematically investigated to identify root problems in project activities. | Kim & Reinschmidt, 2011 |
| | CVA3 | Appropriate corrective actions are implemented when significant cost variances are detected. | AbouRizk & Dozzi, 1993; Chang, 2001 |
| | CVA4 | Insights from cost variance analysis are used to prove future project planning and cost management practices. | De Pena & Fisher, 1994; Walker, 2000 |
| | CVA5 | Management closely reviews cost variance reports and uses them to guide project cost control decisions. | Creedy et al., 2010; Stoy et al., 2008 |
| UAI | UAI1 | Accounting information is regularly used for financial decision-making. | Arya et al., 2000; Baalousha & Çelik, 2011 |
| | UAI2 | Cost and financial information are systematically used when making decisions regarding project resource allocation and budgeting. | Hair et al., 2019; Al-Hashimy & Yao, 2025 |
| | UAI3 | Project managers rely on accounting data to monitor project performance and implement cost control actions. | Chen et al., 2011 |
| | UAI4 | Accounting reports enhance the quality, accuracy, and timeliness of project-related managerial decisions. | Walker, 2000; Minchin et al., 2010 |
| | UAI5 | Financial and cost information is integrated into broader project management decisions, including planning, monitoring, and evaluation. | Arya et al., 2000; Gupta & Galloway, 2003 |

The study targeted medium and large-sized Saudi construction firms with 50 or more employees. The data about these firms is taken from the Saudi Contractors Authority and the Riyadh Chamber of Commerce & Industry. To enhance representativeness, a purposive sampling is employed to confirm the knowledge and experience of MAP among the respondents. For instance, the questionnaire was distributed to project managers, cost controllers, cost engineers, finance managers, accountants, and planning & control engineers. Initially, we collected a total of 230 responses and conducted an initial quality test to ensure the completeness of the data. Only 8 responses were found incomplete, which were removed from the final data and analysis. Thus, 222 complete responses were included in the analysis, which is sufficient for statistical analyses of SEM (Hair et al., 2019).

The data was analyzed by using PLS-SEM through SmartPLS 3. It is suitable to handle complex models effectively with the available sample size. At first, the outer model is tested. Internal consistency is evaluated by Cronbach's Alpha and CR. The

value of more than 0.70 is considered acceptable. Moreover, convergent validity was examined by the AVE, which should be more than 0.5. Discriminant validity is tested by HTMT, which should be less than 0.85. Moreover, the structural model is estimated to test the hypotheses and the model's overall explanatory power. Then, model fit is tested by SRMR, which should be less than 0.08 to corroborate a good fit. Moreover, d_ULS, d_, and NFI are also applied to test the model fit.

## 4. Data Analysis

In Table 2, outer loadings of all five indicators, PCC1-PCC5, are found between 0.714 and 0.803, which are more than 0.7 and within an acceptable range. Thus, the relationship between each survey item (PCC1-PCC5) and the PCC construct is statistically significant, which is further supported with internal consistency ( $\boldsymbol{\alpha} = 0.827$ and CR = 0.878). Moreover, AVE is 0.591, which is more than 0.5. In addition, VIF is found between 1.392 and 2.575, which are less than 5 and show an absence of multicollinearity among the items. Similarly, the CMR construct also retained all five items (CMR1-CMR5) with outer loading from 0.730 to 0.847. Moreover, internal consistency is also validated ( $\boldsymbol{\alpha}$ = 0.861 and CR = 0.900). The convergent validity is corroborated with an AVE of 0.644. The VIF of all items is less than 5, which shows the absence of multicollinearity. The VIF values for CMR2 and CMR4 are slightly high, with values of 2.660 and 2.569. However, they remain within acceptable limits and are less than 5.

An item BC2 in the construct of BC is deleted due to a low outer loading value. However, the rest of BC1, BC3, BC4, and BC5 demonstrate robust loadings between 0.782 and 0.809. Moreover, reliability is found to be strong ( $\boldsymbol{\alpha} = 0.812$ and CR = 0.876). BC's convergent validity is validated with a high AVE value of 0.639. Moreover, the VIF statistics are found from 1.534 to 1.799, which are less than 5. Thus, there is no multicollinearity issue in the items of BC. In the CVA construct, CVA2 and CVA3 are deleted due to low outer loading values. However, the remaining items (CVA1, CVA4, and CVA5) show loadings between 0.773 and 0.873, which are within reliable limits. Moreover, CVA is found to be reliable ($\boldsymbol{\alpha} = 0.867$ and CR = 0.771). The convergent validity is also corroborated (AVE = 0.6861). Moreover, the VIF statistics of CVA1, CVA4, and CVA5 are found from 1.428 to 1.739. Thus, there is no multicollinearity issue in the remaining items of CVA. The last UAI construct is refined by deleting UAI2, which has a lower outer loading value. However, the remaining items (UAI1, UAI3, UAI4, and UAI5) have outer loading values from 0.805 to 0.852. Moreover, the strongest convergent validity is corroborated ($\alpha$ = 0.852 and CR = 0.900). In addition, convergent validity is corroborated (AVE=0.692), and VIF (1.789-2.201) confirms the absence of multicollinearity among items.

**Table 2**
Confirmatory Factor Analysis

| Latent Variables | Indicators | Outer Loading | Items deleted | Internal consistency reliability ($\alpha$) | Internal consistency reliability(CR) | Convergent Validity (AVE) | VIF |
|---|---|---|---|---|---|---|---|
| PCC | PCC1 | 0.784 | | 0.827 | 0.878 | 0.591 | 1.637 |
| | PCC2 | 0.795 | | | | | 2.497 |
| | PCC3 | 0.803 | | | | | 2.575 |
| | PCC4 | 0.714 | | | | | 1.392 |
| | PCC5 | 0.745 | | | | | 1.578 |
| BC | BC1 | 0.782 | BC2 | 0.812 | 0.876 | 0.639 | 1.534 |
| | BC3 | 0.796 | | | | | 1.613 |
| | BC4 | 0.809 | | | | | 1.761 |
| | BC5 | 0.809 | | | | | 1.799 |
| CMR | CMR1 | 0.773 | | 0.861 | 0.900 | 0.644 | 2.015 |
| | CMR2 | 0.847 | | | | | 2.660 |
| | CMR3 | 0.837 | | | | | 2.384 |
| | CMR4 | 0.821 | | | | | 2.569 |
| | CMR5 | 0.730 | | | | | 1.609 |
| CVA | CVA1 | 0.773 | CVA2 | 0.771 | 0.867 | 0.686 | 1.428 |
| | CVA4 | 0.837 | CVA3 | | | | 1.698 |
| | CVA5 | 0.873 | | | | | 1.739 |
| UAI | UAI1 | 0.832 | UAI2 | 0.852 | 0.900 | 0.692 | 1.838 |
| | UAI3 | 0.852 | | | | | 2.201 |
| | UAI4 | 0.838 | | | | | 2.008 |
| | UAI5 | 0.805 | | | | | 1.789 |

In Table 3, the HTMT values are less than 0.85 in all cases. Thus, discriminant validity is corroborated, which means that all constructs showed greater variance with their indicators compared to indicators from other constructs. The HTMT value is high (0.841) for correlations between CVA and UAI, which is at least lower than the threshold of 0.85. Moreover, the high correlations are also found between PCC and CVA (0.790) and between PCC and UAI (0.740). However, these values are less than 0.85. Fig. 1 shows a visualization of the finalized measurement model. It shows the proposed structural paths between constructs to test the hypothesized relationships by using PLS-SEM. The structural model reveals the hypothesized causal relationships with four direct paths from BC to PCC ($H_1$), from CMR to PCC ($H_2$), from CVA to PCC ($H_3$), and from UAI to PCC ($H_4$).

**Table 3**
HTMT Ratio

| Variables | BC | CMR | CVA | PCC | UAI |
|---|---|---|---|---|---|
| BC | | | | | |
| CMR | 0.638 | | | | |
| CVA | 0.688 | 0.727 | | | |
| PCC | 0.717 | 0.717 | 0.790 | | |
| UAI | 0.696 | 0.734 | 0.841 | 0.740 | |

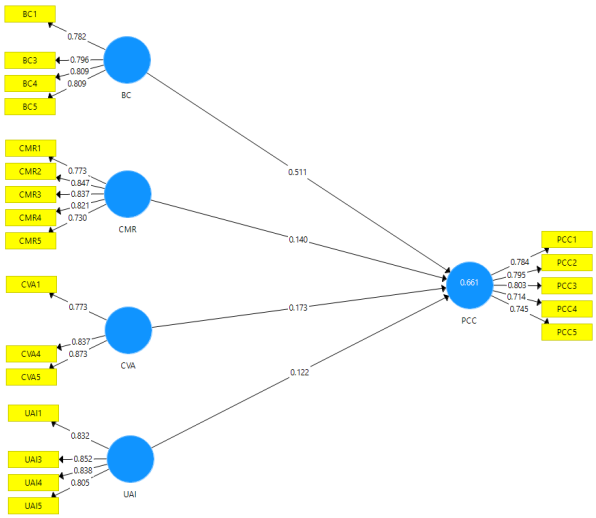


**Fig. 1.** Measurement Model

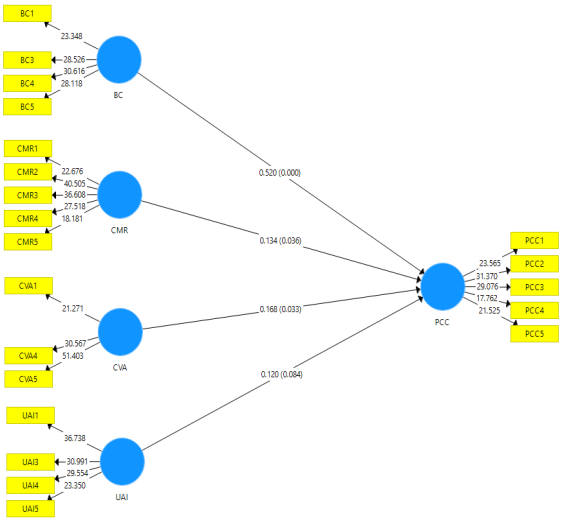


**Fig. 2.** Structural Model

Fig. 2 and Table 4 show the path coefficients of the hypothesized relationships between indicators of MAPs and PCC in Saudi construction firms. The most powerful relationship is observed between BC and PCC with a highly statistically significant path coefficient (β) of 0.520, which validates H1. This finding confirms that BC is the most influential MAP for achieving effective PCC. The path coefficient shows that a one-unit increase in the effective implementation of BC increases 0.52 units of perceived PCC effectiveness. Thus, a robust and well-managed budget leads to rationalized spending, which helps to achieve effective PCC. Moreover, H2 is also accepted by a coefficient of 0.134 in the nexus between CMR and PCC, which is statistically significant at 5%. The path coefficient shows that a one-unit increase in the effective CMR may increase 0.134 units of perceived PCC effectiveness. The acceptance of H2 confirms that systematic CMR provides timely, important data for managerial awareness. However, the path coefficient of CMR is relatively lower than that of BC. It shows that CMR practices individually have a smaller direct impact on PCC compared to the BC framework. Similarly, the relationship between CVA and PCC is also positive and statistically significant with a path coefficient of 0.168, which validates H3. Thus, a one-unit increase in the effective CVA may increase 0.168 units of perceived PCC effectiveness. Consequently, the analytical process of diagnosing variances is a critical step beyond mere data collection. However, the path coefficient of CVA is relatively lower than BC, and CVA practices individually have a smaller direct impact on PCC compared to the BC framework. Lastly, H4 is also accepted in the relationship between UAI and PCC with a relatively low level of significance (10%) and the lowest path coefficient of 0.120. Thus, a one-unit increase in the effective UAI decision-making may increase 0.12 units of perceived PCC effectiveness.

**Table 4**
Path Coefficients

| Path | Original Sample | Sample Mean | S.D. | t-statistic | p-values | Hypotheses |
|---|---|---|---|---|---|---|
| BC → PCC | 0.520 | 0.516 | 0.063 | 8.291 | 0.000 | **$H_1$**: Accepted |
| CMR → PCC | 0.134 | 0.137 | 0.063 | 2.116 | 0.036 | **$H_2$**: Accepted |
| CVA → PCC | 0.168 | 0.172 | 0.076 | 2.218 | 0.033 | **$H_3$**: Accepted |
| UAI → PCC | 0.120 | 0.120 | 0.067 | 1.790 | 0.084 | **$H_4$**: Accepted |
| R Square | 0.661 | | | | | |
| R Square Adjusted | 0.655 | | | | | |

Table 4 also shows an $R^2$ value of 0.661 and an adjusted $R^2$ = 0.655. Thus, the hypothesized four independent MAPs' constructs collectively explain 65.5% of the variance observed in PCC effectiveness. In the construction management literature, the estimated value of $R^2$ validates a substantial and robust model fit. Thus, a management accounting system with budgeting, monitoring, analysis, and information use is a central determinant of a project's financial success and PCC.

Fig. 2 concludes that the results strongly validate the theoretical framework of the study, as all four hypotheses are accepted. It shows that BC, CMR, CVA, and UAI are all significant contributors to effective PCC, which can improve the financial performance of Saudi construction projects. In comparison, BC stands as the paramount practice, which provides an essential foundation to control costs. Moreover, CMR and CVA are also supporting factors in operationalizing the budget effectively. Finally, UAI is the least enabling factor with the lowest estimated direct effect.

**Table 5**
Model Fit Summary

| Criteria | Saturated Model | Estimated Model |
|---|---|---|
| SRMR | 0.078 | 0.078 |
| d_ULS | 1.409 | 1.409 |
| d_G | 0.538 | 0.538 |
| Chi-Square | 671.916 | 671.916 |
| NFI | 0.813 | 0.813 |

Table 5 shows the model fit summary. It shows that the estimated SEM smoothly replicates the observed covariance structure of the data as per the specified constructs and their hypothesized paths. The SRMR value is 0.078, which validates a reasonably good job by the model in reproducing the empirical data's correlation matrix. d_ULS and d_G values are 1.409 and 0.538, which indicate a better fit. The Chi-square statistic is 671.916, which is relatively low and reflects that there is no significant difference between the model and the data. Lastly, the NFI value is 0.813, which falls in the acceptable fit range of 0.80-0.90. Thus, the model captures a substantial portion of the covariance structure and is well-fitted.

## 5. Discussions

This empirical exercise investigates the nexus between MAPs and PCC in Saudi construction firms. The results show that all four hypothesized practices of BC, CMR, CVA, and UAI positively enhance PCC in Saudi construction firms, which validates all four hypotheses. In comparison, BC is found to be the most influential factor to gear up PCC, which confirms classical management control theory and is also in line with empirical project management research. BC assumes that project budgets are systematically prepared and approved before the start of project execution. In which budget targets and cost limits are clearly communicated to project managers. Additionally, actual project expenditures are regularly monitored and compared with the approved project budgets. Moreover, budget variances are reviewed by management to identify causes and necessary corrective actions. Thus, budgetary control procedures effectively guide project managers in minimizing costs. Thus, all BC measures help to reduce project cost, which echoes the findings of Creedy et al. (2010) and Shane et al. (2009). Moreover, Kim & Reinschmidt (2011) treat BC as a non-static target and update it as per performance intelligence. This finding has a great policy relevance in Saudi mega-projects, which informs managers to formulate a budget and to institutionalize it as per the project's duration. In the same lines, Terzioglu & Polat (2026) also suggest risk-adjusted estimation and dynamic budgeting for decision-making under uncertainty.

The CMR has a comparatively smaller effect compared to BC, but systematic monitoring contributes to project cost performance significantly. The measurement items of CMR indicate that it focuses on regular monitoring of project costs in the project lifecycle, timely preparation and delivery of cost performance reports. Moreover, it clearly presented financial information, reliability, and accuracy of reported data. This actionable information supports managerial decision-making and corrective actions. These practices collectively form the informational infrastructure, which supports project managers to observe financial progress and respond to cost issues. This result is in line with traditional project control patterns, which were proposed by Singh (1991) and augmented by Naeni et al. (2011) to extend fuzzy-logic adaptations. However, its comparatively smaller effect indicates that CMR provides the project's informational nervous system, but it should also be strengthened with a cost management framework.

CVA also has a positive but comparatively less effect than BC. In CVA measurement, it emphasizes identification of cost variances, systematic investigation of root causes, appropriate corrective actions, use of variance to improve future project planning, and managerial review of variance reports, which can guide cost control decisions. These activities represent the diagnostic component of project cost control systems, which enable managers to understand abnormalities and to respond strategically to these abnormalities. The findings are consistent with classical project control literature. For instance, Anon (1985) suggested CVA as an analytical engine to support cost management systems. However, the relatively smaller magnitude of its effect suggests that CVA effectiveness should be raised with a robust budgetary structure and monitoring systems. In the same way, Perera and Kamardeen (2004) also advocated to follow monitoring, scheduling, and analytical control systems with effective integration of a clearly defined project cost baseline and project control framework.

UAI has the least effect on PCC compared to BC, CVA, and CMR. The UAI construct is measured by the regular use of accounting information and financial data for project cost planning and budgeting. Thus, it enables managers to follow accounting reports to monitor project performance and implement cost control actions, which can enhance decision quality and can integrate financial information into planning, monitoring, and evaluation. These measures have strong practical importance. However, the low effect of UAI on PCC in Saudi construction firms indicates that the presence of UAI alone does not guarantee effective PCC. However, many factors can reduce the effect of UAI on PCC. For instance, decision-

making may be influenced by centralized authority structures in Saudi firms instead of formal accounting data. In this context, the literature argues that organizational barriers may reduce the strategic use of accounting information (Rowings, 1991). Moreover, the literature emphasizes that the effectiveness of information systems depends on the alignment between information design, incentives, and decision-making authority (Arya et al., 2000; Maskin & Tirole, 2008). In addition, the modern literature suggests that the effectiveness of electronic accounting systems depends heavily on technical infrastructure and staff competency (Al-Hashimy & Yao, 2025).

The results contribute to theory by moving the discourse from advocating for MAPs towards modeling their interdependent hierarchy for the Saudi construction sector. The results refine control theory by suggesting that all control functions are necessary. However, ex-ante planning (BC) showed a more powerful direct influence than ex-post feedback processes (CMR, CVA, UAI) in Saudi firms. The findings suggest that regulatory and procurement frameworks should enforce the implementation of strong and continuous budget control practices instead of just focusing on project budgets. Thus, policymakers should ensure that contractors regularly monitor, update, and manage project budgets to maintain effective PCC.

## 6. Conclusion

The study explores the effects of BC, CMR, CVA, and UAI on PCC in Saudi construction firms by collecting data from 222 respondents from medium-to-large Saudi construction firms chosen through a purposive sampling technique. The data was analyzed by using PLS-SEM to test the hypothesized relationships. The results support all hypotheses with a distinct hierarchy of influence. BC is found as the most foundational driver of PCC with the strongest and most significant effect. Thus, ex-ante planning (BC) shows more influence on PCC compared to ex-post feedback processes (CMR, CVA, UAI) in Saudi firms. Therefore, systematically prepared and approved project budgets, well-communicated budget targets and cost limits, monitoring actual project expenditures, and budget variance reviews may help to improve PCC in Saudi construction firms. This finding underscores the importance of a dynamic and authoritative blueprint for financial discipline. Moreover, CMR also positively influences PCC with a moderating level of influence. Thus, regular monitoring of project costs, cost performance reports, and the reliability and accuracy of reported data might support managerial decision-making and corrective actions in Saudi firms. Moreover, CVA also moderately influences PCC in Saudi construction firms. Thus, identification of cost variances, appropriate corrective actions for future project planning, and managerial review of variance reports would support cost control decisions. Lastly, UAI shows the lowest but a significant influence on PCC in Saudi construction firms. Thus, the regular use of accounting information and financial data for project cost planning and budgeting might enable managers to follow accounting reports to monitor project performance and improve PCC. Collectively, all hypothesized MAPs explain a substantial proportion of variance in PCC success, which is proven as an integrated control system with high practical relevance.

The results advance management control theory by moving beyond just listing best practices to modeling their interdependent hierarchy, as BC shows the most influential effect in Saudi construction firms. Moreover, the results provide empirically supported policies for Saudi construction firms. For instance, Saudi construction firms should invest in adaptive budgetary control processes to ensure that budgets are supported by timely monitoring and deep analytical processes. Moreover, firms should work on bridging the information-usage gap by fostering a data-driven decision-making culture. At the country level, policymakers should develop a legal framework for the construction firms to implement continuous budget control practices, which could also promote greater fiscal accountability across public mega-projects.

This study face limitation in terms of relying on cross-sectional data. However, a future study can develop longitudinal data, which could have better power to conduct causality analysis. Moreover, the present study examines selected accounting and cost control practices. However, future research can extend the scope of the study by testing the moderating effects of organizational culture, leadership style, digital project management tools, and risk management practices. Moreover, future research may conduct cross-country comparisons to understand and compare the effects of MAPs on PCC in different institutional environments.

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