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Rethinking the Study of Cost Overruns: A Review and Path Forward

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Despite decades of research, cost overruns in construction projects, especially large-scale infrastructure, remain a persistent global issue. Extensive literature has examined this topic, with most studies focusing on identifying the causes of cost overruns. However, significant disagreement remains among researchers regarding their root causes. This paper critically examines these divergent perspectives to work toward a common understanding through narrative synthesis and deductive reasoning. An exploratory literature review supported by Natural Language Processing (NLP) was then conducted to identify commonly overlooked themes in cost overrun research, clarify conceptual and methodological shortcomings, and outline directions for future inquiry. The review identified three recurring gaps: an overreliance on perception-based studies, insufficient attention to exogenous factors, and a limited examination of causal relationships and underlying root causes. This paper contributes by integrating perspectives on the debated root causes of cost overruns into a cohesive framework that articulates where and why, current understandings diverge. It calls for a transition toward empirically grounded, data-driven methodologies that capture the complex interdependencies among causes while incorporating both endogenous and exogenous factors, including political and institutional influences. These contributions strengthen theoretical development and promote more robust, evidence-based approaches to understanding and managing cost overruns.

Keywords: Cost Overrun, Cost Management, Construction Project Management.

Introduction

Cost overruns remain a persistent and widely studied challenge in construction management (Abdelalim et al., 2025). They occur when actual project expenditures exceed original estimates, resulting in financial loss, stakeholder disputes, schedule delays, and reduced value for money. This issue is particularly important in large infrastructure projects, where reliance on public funding mean even small budget increases can have significant economic impacts. For example, the West Gate Tunnel project in Melbourne, Australia, has nearly doubled its initial budget, according to the Victorian Auditor-General. As the additional costs are ultimately borne by taxpayers, this escalation has sparked public backlash and raised questions about the effectiveness of project appraisal and business case evaluation.

Although there is an extensive body of research on cost overruns, particularly regarding their causes, the problem remains unresolved (Abdelalim et al., 2025). Advancing understanding in this area requires first identifying the key shortcomings of prior studies and establishing a stronger conceptual basis for future research. A central point of contention concerns Flyvbjerg's argument that optimism bias and strategic misrepresentation are the primary causes of cost overruns, an interpretation that has

been both supported and challenged (Cantarelli et al., 2025; Love & Ahiaga-Dagbui, 2018). Clarifying the validity and practical relevance of these claims is therefore essential. If they are accepted as accurate, the root causes of cost overruns may be considered largely established, and existing estimation approaches derived from these assumptions could be viewed as sufficient, thereby weakening the justification for further inquiry or alternative explanations. In response to this concern, this study first examines the relevance of Flyvbjerg's assumptions through an analysis of past research and then identifies common conceptual and methodological shortcomings within the existing literature. By addressing these issues, the paper seeks to clarify current limitations and suggest directions for more integrative and empirically grounded research.

The remainder of this paper is structured as follows. Section 2 presents an overview of Flyvbjerg's assumptions and discusses their relevance and position within the existing literature. Section 3 describes the research methodology. Section 4 presents the identified gaps and shortcomings in previous studies. Section 5 discusses the key findings, and Section 6 concludes with final remarks and a forward-looking perspective on the study's contribution to the field.

Overview

Flyvbjerg and his collaborators have produced some of the most influential and widely cited research on cost overruns, significantly shaping current understanding of this issue (Lind & Brunes, 2015). In their 2002 study, Flyvbjerg et al. identified two principal drivers of cost overruns in infrastructure projects: optimism bias, which leads to systematic underestimation of costs due to cognitive and psychological factors, and strategic misrepresentation, where costs are intentionally understated to secure project approval and funding (Flyvbjerg et al., 2002). To address these issues, they proposed Reference Class Forecasting (RCF), a three-step method that produces probabilistic forecasts by: (1) identifying a relevant class of comparable past projects, (2) establishing the statistical distribution of their outcomes, and (3) positioning the current project within this distribution (Flyvbjerg et al., 2004). This procedure was initially adopted by the UK Department of Transport, and despite limited research into its methodology and applicability, the RCF has seen widespread adoption among researchers across various countries (Ahiaga-Dagbui & Smith, 2014; Baerenbold, 2023; Park, 2021). Recent reports further supported the effectiveness of RCF. For instance, a 2020 report by the UK Department for Transport identified RCF as a valid best-practice approach to cost estimation, consistent with other studies highlighting its superior performance over alternative methods (Batselier & Vanhoucke, 2016; Park, 2021). In another instance, the 2021 Market Capacity Report by Infrastructure Australia, an advisory body to the Australian Government, identified optimism bias as a significant contributor to cost overruns and recommended adopting RCF as a countermeasure. Despite the widespread support for Flyvbjerg's identified root causes and his proposed methodology, many researchers in the field disagree with his conclusions (Cantarelli et al., 2025; Love & Ahiaga-Dagbui, 2018). The following section explores the opposing view and examines the relevance of Flyvbjerg's assumptions about the causes of cost overruns within the context of construction projects.

Positioning Optimism Bias and Strategic Misrepresentation in the Construction Context

Several studies have challenged Flyvbjerg's assertion that bias and misrepresentation are the exclusive root causes of cost overruns (Ahiaga-Dagbui & Smith, 2014; Love et al., 2022; Love, Ika, J Matthews, et al., 2024; Rajabi Asadabadi & Zwikael, 2024). Researchers argue that evidence supporting Flyvbjerg's claims is limited, as it is difficult to substantiate such claims (Eliasson, 2025; Love, Ika, & Pinto, 2024). Love and Ahiaga-Dagbui (2018) even regarded Flyvbjerg's assumptions as fake news, which shows how literature is divided in this area. The reference point for measuring cost overruns has perhaps been one of the main sources of this debate. While Flyvbjerg measures overruns from the decision-to-build stage, many researchers argue that the baseline should be set at the contract price (Love & Ahiaga-Dagbui, 2018). This suggests that the root causes proposed by Flyvbjerg are considered applicable even during the initial or conceptual phase, when project information remains

incomplete. In a phase-gate project development framework, these stages correspond to Front-End Loading (FEL) 1 and FEL 2, where the project scope is still insufficiently defined and serves primarily to support business case selection for the investing authority (Hollmann, 2016). Loading refers to the progressive definition of project scope prior to funding decisions, with the level of scope maturity increasing across successive FEL phases (Hollmann, 2016).

Many infrastructure projects undergo long gestation periods between initial approval and the commencement of construction (Hollmann, 2016). During this time, project scope and definition often change as stakeholders negotiate funding arrangements and seek the necessary approvals (Ahiaga-Dagbui & Smith, 2014; Andersen et al., 2016). For example, Steininger et al. (2020) reported that a 16-year delay between approval and construction commencement of the Stuttgart railway project led to significant cost increases due to major scope changes. Andersen et al. (2016) reached the same conclusion, finding that in 12 Norwegian infrastructure projects with exceptionally high-cost overruns, most escalation occurred in the front-end phase, averaging about 350%, compared with about 45% during implementation. They attributed these overruns to extensive scope changes, including changes at the conceptual level, as well as to disagreements over whether the project itself was justified. For instance, the planned upgrade of an old ski jump expanded into two new hills and a large arena for the 2007 Skiing World Cup, while the Oslo Opera House was considered an overinvestment that generated intense political debate during its front-end phase. Taken together, these studies suggest that the front-end phase is where the largest cost escalations occur, primarily driven by uncertainty, scope expansion, and contested project justification.

It is perhaps at this stage that optimism bias and strategic misrepresentation occur or exert their strongest influence, rather than during the project implementation phase (Ahiaga-Dagbui & Smith, 2014). This was observed by Andersen et al. (2016) as they indicated that, in some cases, cost underestimation was politically or strategically motivated. For example, in the case of the Oslo Opera House, the substantial costs associated with the required road network redesign were excluded from the initial estimate and were later delivered as a separate project that ultimately exceeded the cost of the opera itself. Andersen et al. (2016) also reported that about half the projects had strong local promoters, and when financiers differed from recipients, the latter often understated costs or overstated benefits.

The purpose of the above explanation was to address the controversy in the literature regarding Flyvbjerg's assumptions and to emphasize that optimism bias and strategic misrepresentation, if applicable, primarily relate to the front-end phase rather than the construction phase. The next section presents the methodological approach adopted to identify recurring shortcomings and areas of neglect in the body of research on construction cost overruns.

Methodology

An exploratory literature review was conducted to identify conceptual gaps and emerging directions for advancing research on cost overruns in construction projects. This type of review typically addresses a broad and loosely defined problem context, often encompassing multiple objectives and an open-ended scope (Soufan et al., 2022, 2024). It is particularly appropriate when research goals are uncertain or evolving, as findings can redirect the inquiry as new insights emerge (Soufan et al., 2022, 2024). These features make the exploratory review an effective method for identifying gaps in the existing literature and informing future research in the field.

Scopus was selected as the primary database, as its comprehensive coverage and reliability align with the exploratory nature of this study. A comprehensive review of cost overruns is more appropriate when the research question is clearly defined, and the scope of investigation is narrow. To identify relevant studies, a search query including the terms "cost overrun", "budget overrun", and "cost escalation" was applied to the title, abstract, and keyword fields. The search was further refined by

limiting the subject areas to engineering and business management and accounting, which yielded the highest number of relevant publications. Given the extensive research on cost overruns, this review focused on peer-reviewed journal articles published in English between 2015 and 2025.

The initial search yielded 1,302 papers. To streamline the screening process, a natural language processing (NLP)-based script was developed using a BERT-derived transformer model (SPECTER) to automatically identify semantically relevant studies. SPECTER is trained on scientific literature using citation relationships as supervision (Cohan et al., 2020). It generates semantic embeddings that represent the conceptual meaning of a paper as a numerical vector based on its title and abstract (Cohan et al., 2020). In the developed script, a set of query statements reflecting the study's focus on cost overruns and related research gaps were embedded using SPECTER and used as semantic reference points. The queries were as follows:

- This paper primarily addresses research gaps regarding the causes, implications, or solutions to cost overruns in construction projects, with a main focus on cost overrun rather than general project performance or management.
- The study investigates the causes of cost overrun in construction.
- The research identifies and analyses the causes of cost overruns in construction projects.
- The research examines cost overruns in infrastructure projects.
- The study found factors that influence cost overrun in construction projects.

The code was provided with an initial pool of 1,302 papers in RIS format and first removed duplicate entries based on DOI; no duplicates were identified. The semantic embeddings generated for each paper were then compared with the query embeddings to assess relevance. Papers with cosine similarity scores exceeding 0.85 were retained. As no guidelines existed for selecting an appropriate cosine similarity threshold in this context, this value was chosen empirically with the aim of not removing too many papers from the pool. Increasing the threshold increases the stringency of the screening process, thereby reducing the number of papers retained.

To minimize the exclusion of potentially relevant studies, a secondary screening step re-evaluated omitted papers using title-only similarity against the phrases cost overrun in construction and cost overrun in infrastructure. Eventually, the code produced a filtered RIS file containing the retained references, identifying 260 papers as relevant to the topic of cost overrun. The resultant RIS file was exported into Covidence for further screening. Papers that were irrelevant, lacked a DOI, focused on COVID-19, or provided insufficient explanation of their methodology or data collection process were excluded. In total, 108 papers were reviewed in depth to gain a broader understanding of cost overruns in construction and infrastructure projects. The following section discusses the conceptual and methodological shortcomings identified in the review.

Results

It was observed that most studies in this area focused on identifying the causes of cost overruns and ranking their relative importance, accounting for 42 papers (38%). This figure increased to 66 papers (61%) when including studies that identified the causes of cost overruns alongside other research objectives. The next most examined subject was hypothesis-based research, represented by 21 papers that either introduced new conceptual perspectives or explored the relationships between selected variables and cost overruns. Another 17 papers focused on cost control strategies and mitigation measures, addressing them as either primary or secondary research objectives. The other, less investigated areas of focus, included forecasting models, evaluation of project cost performance, the influence of contract or procurement types on cost overruns, analyses of causal relationships, and the impact of Building Information Modelling (BIM) on cost outcomes. Furthermore, a detailed review identified three conceptual and methodological shortcomings, which constitute research gaps warranting further investigation and are presented in Table 1.

Table 1. Identified research gaps

	Research gaps
1	Narrow focus on exogenous factors
2	Continued reliance on perception-based data collection methods
3	Limited attention to interrelationships and causal linkages

Moving Beyond the Traditionally Believed Causes

Contrary to Flyvbjerg's (2002) assumptions and his reaffirmed stance in a 2018 (Flyvbjerg et al., 2018) article responding to critiques, many scholars argued that cost overruns arose mainly from technical and project-specific factors. Putting aside the technical causes of cost overruns that mainly referred to forecasting errors such as inaccurate models or scope changes, project specific factors (such as complexity, size, etc.) have received the most attention (Catalão et al., 2022). These are also known as endogenous factors (Catalão et al., 2022). However, the review of the literature shows that there exist exogenous factors that considerably affect the cost of construction projects yet have received limited attention. Exogenous factors include economic, political, institutional, and psychological influences, among which the political and institutional aspects have received the least attention. It is worth noting that political factors extend beyond strategic misrepresentation.

For instance in terms of political factors, cost overruns were found to increase during election periods (Catalão et al., 2022; Miranda Sarmento & Renneboog, 2017; Terrill et al., 2016). This was attributed to politicians seeking to expedite project delivery to attract voter support (Sarmento & Renneboog, 2017). Cost overruns were also higher under minority or left-leaning governments (Catalão et al., 2022). Projects managed by local governments tended to experience fewer cost overruns (Catalão et al., 2022). This was attributed to local authorities' deeper contextual knowledge, closer community ties, and more effective management (Pinheiro Catalão et al., 2019).

In terms of institutional factors, strong institutional and regulatory frameworks have the potential to mitigate cost overruns (Catalão et al., 2022). This was particularly evident in Scandinavian countries, where established budgeting and cost estimation practices contributed to more accurate cost forecasts. For example, in Sweden, infrastructure investment plans pass through three tollgates, with government approval required at each stage to either proceed or cancel a project based on updated cost–benefit assessments. The analysis of Swedish infrastructure projects demonstrated the effectiveness of this approach, as cost estimates at the final decision tollgate were typically close to the actual final costs (Eliasson, 2025). Similarly, the slight cost underruns observed in Norwegian infrastructure projects, as noted by Welde and Klakegg (2024), were attributed to quality assurance reviews conducted before budget approval and the application of the Successive Principle in cost estimation. Under this approach, 8–12 major cost categories and their key drivers were identified, each assigned low, most-likely, and high estimates. The analysis then iteratively refined the variables contributing most to overall uncertainty, following the 80/20 rule, until the principal uncertainties were reduced. This process typically yielded 30–40 key factors and produced more reliable estimates.

In addition to the institutional frameworks discussed above, corruption (Catalão et al., 2023; Sarmento & Renneboog, 2017) and weaker accountability have also been reported to be associated with higher cost overruns (Catalão et al., 2023). The above cases clearly illustrate how institutional and political factors can influence project cost performance.

Methodological Shortcoming

A recurring methodological pattern was observed across the reviewed literature, particularly in studies aimed at identifying and ranking the causes of cost overruns. Researchers typically began by extracting potential causes from previous studies, which were then transformed into questionnaire or interview items. Experts were subsequently asked to assess the relevance or importance of these items, and the collected responses were analyzed statistically to identify the most influential factors.

Some studies extended this approach by developing predictive models, most commonly regression-based, to forecast construction costs. This methodological approach, based on participants' perceptions, has also been widely used in other areas of cost overrun research, such as studies seeking to identify preventive measures, to examine the influence of BIM on cost performance, to investigate interrelationships among causes, and in other similar contexts.

In numerical terms, out of the 108 studies reviewed, 61% (66) relied on perception-based questionnaires or interviews, in which participants were primarily asked to rank or rate the importance of various factors using Likert or similar scales. When literature reviews and studies without primary data collection were excluded, this proportion rose to approximately 69%, highlighting the dominance of perception-based approaches in this area. It should be noted that not all questionnaire- or interview-based studies were perception-based, as in some cases participants were not asked to rank factors according to their personal judgments or perceptions. For instance, in some cases, questionnaires were used to collect historical cost data and were therefore classified as a dataset-based approach in this study. Similarly, some case study investigations that collected information through interviews were not classified as perception based, as their methodologies demonstrated greater rigor, for instance, through more comprehensive investigation and reporting, the use of thematic analysis, and the avoidance of Likert scale weighting.

Such perception-based approaches usually provide only minor contextual adjustments (such as country, sector, or sample size) and contribute little to theoretical or methodological advancement. A key weakness of this approach lies in the subjectivity of data collection, as respondents' rankings may not accurately represent the true influence of each factor, thereby undermining the validity of the findings. Furthermore, the arbitrary selection of factors from the literature can result in conceptual overlap and multicollinearity, as some variables may in fact represent underlying causes of others (Lind & Brunes, 2015). Reliance on this approach seems to have persisted, and as illustrated in Figure 1, the trend is even showing an upward trajectory. Ahiaga-Dagbui and Martek (2023) highlighted several limitations of perception-based surveys, including memory bias, oversimplification, respondent fatigue, poor design, and misinterpretation, particularly among non-native speakers. They argued that such methods are more suitable for studying human perceptions of construction phenomena and recommended greater use of untapped empirical databases as an alternative.

Another limitation of such methodologies lies in the illusion of precision created by subsequent modelling efforts that are based on arbitrarily selected variables and subjective importance rankings. For instance, regression analysis, one of the most commonly used cost-estimation techniques (Atapattu et al., 2023), performs best when variables are few, relationships are well established, and data are abundant and reliable. When variables are numerous, complex, and interdependent, they can easily yield spurious correlations (Ahiaga-Dagbui & Martek, 2023). A striking example illustrates this issue: applying stepwise regression to 31 observations with 30 variables (retaining only those with $t > 2.0$) produced an adjusted R^2 of 0.85 and eight seemingly significant predictors, until it was revealed that the data had been drawn from a table of random numbers. This demonstrates how statistical manipulation and misapplication can create a false sense of validity and lead to unsupported conclusions (Ahiaga-Dagbui & Martek, 2023). Furthermore, a model's fit to historical data often bears little relation to its ability to predict new or unseen cases (Ahiaga-Dagbui & Martek, 2023).

Interrelationships and Root Causes

Another gap identified in the literature, was that most studies failed to clearly recognize or account for the interdependencies among the causes of cost overruns. As a result, the causal relationships between these factors were often overlooked, leading to the neglect of their underlying root causes. This is important as addressing cost overrun factors in the early stages of a project can help prevent overruns in later stages (Annamalaisami & Kuppuswamy, 2022). Of the reviewed studies, only 15 examined the interrelationships among causes. Except for one study that employed a Bayesian approach to infer

these interrelationships directly from data, the others established causal relationships deductively, drawing on the literature, expert judgment, or logical reasoning. Some studies remained at this stage by depicting causal relationships qualitatively, while other studies further investigated or quantified the hypothesized structure mainly using Structural Equation Modeling. The use of deductive model structures made such studies primarily confirmatory rather than exploratory, which limited their ability to reveal new or unexpected interdependencies among cost overrun factors. Furthermore, all studies relied on perception-based data collection methods, typically combining literature review with questionnaires or interviews, which could introduce additional subjectivity to an already deduction-based model.

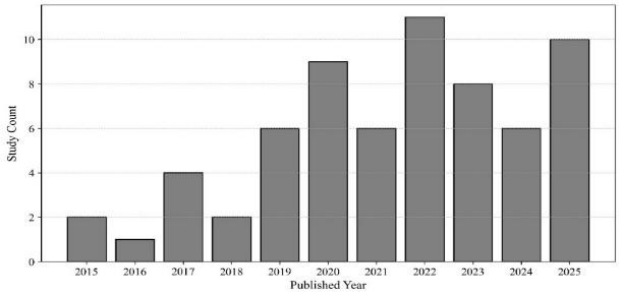

Figure 1. Count of studies relied on perception-based approaches

Discussion

Initially, the study aimed to clarify the contested root causes of cost overruns by addressing divisions in the literature and to show that optimism bias and strategic misrepresentation are likely relevant only in the early stages of project development, rather than during implementation. This suggests that the identified root causes of cost overruns depend on the reference point chosen for analysis. However, cost estimates in the early stages are highly volatile due to incomplete scope information; therefore, using this phase as the reference point for assessing cost overruns may lead to misleading interpretations of project performance. This is not to suggest that early-phase cost overruns should be ignored or accepted without scrutiny. Rather, a degree of cost flexibility should be expected at these stages, and research should first distinguish between early and implementation phases when identifying root causes, conducting statistical analyses, and developing forecasting models.

Furthermore, the study revealed that research on cost overruns in construction and infrastructure projects has expanded in scope but remained limited in methodological depth. A prevailing reliance on perception-based approaches, such as questionnaires and interviews, undermines the reliability of research findings, as these are derived from participants' subjective responses rather than empirically validated data. This overreliance is largely attributable to the difficulty of obtaining reliable datasets in the construction domain, where data repositories are limited and construction companies are often reluctant to share project information. These methodological weaknesses have also been acknowledged by other researchers (Ahiaga-Dagbui et al., 2017; Amadi & Higham, 2019; Gómez-Cabrera et al., 2024). Nevertheless, the literature shows little evidence of methodological advancement, as many recent studies continue to rely on the same perception-based approaches despite their known limitations. These methods largely capture practitioners' opinions rather than objective empirical evidence. Consequently, drawing inferences from statistical models developed using such subjective data can be misleading, as high-precision results may merely reflect internal model fitting rather than true explanatory power. The sophistication of subsequent modeling techniques cannot compensate for the fundamental weakness of the underlying data; in fact, models may appear accurate even when based on arbitrary or unreliable inputs.

Another notable gap identified in the literature was the limited consideration of exogenous factors, particularly political and institutional influences, when attempting to explain the causes of cost

overruns, develop forecasting models, or validate analytical frameworks. Most studies that addressed political aspects rarely went beyond the notion of strategic misrepresentation, overlooking broader governance-related and institutional dynamics that contribute to cost escalation. The limited attention given to such factors has also been noted by some previous studies (Catalão et al., 2022; Irfan et al., 2020; Love et al., 2022). The predominant focus of the literature on endogenous factors results in a partial understanding of the mechanisms that drive cost growth and overlooks the broader conditions that shape project performance and cost results.

Furthermore, only a small fraction of studies examined the interrelationships among causes or aimed at identifying the root causes of cost overruns. However, all of these studies exhibited the same methodological weakness previously discussed, as either the datasets or the construction of the cause–effect relationships were based on expert judgment. This reliance on subjective inputs limits the objectivity and empirical robustness of the findings, raising concerns about the validity of the inferred causal structures.

The findings benefit future researchers by showing that the relevance of widely debated root causes of cost overruns depends on the project phase, thereby highlighting the need to clearly distinguish between early development and implementation phases when analyzing cost overruns and developing forecasting models. This also implies that the RCF cost estimation method, as one of the most widely used estimation approaches, particularly in Europe (Cantarelli et al., 2025), is most appropriate for use in the pre-implementation stages, and that different estimation tools may be required for subsequent phases. This is because RCF was developed to address optimism bias and strategic misrepresentation. However, corroborating this assumption remains a subject for future research, as it was beyond the scope of this study. The study also paves the way for future research by clearly identifying three major gaps in literature. In addition, the findings caution construction practitioners against relying on estimation approaches based on subjective inputs and highlight the importance of incorporating exogenous factors into cost estimation.

Conclusion

A vast body of literature exists about cost overruns. Over the years, literature has become increasingly divided regarding their root causes. While many researchers have accepted optimism bias and strategic misrepresentation, along with the subsequent use of RCF for prediction purposes, others have challenged these assumptions. The contribution of this paper lies in critically analysing the literature on both sides to work toward a more balanced understanding. It next addresses several recurring methodological and conceptual shortcomings in the field, particularly the persistent reliance on perception-based data collection methods, where the importance or relevance of causes and mitigation measures is determined by participants' subjective judgments. Furthermore, the paper highlights the neglect of exogenous factors, particularly political and organizational influences, and emphasizes that the political dimension of cost overruns extends beyond strategic misrepresentation. Finally, it was observed that most studies have not examined the interrelationships among causes or identified their underlying root causes, and that those which have attempted to do so have largely relied on expert opinion as the primary basis for model development or data collection.

This paper relied on natural language processing techniques to identify the most relevant studies on the topic of cost overrun. Although the methodology was rigorous, the excluded papers were not manually reviewed, and while this is unlikely, it remains possible that some relevant publications were inadvertently omitted. Another limitation was the restricted ability to examine specific subtopics in depth, largely due to the exploratory nature of the study and its broad coverage of application areas. While the authors acknowledge the challenges of obtaining real project cost data, future research should move beyond perception-based approaches and adopt empirical, data-driven methods grounded in actual project records, audits, contract documents, and cost databases. It is recommended that future studies incorporate exogenous factors and consider both exogenous and endogenous

determinants when examining cost overruns. Researchers should also investigate causal relationships among cost overrun drivers and develop models that capture these interdependencies. This can be achieved through data-driven approaches such as Bayesian modelling, which infer causal dependencies from data rather than expert opinion, allowing relationships to emerge from evidence rather than subjective judgments.

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