Delays and Cost Overruns in Infrastructure Projects in Cotabato City, BARMM: Causes, Impacts, and Mitigation Strategies

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Abstract

Delays and cost overruns remain persistent challenges in infrastructure development, especially in fast-growing urban areas like Cotabato City, BARMM. This study investigates the root causes of these issues across both government and private construction projects through a mixed-methods approach. Quantitative data were obtained from structured surveys, while qualitative insights were gathered through interviews with key industry professionals. Analysis using the Relative Importance Index (RII) identified the leading delay factors as material procurement delays (RII = 0.884), poor site supervision (RII = 0.837), and unskilled or insufficient labor (RII = 0.814). For cost overruns, the primary contributors included increase in material costs (RII = 0.902), inflation/economic fluctuations (RII = 0.873), and underestimation of project costs (RII = 0.842). Pearson's correlation coefficient (r = 0.818) indicated a strong positive relationship between delay and cost overrun factors, confirming their interconnected nature. Thematic analysis supported these findings, revealing recurring issues such as weak project oversight, communication gaps, and limited institutional capacity. Respondents underscored the need for clear contractual terms, early risk identification, and stronger stakeholder coordination. The study recommends the implementation of construction-specific policies to streamline procurement, permitting, and accountability mechanisms—grounded in real project experiences and supported by capacity-building initiatives. These findings contribute to informed policy-making and institutional reform aimed at improving infrastructure delivery and reducing inefficiencies in BARMM.

Keywords: Construction Delay, Cost Overrun, Cotabato City, BARMM, Infrastructure Project

1. Introduction

The construction industry plays a vital role in driving national and regional development by providing critical infrastructure such as roads, bridges, buildings, and public utilities that serve as the backbone of various economic activities [1, 2, 3, 4]. It generates employment, facilitates innovation, and supports broader efforts to improve quality of life. Despite these contributions, the sector consistently struggles with challenges—particularly project delays and cost overruns—that hinder the timely and cost-effective delivery of infrastructure [5]. These issues are not confined to developing countries but are recognized globally as persistent barriers to efficient project execution [6].

In the Philippines, construction has remained a central pillar of economic growth, especially through flagship initiatives like the "Build, Build, Build" program launched in 2017 to fast-track infrastructure modernization and public service delivery [7, 8]. Recent data show that the construction industry contributed 9.0% to the country's Gross Domestic Product (GDP) in the third quarter of 2023 [9]. However, this momentum is often hampered by recurring inefficiencies. Delays and cost overruns continue to surface, driven by factors such as inaccurate estimates, design changes, procurement bottlenecks, and weak financial and project oversight [10, 11].

These challenges are especially evident in the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM)—a region historically affected by conflict and underdevelopment. Since its formal establishment in 2019, BARMM has made strides in closing infrastructure gaps by investing in roads, housing, water systems, and public facilities [12]. Between 2020 and 2023 alone, the Bangsamoro government funded the construction of 17,283 housing units, 103 bridges, 102 flood control systems, 281 Level II water systems, and over 1,800 kilometers of roads and highways [13]. Yet despite these efforts, implementation remains uneven. Many infrastructure projects, particularly in Cotabato City—the region's administrative hub—continue to suffer from delays and escalating costs, raising concerns about resource efficiency and long-term impact [14].

Globally, studies have shown that nine out of ten construction projects exceed budget expectations [5]. In developing regions, these inefficiencies are often rooted in weak project planning, inflation, fluctuating input costs, and limited institutional oversight [15]. Time delays are frequently triggered by regulatory hurdles, design changes, supply chain disruptions, and low workforce productivity [16, 17]. The consequences are far-reaching: stalled services, legal disputes, diminished investor confidence, and public dissatisfaction [6, 18].

In BARMM, these issues are compounded by regional security risks, logistical barriers, and governance constraints that further complicate project delivery [10]. Delays and budget overruns not only waste limited public resources but also risk deepening the socio-economic divide in an already vulnerable region [11]. When infrastructure projects fail to materialize as planned, the public loses trust, and critical services are delayed—setting back development efforts in a region striving for peace and progress.

Addressing these challenges begins with a deeper understanding of their root causes. This study seeks to examine the specific factors contributing to delays and cost overruns in public and private infrastructure projects in Cotabato City, BARMM. By identifying these issues and proposing actionable solutions, the study aims to contribute to more efficient project implementation and better-informed policy interventions that can help transform infrastructure delivery in the region [11].

2. Methodology

2.1 Research Design

This study employed a mixed-methods research design, combining quantitative and qualitative approaches to comprehensively examine the causes of delays and cost overruns in infrastructure projects in Cotabato City, BARMM. This integration enhanced the credibility and contextual richness of the findings by merging statistical patterns with real-world experiences [19]. The quantitative phase followed a descriptive design using structured surveys to profile respondents and assess key variables. Data analysis involved descriptive statistics, the Relative Importance Index (RII) to rank delay and cost overrun factors, and Pearson's correlation to determine the strength of their relationship. In parallel, a phenomenological approach guided the qualitative phase, wherein semi-structured interviews were conducted with engineers, contractors, consultants, and project owners. Thematic analysis followed Braun and Clarke's six-phase framework, which included data familiarization, coding, theme development, and interpretation [20]. Together, these methods enabled a robust triangulation of data, offering a holistic understanding of infrastructure inefficiencies and supporting the development of context-specific recommendations for improved project implementation in BARMM.

2.2 Locale of the Study

This study was conducted in Cotabato City, a rapidly urbanizing area within the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM). Officially integrated into BARMM on December 15, 2020, Cotabato City now serves as a key administrative and economic center in the region. As a third-class component city located at 7°13′12″N, 124°15′00″E, it covers a land area of 176 square kilometers and comprises 37 barangays, with a total population of 325,079 as recorded in the 2020 Census [21,22].

2.3 Sampling Method

This study adopted a mixed sampling approach tailored to its two-phased research design. For the quantitative component, a stratified random sampling technique was employed to ensure proportional representation across key subgroups within the construction sector. These strata included professionals from government infrastructure projects, private commercial developments, and residential construction firms. By dividing the population into strata based on sectoral classification, the method minimized sampling bias and enhanced the representativeness of the sample [19]. This ensured that insights derived from the data reflected the varied perspectives and experiences of stakeholders involved in infrastructure projects across Cotabato City, BARMM.

For the qualitative component, the study employed purposive sampling to identify and engage key informants with extensive experience in managing project delays and cost overruns. This non-probability technique enabled the deliberate selection of individuals—such as project managers, contractors, consultants, and site engineers—who were most capable of providing rich, context-specific insights into the research problem [23]. The emphasis was on depth and relevance of experience rather than random selection, which is appropriate for qualitative inquiries focused on thematic exploration.

The sample size for the quantitative phase was determined using Slovin's formula [24]:

$$n = \frac{N}{1+Ne^2} \qquad (1)$$

where n is the required sample size, N is the total population size, and e is the margin of error.

This formula provided an efficient and statistically valid basis for determining the number of survey respondents required to generalize findings within an acceptable margin of error.

For the qualitative interviews, a total of 10 key informants were targeted, consistent with qualitative research guidelines that emphasize data saturation over numerical adequacy [25]. This range was sufficient to uncover major themes while maintaining analytical depth, particularly within the scope of phenomenological inquiry.

2.4 Respondents of the Study

The respondents of this study were professionals directly involved in the planning, execution, and supervision of public and private infrastructure projects in Cotabato City, BARMM. For the quantitative phase, 43 individuals participated, consisting of 17 from the government sector and 26 from private construction firms. These included project managers, consultants, contractors, site engineers, and project owner. For the qualitative phase, 10 key informants were purposively selected based on their experience, role, and involvement in project decision-making. Their insights provided valuable context to complement the quantitative data. Participation was voluntary, with informed consent obtained from all respondents.

Only individuals with direct engagement in infrastructure project implementation were included, and strict confidentiality was maintained throughout the study.

2.5 Research Instrument

This study utilized two primary instruments for data collection: a structured survey questionnaire and a semi-structured interview guide, both developed based on the study objectives and variables identified in the literature. The questionnaire included respondent profile questions and items measuring perceptions of delay and cost overrun factors using a 5-point Likert scale, where 1 indicated "Not Significant" and 5 indicated "Extremely Significant." The instrument underwent a three-stage validation process: expert review by construction professionals and academics, pilot testing with a small non-sample group, and reliability testing using Cronbach's Alpha to assess internal consistency [26]. Respondents from the government sector answered based on public projects, while private sector respondents provided insights based on the type of project, they most frequently managed. For the qualitative phase, a semi-structured interview guide was used to conduct in-depth interviews with purposively selected key informants. All participants provided informed consent, and interviews were audio-recorded—with permission—and transcribed for thematic analysis. Ethical standards and participant confidentiality were strictly upheld throughout the process.

Cronbach's Alpha formula:

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum \sigma^2{}_i}{\sigma^2{}_t}\right) \quad (2)$$

where: α – Cronbach's Alpha, K – number of items, $\sigma^2{}_i$ – variance of each item, and $\sigma^2{}_t$ – variance of the total score

2.6 Data Analysis

This study applied both quantitative and qualitative methods to analyze data and provide a comprehensive understanding of the causes of delays and cost overruns in infrastructure projects in Cotabato City, BARMM.

Quantitative data were analyzed using descriptive statistics, the Relative Importance Index (RII), and Pearson's correlation. Frequency and percentage were used to profile respondents and summarize their responses.

Percentage Formula:

$$Percentage = \left(\frac{Frequency}{Total\ Responces}\right) x\ 100 \quad (3)$$

To rank the significance of delay and cost overrun factors, the RII was employed:

RII formula:

$$RII = \frac{\Sigma\, w}{A\ x\ N} \quad (4)$$

where w is the weight assigned, A is the highest Likert scale value, and N is the number of respondents.

Pearson's Product-Moment Correlation was used to assess the relationship between delay and cost overrun factors.

Pearson's r formula:

$$r = \frac{\sum(x_i-\bar{x})(y_i-\bar{y})}{\sqrt{\sum(x_i-\bar{x})^2} \cdot \sqrt{\sum(y_i-\bar{y})^2}} \quad (5)$$

where:

x_i and y_i represent individual data points for the variables

$\bar{x}$ and $\bar{y}$ are the mean values of the respective variables

Qualitative data from interviews were analyzed using Braun and Clarke's six-phase thematic analysis, including familiarization, coding, theme development, review, definition, and narrative synthesis. This process enabled the identification of recurring patterns and supported the interpretation of stakeholder perspectives on project inefficiencies.

2.7 Ethical Consideration

This study strictly adhered to ethical research standards to ensure the protection and rights of all participants. Informed consent was obtained from all respondents after explaining the study's purpose, procedures, and voluntary nature. Participation was entirely voluntary, with individuals free to withdraw at any stage without consequence. To maintain confidentiality, all data were anonymized, and no personally identifiable information appeared in any reports. Digital records were securely stored and encrypted, accessible only to the researcher and authorized faculty advisers. The study involved minimal risk, with no sensitive or invasive questions posed. Ethical clearance was granted by the university's Institutional Ethics Review Committee (IERC), and data collection commenced only after formal approval.

3. Result and Discussion

3.1 Reliability of Research Instruments

Before the full deployment of the survey, pilot testing was conducted with 15 respondents to assess the internal consistency of items related to project delays and cost overruns. Reliability analysis was performed using Cronbach's Alpha, a standard statistical measure for evaluating internal consistency. As noted by Taber, 2018 [26], a Cronbach's Alpha value of 0.70 or higher is considered acceptable, while values above 0.90 indicate excellent reliability. The analysis yielded a Cronbach's Alpha of 0.914 for the 15 delay-related items and 0.909 for the 14 cost overrun-related items, both indicating excellent internal consistency. These results confirm that the instrument was statistically reliable and appropriate for full-scale data collection. Summary results are presented below:

Table 1: Reliability Statistics for Delay Factors

Measure	Value
Cronbach's Alpha	0.914
Number of Items	15

Table 2: Reliability Statistics for Cost Overrun Factors

Measure	Value
Cronbach's Alpha	0.909
Number of Items	14

Table 3 presents the questionnaire distribution and corresponding response rates by professional role. Out of 67 distributed questionnaires, 43 were completed and returned, resulting in an overall response rate of approximately 64.18%. Site engineers accounted for the highest number of responses (24), followed by project managers (8), contractors and consultants (4 each), and owners/clients (3). The highest individual response rate was observed among project managers (80.00%), while contractors and owners/clients had lower response rates at 44.44% and 42.86%, respectively. This distribution ensured a representative cross-section of roles involved in infrastructure project execution.

Table 3: Questionnaire distribution and responses

Description	Questionnaire distributed	Number of Respondents	Percentage of responses
Project Manager	10	8	80.00%
Contractor	9	4	44.44%
Consultant	6	4	66.67%
Site Engineer	35	24	68.57%
Owner/client	7	3	42.86%
Total	67	43	64.18%

3.2 Profile of Respondents

Table 4 presents the demographic profile of the 43 respondents who participated in the study. The sample comprised 39.5% from government agencies and 60.5% from private construction firms, ensuring balanced representation across sectors. Most respondents were project or site engineers (55.8%), followed by project managers (18.6%), contractors and consultants (9.3% each), and project owners/clients (7%).

In terms of professional experience, 65.2% had ten years or less, while 27.9% had more than ten years of industry exposure. A majority (72.1%) were engaged in government-funded projects, with the rest in the private sector. Medium-scale projects (₱10M–₱50M) were the most common (41.9%), followed by small-scale (32.6%) and major infrastructure projects (16.3%). Geographically, most projects were local (53.5%) or regional (41.9%), reflecting the urban development focus within Cotabato City and the broader BARMM region.

This diverse respondent composition allowed for robust and context-specific insights into infrastructure project challenges in both public and private sectors.

Table 4: Demographic Profile of Respondents

Category	Classification	Frequency	Percentage (%)
Type of Employer	Government Sector	17	39.5
	Private Sector	26	60.5
Position/Role	Project Owner/Client	3	7
	Project/Construction Manager	8	18.6
	Contractor	4	9.3
	Consultant	4	9.3
	Project/Site Engineer	24	55.8
Years of experience	Less than 5 years	14	32.6
	5-10 years	14	32.6
	11-15 years	7	16.3
	More than 15 years	5	11.6
	Not Applicable	3	7
Type of Project Handled	Government-funded Projects	31	72.1
	Private Projects	12	27.9

Project Size	Small-scale (<₱10M)	14	32.6
	Medium-scale (₱10M - ₱50M)	18	41.9
	Large-scale (₱51M - ₱100M)	4	9.3
	Major Infrastructure (>₱100M)	7	16.3
Project Coverage	Local (City/Municipality)	23	53.5
	Regional (BARMM/Province-wide)	18	41.9
	National	2	4.7

3.3 Delay Factors

Table 5 presents a comparative analysis of the factors contributing to project delays in infrastructure development, using Relative Importance Index (RII) values based on responses from 43 construction professionals. The results are categorized into three groups: overall respondents, those handling government-funded projects, and those managing private sector projects. This consolidated view provides a comprehensive understanding of how delay factors vary by project ownership and execution environment.

Across all categories, “Delay in material procurement” emerged as the most critical factor, ranking 1st overall (RII = 0.88), 1st in government projects (RII = 0.85), and 1st in private projects (RII = 0.91). This finding underscores the pervasive issue of supply chain inefficiencies and material availability challenges in infrastructure construction [27]. Bascon et al. [28] previously emphasized the impact of late material deliveries on project timelines in the Philippines, especially in vertical and urban development settings. The high RII values reflect recurring procurement bottlenecks across both sectors.

In the private sector, operational factors like poor site management and supervision (RII = 0.88) and frequent design changes (RII = 0.85) were ranked 2nd and 3rd, respectively. These findings suggest that internal project coordination, execution oversight, and flexibility in design implementation play significant roles in private sector delays. These are often tied to pressures for profitability and speed, making any misstep in execution or design highly impactful. Similarly identified weak managerial oversight and labor-related inefficiencies as major delay drivers in developing countries [29, 30]

In contrast, respondents from government projects perceived political interventions and bureaucratic delays (RII = 0.82) as the 3rd most critical factor, whereas this factor ranked last (15th) in private sector projects with a notably low RII of 0.56. This notable disparity emphasizes the distinct administrative and political complexities in public infrastructure delivery, where protracted permitting procedures, inter-agency coordination issues, and inflexible budget cycles often contribute to significant project delays. These bureaucratic challenges have been observed to vary by location, with similar patterns documented in other developing contexts [31]. Additionally, rigid institutional protocols and procedural inefficiencies have been found to disrupt project timelines and compromise effective financial management [32, 33].

Another notable contrast lies in financial mismanagement, which was ranked 2nd (RII = 0.84) by respondents from government projects but only 9th (RII = 0.76) among those in the private sector. This discrepancy indicates that public sector contractors are often more affected by cash flow constraints, delayed fund releases, and insufficient financial planning—issues typically intensified by bureaucratic procedures and politically influenced budgeting. These findings align with prior research that identified weak financial control and funding delays as major contributors to project delays, especially within the context of public infrastructure in developing countries [34,36].

Interestingly, weather conditions, a typically significant external factor in tropical construction environments, ranked relatively low across all categories—12th overall (RII = 0.72). This outcome may reflect the respondents' perception that internal managerial and procedural inefficiencies are more dominant causes of delays than environmental variables.

Moreover, the consistent ranking of factors such as "unskilled or insufficient labor," "inaccurate project estimates," and "poor contractor performance" across both public and private sectors reveals persistent, industry-wide inefficiencies. These findings point to fundamental shortcomings in workforce development, project planning, and contractor accountability—systemic challenges that are not confined to a specific type of project ownership but demand strategic, sector-spanning reforms.

In conclusion, while procurement and supervision issues are common to both sectors, the nature of delays diverges notably. Public sector projects are particularly burdened by political and bureaucratic constraints, whereas delays in the private sector are more often linked to operational inefficiencies and coordination challenges. These distinctions underscore the importance of tailored mitigation strategies: public infrastructure delivery could be improved through regulatory streamlining and timely funding mechanisms, while private projects would benefit from enhanced project management practices, precise scheduling, and investments in workforce upskilling [27].

Table 5: Consolidated Ranking of Delay Factors

Factors Causing Delays	Overall		Government		Private	
	RII	Rank	RII	Rank	RII	Rank
Delay in material procurement	0.88	1	0.85	1	0.91	1
Poor site management and supervision	0.84	2	0.78	7	0.88	2
Unskilled or insufficient labor	0.81	3	0.79	5	0.83	5
Inefficient project scheduling and planning	0.80	4	0.74	9	0.85	4
Frequent design changes	0.80	5	0.72	11	0.85	3
Poor financial management by contractor	0.79	6	0.84	2	0.76	9
Change of project scope or priorities	0.79	6	0.75	8	0.82	6
Inaccurate project cost/time estimates	0.77	8	0.73	10	0.80	7
Delayed payments from owner/client	0.77	9	0.80	4	0.75	10
Inadequate risk management practices	0.75	10	0.79	5	0.73	11
Poor contractor performance	0.75	11	0.72	11	0.77	8
Weather conditions	0.72	12	0.72	11	0.72	12
Lack of stakeholder coordination	0.70	13	0.71	14	0.69	13
Delay in permits and approvals	0.68	14	0.68	15	0.68	14
Political interventions/bureaucratic delays	0.67	15	0.82	3	0.56	15

3.5 Cost Overrun Factors

Table 6 provides a consolidated overview of the top factors contributing to cost overruns in infrastructure projects, based on the Relative Importance Index (RII) derived from 43 respondents representing both public and private sectors in Cotabato City, BARMM.

Among all respondents, "increase in material costs" (RII = 0.90) was identified as the leading factor, ranking first in both the overall and private sector categories (RII = 0.97). This underscores the significant impact of fluctuating raw material prices and market instability on construction budgets [11,28,35]. Volatility driven by inflation, energy prices, and currency fluctuations emerged as a critical challenge, especially for private sector projects operating within narrower profit margins and tighter timelines.

"Inflation and economic fluctuations" followed closely as the second most significant factor (RII = 0.87 overall, 0.92 private sector), further reinforcing the role of macroeconomic forces in driving project cost escalations. These factors disproportionately affect private developers, who often lack the financial buffers and risk-sharing mechanisms accessible to public entities.

In contrast, respondents from government projects emphasized "contractor financial instability" (RII = 0.89) and "legal disputes/claims" (RII = 0.81) as top concerns. These reflect structural challenges in public procurement systems, including delayed disbursements, rigid qualification processes, and protracted legal procedures. Institutional inefficiencies and bureaucratic compliance requirements were also noted to exacerbate final project costs and timelines [5].

Although "poor labor productivity" and "design-related rework" ranked consistently among the top five across both sectors, they were particularly emphasized in government projects. This may be attributed to the typically larger workforce scale and more demanding reporting standards, which make inefficiencies more apparent and costly [36].

Interestingly, "interest rate/cost of borrowing" and "legal disputes" were ranked among the least critical in private projects (13th and 14th, respectively), suggesting greater financial adaptability and dispute resolution efficiency in the private sector.

In summary, private sector cost overruns are predominantly driven by market volatility and macroeconomic uncertainty, whereas government projects are more affected by internal financial fragility, administrative delays, and labor inefficiencies. These findings underscore the importance of sector-specific mitigation strategies—such as price escalation clauses and flexible financing models for private developments, and enhanced procurement governance and financial oversight for public infrastructure initiatives.

Table 6: Cost Overrun Factors

Factors Causing Delays	Overall		Government		Private	
	RII	Rank	RII	Rank	RII	Rank
Increase in material costs	0.90	1	0.80	5	0.97	1
Inflation/economic fluctuations	0.87	2	0.80	5	0.92	2
Underestimation of project costs	0.84	3	0.78	8	0.88	3
Re-work due to design errors	0.82	4	0.75	10	0.87	4
Poor labor productivity	0.82	5	0.81	3	0.82	6
Delays in financial disbursement	0.80	6	0.79	7	0.82	7
Scope changes/variation orders	0.80	6	0.72	13	0.86	5
Contractor financial instability	0.78	8	0.89	1	0.70	11

Poor contract management	0.76	9	0.78	8	0.75	9
Inadequate contingency allowance	0.75	10	0.74	12	0.75	8
Material wastage	0.74	11	0.75	10	0.74	10
Ground/site condition issues	0.73	12	0.84	2	0.65	12
Legal disputes/claims	0.66	13	0.81	3	0.56	14
Interest rate/cost of borrowing	0.65	14	0.71	13	0.61	13

3.6 Delays and Cost Overruns Correlation

Table 7 summarizes the Pearson correlation coefficients used to assess the relationship between project delays and cost overruns across different sectors. The analysis reveals statistically significant and strong positive correlations across all respondent groups, indicating that delays are closely linked with increased project costs, irrespective of ownership type.

For all respondents combined, the correlation coefficient was $r = 0.818$ ($p < 0.001$), suggesting that delays in project execution significantly increase the likelihood of cost overruns. This finding highlights the cumulative effect of time-related inefficiencies in construction, where extended schedules often lead to higher labor expenses, material cost inflation, and prolonged equipment rentals. These results align with earlier studies that emphasized how scheduling delays contribute directly to cost escalation in developing contexts [5, 6, 11].

When disaggregated by project type:

- Government Sector ($r = 0.757$) – The correlation, while still strong, is slightly lower than in the private sector. This may be due to institutional constraints such as rigid budget caps, delayed fund releases, or contingency allocations that can buffer some financial impacts of delays. However, given the bureaucratic processes typical of public projects, even minor scheduling slippages can cause significant financial ripple effects. This underscores the need for streamlined administrative procedures and improved monitoring in public infrastructure delivery.
- Private Sector ($r = 0.905$) – The strongest correlation was observed in private projects, indicating a near-direct link between schedule delays and cost overruns. Private developments typically operate under strict timelines, narrow profit margins, and performance-based contract terms. As a result, any delay can rapidly escalate costs, lead to financing burdens, or undermine investor confidence. These findings point to the critical need for robust project controls, predictive scheduling tools, and agile risk management frameworks in private sector construction.

In conclusion, the correlation analysis confirms that project delays are a strong predictor of cost overruns across both sectors. While the mechanisms may differ, the consistent significance across groups reinforces the importance of integrated time and cost management, early warning systems, and proactive delay mitigation to improve infrastructure project performance in BARMM and similar development settings.

Table 7: Pearson Correlation between Project Delays and Cost Overruns

Respondent Group	Correlation Coefficient (r)	Significance (p-value)	Interpretation
Combined (Government and Private Sectors)	0.818**	< 0.001	Strong positive correlation

Government Sector	0.757**	< 0.001	Strong positive correlation
Private Sector	0.905**	< 0.001	Very strong positive correlation

3.7 Thematic Analysis: Mitigation Strategies and Stakeholder Experiences

Mitigation Strategies to Minimize Delays and Cost Overruns

Guided by Braun and Clarke's thematic analysis framework [19], five key strategic themes emerged from the qualitative interviews, offering actionable insights to address project delays and cost overruns in Cotabato City, BARMM:

1. Proactive Project Management – this was the most frequently emphasized theme across respondents. Participants underscored the importance of comprehensive planning, clearly defined project scopes, risk anticipation, and the establishment of contingency budgets. These measures were viewed as foundational to minimizing disruptions and managing uncertainties throughout the project lifecycle. The findings are consistent with previous studies highlighting that front-loaded planning significantly improves project resilience against unforeseen challenges [11, 31, 37].
2. Competent Resource Selection – several informants stressed the need for a merit-based contractor selection process, emphasizing experience, track record, and technical capacity over lowest-cost bids. Participants linked poor contractor performance to rework, low-quality outcomes, and mismanagement of schedules. This reinforces prior evidence that contractor capability directly influences overall project delivery [27, 34].
3. Clear Contractual Agreements – well-structured and detailed contracts were frequently cited as essential for ensuring mutual accountability, clarifying deliverables, and avoiding disputes. Respondents indicated that clear contractual terms help prevent scope creep and provide a legal framework for resolving conflicts. Such insights align with earlier research suggesting that contractual clarity is a safeguard against miscommunication and uncontrolled project modifications [32, 38].
4. Efficient Resource Management – timely procurement, optimized labor deployment, and adequate equipment availability were identified as practical strategies for reducing delays and controlling costs. Respondents noted that logistical inefficiencies often stem from reactive rather than planned resource management. These reflections support prior findings that effective resource allocation is critical to project efficiency and timeliness [39].
5. Effective Communication and Control – the final theme emphasized the role of transparent communication and responsive site coordination in minimizing escalation of minor setbacks. Interviewees shared that regular meetings, prompt issue resolution, and updated progress tracking systems contribute significantly to timely decision-making and project coherence. These observations echo earlier studies that associated improved communication flow with reductions in delay-related risks [40, 41, 42].

Collectively, these themes underscore the importance of embedding systematic project controls, professional development, and inter-agency collaboration in infrastructure implementation. They also highlight that both government and private sectors can benefit from institutionalized project management practices tailored to local contexts in BARMM.

Stakeholder Experiences with Delays and Cost Overruns

Insights from qualitative interviews with industry professionals revealed seven core themes that reflect the lived experiences and practical challenges encountered during infrastructure project implementation in Cotabato City, BARMM:

1. Planning and Resource Constraints – respondents frequently pointed to inaccurate cost forecasting, labor shortages, and delays in material procurement as primary contributors to both time and budget overruns. These operational gaps, particularly during the early stages of the project lifecycle, were identified as systemic and recurring across both public and private projects. These reflections mirror earlier findings that poor resource planning is a persistent bottleneck in construction delivery [11, 31].
2. Stakeholder Coordination and Bureaucracy – slow permit approvals, fragmented inter-agency processes, and frequent design revisions were consistently reported, particularly in government-led projects. Participants emphasized that misalignment among key stakeholders led to inefficiencies, confusion, and schedule disruptions. This theme affirms previous literature that identified bureaucratic complexity as a major hindrance to project execution [27, 32].
3. Financial and Environmental Constraints – many participants cited cash flow delays, rigid procurement processes, and vulnerability to weather disturbances as significant external constraints. These challenges often compounded internal inefficiencies, causing cascading effects on project timelines and budgets. Similar concerns have been highlighted in studies emphasizing how economic and environmental volatility undermines construction performance [21, 30].
4. Proactive Risk and Contract Management – respondents recognized the importance of early risk identification, structured monitoring systems, and clearly defined roles and responsibilities. Projects that employed proactive management strategies were seen to experience fewer disruptions and demonstrated greater cost discipline. This aligns with findings that risk management frameworks are essential in minimizing uncertainties and disputes [31].
5. Capacity Building and Technology Use – the adoption of digital tools for project tracking, combined with regular technical training for personnel, was highlighted as a promising approach to reducing rework and improving coordination. Interviewees shared that investment in workforce capability and technology integration led to measurable improvements in project efficiency. These perspectives are supported by previous studies linking innovation adoption to enhanced performance in construction [33, 34].
6. Institutional Strengthening and Collaboration – calls for streamlined regulatory frameworks, enhanced transparency, and more inclusive stakeholder engagement emerged across interviews. Respondents suggested that coordinated governance and community involvement could reduce procedural delays and increase accountability. These strategies reflect broader recommendations for institutional reform in developing infrastructure sectors [23, 30].
7. Public vs. Private Sector Dynamics – a notable contrast was observed between the two sectors: government projects were seen as more prone to bureaucratic delays and approval obstruction, while private sector projects exhibited faster implementation but sometimes suffered from lax supervision. This dichotomy underscores the need for sector-specific improvement strategies and echoes earlier findings on differing operational environments and constraints [20, 34].

4. Conclusions

This study explored the causes, impacts, and mitigation strategies for delays and cost overruns in infrastructure projects within Cotabato City, BARMM, utilizing a mixed-methods research design. Through quantitative survey analysis and qualitative interviews with professionals from both government and private sectors, the following conclusions were drawn:

- Delays and cost overruns are persistent challenges in Cotabato City's infrastructure development. The most influential delay factors—based on Relative Importance Index (RII)—were delay in material procurement, inefficient scheduling and planning, and poor site supervision and coordination. Cost overruns, meanwhile, were largely attributed to rising material costs, scope changes, and funding delays, reflecting both internal project inefficiencies and external market pressures.
- A statistically strong positive correlation ($r = 0.818$, $p < 0.001$) between delay and cost overrun factors confirms their interdependence. As delays increase, projects are more likely to incur cost escalations—supporting the assertions of Flyvbjerg et al. (2003) [5] and Olawade et al. (2010) [32] that time and cost overruns are compounding phenomena in construction management.
- Sector-specific distinctions were evident. Government projects were more prone to bureaucratic obstructions and budget limitations, while private sector projects, despite faster execution, were affected by inconsistent oversight and variable contractor performance. These differences suggest the need for tailored strategies to address unique sectoral challenges.
- The qualitative thematic analysis revealed seven recurring themes: planning and resource constraints, stakeholder coordination and bureaucracy, financial and environmental limitations, proactive contract and risk management, capacity building and technology use, institutional strengthening, and public-private sector dynamics. These themes reinforced the quantitative results and provided context-specific insights into the operational realities of local construction practices.
- The findings emphasize that while systemic and recurring issues persist, the adoption of proactive mitigation strategies can significantly reduce delays and cost overruns. These include improved early-stage planning, use of digital technologies such as BIM and project tracking software, stringent contractor selection, clear contract frameworks, and strengthened inter-agency collaboration.

5. Recommendations

In light of the study's findings on the causes and impacts of delays and cost overruns in infrastructure projects in Cotabato City, BARMM, the following recommendations are proposed to address project inefficiencies and enhance infrastructure delivery outcomes:

1. Strengthen Pre-Construction Planning – conduct detailed feasibility studies, establish clear project scopes, and engage stakeholders early in the planning process. Tools such as the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT) should be integrated into scheduling practices to improve timeline accuracy and project readiness.
2. Enhance Procurement and Financial Flow Mechanisms – efficient procurement processes and ensure timely disbursement of project funds, particularly in government-led projects. Addressing administrative restrictions will reduce stoppages and maintain construction momentum.
3. Promote the Use of Digital and Risk Management Tools – encourage the adoption of Building Information Modeling (BIM), digital project tracking systems, and structured risk assessment frameworks. These tools can minimize coordination gaps, improve design accuracy, and proactively manage project uncertainties.
4. Invest in Professional Capacity Development – support continuous education and training for engineers, project managers, and field personnel. Collaborations with academic institutions and indus-

try partners should be fostered to develop a skilled and responsive local construction workforce.

5. Advance Policy Reform and Institutional Strengthening – push for regulatory reforms such as simplified permitting systems and updated construction governance policies. Establish a one-stop shop mechanism to expedite approvals, enforce compliance, and increase transparency in infrastructure project implementation.
6. Encourage Public-Private Sector Collaboration – create multi-stakeholder platforms that enable dialogue, standard alignment, and experience sharing between government agencies and private contractors. Collaborative forums can foster innovation and address shared challenges in infrastructure development.
7. Pursue Future Research Directions – future studies should expand the research scope beyond Cotabato City to include other areas within BARMM. Additionally, focused investigations on specific variables—such as the impact of political influence, climate risks, or contractor prequalification—may provide deeper insights for policy and practice improvements.

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