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Assessment of Causes of Cost Overruns in Construction Projects in Uganda: A Case Study of Public Building Projects

Lugya Dacuan[1], Jjuko Edrine[2]
1, 2 Metropolitan International University

Abstract

This study assessed the causes of cost overruns in public building projects in Uganda. A mixed design combined a relative importance ranking of ten perceived causes, based on 120 simulated practitioner responses, with a quantitative analysis of 140 simulated completed projects. Descriptive statistics, Pearson correlations, multiple linear regression and binary logistic regression were applied, with full diagnostic testing. Delayed payment of certificates, incomplete design at tender and variation orders were ranked as the three most important causes. The mean cost overrun in the simulated sample was 26.0 percent of the contract sum. The linear model explained 65.1 percent of the variance in overruns, with schedule delay, variation orders, incomplete design, delayed payment and delayed site possession increasing overruns and contractor experience reducing them. In the logistic model, incomplete design raised the odds of a substantial overrun 3.31 times. The study concluded that overruns originated mainly in weaknesses in project preparation, client-side payment performance and change management, and it recommended complete designs before tendering, timely payment and strict control of variations. All figures were simulated for illustration and do not describe real projects.

Keywords: cost overruns; public building projects; variation orders; project delay; construction; Uganda

1.0 Background

Cost overruns, defined as the amount by which the final cost of a project exceeds its contract sum or original budget, are among the most persistent problems in construction worldwide. Flyvbjerg et al. (2002), in a study of hundreds of public works projects, found that cost escalation was the rule rather than the exception and argued that it arose from a combination of technical error, optimism bias and strategic misrepresentation. Morris and Hough (1987) similarly showed that major projects regularly failed to meet cost targets. For governments, overruns reduce the number of facilities that can be delivered with a given budget and weaken fiscal discipline(Akankwasa et al., 2022).

Public building projects in Uganda, including schools, hospitals, administrative blocks, markets and staff housing, were financed through the national budget, local government grants and donor funds, and were procured under the Public Procurement and Disposal of Public Assets Act, 2003 and managed within the framework of the Public Finance Management Act, 2015(Alex & Devis, 2023). Responsibility was spread across the Ministry of Works and Transport, line ministries, local governments, consultants and contractors. The national development plans prioritised infrastructure as a driver of growth, and the sustained expansion of the public building programme made the control of costs a matter of considerable fiscal significance(Suzan & Gracious Kazaara, 2023).

Research in East Africa and elsewhere identified many causes of overruns, including poor estimation, variations,

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delays, inflation, payment problems and weaknesses in supervision. Alinaitwe et al. (2013) investigated the causes of delay and cost overrun in Uganda's public sector construction projects and identified problems such as inadequate planning, poor contractor management and financing difficulties, and Muhwezi et al. (2014) reported factors causing delay on Ugandan building projects. Internationally, studies of Vietnam, Gaza and Indonesia reported comparable causes, with variations and delays prominent among them (Le-Hoai et al., 2008; Enshassi et al., 2009; Kaming et al., 1997). The recurring character of these findings suggested that overruns were systemic, but the relative contribution of different causes in Ugandan public building projects needed to be quantified. This study therefore assessed the causes of cost overruns in two complementary ways(Alex & Moses, 2024). It ranked perceived causes using the relative importance index, a widely used method for aggregating practitioners' ratings (Kometa et al., 1994), and it modelled actual overruns in a dataset of completed projects, testing the relationships between project characteristics, client and contractor performance and the size of overruns(Julius & Nancy, 2026). Combining perception and project-level evidence allowed the study to compare what practitioners believed to be the main causes with what the data suggested.

2.0 Problem Statement

Public building projects in Uganda were often completed at costs exceeding their contract sums, which reduced the value obtained from public funds and delayed the completion of other projects. Although causes such as variations, payment delays and poor design were frequently cited, there was little quantitative evidence on their relative importance or on how much each contributed to the size and likelihood of overruns. Without such evidence, interventions risked being generic and poorly targeted. This study addressed the problem by ranking the perceived causes of overruns and by modelling the determinants of the magnitude and probability of overruns in public building projects.

3.0 Main Objective

To identify and rank causes of cost overruns in Ugandan public buildings.

4.0 Literature Review

The literature on cost overruns offered several explanatory frameworks. Technical explanations attributed overruns to forecasting errors, inadequate designs and unforeseen conditions. Psychological explanations pointed to optimism bias, in which planners systematically underestimated costs and risks, and political-economic explanations argued that project promoters deliberately understated costs to secure approval (Flyvbjerg et al., 2002; Flyvbjerg, 2003). Odeck (2004) examined road projects in Norway and found that overruns were associated with project size and duration, among other factors, which showed that the problem was not confined to developing countries.

Empirical studies of construction projects in developing countries consistently ranked client-side and design-related factors among the top causes. Kaming et al. (1997) reported that inaccurate material estimates, design

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changes and inflation were prominent causes of cost overruns on high-rise projects in Indonesia. Le-Hoai et al. (2008) found in Vietnam that poor site management and supervision, poor project management, financial difficulties of the owner and design changes were leading causes. Enshassi et al. (2009), studying Gaza, highlighted material price escalation, delays in payment and the effect of political conditions. In Uganda, Alinaitwe et al. (2013) and Muhwezi et al. (2014) identified poor planning, funding problems and contractor management, as well as delays in payment.

Schedule delay and cost overrun were closely linked in the literature, since delay extended time-related costs such as site overheads, supervision and financing, and exposed projects to inflation (Assaf & Al-Hejji, 2006). Variation orders, which changed the scope, quantity or quality of work after contract award, were regarded as a principal route through which design deficiencies translated into additional costs. Contractor capacity, including experience and financial strength, was seen as a moderating factor because more experienced contractors anticipated problems and managed resources efficiently.

The gap in the literature was the combination of perception-based ranking with project-level modelling for Ugandan public buildings. Most existing studies relied on questionnaire rankings alone, which reflected opinion rather than measured effects. This study drew on an agency and project governance perspective, in which overruns arose from information asymmetries and misaligned incentives between clients, consultants and contractors, and tested it by estimating the effects of design completeness, payment performance, change management and delay on overruns.

5.0 Methodology

Research design. The study used a mixed, cross-sectional design (Creswell & Creswell, 2018). The perception component ranked causes of overruns using the relative importance index. The project component modelled the magnitude and probability of overruns in a dataset of completed public building projects.

Population and sample. The population consisted of public building projects completed between 2012 and 2024 under central and local government contracts. A sample of 140 completed projects was simulated, and a separate sample of 120 practitioners, comprising engineers, quantity surveyors, project managers and contractors, was simulated for the ranking. The project sample exceeded the minimum of 50 + 8m (106 for seven predictors) for multiple regression (Tabachnick & Fidell, 2019), and the 83 projects with substantial overruns gave about 11.9 events per predictor for logistic regression, above the guideline of ten (Peduzzi et al., 1996).

Measurement. Cost overrun was calculated as the difference between the final account and the original contract sum, expressed as a percentage of the contract sum, and a substantial overrun was defined as an overrun of 25 percent or more. Practitioners rated ten causes on a five-point scale (1 = not important, 5 = extremely important), and the relative importance index (RII) was calculated as the sum of the ratings divided by the product of the highest possible rating and the number of respondents (Kometa et al., 1994). Table 1 summarises the project-level variables.

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Table 1: Variables and measurement

Variable	Role	Measurement
Cost overrun	Dependent (linear)	(Final account − contract sum) ÷ contract sum × 100
Substantial overrun	Dependent (logistic)	1 = overrun of 25% or more; 0 = otherwise
Schedule delay	Independent	Months beyond the original contract period
Variation orders	Independent	Number of variation orders issued
Incomplete design at tender	Independent	1 = drawings or specifications incomplete at tender; 0 = complete
Delayed payment	Independent	1 = certificates paid late; 0 = paid on time
Delayed site possession	Independent	1 = late handover of site; 0 = on time
Contractor experience	Control	Years of operation of the contractor
Contract value	Control	Natural logarithm of contract sum in UGX million

Source: Primary Data, 2026

Analytical procedure. The RII was used to rank the causes. For the project data, descriptive statistics, Pearson correlations and chi-square tests summarised the data. A multiple linear regression modelled the percentage overrun and a binary logistic regression modelled the probability of a substantial overrun. Linear-model diagnostics comprised variance inflation factors (O'Brien, 2007), the Breusch–Pagan test (Breusch & Pagan, 1979), the Shapiro–Wilk test (Shapiro & Wilk, 1965), the Jarque–Bera test, the Durbin–Watson statistic (Durbin & Watson, 1951) and Cook's distance (Cook, 1977). The logistic model was evaluated with the likelihood-ratio test, the Hosmer–Lemeshow test (Hosmer & Lemeshow, 2013), pseudo-R^2 measures (Nagelkerke, 1991), the ROC curve and a classification table, with significance at the 0.05 level.

Hypotheses. Nine hypotheses were tested. Cost overruns were expected to rise with schedule delay (H1), variation orders (H2), incomplete design (H3), delayed payment (H4) and delayed site possession (H5), to fall with contractor experience (H6) and to rise with contract value (H7). The odds of a substantial overrun were expected to rise with incomplete design (H8) and delayed payment (H9).

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6.0 Results

6.1 Ranking of the causes of cost overruns

Table 2: Relative importance index of causes of cost overruns (N = 120 respondents)

Rank	Cause of cost overrun	Mean	SD	RII
1	Delayed payment of certificates	4.28	0.78	.857
2	Incomplete or inadequate design at tender	4.21	0.82	.842
3	Variations and change orders	4.18	0.77	.835
4	Poor cost estimation	3.98	0.89	.795
5	Price escalation and inflation	3.78	0.89	.757
6	Delays in site possession	3.76	0.84	.752
7	Poor contractor management	3.52	0.93	.705
8	Procurement irregularities and corruption	3.48	0.90	.697
9	Shortage of materials and equipment	3.14	0.94	.628
10	Adverse weather	2.53	0.92	.507

RII = sum of ratings ÷ (5 × N). **Source: Primary Data, 2026**

Table 2 shows that delayed payment of certificates was ranked as the most important cause (RII = .857), followed closely by incomplete or inadequate design at tender (RII = .842) and variations and change orders (RII = .835). These three causes were the only ones with RII values above 0.80, which indicated a high level of importance, and the narrow gaps between them suggested broad agreement that client-side payment performance, design preparation and change management were the principal sources of overruns. A second group of causes with RII values between 0.70 and 0.80 comprised poor cost estimation (.795), price escalation and inflation (.757), delays in site possession (.752) and poor contractor management (.705), while procurement irregularities and corruption (.697), shortage of materials and equipment (.628) and adverse weather (.507) were rated lowest. The ranking was consistent with earlier findings on Ugandan public projects (Alinaitwe et al., 2013) and with the international evidence that design and payment problems dominated (Le-Hoai et al., 2008; Enshassi et al., 2009). The relatively low ranking of procurement irregularities may have reflected respondents' reluctance to identify corruption, a sensitivity that a real survey would need to address through anonymity and indirect questioning.

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6.2 Descriptive statistics

Table 3: Descriptive statistics for continuous variables (n = 140)

Variable	Mean	SD	Min	Max	Skewness	Kurtosis
Cost overrun (% of contract sum)	26.04	11.71	-3	57.8	-0.20	-0.21
Schedule delay (months)	9.31	4.35	1	21.7	0.49	-0.23
Number of variation orders	5.19	2.22	0	13	0.52	0.81
Contract value (ln UGX million)	7.51	1.03	5	10	0.18	-0.33
Contractor experience (years)	10.01	4.16	2	22	0.48	0.01

Source: Primary Data, 2026

As Table 3 shows, the mean cost overrun was 26.0 percent of the contract sum (SD = 11.7), with a range from -3.0 percent, which was a small saving, to 57.8 percent. The distribution was nearly symmetric (skewness = -0.20, kurtosis = -0.21). A mean overrun of about a quarter of the contract sum implied that, on an average contract of about UGX 1800 million, the final cost exceeded the contract sum by roughly UGX 480 million(Nelson et al., 2022). Projects were delayed by a mean of 9.3 months (SD = 4.3), and a mean of 5.2 variation orders (SD = 2.2) were issued per project. Contractors had on average 10.0 years of experience (SD = 4.2). Skewness and kurtosis values were within ±1, which supported parametric analysis (Field, 2018).

Table 4: Frequency distribution of categorical variables (n = 140)

Variable (coded 1)	Yes (f)	Yes (%)	No (f)	No (%)
Incomplete design at tender	68	48.6	72	51.4
Delayed payment of certificates	77	55.0	63	45.0
Delayed site possession	46	32.9	94	67.1
Substantial overrun (25% or more)	83	59.3	57	40.7

Source: Primary Data, 2026

Table 4 shows that 48.6 percent of the projects were tendered with incomplete designs, 55 percent experienced delayed payment of certificates and 32.9 percent suffered delayed site possession. A substantial overrun of 25 percent or more occurred in 59.3 percent of projects (83 of 140), which meant that nearly three in five public building projects overran by at least a quarter. Projects with incomplete designs had a mean overrun of 30.7 percent (n = 68) compared with 21.7 percent (n = 72) for those with complete designs, a difference of 9.0 percentage points that was highly significant (Welch $t = 4.92$, $p < .001$).

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Table 5: Cross-tabulation of substantial overrun by design completeness and payment performance

Group	n	Outcome = 1 (f)	Outcome = 1 (%)	$\chi^2(1)$	p	φ
Complete design at tender	72	31	43.1	16.18	<.001	.340
Incomplete design at tender	68	52	76.5			
Payment on time	63	26	41.3	15.40	<.001	.332
Payment delayed	77	57	74.0			

Source: Primary Data, 2026

Table 5 shows that 43.1 percent of projects with complete designs had substantial overruns, compared with 76.5 percent of projects with incomplete designs, $\chi^2(1) = 16.18$, $p < .001$, $\varphi = .340$, a moderate-to-large association (Cohen, 1988). Delayed payment showed a similarly strong association: 41.3 percent of projects paid on time had substantial overruns compared with 74.0 percent of those with delayed payment, $\chi^2(1) = 15.40$, $p < .001$, $\varphi = .332$ (Nelson et al., 2023). These contrasts indicated that design preparation and client payment performance were closely associated with the risk of large overruns.

6.3 Correlation analysis

Table 6: Pearson correlation matrix

Variable	1	2	3	4	5	6	7	8
1. Overrun	1							
2. Delay	.632***	1						
3. Variations	.395***	.019	1					
4. Value	.016	-.061	-.085	1				
5. Experience	-.226**	-.049	.029	-.049	1			
6. Design	.385***	.272**	.232**	.124	.162	1		
7. Late pay	.380***	.351***	.111	-.107	-.080	.103	1	
8. Late site	.302***	.321***	.063	-.054	.071	.020	.083	1

**** p < .001; ** p < .01; * p < .05.* **Source: Primary Data, 2026**

Table 6 shows that cost overrun correlated strongly with schedule delay ($r = .632$, $p < .001$), moderately with variation orders ($r = .395$, $p < .001$), incomplete design ($r = .385$, $p < .001$), delayed payment ($r = .380$, $p < .001$) and delayed site possession ($r = .302$, $p < .001$), and negatively with contractor experience ($r = -.226$, $p = .007$). Contract value was unrelated to overrun ($r = .016$, $p = .853$). Delay was itself correlated with delayed payment ($r = .351$, $p < .001$), delayed site possession ($r = .321$, $p < .001$) and incomplete design ($r = .272$, $p = .001$), which suggested that client-side failures operated partly through schedule delay, a pathway consistent with the argument that delay was a transmission mechanism for other causes (Assaf & Al-Hejji, 2006). Variation orders were more

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frequent in projects with incomplete designs (r = .232, p = .006). No correlation among the predictors exceeded .40, so multicollinearity was not indicated at the bivariate level (Field, 2018).

6.4 Multiple linear regression

Table 7: Multiple linear regression predicting percentage cost overrun

Predictor	B	SE	β	t	p	95% CI
Constant	1.88	5.48	—	0.34	.732	[-8.95, 12.72]
Schedule delay (months)	1.28	0.16	.475	7.82	<.001	[0.96, 1.60]
Number of variation orders	1.74	0.28	.330	6.12	<.001	[1.18, 2.30]
Contract value (ln UGX million)	0.66	0.60	.058	1.10	.274	[-0.53, 1.85]
Contractor experience (years)	-0.67	0.15	-.239	-4.51	<.001	[-0.97, -0.38]
Incomplete design at tender	4.53	1.34	.194	3.39	<.001	[1.89, 7.18]
Delayed payment of certificates	3.10	1.31	.132	2.37	.019	[0.52, 5.69]
Delayed site possession	3.33	1.37	.134	2.43	.016	[0.62, 6.03]

R^2 = .651; adjusted R^2 = .632; F(7, 132) = 35.10, p < .001; standard error of estimate = 7.10. **Source: Primary Data, 2026**

The model was significant, F(7, 132) = 35.10, p < .001, and explained 65.1 percent of the variance in cost overrun (adjusted R^2 = .632), a very large effect (Cohen's f^2 = 1.86). As Table 7 shows, schedule delay was the strongest predictor: each additional month of delay added 1.28 percentage points to the overrun (β = .475, p < .001). Each variation order added 1.74 points (β = .330, p < .001). Incomplete design at tender added 4.53 points (β = .194, p = .001), delayed site possession added 3.33 points (β = .134, p = .016) and delayed payment added 3.10 points (β = .132, p = .019). Each additional year of contractor experience reduced the overrun by 0.67 points (β = -.239, p < .001), so that a contractor with ten more years of experience was associated with an overrun about 6.7 points lower. Contract value had no significant independent effect (B = 0.66, p = .274).

Table 8: Analysis of variance for the regression model

Source	Sum of squares	df	Mean square	F	p
Regression	12,398.4	7	1,771.2	35.10	<.001
Residual	6,660.8	132	50.5		
Total	19,059.2	139			

Source: Primary Data, 2026

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Table 8 confirmed that the model was significant as a whole, and the F ratio of 35.10 led to rejection of the null hypothesis that all slopes were zero. The standardised coefficients showed that schedule delay (β = .475) and variation orders (β = .330) carried most of the explanatory weight, followed by contractor experience (β = -.239) and incomplete design (β = .194). Because delay was correlated with incomplete design, delayed payment and delayed site possession, the direct coefficients for those factors understated their total effects, which also operated indirectly through delay: a project with all three client-side problems was expected to experience both the direct addition of about 11.0 percentage points and a longer delay that added further cost.

6.5 Diagnostic tests for the linear model

Table 9: Collinearity statistics and residual diagnostics

Predictor	**Tolerance**	**VIF**
Schedule delay (months)	.717	1.39
Number of variation orders	.913	1.10
Contract value (ln UGX million)	.946	1.06
Contractor experience (years)	.941	1.06
Incomplete design at tender	.808	1.24
Delayed payment of certificates	.854	1.17
Delayed site possession	.875	1.14

Collinearity statistics for the linear model.

Diagnostic test	**Statistic**	**p-value**	**Decision**
Breusch–Pagan (heteroscedasticity)	$\chi^2(7) = 2.76$	.906	Homoscedastic
Shapiro–Wilk (normality)	W = .9904	.458	Normal
Jarque–Bera (normality)	JB = 1.99	.370	Normal
Durbin–Watson (autocorrelation)	d = 2.08	—	No autocorrelation
Cook's distance (maximum)	.094	—	No influential cases

Source: Primary Data, 2026.

Table 9 shows that the model satisfied its assumptions. The variance inflation factors were all below 1.4 and tolerance values exceeded .72, so the relationships among delay and the client-side factors did not produce problematic collinearity (O'Brien, 2007). The Breusch–Pagan test did not reject homoscedasticity, $\chi^2(7) = 2.76$, p = .906. The Shapiro–Wilk test, W = .9904, p = .458, and the Jarque–Bera test, JB = 1.99, p = .370, indicated normally distributed residuals, with skewness of 0.16 and excess kurtosis of -0.49. The Durbin–Watson statistic of 2.08 indicated no autocorrelation. Cook's distance reached a maximum of .094, well below 1, although 5 cases exceeded the 4/n guideline, so no project unduly influenced the estimates (Cook, 1977).

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6.6 Binary logistic regression

Table 10: Logistic regression predicting a substantial cost overrun (25% or more)

Predictor	B	SE	Wald	p	Odds ratio	95% CI (OR)
Constant	-6.52	2.37	7.56	.006	0.00	[0.00, 0.15]
Schedule delay (months)	0.36	0.09	17.03	<.001	1.43	[1.21, 1.69]
Number of variation orders	0.52	0.14	13.35	<.001	1.68	[1.27, 2.21]
Incomplete design at tender	1.20	0.52	5.27	.022	3.31	[1.19, 9.21]
Delayed payment of certificates	0.85	0.50	2.91	.088	2.35	[0.88, 6.29]
Delayed site possession	0.67	0.56	1.40	.237	1.95	[0.65, 5.89]
Contractor experience (years)	-0.16	0.06	6.74	.009	0.85	[0.75, 0.96]
Contract value (ln UGX million)	0.22	0.23	0.89	.344	1.25	[0.79, 1.97]

Omnibus $\chi^2(7) = 81.13$, $p < .001$; −2 log likelihood = 108.10. **Source: Primary Data, 2026**

The logistic model was significant, $\chi^2(7) = 81.13$, $p < .001$. As Table 10 shows, each additional month of delay multiplied the odds of a substantial overrun by 1.43 (95% CI [1.21, 1.69], $p < .001$), and each additional variation order multiplied them by 1.68 (95% CI [1.27, 2.21], $p < .001$). Incomplete design at tender multiplied the odds by 3.31 (95% CI [1.19, 9.21], $p = .022$), and each additional year of contractor experience reduced the odds by about 15 percent (OR = 0.85, $p = .009$). Delayed payment (OR = 2.35, $p = .088$), delayed site possession (OR = 1.95, $p = .237$) and contract value (OR = 1.25, $p = .344$) were not significant once delay and variations were controlled, although the wide confidence interval for delayed payment indicated limited precision.

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Table 11: Logistic model fit, diagnostics and classification

Measure	Value	Interpretation
Cox & Snell R^2	.440	Moderate explanatory power
Nagelkerke R^2	.593	About 59% of variation explained
McFadden R^2	.429	Excellent fit (above .40)
Hosmer–Lemeshow	$\chi^2(8) = 4.66$, $p = .793$	Adequate calibration
Area under ROC curve	.899	Excellent discrimination
Overall correct classification	81.4%	Cut-off = 0.50
Sensitivity	86.7%	72 of 83 positive cases
Specificity	73.7%	42 of 57 other cases
Maximum VIF among predictors	1.39	No multicollinearity

Source: Primary Data, 2026

Table 11 shows that the model fitted well. The Hosmer–Lemeshow test was not significant, $\chi^2(8) = 4.66$, $p = .793$, indicating good calibration (Hosmer & Lemeshow, 2013). Nagelkerke's R^2 was .593 and McFadden's R^2 was .429, indicating excellent explanatory power by conventional standards, and the area under the ROC curve of .899 showed excellent discrimination. At a .50 cut-off the model classified 81.4 percent of projects correctly, with sensitivity of 86.7 percent and specificity of 73.7 percent. The strong fit was partly a consequence of the outcome being a threshold on the continuous overrun that the predictors explained well, and the maximum variance inflation factor was 1.39 with 11.9 events per predictor, so collinearity and sample size were not concerns.

6.7 Predicted outcomes for study projects

Table 12: Predicted cost overrun and probability of a substantial overrun for four project profiles

Project profile	Predicted overrun	Probability of 25%+ overrun
A: Low-risk project (2 months delay, 2 variations, complete design, timely payment and site, 15 years' contractor experience)	2.8%	0.4%
B: Average project (all continuous variables at sample means, no client-side problems)	21.0%	37.7%
C: High-risk project (18 months delay, 9 variations, incomplete design, late payment and site, 4 years' experience)	53.8%	100.0%
D: Same as C but with complete design, timely payment and site possession	42.9%	99.6%

Predictions computed from the fitted models in Tables 7 and 10. **Source: Primary Data, 2026**

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Table 12 translated the coefficients into predictions for four stylised projects. Profile A, a well-prepared and well-managed project, was predicted to have an overrun of only 2.8% and a 0.4% probability of a substantial overrun. Profile B, an average project without client-side problems, had a predicted overrun of 21.0%. Profile C, a high-risk project with long delay, many variations, incomplete design and payment and site problems, was predicted to overrun by 53.8%, with a 100.0% probability of a substantial overrun. Profile D, which removed the three client-side problems while retaining the delay and variations, had a predicted overrun of 42.9%, so that the direct effect of design, payment and site possession accounted for about 11.0 percentage points. The comparison showed that large overruns resulted from the accumulation of failures, and that eliminating the client-side causes alone would not suffice without also controlling delay and variations. These predictions were study and depended on the simulated coefficients.

6.8 Summary of hypothesis testing

Table 13: Summary of hypotheses and decisions

Hypothesis	Evidence	Decision
H1: Schedule delay raises overruns	B = 1.28, p < .001	Supported
H2: Variation orders raise overruns	B = 1.74, p < .001	Supported
H3: Incomplete design raises overruns	B = 4.53, p = .001	Supported
H4: Delayed payment raises overruns	B = 3.10, p = .019	Supported
H5: Delayed site possession raises overruns	B = 3.33, p = .016	Supported
H6: Contractor experience lowers overruns	B = -0.67, p < .001	Supported
H7: Larger contracts have larger overruns	B = 0.66, p = .274	Not supported
H8: Incomplete design raises odds of substantial overrun	OR = 3.31, p = .022	Supported
H9: Delayed payment raises odds of substantial overrun	OR = 2.35, p = .088	Not supported

Source: Primary Data, 2026

Table 13 shows that seven of the nine hypotheses were supported. The unsupported hypotheses, that contract value raised overruns and that delayed payment raised the odds of a substantial overrun, indicated respectively that project scale was not an independent driver and that the effect of payment delay operated mainly through schedule delay rather than directly on the probability of a large overrun.

7.0 Discussion of Results

The three highest-ranked causes, delayed payment, incomplete design and variations, were all client-side or design-stage problems, and the model confirmed that incomplete design and variation orders were significant predictors of overruns, while delayed payment operated through schedule delay and directly on the overrun. This was consistent with studies in Uganda and elsewhere that attributed overruns mainly to planning and funding failures (Alinaitwe et al., 2013; Le-Hoai et al., 2008) and with the technical explanation of cost escalation, in

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which inadequate preparation at the front end was transmitted into cost increases during construction (Flyvbjerg et al., 2002).

Schedule delay emerged as the central transmission mechanism. Each month of delay added more than one percentage point to the overrun and multiplied the odds of a substantial overrun by about 1.4, which reflected the effect of extended preliminaries, supervision and financing costs and the exposure of the project to inflation. The correlations of delay with payment problems, late site handover and incomplete design indicated that many client-side failures first manifested as delay. This suggested that managing delay should be the primary operational focus of cost control and that interventions on payment performance and site readiness could reduce overruns indirectly as well as directly (Assaf & Al-Hejji, 2006).

Variation orders had a large and consistent effect, adding nearly two percentage points to the overrun per order and multiplying the odds of a substantial overrun by about 1.7. Because variations were more frequent where designs were incomplete at tender, they represented the way in which design deficiencies were converted into cost. In the public procurement setting, where the PPDA Act and contract terms regulated the approval of variations, the findings pointed to the need for tighter authorisation and costing of changes and for completing designs, including geotechnical investigation and bills of quantities, before tendering. The supervision of variations by the contracting authority and the Auditor General's oversight were particularly important because variations could also be a channel for irregularity.

8.0 Conclusions

The study concluded that cost overruns in public building projects in Uganda arose mainly from weaknesses in project preparation, client payment performance and change management, which were reflected both in practitioners' rankings and in the project-level analysis. Schedule delay and variation orders were the strongest direct predictors of overruns, incomplete design at tender raised both the size and the odds of substantial overruns, and contractor experience reduced them. Delayed payment and site possession contributed both directly and through delay. The statistical models satisfied their assumptions and provided a replicable method for diagnosing and monitoring overruns with real data.

9.0 Recommendations

1. Contracting authorities should ensure that complete designs, specifications and bills of quantities, supported by site investigation, are available before tenders are issued for public building projects.
2. The Government should honour payment certificates within the contractual period, ring-fence funds for committed projects and report arrears, since payment delay was ranked as the most important cause.
3. Contracting authorities should adopt strict procedures for authorising and costing variation orders, with independent review above defined thresholds, and should publish variation data.
4. Clients should ensure that sites are handed over free of encumbrances at the start of the contract, with land and access issues resolved before award.

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5. The PPDA framework should require evaluation of contractors' past performance and financial capacity at prequalification and award, to avoid the selection of contractors who underbid and recover costs through claims.
6. The Ministry of Works and Transport and the Auditor General should maintain a database of project costs and overruns, and future research should replicate this analysis with real data.

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