

CONSTRUCTION COST ESTIMATES:

Getting it Right Every Time and at Every Stage of Development

Priscilla Akabudike FNIQS, PMP

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1. INTRODUCTION

Construction cost estimation is the process of predicting the total cost required to complete a project within a defined scope. If correctly done, it is the financial backbone of every development decision, from initial feasibility through to handover. If done poorly, it triggers cost overruns, project abandonment, contractual disputes, and the erosion of stakeholder trust.

Accurate cost estimate is critical at every project stage and therefore should be treated as a continuous, structured process that evolves as information becomes more detailed. Understanding the types of estimates, how they align with project phases, the consequences of inaccuracy, and the principles of best practice are essential for all stakeholders.

This paper posits that the solution to getting it right is not complexity, it is discipline. Such discipline is achieved by matching estimate type to project stage and applying professional rigour throughout the development lifecycle of construction projects.

2. WHY COST ESTIMATION MATTERS

A cost estimate does four things simultaneously: it tests feasibility, guides design decisions, forms the basis of procurement, and sets the financial benchmark against which project performance is measured. It is, in that sense, the most consequential document produced in the early life of a project. For clients, an accurate estimate underpins the business case, supports financing, and enables realistic return-on-investment projections. An inaccurate one can set a project on a trajectory from which it never recovers, through reactive value engineering, investor withdrawal, or contractual disputes with contractors over unforeseen costs.

For contractors, the estimate is the financial blueprint of a bid. Underestimating costs risks significant loss, overestimating costs a contract. The margin between these is the space in which professional estimating operates. Accurate cost estimation delivers value across the full project lifecycle by enabling informed go/no-go decisions, supporting resource planning, establishing a control baseline, and building the client relationships that generate repeat business.

3. TYPES OF CONSTRUCTION COST ESTIMATES

Estimates are not one-size-fits-all. They vary in method, purpose, and accuracy according to the stage of project development. Three broad categories apply across the project lifecycle:

a. Conceptual Estimate (Order of Magnitude)

Prepared when scope and design information is minimal. The purpose is directional, to determine whether a project is worth pursuing, not to fix a budget. Methods rely on cost-per-unit-area benchmarks, historical data, and expert judgment. Accuracy range: -30% to +50% of eventual estimated cost (AACE International, 2020).

b. Preliminary Estimate

Prepared at schematic design stage when the project takes shape but details still developing. An elemental cost breakdown is used, incorporating site-specific factors and early design decisions. Accuracy range: -15% to +30%.

c. Detailed / Definitive Estimate

Prepared from complete design documentation. Comprehensive quantity takeoffs are measured against finalised drawings and specifications, priced with current market rates, labour costs, and subcontractor quotations. This estimate forms the basis for tender, contract, and cost control. Accuracy range: -5% to +10% (AACE International, 2020; RICS, 2012).

Each project phase demands a different estimating approach. The single most common cause of cost overrun is applying the precision expectations of a later estimate to the information available at an earlier stage. Table 1 maps estimate type to project stage and accuracy expectation.

Table 1: Estimate types, accuracy ranges and contingency guidance by project stage

Project Stage	Estimate Type	Typical Accuracy	Contingency Guide
Concept / Feasibility	Conceptual (Order of Magnitude)	-30% to +50%	15 – 25%
Schematic Design	Preliminary / Elemental	-15% to +30%	10 – 15%
Detailed Design / Construction Documents	Detailed / Definitive	-5% to +10%	5 – 10%

Sources: AACE International (2020), IPA (2021).

At the feasibility stage, the estimate provides a rough order of magnitude to support a go/no-go decision. It must be accompanied by an explicit Basis of Estimate (BOE) document stating what is included, what is excluded, and the level of design definition achieved. Failure to communicate these qualifications is itself a cause of downstream cost escalation.

At schematic stage, elemental cost breakdowns allow design teams to make decisions about structural form, cladding, and services strategy with an understanding of cost consequences. The quantity surveyor's role here shifts from passive calculator to active design cost adviser. At detailed design, the estimate becomes the contract instrument. Measurement follows recognized standards, such as BESMM4R in Nigeria and NRM2 in the United Kingdom, which provide the common language through which all parties understand what is being priced.

4. WHAT MAKES A GOOD COST ESTIMATE?

A good estimate is not just a number. It is a documented, defensible representation of cost that can be explained, challenged, and updated. The following characteristics define estimate quality:

- Accuracy — the estimate reflects the information available at that stage and is calibrated accordingly.
- Confidence Level — this is a statistical measure that quantifies the likelihood of the effort level. uncertainty is quantified and communicated, not concealed. Three-point estimating (optimistic / most-likely / pessimistic) is a practical way to express probabilistic ranges.
- Documentation — the Basis of Estimate is recorded and agreed. Assumptions are stated. Exclusions are listed. This is a professional obligation, not a courtesy.
- Risk Detailing — contingency is calculated, not guessed. It reflects the project's stage, complexity, and specific risk profile.
- Validity — unit rates, productivity factors, and pricing sources are current and appropriate to the project's location and market.
- Continuous Refinement — each estimate is updated as design information improves. The estimate that is not reviewed becomes a liability.

5. KEY COMPONENTS OF A CONSTRUCTION COST ESTIMATE

Every construction cost estimate is built from the same core components. Understanding each one, and its relationship to the others, is the foundation of professional estimating practice. These components are:

a. Direct Costs

The costs directly attributable to the physical execution of the works: materials (procurement, delivery, storage, taxes), labour (wages, on-costs), plant and equipment (owned or hired), and nominated subcontract costs.

b. Indirect Costs (Project Overheads)

Project-specific costs that support direct operations: site establishment, management salaries, permits, insurance, taxes, and financing charges. These are frequently underestimated in early-stage estimates when the full management requirement is not yet defined.

c. Markup

Applied after all direct and indirect costs are aggregated. Comprises general and administrative overhead (head-office costs allocated across projects) and profit. Markup strategy varies, flat percentage, sliding scale by project size, or a variable rate based on competitive conditions.

The Estimating Equation is given below:

$$\text{Total Estimate} = \text{Direct Costs} + \text{Indirect Costs} + \text{Contingency} + \text{Markup}$$

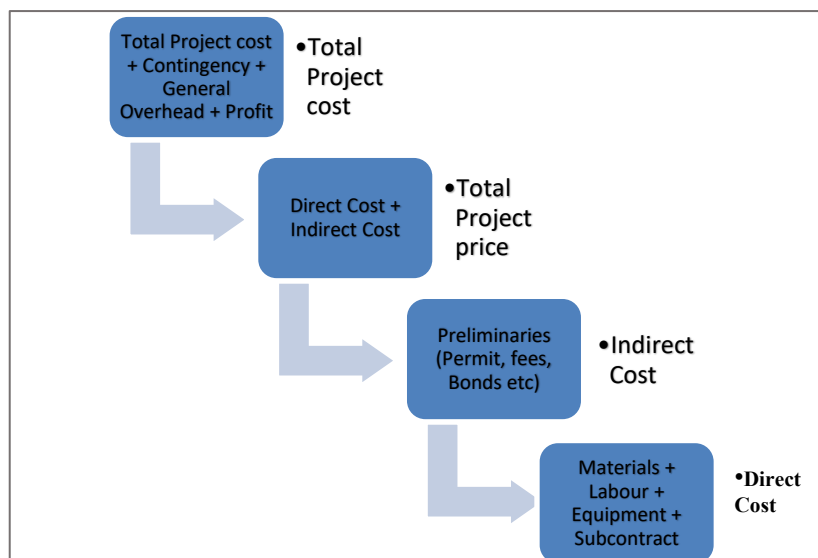


Fig. 1. The Estimating Equation

6. COMMON PITFALLS IN COST ESTIMATING

Estimation failure is rarely the result of a single error. It typically arises from a combination of the following:

- i. Scope ambiguity — estimates built on vague or incomplete briefs inherit that vagueness in every line item.
- ii. Use of historical data without context — rates and benchmarks from past projects become misleading without adjustment for scale, location, procurement route, and prevailing market conditions.

- iii. Optimism bias — the well-documented human tendency to underestimate costs and overestimate benefits in complex undertakings (Flyvbjerg, 2006). It is not a character flaw; it is a cognitive pattern that professional process must actively counter.
- iv. Inadequate contingency — applying a flat contingency percentage without reference to actual risk exposure routinely produces estimates that understate likely cost.
- v. Market volatility — material prices, currency fluctuations, and supply chain disruptions can invalidate estimates quickly, particularly in economies with high inflation.
- vi. Insufficient site investigation — unforeseen ground conditions, hidden utilities, and contamination are among the most expensive surprises in construction. Pre-design surveys deliver a positive return on reduced cost uncertainty.

7. CASE STUDIES IN CONSTRUCTION COST ESTIMATION

The following two case studies illustrate the consequences of estimation failure in practice. They demonstrate that the pitfalls in Section 6 are not theoretical, they are recurring and costly.

Case Study 1: Construction of a university auditorium in one of Nigeria's higher institutions.

Background

This case study focuses on a 2008 construction project for a new university auditorium, which included the primary auditorium and additional facilities such as meeting rooms, and administrative offices. The project was tendered using an unpriced Bill of Quantities (BOQ) and approved construction drawings and the contract was awarded to a successful contractor.

The Problem

On completion of the substructure phase of the project, the contractor encountered a critical financial discrepancy. Despite procuring materials and engaging labour at rates consistent with those used during his tendering process, the project was significantly over budget. The actual site expenditure was far exceeding the cost projections implied by his own priced BOQ. The core question became: What went wrong?

Findings

A review of the tendering and pricing documents revealed two main errors:

First, the contractor's pricing methodology was flawed; it was rushed due to tight submission deadlines, leading to the use of an unrelated Bill of Quantities (BOQ) as a benchmark, which lacked proper assessment of the new project's requirements.

Second, there was a significant mismatch between the tender documents and the actual project specifications. The BOQ utilized for bidding did not accurately reflect the drawings provided, as it was based on a template from a different building type, resulting in discrepancies in the scope and complexity of the work necessary for the auditorium construction.

Lessons Learned

This case illustrates the risks associated with taking administrative shortcuts during the tendering phase. Key lessons include the importance of engaging a qualified quantity surveyor to ensure accurate preparation and pricing of the Bill of Quantities (BOQ), as this oversight led to significant inaccuracies. Additionally, the client organization mismatched the tender documentation which undermines the contract's financial controls. Lastly, the case shows that rushing tenders to meet deadlines can lead to hidden costs, where the attempt to save time ultimately results in greater financial losses during project execution.

Case Study 2: Public Building Projects in Abuja, Nigeria

Table 2: Case Study 2 overview

Study Reference	Saidu and Shakantu (2017), <i>Acta Structilia</i> , 24(1), pp. 53–72
Location	Abuja, Federal Capital Territory, Nigeria
Sector	Public and private building construction
Sample	30 ongoing building projects
Method	Archival analysis: bills of quantities, progress reports, drawings, specifications

Background

Abuja has seen sustained construction activity since becoming Nigeria's capital. Yet the sector is persistently characterized by cost overruns and project abandonment. These problems have been documented across multiple decades of research. Saidu and Shakantu (2017) conducted one of the most rigorous investigations of this phenomenon, examining 30 live building projects to measure the gap between initial estimates and emerging outturn costs.

Findings

Average cost overrun across the 30 projects stood at 44.46 per cent (error margin not expected for detailed estimates), measured at an average completion level of 52.4 per cent. The minimum overrun recorded was 5.56 per cent; the maximum was 216.08 per cent, on a project that had reached only 5 per cent completion. In other words, by halfway through construction, the projects have typically consumed nearly half as much money again as the original estimate.

Root Causes

- Estimates prepared without sufficient design information; projects priced at conceptual accuracy were procured as if detailed estimates had been produced.
- Material price volatility driven by foreign exchange fluctuation and import dependency.
- Inadequate or absent pre-construction site investigations.
- Interrupted financing, causing scope changes and remobilisation costs during construction.

Lessons Learned

The core failure was a systematic mismatch between estimate type and project stage. Contingency allowances were insufficient because they were not calibrated to the actual level of design uncertainty. Consistent application of the BESMM4 measurement standard and a stage-gated estimating framework, as proposed in Section 9 of this paper, would directly address the root causes identified.

8. DIGITAL TOOLS FOR COST ESTIMATION

Digital platforms are changing how estimates are produced, automating quantity takeoffs, integrating real-time pricing, and enabling collaborative workflows across design and cost teams. If used well, they improve speed, consistency, and auditability. If used poorly, they automate errors at scale.

No software resolves an inadequately defined scope or compensates for absent professional judgment. The quality of any estimate remains a direct function of the quality of its inputs. Extant digital tools for cost estimation include:

Building Information Modelling (BIM)

At the 5D level, where a three-dimensional building model is linked to cost data, BIM enables automatic quantity generation, real-time cost tracking, and immediate reflection of design changes in the cost model. Research confirms that BIM adoption for cost management among Nigerian quantity surveyors remains low, with primary barriers being software cost, training cost, and a shortage of trained practitioners (Ade-Ojo et al., 2025). Professional bodies (NIQS) have a direct role to play in establishing BIM training standards.

Artificial Intelligence and Machine Learning

Machine learning models, when trained on completed project datasets, can generate probabilistic cost estimates from limited input data, improving the rigour of order-of-magnitude estimation. These applications are still in an early-stage and require large, standardized datasets, which remain difficult to assemble. Their output must be interpreted by qualified professionals who understand the model's assumptions and limitations.

Software Selection Criteria

When selecting estimating software, the following features represent the minimum for professional-grade practice:

Table 3: Minimum features for professional estimating software

Feature	Why It Matters
Cloud Access	Enables remote collaboration and real-time updates
Integrated Takeoffs	Reduces arithmetic errors and accelerates measurement
Cost Database Integration	Ensuring pricing aligns with current market rates
Template Support	Saves time and supports consistency across projects
User Permissions	Essential for large teams and controlled subcontractor input
Reporting and Exports	Makes sharing with clients and teams seamless and auditable

9. BEST PRACTICE FRAMEWORK

The following four-phase framework provides a practical, stage-linked pathway to producing accurate, defensible estimates. Each phase corresponds to a defined point in the project development lifecycle.

Phase 1: Foundation and Scope Definition (Feasibility Stage)

- Engage a qualified quantity surveyor from the outset. Early professional involvement is the single most effective means of establishing realistic budget expectations.
- Adopt a standardized Work Breakdown Structure. This can be done using the BESMM4R in Nigeria; NRM1/NRM2 in the UK. Consistency enables comparability and reduces the risk of omission.
- Document the Basis of Estimate. State what is included, what is excluded, the level of design achieved, and the contingency rationale. This document must be agreed with the client before the estimate is issued.

Phase 2: Data Collection and Quantification (Schematic to Detailed Design)

- Conduct a physical site visit. Drawings cannot reveal ground conditions, access constraints, or existing fabric. The site visit is not optional.
- Perform a thorough quantity takeoff using recognized measurement rules. Maintain consistent units throughout and cross-check quantities before pricing.

- Verify unit rates against current market intelligence. Historical rates require adjustment for inflation, location, procurement route, and project complexity.

Phase 3: Risk Assessment and Pricing (All Stages)

- Calibrate contingency to the project's stage, type, and risk profile, not to convention. As a guide: 15–25% at feasibility; 10–15% at schematic; 5–10% at detailed design. Heritage and brownfield projects warrant higher allowances at every stage.
- Apply markup strategically. Profit and overhead must reflect business costs, competitive conditions, and project-specific risk, not a standard formula applied without thought.

Phase 4: Validation, Submission, and Learning

- Conduct an independent review before submission. Verify scope completeness, quantity accuracy, rate alignment, and markup application. Cross-check the estimate against available benchmarks.
- Issue the estimate as a formal document, not a spreadsheet. Include the full Basis of Estimate, assumptions, exclusions, and risk register.
- Capture actual cost data after project completion and feed it back into the organization's benchmark database. The estimating process ends when the lessons from this project improve the next one.

Table 4: Best practice framework summary

Phase	Project Stage	Key Actions	Contingency
1. Foundation	Feasibility	Engage QS; define scope; prepare basis of estimate (BOE)	15–25%
2. Quantification	Schematic–Detailed	Site visit; takeoff; rate verification	10–15%
3. Risk and Pricing	All stages	Calibrate contingency; apply markup	5–10%
4. Validation and Learning	Post-estimate	Independent review; issue BOE; capture data	—

10. CONCLUSION

Construction cost estimation is not a one-time event. It is a continuous, evolving process that must adapt as project information improves from rough order-of-magnitude at feasibility to precise contract sums at tender. The two case studies presented in this paper confirm what the research consistently demonstrates: that cost overrun is not an inevitability of construction, it is the predictable result of mismatched estimate types, insufficient contingency, and inadequate documentation.

The tools available to quantity surveyors, BIM, AI-assisted estimating, and integrated cost databases, offer real improvements in speed and consistency, but they are amplifiers, not substitutes, for professional judgment.

The discipline of getting it right at every stage rest on the same foundations it has always been; engagement of a qualified QS, a clear scope, reliable data, risk and contingency planning, a documented basis of estimate, and a commitment to learning from every project completed.

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