

Earned Value Management and Forecasting to Improve Cost Predictability in Saudi Industrial Projects.

Abstract:

Cost predictability in industrial projects depends on recognizing the financial consequences of incomplete work before expenditure makes them unavoidable. Earned value management provides a common basis for comparing authorized scope, accomplished work, and incurred cost, but its indicators do not automatically produce a credible estimate at completion. This structured narrative review examines the conditions under which earned value information can support cost forecasting in Saudi industrial delivery. It combines research on earned value systems, statistical forecasting, organizational maturity, and regional construction risks with authoritative estimating guidance. The synthesis develops a proposed forecasting process that separates baseline authorization, performance measurement, remaining-work estimation, uncertainty assessment, and management approval. A worked example shows that identical reporting inputs can generate substantially different completion estimates when assumptions about future efficiency change. The analysis argues for reconciliation between index-based forecasts, bottom-up estimates, and appropriate historical comparisons, with particular attention to procurement, commissioning, scope change, and accounting cut-offs. Forecast quality should be evaluated through preserved historical predictions, consistent scope, and separate measures of error and directional bias. The proposed process is relevant to Saudi industrial organizations but has not been validated against a Saudi project dataset. It offers a testable basis for improving forecasting discipline without claiming a measured reduction in project overruns.

Keywords: earned value management; estimate at completion; cost predictability; industrial projects; Saudi Arabia; forecasting; contingency; project controls.

1. Introduction

Industrial projects create financial exposure well before all costs appear in the accounting system. Design development changes quantities, equipment orders establish commitments, construction productivity determines resource demand, and testing can reveal additional work near completion. A report showing expenditure below the authorized budget can therefore coexist with a deteriorating final-cost outlook. Cost predictability requires a defensible estimate of the obligations and work that remain, together with an explanation of how new information changes that estimate.

Earned value management addresses part of this problem by placing planned work, completed work, and actual cost on a common budget basis. However, an earned value management system also depends on organizational conditions and the maturity of its supporting processes. Studies of earned value systems highlight the importance of considering technical and social aspects together. Authoritative estimating guidance similarly connects credible estimates with scope definition, assumptions, data, risk analysis, documentation, and updating. These perspectives position forecasting as a managed analytical process rather than an automatic output of a performance ratio.

The Saudi industrial setting makes this distinction relevant. Research on oil and gas construction identifies scope development, planning, design, and estimating weaknesses among reported sources of time and cost overrun. Research on government-funded buildings also examines influential risk factors, although building evidence cannot be assumed to represent process plants. The implication is that a forecasting method should account for the actual work and contracting conditions of an industrial program rather than import a regional overrun percentage or a universal adjustment factor.

This paper asks how earned value information can strengthen the prediction of final cost when integrated with remaining-work estimates, uncertainty assessment, and documented decisions. Its contribution is a proposed process for selecting and challenging forecasts under changing delivery conditions. It is a review and conceptual analysis, not a statistical evaluation of Saudi projects. The distinction matters because using established formulas correctly is necessary for sound analysis, while demonstrating improved forecast accuracy requires preserved predictions and completed-project outcomes.

80 2. Background and Literature Review

81 Empirical earned value research supports the usefulness of performance-based forecasting while
82 also showing that accuracy must be evaluated under specific conditions. Empirical evaluations
83 compare time and cost forecasting methods using project records. These evaluations provide
84 evidence for evaluation rather than a basis for declaring one estimator universally superior.
85 Foundational forecasting research distinguishes conventional earned value schedule measures from
86 time-oriented alternatives, and later research evaluates additional duration approaches. These
87 distinctions remain important when schedule effects enter a cost forecast.

88 Forecasting research also challenges reliance on an entirely internal view. Probabilistic forecasting
89 studies combine project-specific and historical information through a probabilistic approach.
90 Bayesian forecasting studies integrate current performance, historical projects, and expert judgment
91 in a Bayesian formulation applied to oil and gas projects. These studies support disciplined
92 combination of evidence, but their reported performance cannot be assumed for organizations with
93 different data quality or contract conditions. Bayesian calculations also depend on the credibility
94 and independence of their information sources.

95 Reference class forecasting and exponential smoothing offer complementary perspectives.
96 Comparative studies evaluate historical comparison against conventional methods, while subsequent
97 research integrates smoothing with earned value and reference class information. Regression-based
98 forecasting research develops a regression model incorporating earned schedule. These
99 contributions suggest several ways to recognize changing performance patterns. Their practical use
100 requires distinguishing a genuine change in future productivity from temporary reporting
101 corrections or a shift in the type of work being executed.

102 More recent studies extend forecasting and measurement further. Recent measurement studies
103 develop continuous earned value formulations; regression studies examine regression-based cost
104 forecasting; and contingency studies investigate how contingency use affects completion estimates.
105 Evidence from building projects in Pakistan illustrates an application of earned value outside the
106 Saudi context. Such studies broaden methodological options but do not remove the need to verify
107 whether their data structures and work conditions transfer to industrial delivery.

108 Organizational research provides an essential counterweight to algorithm selection. Organizational
109 studies examine implementation conditions and system maturity, while statistical control research
110 develops a framework for evaluating statistical project controls. Together, these sources support a
111 layered interpretation: measurement must be reliable, forecasts must be suitable for the remaining
112 work, and exceptions must lead to accountable decisions. The present synthesis organizes these
113 requirements into an explicit forecasting process and a proposed approach for evaluating its
114 effectiveness.

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123 3. Research Aim Objectives and Questions

124 The aim is to develop a practical, evidence-informed process for using earned value management to
125 improve cost forecasting discipline in Saudi industrial projects. Five objectives structure the
126 analysis: establish the prerequisites for meaningful earned value measurement; compare the
127 assumptions behind common completion estimates; identify how remaining scope and schedule
128 exposure should influence forecasts; specify governance for forecast approval and revision; and
129 define an evaluation method that separates accuracy, bias, and management response.

130 Three research questions follow. RQ1 asks which measurement and accounting conditions must
131 hold before earned value indicators can support cost prediction. RQ2 asks how organizations should
132 reconcile index-based, bottom-up, and historically informed forecasts. RQ3 asks what evidence
133 would demonstrate an improvement in cost predictability for Saudi industrial delivery. These
134 questions define predictability as the quality and timeliness of the estimate, rather than equating it
135 with compliance with the original budget.

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137 4. Review Methodology

138 A structured narrative review was conducted using targeted searches of publicly accessible
139 scholarly publisher pages, institutional publication records, and authoritative estimating resources in
140 October 2026. Search concepts included earned value management, estimate at completion, cost
141 forecasting, Bayesian estimation, reference class forecasting, contingency management, system
142 maturity, and Saudi industrial cost overruns. Foundational studies were retained where they
143 explained methods or measurement distinctions still needed for the research questions. Recent work
144 was included to examine developments in forecasting and implementation assessment.

145 Inclusion required a traceable source and a direct connection to performance measurement,
146 completion forecasting, uncertainty, implementation conditions, or the Saudi construction context.
147 Academic evidence was distinguished from professional guidance. Public abstracts and accessible
148 text supported only the findings visible in those materials. Studies focused solely on duration were
149 used to explain schedule measurement and cost exposure, not as proof of cost forecast
150 improvement. Unverified commercial claims, anonymous examples, and unsupported numerical
151 benefits were excluded.

152 Sources were organized by the forecasting problem they addressed. The analytical categories were
153 baseline integrity, recognition of completed work, estimator assumptions, treatment of future
154 exposure, organizational review, and forecast evaluation. Quality appraisal considered provenance,
155 transparency of the available method description, the nature of the evidence, and transfer
156 limitations. No full bibliographic database export or reproducible exhaustive screening was
157 performed. The paper therefore does not claim systematic-review coverage or report fabricated
158 screening totals.

159 The synthesis produces a conceptual process and a worked arithmetic example. The example uses
160 assumed values solely to compare equations under identical starting conditions; it is not a case
161 study, simulation experiment, or observation from a completed industrial project. No pooled effect
162 size is calculated because the selected studies differ in samples, methods, and outcome definitions.
163 The findings consequently concern defensible forecasting practice and testable propositions rather
164 than a quantified expected benefit for Saudi programs.

165 5. Thematic Findings and Analysis

166 5.1 Establishing a Credible Performance Baseline

167 A useful earned value baseline begins with authorized scope translated into work packages that can
168 be planned, measured, and assigned to accountable managers. Budget at completion, or BAC, is the
169 authorized budget for the scope represented in the analysis. Planned value, or PV, distributes that
170 budget across the approved schedule. Earned value, or EV, assigns the corresponding budget value
171 to completed work. Actual cost, or AC, records the incurred cost of the same work and reporting
172 period. Consistency among these definitions is a prerequisite for interpretation.

173 Baseline integrity does not mean freezing an obsolete plan indefinitely. Approved scope changes
174 may require controlled revisions, but the original position, approved adjustments, and current
175 position should remain distinguishable. Otherwise, a project can appear to recover simply because
176 the reference has moved. The estimating principles discussed by GAO and NASA's implementation
177 guidance support disciplined scope and performance management. Their use here is
178 methodological; neither source establishes a Saudi regulatory requirement or certifies a particular
179 industrial implementation.

180 Baseline quality also includes schedule realism. GAO's schedule assessment guidance links reliable
181 schedules with understanding the cost consequences of delay. A time-phased budget founded on
182 unrealistic engineering or procurement dates can generate misleading planned values even if every
183 subsequent calculation is correct. The baseline review should therefore examine dependencies,
184 resource assumptions, major equipment delivery, construction access, and turnover sequence before
185 the performance curve is treated as a reliable reference.

186 5.2 Recognizing Work and Cost in the Same Period

187 Completed work must be recognized through evidence appropriate to the task. Engineering can use
188 accepted deliverables with defined milestone weights; installation can use verified quantities; and
189 testing can use accepted completion criteria. A single subjective percentage applied across all
190 disciplines conceals important differences in uncertainty. The measurement procedure should
191 explain what counts as partial accomplishment, who verifies it, and how rejected or repeated work
192 affects previously reported progress.

193 Accounting timing creates a separate challenge. Work may be accomplished before an invoice is
194 received, while advance payments may occur before equivalent physical accomplishment. Accruals
195 and the treatment of stored materials therefore matter when comparing EV and AC. A cost
196 performance index calculated using incomplete actuals can show apparent efficiency that disappears
197 when late costs are posted. The reporting package should state the accounting cut-off, outstanding
198 estimates of incurred cost, and any mismatch with the physical progress date.

199 Procurement requires particular care. The financial commitment, supplier payment, delivered
200 equipment, and installed equipment are different events. An approved earning method may
201 recognize procurement milestones, but it should not allow one milestone to be mistaken for overall
202 facility readiness. Remaining vendor obligations and associated installation work must remain
203 visible in the forecast. The measurement owner should also explain whether the analytical
204 perspective is that of the project owner or a delivery contractor, since cost and revenue recognition
205 differ.

206 5.3 Understanding the Assumptions Behind Completion Estimates

207 The familiar performance measures are diagnostic starting points. Cost variance is $CV = EV - AC$,
208 and cost performance index is $CPI = EV / AC$. Schedule variance is $SV = EV - PV$, while

209 conventional schedule performance index is $SPI = EV / PV$. These values compare performance
 210 against an authorized basis. A negative cost variance indicates that the recognized work has cost
 211 more than its assigned budget value; it does not identify the cause or prescribe the most credible
 212 estimate of remaining cost.

213 Three common completion estimates make different assumptions. $EAC = AC + (BAC - EV)$
 214 assumes the remaining authorized work will be achieved at its budgeted cost. $EAC = BAC / CPI$
 215 assumes cumulative cost efficiency continues for all remaining work. $EAC = AC + (BAC - EV) /$
 216 $(CPI \times SPI)$ applies a combined cost and schedule performance factor to the remaining budget. The
 217 last formula is a heuristic whose suitability must be justified; SPI is not a universal multiplier for the
 218 financial effects of delay.

219 The formulas are undefined or uninterpretable when their denominators are zero or when earned
 220 value does not represent comparable scope. Early in delivery, a small amount of recognized work
 221 can make cumulative ratios unstable. Later, an apparently stable ratio can still fail to represent a
 222 different mix of remaining activities. Forecast selection should therefore state the assumed future
 223 performance mechanism. Table 1 compares the estimators by their intended interpretation and
 224 principal limitation, rather than ranking them without project evidence.

225 Table 1. Completion forecasting methods and the assumptions requiring review.

Forecast method	Assumption or basis	Principal review question
Budgeted remainder	$EAC = AC + BAC - EV$	Can remaining work achieve budgeted efficiency?
Cumulative CPI	$EAC = BAC / CPI$	Does earlier efficiency represent remaining work?
CPI and SPI heuristic	$EAC = AC + (BAC - EV) / (CPI \times SPI)$	Is the compounded schedule effect justified?
Bottom-up estimate	$EAC = AC + \text{assessed ETC}$	Are quantities, commitments and indirect costs complete?
Historical comparison	Comparable completed-project outcomes	Are scope and delivery conditions comparable?
Probabilistic assessment	Documented uncertainty and dependencies	Are risks already included elsewhere in EAC?

226 5.4 Building an Estimate of the Remaining Work

227 A bottom-up estimate to complete, or ETC, evaluates the resources and obligations still required to
 228 finish the defined scope. The corresponding EAC is $AC + ETC$. This identity is straightforward, but
 229 the quality of ETC depends on remaining quantities, rates, commitments, productivity, indirect
 230 support, and execution sequence. For industrial work, late engineering releases, equipment
 231 modifications, and commissioning support may be poorly represented by the productivity achieved
 232 during early construction.

233 The estimating team should reconcile its ETC to procurement and subcontract records. Unpaid
 234 committed amounts should not be added indiscriminately to a forecast that already includes them.
 235 Conversely, a purchase order balance does not necessarily capture outstanding variation exposure or

236 unplaced orders. A transparent reconciliation distinguishes incurred cost, remaining committed
237 obligations, uncommitted known scope, and separately assessed uncertainty. This structure makes
238 omissions and double counting easier to challenge than a single aggregate allowance.

239 A useful management question is what evidence would have to change for the forecast to change.
240 An estimate that remains fixed despite altered quantities, delivery dates, or resource rates may
241 reflect a target rather than a prediction. Probabilistic forecasting studies show the rationale for
242 bringing different forecasting perspectives together. Here, the proposed process retains the bottom-
243 up estimate and the performance-based comparator separately until their differences have been
244 explained and an authorized forecast basis has been selected.

245 **5.5 Connecting Schedule Exposure to Cost**

246 Conventional SPI is based on budgeted value, not elapsed time or a network-based completion date.
247 It can therefore obscure a delayed critical package behind progress on noncritical high-value work.
248 Research on earned schedule and duration management demonstrates why schedule measurement
249 deserves separate treatment. Cost forecasting should examine the forecast completion dates of the
250 work that drives indirect costs, supplier support, temporary facilities, and operational handover
251 rather than treating SPI alone as a forecast of these obligations.

252 Historical Saudi delay research identifies change orders among the major reported concerns. This
253 evidence supports attention to scope and approval interfaces, but its age and construction-wide
254 sample limit direct conclusions about present industrial programs. A project-specific forecast should
255 connect each material schedule exposure to a cost mechanism. Additional supervision, extended
256 equipment hire, expediting, and remobilization are different mechanisms and should be estimated
257 on their own bases, with overlapping allowances removed.

258 The scope of the estimate must also be explicit. Owner financing costs, production losses, and
259 contractor execution costs do not necessarily belong in the same cost performance baseline. They
260 can be reported as separate economic consequences when relevant to the decision. Mixing them
261 without explanation makes historical forecast accuracy difficult to interpret. The forecasting process
262 should identify which costs belong to the controlled delivery estimate and which are evaluated in a
263 wider investment or business assessment.

264 **5.6 Managing Uncertainty and Contingency**

265 A forecast is incomplete when it states only a central value while leaving major uncertainty
266 unexamined. Known remaining work, identified risk events, and broader estimate uncertainty
267 should be distinguished before allowances are introduced. Oil and gas forecasting research
268 demonstrates a probabilistic approach to combining information, while contingency management
269 research examines contingency spending within completion estimation. These studies motivate
270 explicit treatment of uncertainty; they do not justify adding a standard percentage to every account
271 or treating every reserve drawdown as an adverse performance event.

272 The project should document whether its reported EAC includes contingency and which exposures
273 the allowance covers. A risk already included as additional quantity in the bottom-up ETC should
274 not receive a second full allowance in a separate risk total. Similarly, approved additional scope
275 should not remain indefinitely in an uncertainty register after it has entered the current budget and
276 forecast. A reconciliation between scope changes, estimate adjustments, and risk provisions is
277 necessary to preserve the meaning of the headline cost outlook.

278 Where probability ranges are calculated, dependencies deserve attention. A common access
279 constraint can affect several work packages simultaneously, so assuming independence may
280 understate the upper tail. Conversely, adding every worst-case event produces a figure that need not

281 correspond to a coherent scenario. Confidence statements should be tied to a documented model,
282 evidence, and assumptions. Without such a model, the forecast can present an explicitly judgmental
283 range, but it should not label that range as a statistically calibrated percentile.

284 **5.7 Integrating Historical and Current Evidence**

285 Historical comparisons can reveal whether a project-specific estimate assumes unusually favorable
286 remaining performance. Reference class forecasting evaluates outcomes of comparable completed
287 work. Selecting that comparison group requires attention to facility type, contract strategy, estimate
288 maturity, scale, location, and the scope included in reported final cost. A broad collection of
289 unrelated projects may produce a stable average while providing a weak basis for the industrial
290 package being reviewed.

291 Exponential smoothing can give recent performance a different influence from earlier performance.
292 This may be useful when productivity changes, but a recent improvement can also arise from
293 delayed posting or a favorable work mix. Regression and continuous earned value formulations
294 offer further analytical options. Their selection should depend on available data, interpretability, and
295 chronological validation. Increasing model complexity without preserving the information available
296 at each reporting date can produce an unrealistic retrospective impression of accuracy.

297 An outside view can also challenge optimistic assumptions in investment settings. Research on
298 infrastructure estimating examines systematic cost underestimation in transport infrastructure,
299 which is a different domain from Saudi industrial construction. The transferable issue is the need to
300 examine incentives and assumptions, not to import that study's cost distribution. The proposed
301 process therefore uses historical evidence as an independent challenge and documented input, while
302 retaining accountability for the final project-specific estimate.

303 **5.8 Approving and Explaining Forecast Revisions**

304 Forecast review should preserve the distinction between a financial target, an authorized budget, and
305 an expected outcome. Managers can retain a demanding target while acknowledging that the most
306 credible current prediction exceeds it. Suppressing that distinction weakens early warning and
307 encourages unsupported assumptions about future recovery. Evidence on EVMS implementation
308 conditions reinforces the importance of leadership and the operating environment alongside
309 technical calculation.

310 Each material revision should be explained through a bridge from the previous approved EAC to the
311 proposed EAC. Useful categories include scope change, quantity development, unit rates,
312 productivity, schedule extension, and risk reassessment. Reporting these categories separately
313 allows management to see whether a deterioration reflects execution inefficiency, newly authorized
314 work, or better recognition of an existing obligation. Reallocations should remain distinguishable
315 from genuine increases in the expected total.

316 The proposed control cycle in Figure 1 links measurement to alternative forecasts, challenge,
317 approval, and action. Statistical control approaches provide a rationale for examining how warning
318 signals are interpreted, but a threshold crossing is not itself a diagnosis. Any intervention should
319 record its expected cost, schedule effect, responsible owner, and evidence of effectiveness. A
320 recovery assumption should enter the forecast only with a traceable implementation basis, while
321 residual exposure remains visible.

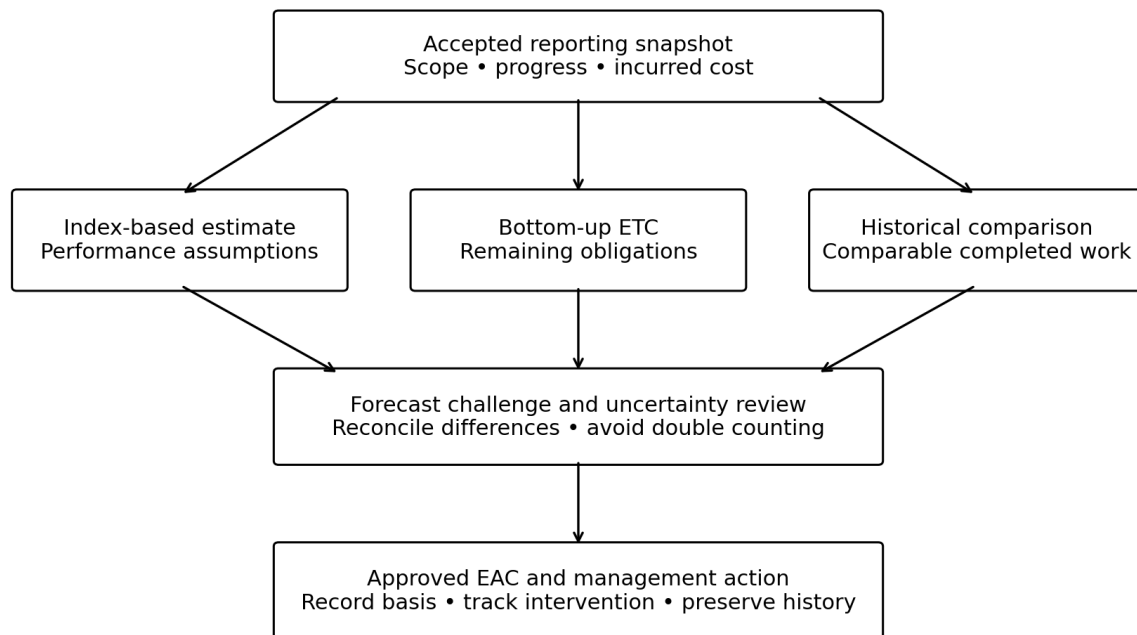
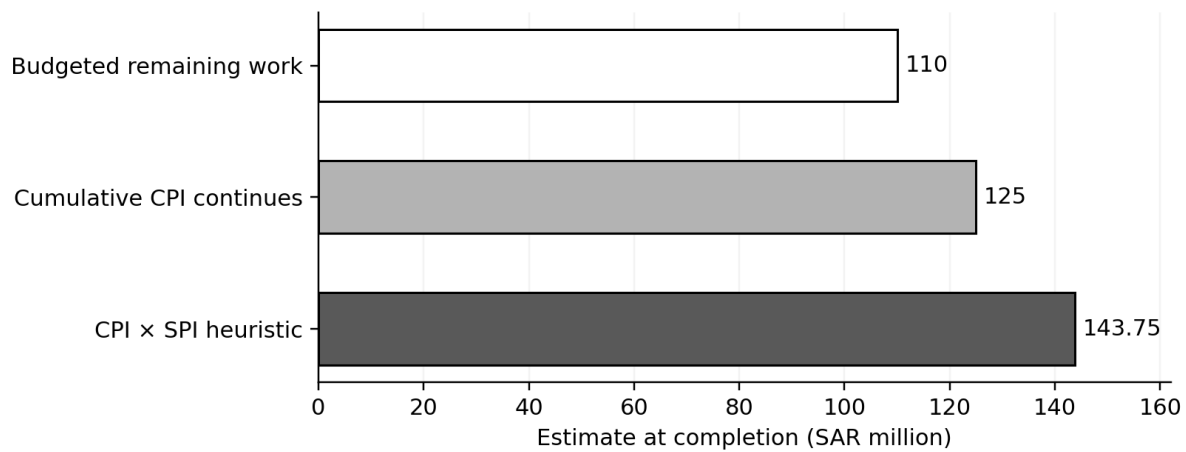


Figure 1. Proposed cost forecasting and review cycle. Original conceptual framework; arrows indicate information and decision flow.

6. Analytical Illustration and Discussion

Consider an assumed work package with BAC of SAR 100 million, PV of SAR 50 million, EV of SAR 40 million, and AC of SAR 50 million. These are invented instructional inputs, not observations from an industrial project. They produce $CPI = 0.80$, $SPI = 0.80$, $CV = -SAR\ 10$ million, and $SV = -SAR\ 10$ million. The remaining budgeted work is $BAC - EV = SAR\ 60$ million. These inputs are sufficient to calculate several contrasting forecasts, but insufficient to establish which forecast is correct.

If the remaining work proceeds at budgeted cost, EAC is $50 + 60 = SAR\ 110$ million. If cumulative cost efficiency continues, EAC is $100 / 0.80 = SAR\ 125$ million. Applying the combined performance factor gives $EAC = 50 + 60 / (0.80 \times 0.80) = SAR\ 143.75$ million. The spread reflects assumptions about the future, not a difference in the underlying observed status. Figure 2 displays the calculated values to make that dependence explicit.



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339 Figure 2. Completion estimates under alternative assumptions. Arithmetic illustration using assumed inputs;
 340 not empirical results.

341 The example demonstrates why presenting an unexplained EAC as a precise fact is problematic.
 342 The lowest estimate assumes the unfavorable efficiency does not continue, while the highest applies
 343 a compounded penalty that may not represent actual remaining obligations. Neither should be
 344 accepted solely because it produces a preferred funding position or a more cautious number.
 345 Management needs remaining-work evidence, realistic schedule exposure, and an account of
 346 whether the performance variance is recurring, temporary, or caused by measurement timing.

347 A further challenge is target feasibility. The to-complete performance index for achieving BAC is
 348 $TCPI = (BAC - EV) / (BAC - AC)$, provided the denominator is positive. In this example it equals
 349 $60 / 50 = 1.20$. Achieving the original budget would therefore require future budgeted
 350 accomplishment per unit of actual cost to exceed one, despite a cumulative CPI of 0.80. This is not
 351 proof that recovery is impossible. It identifies the scale of improvement that requires a credible and
 352 documented execution plan.

353 The difference between forecast quality and project performance is equally important. A project can
 354 accurately predict a major overrun and still perform poorly against its original authorization.
 355 Conversely, a project can finish near budget while having issued unreliable intermediate forecasts
 356 that complicated funding decisions. A rigorous evaluation should therefore report both final delivery
 357 performance and the accuracy of historical predictions. They answer different management
 358 questions and should not be combined into one success indicator.

359 A final observation concerns timing. A forecast that becomes accurate only when most expenditure
 360 is irreversible offers limited early warning. Cost predictability should be assessed at comparable
 361 progress positions or fixed horizons before completion. Changes in approved scope should be
 362 reconciled separately so that an estimator is not penalized for work that had not yet been authorized
 363 or identified. Table 2 defines a minimum evaluation set that can support this distinction in a future
 364 implementation study.

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368 Table 2. Proposed evaluation measures for cost predictability and forecasting discipline.

Evaluation aspect	Measure or evidence	Interpretation safeguard
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Evaluation aspect	Measure or evidence	Interpretation safeguard
Accuracy	Absolute difference between EAC and outturn	Compare equivalent scope and forecast horizons
Directional bias	Signed difference between EAC and outturn	Declare sign convention and aggregation method
Early warning	Forecast history before irreversible expenditure	Separate late accuracy from timely recognition
Revision quality	Bridge from previous to approved EAC	Distinguish scope change from performance change
Measurement reliability	Progress evidence and accrued-cost reconciliation	Preserve cut-offs and late adjustments
Management response	Action records and subsequent assumptions	Do not attribute all delivery effects to forecasting

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370 7. Implications for Saudi Industrial Organizations

371 Implementation should begin with a manageable control account or representative package whose
372 scope, quantities, and incurred cost can be reconciled. Extending earned value across an entire
373 industrial portfolio before resolving measurement rules can multiply inconsistent reporting. A pilot
374 should demonstrate that the same reporting snapshot can be reconstructed, that late costs are treated
375 consistently, and that approved change enters the correct baseline and forecast states.

376 Existing Saudi studies establish that delivery risks warrant attention, but they should not be treated
377 as a current census of industrial performance. Each organization should examine its own design
378 maturity, procurement dependencies, interfaces, and available historical records. For example,
379 imported equipment exposure should be evaluated from actual purchase terms and delivery
380 obligations rather than assumed exchange-rate or inflation effects. The appropriate estimate follows
381 the contract and evidence, not a generic regional risk label.

382 Forecast review should bring planning, cost, procurement, engineering, construction, and
383 commissioning representatives into a common process. The purpose is to identify remaining
384 obligations that a single discipline may overlook. This is particularly important near mechanical
385 completion, when a high aggregate progress percentage can conceal unresolved testing, vendor
386 support, or turnover work. Management should also establish a correction route for disputed
387 progress and accounting records so that measurement disagreements do not remain hidden inside the
388 estimate.

389 Evidence from a different national construction context suggests that structured earned value
390 reporting can be operationally useful, but transfer should be tested. For Saudi industrial
391 organizations, the proposed benefits are clearer assumptions, earlier recognition of exposure, and
392 more traceable revisions. Quantified claims about accuracy gains or cost savings require evaluation
393 against an agreed starting position. Training, administration, and the effort required to collect
394 reliable work-package data should be included when judging the economic value of the process.

395 8. Challenges Limitations and Future Research

396 Forecast accuracy is affected by incomplete historical records, commercially restricted information,
397 changes in scope, and inconsistent accounting treatment. These difficulties become more serious
398 when several contractors use different earning methods. A single portfolio curve may conceal them.
399 The proposed framework requires explicit reconciliation at meaningful control levels and a
400 documented treatment of missing information, rather than automatically replacing unavailable
401 values with zero or the previous period's estimate.

402 Future research should preserve each approved forecast as it existed at the reporting date and
403 compare it with a consistently defined outturn. Absolute error can express the magnitude of the
404 difference, while signed error reveals a tendency toward underprediction or overprediction.
405 Research on forecast accuracy explains why forecast accuracy measures require careful selection.
406 For completion-cost evaluation, the denominator, scope adjustments, currency basis, and treatment
407 of close-out settlements should be declared before comparisons are made.

408 A prospective study could compare a documented baseline process with the proposed structured
409 review while recording differences in scope maturity, contract type, and project stage. Package-level
410 data can support analysis, but observations from the same project are correlated and should not be
411 treated as independent projects. Qualitative evidence should examine whether teams acted on
412 forecast changes and whether leadership permitted unfavorable predictions to be reported. This
413 would help distinguish technical improvement from changes in reporting behavior.

414 This paper has not tested such a design. Its targeted retrieval, reliance on some publicly accessible
415 abstracts, and inclusion of studies from different sectors constrain the strength of its conclusions.
416 The worked example validates arithmetic only; it does not measure forecasting performance. The
417 contribution is an explicit process linking earned value, remaining-work estimates, risk assessment,
418 and accountable review, which can be examined using actual Saudi industrial project evidence.

419 9. Conclusion

420 Earned value management can provide a consistent basis for interpreting cost performance, but
421 reliable completion forecasting requires more than extending a cumulative ratio. Scope and
422 accounting consistency, credible recognition of work, remaining procurement and commissioning
423 obligations, schedule exposure, and uncertainty all influence the expected final cost. The most
424 defensible forecast is therefore the one whose assumptions and evidence can be explained and
425 challenged.

426 The proposed process retains index-based comparators, develops a bottom-up estimate, uses
427 appropriate historical information, and records how management approves and revises the outlook.
428 Its practical objective is to make financial exposure visible while decisions remain possible.
429 Whether it improves cost predictability in Saudi industrial projects must be established through
430 preserved historical predictions and consistent outcome measurement. This separates a promising
431 forecasting discipline from an unsupported claim of demonstrated delivery improvement.

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