Issue No. 3 · 2026
ADVANCED STUDIES
IN ARCHITECTURE AND CIVIL ENGINEERING
(ASACE)

ISSN 3134-8475 (Print)
ISSN 3134-8483 (Online)

UDC 69.003:338.5
Review article
https://doi.org/10.51488/3134-8483/3-02

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DIAGNOSING INTERNAL AND EXTERNAL FACTORS AFFECTING PRICING SYSTEM EFFECTIVENESS IN KAZAKHSTAN'S CONSTRUCTION INDUSTRY

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ABSTRACT
Introduction. Kazakhstani construction enterprises price their work under two pressures: volatile resource costs and weak internal estimating. Cost-overrun studies describe both groups of drivers in detail, yet rarely use them together to diagnose the contract margin. Here we examine how they act jointly on pricing effectiveness. **Materials and Methods.** The review is a structured narrative synthesis of 20 peer-reviewed studies published in 2022–2026, supplemented by nine institutional and standards-based records. We applied explicit thematic eligibility criteria and a factor classification, worked with national construction-price statistics, reconstructed one value by chaining indices, and built a hypothetical resource-weighted sensitivity model. Enterprise-level financial data were not available. **Results and Discussion.** We arrive at twelve diagnostic indicators, split between internal and external factors. Official statistics show construction prices up 1.2% in the twelve months to September 2024 and 10.4% in the twelve months to September 2026; for September 2025, a figure of about 2.2% was reconstructed from rounded published indices. In the illustrative fixed-price contract, baseline cost is KZT 100 million and revenue KZT 115 million. If the observed 4.0% national rise in material prices is combined with assumed changes for labour, equipment, logistics and overhead, forecast cost climbs to KZT 104.30 million and the sales margin drops from 13.04% to 9.30%. A decision matrix links exposure measures to procurement, contractual and forecasting responses. **Conclusions.** In diagnosing construction pricing, measured sector indices have to be kept apart from hypothetical enterprise-level outcomes. Used together, resource-weighted sensitivity, cost records and digital monitoring could make price decisions more transparent. The approach still needs validation on contractor data.

KEYWORDS: cost volatility; margin stability; estimation accuracy; risk exposure; digital monitoring; quantity takeoff.

FOR CITATION:
Saken Q.S., Tukhtamisheva A.Z. Diagnosing internal and external factors affecting pricing system effectiveness in Kazakhstan's construction industry. Advanced Studies in Architecture and Civil Engineering. 2026; 1 (3): 24-42. https://doi.org/10.51488/3134-8483/3-02

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Issue No. 3 · 2026
ADVANCED STUDIES
IN ARCHITECTURE AND CIVIL ENGINEERING
(ASACE)

ISSN 3134-8475 (Print)
ISSN 3134-8483 (Online)

ӘОЖ 69.003:338.5
Шолу мақала
https://doi.org/10.51488/3134-8483/3-02

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ҚАЗАҚСТАННЫҢ ҚҰРЫЛЫС САЛАСЫНДАҒЫ БАҒА БЕЛГІЛЕУ ЖҮЙЕСІНІҢ ТИІМДІЛІГІНЕ ІШКІ ЖӘНЕ СЫРТҚЫ ФАКТОРЛАРДЫҢ ӘСЕРІН ДИАГНОСТИКАЛАУ

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АҢДАТПА
Кіріспе. Қазақстан құрылыс кәсіпорындарында баға ресурстар құнының өзгеруі мен ішкі сметалық есептеудегі олқылықтардың әсерімен қалыптасады. Бюджеттің асуына арналған зерттеулер бұл факторларды жақсы сипаттағанымен, маржа диагностикасында оларды сирек біріктіреді. Шолуда олардың баға белгілеу тиімділігіне бірлескен әсері талданады. **Материалдар мен әдістер.** Құрылымдалған сипаттамалық шолуға 2022–2026 жылдары жарияланған 20 рецензияланған зерттеу мен тоғыз ресми әрі стандарттық дереккөз енді. Жұмыста тақырыптық іріктеу өлшемдері мен факторлар жіктемесі қолданылды, ресми баға статистикасы талданды, бір көрсеткіш тізбекті индекстеу арқылы қалпына келтірілді, ресурстық үлеске негізделген шартты сезімталдық моделі құрылды. Кәсіпорындардың нақты қаржылық деректері пайдаланылған жоқ. **Нәтижелер және талқылау.** Ішкі және сыртқы факторлар бойынша барлығы он екі диагностикалық көрсеткіш ұсынылды. Ресми деректер бойынша құрылыс бағасы 2024 жылғы қыркүйекке дейінгі он екі айда 1,2%-ға, ал 2026 жылғы қыркүйекке дейінгі он екі айда 10,4%-ға өсті. 2025 жылғы қыркүйектегі шамамен 2,2% мәні дөңгелектелген ресми индекстерден есептелді. Шартты тұрақты бағалы келісімшартта бастапқы өзіндік құн 100 млн теңге, түсім 115 млн теңге. Материалдар бағасының ресми тіркелген 4,0% өсуіне еңбек, техника, логистика және үстеме шығындар бойынша болжамды өзгерістерді қосқанда, болжамды өзіндік құн 104,30 млн теңгеге жетеді, ал сату маржасы 13,04%-дан 9,30%-ға дейін төмендейді. Диагностикалық матрица тәуекел көрсеткіштерін сатып алу, шарттық және болжамдық шешімдермен байланыстырады. **Қорытынды**. Құрылыс бағасын диагностикалағанда ресми салалық индекстерді кәсіпорынның шартты экономикалық нәтижелерімен шатастыруға болмайды. Ресурстық сезімталдық талдауы, есеп деректері мен цифрлық мониторинг бірге қолданылса, баға шешімдері ашығырақ болуы мүмкін, дегенмен бұл тәсілді нақты жобалардың деректерінде тексеру қажет. Бұл тәсіл факторлардың басқарылу дәрежесін, тәуекел белгілерін және шарт бойынша ықтимал шараларды жүйелі талдауға арналған.

ТҮЙІН СӨЗДЕР: шығын құбылмалылығы; пайда маржасы; смета дәлдігі; тәуекел деңгейі; цифрлық мониторинг; ресурс бағасы.

ДӘЙЕКСӨЗ ҮШІН:
Сакен Қ.С., Тухтамишева А.З. Қазақстанның құрылыс саласындағы баға белгілеу жүйесінің тиімділігіне ішкі және сыртқы факторлардың әсерін диагностикалау. Advanced Studies in Architecture and Civil Engineering. 2026; 1 (3): 24-42. https://doi.org/10.51488/3134-8483/3-02

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Issue No. 3 · 2026
ADVANCED STUDIES
IN ARCHITECTURE AND CIVIL ENGINEERING
(ASACE)

ISSN 3134-8475 (Print)
ISSN 3134-8483 (Online)

УДК 69.003:338.5
Обзорная статья
https://doi.org/10.51488/3134-8483/3-02

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ДИАГНОСТИКА ВЛИЯНИЯ ВНУТРЕННИХ И ВНЕШНИХ ФАКТОРОВ НА ЭФФЕКТИВНОСТЬ СИСТЕМЫ ЦЕНООБРАЗОВАНИЯ В СТРОИТЕЛЬНОЙ ОТРАСЛИ КАЗАХСТАНА

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АННОТАЦИЯ

Введение. Цены строительных предприятий Казахстана зависят от колебаний стоимости ресурсов и слабых мест внутренних сметных расчетов. В работах о превышении бюджетов эти причины описаны подробно, но в единую диагностику договорной маржи их сводят редко. Обзор оценивает их совместное влияние на эффективность ценовых решений. **Материалы и методы.** Проведен структурированный описательный обзор 20 рецензируемых исследований 2022–2026 годов, дополненный девятью нормативными, статистическими и институциональными источниками. Отбор велся по явным тематическим критериям, затем факторы классифицированы, проанализированы официальные индексы строительных цен, одно значение восстановлено цепным методом и построена условная ресурсно-взвешенная модель чувствительности. Финансовые данные предприятий не использовались. **Результаты и обсуждение.** Предложено двенадцать диагностических показателей, внутренних и внешних факторов. По официальной статистике, за год к сентябрю 2024 года строительные цены выросли на 1,2%, а за год к сентябрю 2026 года – на 10,4%. Значение для сентября 2025 года (около 2,2%) рассчитано по опубликованным округленным индексам. В условном примере первоначальная себестоимость контракта составляет 100 млн тенге, выручка – 115 млн тенге. Если к фактическому росту индекса стоимости материалов на 4,0% добавить предполагаемое удорожание труда, техники, логистики и накладных расходов, прогнозная себестоимость достигает 104,30 млн тенге, а маржа продаж снижается с 13,04% до 9,30%. Диагностическая матрица связывает показатели риска с закупочными, договорными и прогнозными решениями. **Выводы.** Наблюдаемые отраслевые индексы нельзя смешивать с расчетными результатами условного проекта. Совместное применение ресурсного анализа чувствительности, учетных данных и цифрового мониторинга может улучшить ценовые решения.

КЛЮЧЕВЫЕ СЛОВА: изменчивость затрат; маржа прибыли; точность сметы; ценовые риски; цифровой мониторинг; стоимость ресурсов.

ДЛЯ ЦИТИРОВАНИЯ:

Сакен К.С., Тухтамишева А.З. Диагностика влияния внутренних и внешних факторов на эффективность системы ценообразования в строительной отрасли Казахстана. Advanced Studies in Architecture and Civil Engineering. 2026; 1 (3): 24-42. https://doi.org/10.51488/3134-8483/3-02

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Issue No. 3 · 2026
ADVANCED STUDIES
IN ARCHITECTURE AND CIVIL ENGINEERING
(ASACE)
ISSN 3134-8475 (Print)
ISSN 3134-8483 (Online)

1 INTRODUCTION

Construction pricing sits between economics and engineering. A contractor has to take technical specifications, resource quantities, supply conditions, schedules and contractual obligations and turn them into an offer that is financially feasible. A standardized manufactured product can be priced from a catalogue. Construction work rarely can: every contract comes with its own architectural solution and ground conditions, its own logistics and procurement arrangements, a particular subcontracting structure and a particular allocation of risk. Two things therefore decide the financial result of a construction enterprise. One is the accuracy of the initial estimate. The other is how well the firm keeps its cost forecasts valid, and reacts when conditions change, while the project is being built.

In Kazakhstan the problem is sharper still. Projects are spread over regions that lie far apart and differ in transport access, climate, labour supply and procurement conditions. Changes in construction prices can be followed through the official indices published by the Bureau of National Statistics [1], and the national methodology for compiling them treats construction-price dynamics as a statistical domain of its own, with separate measurement procedures [2].

At the same time, the construction sector is being digitalized. Under the government plan for 2026–2027, information modelling, digital documentation and integrated information processes are to cover the whole construction lifecycle [3]. This creates an opportunity to connect the technical and the economic sides of pricing through shared data.

Why construction costs overrun is a well-studied question. Afana et al. [4] sorted 99 cost-overrun factors into 10 categories, including resource management, design, contractors, clients, financial management, bidding and estimation, regulatory conditions and external risks. Abdelalim et al. [5], working from 69 selected high-impact studies, identified 66 factors. They stressed that these drivers depend on one another and gave particular attention to planning, estimation, design, contractual ambiguity and unforeseen conditions.

Material prices matter, but neither they nor any other single variable explains construction costs by itself. Cost-overrun research and pricing-effectiveness research also ask slightly different economic questions. A project may finish within its original budget and still earn too little, simply because it was underpriced from the start. The opposite case occurs as well: extra costs need not reduce the contractor’s profit when valid price-adjustment clauses or compensation mechanisms exist.

This distinction shapes the rest of the paper. Cost performance concerns delivery within planned expenditure. Pricing effectiveness is a broader matter. Does the enterprise set a price, and then hold it, that is competitive, defensible under the contract, responsive to risk and high enough to reach the intended economic result?

Research on Building Information Modelling (BIM) indicates that it can reduce information fragmentation and help coordinate project components. Alnaser et al. [6] examined how BIM alters the relationships among cost-overrun risk factors; Alhammadi et al. [7] studied the causes of overruns in building projects together with mitigation measures. Both studies are useful for estimating and cost control. Neither, however, connects the identified factors to the economic performance of pricing decisions.

Figure 1 summarizes the economic channels by which internal processes and external exposures shape construction pricing outcomes.

Issue No. 3 · 2026
ADVANCED STUDIES
IN ARCHITECTURE AND CIVIL ENGINEERING
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ISSN 3134-8475 (Print)
ISSN 3134-8483 (Online)

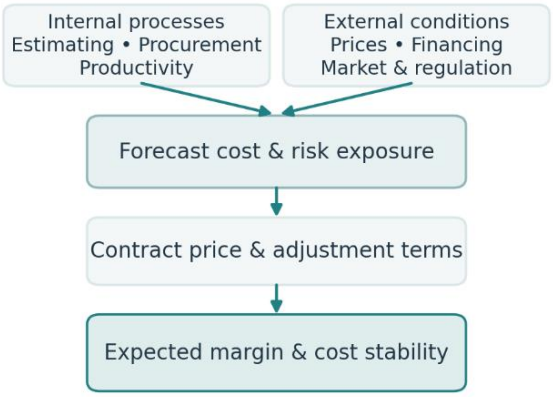


Fig. 1. Construction pricing mechanisms. Source: authors' conceptual synthesis based on [4-7]. Not empirically validated.

The problem, then, is the absence of a sufficiently integrated diagnostic structure that would link internal enterprise capabilities and external market conditions to pricing effectiveness in Kazakhstan's construction sector.

We aim to synthesize recent evidence on the internal and external determinants of pricing effectiveness and to use it in developing a conceptual diagnostic framework for estimating, risk assessment, price revision and managerial decisions.

The review is organized around four questions. First, which internal and external factors most directly affect how construction prices are formed and how stable they stay? Second, by what mechanisms do these factors reach forecasts, contract margins and pricing decisions? Third, which operational indicators make continuous diagnosis possible? Fourth, how might economic analysis be combined with BIM-based information management and digital cost monitoring in Kazakhstan?

What the article offers is a conceptual synthesis, not a new, empirically validated statistical model. It proposes a diagnostic classification and a set of measurable indicators, and then uses a transparent illustrative scenario to show the economic consequences of factor interactions.

2 METHODS AND MATERIALS

2.1 Review design and evidence base

Methodologically, this is a structured narrative review with a comparative and analytical focus. It draws together findings from construction management, cost estimation, financial risk, information modelling and project control.

The evidence comprises 20 peer-reviewed journal publications from 2022–2026, complemented by nine institutional and standards-based records. A scientific work was included if it dealt directly with cost-overrun mechanisms, estimating accuracy, material-price forecasting, BIM-based quantity extraction, predictive analytics or construction cost management.

Contextual sources were the construction-price series of Kazakhstan's Bureau of National Statistics (BNS) [1, 2], the 2026–2027 construction digitalization initiative [3], the ISO 19650 information-management standards [24, 25], the BNS construction-price release for September 2026 [26], the release on construction activity for January–September 2026 [27] and the national price-index bulletins used to reconstruct the September 2025 value [28, 29]. Each published indicator was recorded with its period and denominator. That way, year-on-year price changes could not be mistaken for physical construction output.

We selected the evidence base purposively, and it is not exhaustive: 20 peer-reviewed articles and nine institutional and standards-based records [1–3, 24–29]. Two caveats follow. Macroeconomic observations

ISSN 3134-8475 (Print)
ISSN 3134-8483 (Online)

are not cost or margin data for individual contractors. And of the three September price-growth observations, one is a reconstructed value, which we state explicitly.

So that the narrative screening can be repeated, studies were checked against stated topical criteria: (i) published between 2022 and 2026; (ii) a peer-reviewed article or review; (iii) explicit treatment of construction estimating, cost overrun, price risk, BIM quantity or cost data, or related digital forecasting. Engineering papers unrelated to cost management were not used as evidence, and neither were bibliographic records we could not verify.

The search concepts, construction AND (cost overrun OR cost estimation OR pricing risk) AND (BIM OR machine learning OR material prices), describe the selection logic. Original search logs and exclusion counts were not retained, so we do not claim a PRISMA systematic-review flow.

At the extraction stage four kinds of figures were kept apart: (a) numerical results reported in a cited study, (b) official national price or activity data, (c) values reconstructed mathematically from rounded official indices, and (d) hypothetical enterprise scenarios. Every analytical output is accompanied by its sources and calculation assumptions. For 2026, data run to September 2026, the latest period available when the manuscript was prepared [26–29].

The stages of evidence synthesis and economic scenario assessment are outlined in Figure 2.

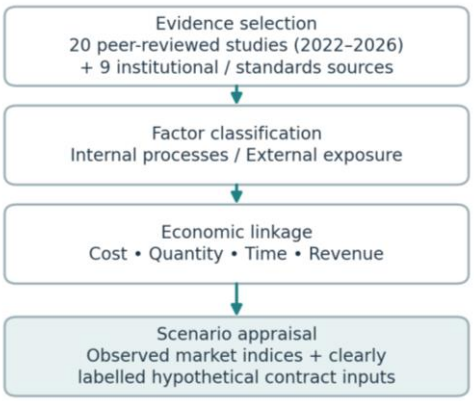


Fig. 2. Review and diagnostic workflow. Note: 20 selected peer-reviewed studies and nine institutional/standards records; no full screening counts were retained.

2.2 Analytical classification

Analysis ran in four linked stages. Stage one grouped the determinants reported in earlier publications by origin: internal enterprise processes on one side, external operating conditions on the other. A determinant counted as internal if a contractor could materially influence it through its own organizational decisions during the project.

At stage two, each determinant was given an economic transmission mechanism. These were changes in resource unit costs, changes in estimated quantities, productivity deviations, financing requirements, claims, completion time or expected revenue.

Stage three selected the diagnostic indicators. Four criteria applied: a measurable definition, data that are available in practice, relevance to contractor pricing decisions, and the possibility of observing the indicator repeatedly.

Last, we tested the conceptual model on an illustrative pricing scenario. Its purpose is to explain economic relationships. It is not field evidence from an identified Kazakhstani contractor.

2.3 Definition of pricing effectiveness

Pricing effectiveness is treated here as a

ISSN 3134-8475 (Print)
ISSN 3134-8483 (Online)

managerial outcome with several dimensions, not as one ratio. A pricing system that works well gives credible cost estimates and protects target profitability under the agreed contractual conditions. It also allows timely revision when there are grounds for it, and it leaves a traceable record behind every price decision.

We use four complementary dimensions: estimation accuracy, margin stability, responsiveness to changing conditions, and transparency and traceability of cost and price information. Each is measurable separately. A composite index is possible, but its weights would need to be justified for the specific enterprise and calibrated empirically.

2.4 Methodological limitations

The studies analysed differ in country, project type, data structure and procurement system. Effect sizes and rankings reported elsewhere therefore cannot be carried over to Kazakhstan without contextual adjustment.

Data are the second limitation. We had no longitudinal dataset of actual estimates, contracts, purchase orders and completed-project accounts from a Kazakhstani construction enterprise, so the diagnostic indicators proposed below are best read as a framework for later empirical testing.

3 RESULTS AND DISCUSSION

3.1 Internal determinants of pricing effectiveness

Internal factors originate mostly in the enterprise's own processes: estimating, planning, procurement, production, finance and information management.

Estimation quality and data consistency. Estimates can be biased systematically by incomplete bills of quantities (BOQ), outdated resource rates, wrong productivity assumptions or inconsistent overhead allocation. The tender price is then unrealistic even before the market has moved. Cost-overrun research names estimation problems among the important causes of later budget deviations [4, 5].

Planning and productivity. How much of each resource a unit of completed work actually consumes depends on labour productivity, equipment utilization, sequencing and site coordination. A firm that relies on theoretical productivity norms, without checking them against its own operations, may underestimate project costs.

Procurement management. Purchase prices and resource availability depend on when purchases are made, which suppliers are chosen, how inventory is managed and how subcontractors are coordinated. The market sets prices; negotiating them and scheduling purchases is up to the enterprise.

Design coordination and change management. Late design revisions and incomplete documentation may lead to rework, changed quantities or unplanned resource needs. For pricing, the trouble starts when these extra costs cannot be recovered under agreed contractual procedures.

Financial management. The cost of delivering a project also depends on cash-flow planning, borrowing needs, payment monitoring and financial reserves. Where financial planning is weak, a contract that looked profitable can become financially strained.

Digital information integration. Pricing information loses reliability when it sits in fragmented spreadsheets and in engineering, procurement and accounting records that are not connected. Once design changes, purchases and site progress fall out of step, managers risk working from obsolete estimates.

Internal determinants, in short, affect two things: the amount spent, and the enterprise's ability to detect, explain and control variations.

3.2 External determinants of pricing effectiveness

External factors arise mostly from conditions outside the construction enterprise's direct control.

Material-price volatility. Changes in the prices of steel, cement, insulation, electrical equipment and finishing materials pass directly into resource budgets. The size of the final effect depends on material cost shares, the timing of procurement, whether substitution is possible and whether the contract provides for

ISSN 3134-8475 (Print)
ISSN 3134-8483 (Online)

price adjustment.

Labour-market conditions. Costs and completion times are both affected by regional shortages of skilled workers, changing wage expectations and subcontractor availability. An enterprise can adapt its recruitment and productivity policies, but the labour market itself is beyond its control.

Inflation and financing conditions. General price changes raise direct and indirect costs alike. Financing conditions, in turn, can alter the cost of working capital and the commercial viability of long contracts.

Currency exposure and imports. Where equipment and materials are imported, costs become sensitive to the exchange rate. How sensitive depends on the share of purchases made in foreign currency and on how closely procurement commitments are aligned with contract revenue.

Regulatory and contractual conditions. Project cost and the room for price adjustment can be affected by permitting requirements, technical standards, taxation, procurement rules and the way the contract allocates risk. To separate market movements from officially measured changes, Kazakhstan's methodology for the construction-price index is a useful reference [2].

Location, logistics, and site uncertainty. Regional differences arise from transport costs, climatic restrictions, variable ground conditions and remoteness; how much they matter depends on the particular project and site.

Recent studies highlight risk factors associated with environmental conditions, project relationships, resources and financing. Turkyilmaz and Polat [8] produced risk-based estimates of completion-cost overruns, while Al Ahmad et al. [9] assessed overrun factors using BIM and structural equation modelling. Relationships established for specific projects should not, however, be generalized until they have been validated.

3.3 Evidence synthesis

Of the methodological lines in the selected literature, three appear most relevant to pricing at enterprise level.

The first concerns identifying and prioritizing factors. Afana et al. [4] and Abdelalim et al. [5] demonstrate that construction costs depend on several interrelated categories rather than on isolated material or labour inputs.

Dynamic cost forecasting is the second. Castro Miranda et al. [10] analysed predictive analytics for early-stage cost estimation, and Yalçın et al. [11] applied machine-learning methods within earned value management. Liu et al. [12] reviewed data-driven forecasting of construction-material prices, an area where historical observations are often combined with economic variables.

The third line is the integration of project and cost information. Cassandro et al. [13] reviewed five-dimensional BIM in cost estimation and management, Ali and Abdullah Habib [14] examined 5D BIM in combination with big-data approaches, and Zabin et al. [15] described both the possibilities and the limits of machine learning applied to BIM data.

More recent studies extend this interdisciplinary direction. Jafary et al. [16] reviewed 77 publications on artificial intelligence and machine learning in BIM-based cost estimation, where data preparation, classification of building components, quantity takeoff and estimation are treated as one connected chain.

Table 1. Quantitative evidence and implications for pricing diagnostics in Kazakhstan

Indicator / source	Observed value and period	Analytical meaning for pricing
Construction output [27]	KZT 7,812.3bn; +11.5% real, Jan–Sep 2026 y/y	Shows market activity, NOT price inflation
Private contractor share [27]	89.0% of construction work, Jan–Sep 2026	Enterprise-level pricing is commercially material

ISSN 3134-8475 (Print)
ISSN 3134-8483 (Online)

Indicator / source	Observed value and period	Analytical meaning for pricing
Work-type mix [27]	Road/rail/metro 25.0%; non-residential 21.5%; residential 12.6%	Cost baskets vary by project type
Overall construction index [26]	110.4, Sep 2026 vs Sep 2025 (= +10.4%)	Macro escalation benchmark; not a contract rate
Purchased material index [26]	104.0 national; 102.6 Almaty; 104.6 Astana; 107.0 Shymkent	Regional material exposure differs by 4.4 pp
Cement group index [26]	113.8, Sep 2026 vs Sep 2025 (= +13.8%)	Input-specific pressure exceeds overall material rise
Afana et al. [4]	99 identified factors; 10 categories	Supports multidimensional risk classification
Abdelalim et al. [5]	66 interrelated factors; 69 selected studies	Supports modelling interacting cost drivers
Jafary et al. [16]	77 reviewed AI–BIM estimation papers	Illustrates size of reviewed technical evidence

Sources: BNS releases [26, 27] and published reviews [4, 5, 16]. Changes in construction output refer to real volume, whereas price indices refer to nominal price movements. Contractor-level margins cannot be inferred directly from these indicators; pp — percentage points.

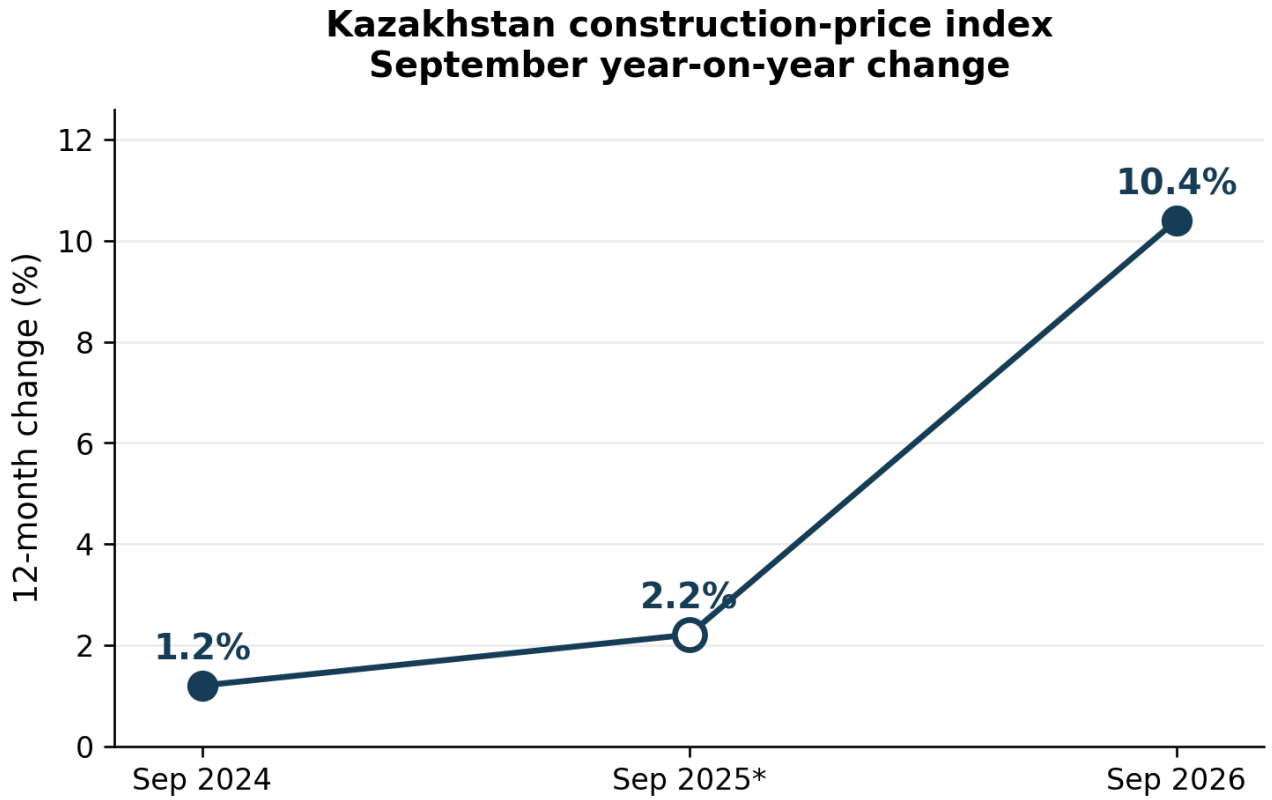


Fig. 3. Kazakhstan construction-price changes. Twelve-month changes at September dates; the 2024 [28] and 2026 [26] values are published observations. The September 2025 value was reconstructed from rounded indices [28, 29]: (1.014 × 1.012 / 1.004 − 1) × 100 ≈ 2.21%. The asterisk marks this approximation; the chart is not a project-cost forecast

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Table 1 separates three kinds of evidence: macroeconomic activity (work volumes), market price movements (input and construction indices) and study counts from the literature. Purchased construction materials rose by 4.0% in September 2026, considerably less than the 10.4% increase in the overall construction-price index [26]. A gap of this size needs a component-level explanation; one cannot simply assume that material prices account for the aggregate escalation. For a given project, the effect depends on the contractor's own resource weights and risk allocation.

Figure 3 shows the published twelve-month change in construction prices rising from 1.2% in September 2024 to 10.4% in September 2026. The September 2025 value of about 2.2% was obtained by chaining national indices rounded to one decimal place: September 2024/December 2023 = 100.4, December 2024/December 2023 = 101.4 and September 2025/December 2024 = 101.2 [28, 29].

Rounding makes this point uncertain, and it should not be presented as a directly published figure. All three observations are changes in price indices. They say nothing about the profitability or cost inflation of any identified contractor.

3.4 Proposed diagnostic matrix

Table 2 contains twelve indicators, six internal management variables and six external exposures. For some external cells, officially published price changes are available; internal measures, by contrast, require company records. Where an internal measure has not been observed, we leave it without a number rather than invent one.

Table 2. Diagnostic factors, measurable metrics and empirical availability

Type	Factor / empirical proxy	Diagnostic metric or observed evidence	Meaning and data restriction
Internal	Estimation quality	WAPE (%) across closed projects	Requires forecast and actual company costs
Internal	Site productivity	Actual / planned labour-hours ratio	Requires timesheets and progress data
Internal	Procurement efficiency	(Purchase − budget price)/budget × 100%	Requires supplier invoices and approved baseline
Internal	Design changes	Unrecovered change costs / contract revenue (%)	Requires signed change-order register
Internal	Financing management	Actual − forecast financing costs (KZT)	Requires project financing ledger
Internal	Information integration	Verified linked cost items / all items (%)	Requires BIM/ERP data-quality audit
External	Material-price escalation	+4.0% national; +2.6% Almaty, +4.6% Astana, +7.0% Shymkent [26]	Observed Sep 2026 y/y; not contract-specific
External	Labour market	Regional wage change (%)	Not measured by the materials index; collect wage series
External	Currency / imports	FX move (%) × exposed procurement share (%)	Requires currency and purchase commitments
External	Financing conditions	Change in borrowing rate (pp)	Market rate alone does not equal project cost
External	Regulatory change	Compliance-cost variation (KZT)	Document affected requirements and timing

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Type	Factor / empirical proxy	Diagnostic metric or observed evidence	Meaning and data restriction
External	Logistics and site	Actual freight/site vs budget (KZT)	Regional prices do not isolate freight effects

Source: authors' classification based on [4-16]; externally observed input-price values are from BNS [26]. The internal key performance indicators (KPIs) are proposals that still require enterprise-level validation; no national values have been reported for them. WAPE - weighted absolute percentage error (Eq. 4); FX - foreign exchange; ERP - enterprise resource planning.

Consider one example. Behind the national 4.0% growth in material costs lies a regional spread from 2.6% in Almaty to 7.0% in Shymkent (September 2026 against September 2025) [26]. A fixed-price contractor with high material intensity has a more exposed margin than a similar contractor with a lower material share. The market index remains a benchmark, though; it does not give the actual price change on any particular project.

3.5 Diagnostic equations

We first propose an indicator of the deviation between expected final cost and baseline cost:

$$D_C = (C_{EAC} - C_0) / C_0 \times 100\% \quad (1)$$

Here C_EAC is the estimated cost at completion and C_0 the approved baseline cost; a positive D_C means that forecast expenditure exceeds the baseline.

The expected contract margin is:

$$M_E = (P - C_{EAC}) / P \times 100\% \quad (2)$$

Here M_E denotes the expected sales margin and P the expected contract revenue, which includes only variations that are sufficiently supported and contractually justified.

The deviation from baseline margin is:

$$\Delta M = M_E - M_0 \quad (3)$$

M_0 is the baseline margin. A negative ΔM indicates that the margin has deteriorated relative to the original commercial assumption.

Once projects are completed, forecast reliability can be checked with the weighted absolute percentage error:

$$WAPE = \Sigma|C_{EAC,j} - C_{A,j}| / \Sigma C_{A,j} \times 100\% \quad (4)$$

$C_{A,j}$ is the actual cost of completed project j. Lower WAPE corresponds to better forecast accuracy, provided forecasts are recorded at comparable project milestones.

External resource sensitivity may be approximated by:

$$\Delta C \approx C_0 \times \Sigma(w_i \times r_i) \quad (5)$$

Here w_i are baseline resource-cost shares and r_i are relative price changes. As a first-order approximation, the formula holds quantities constant and leaves out nonlinear interactions, rework, contractual claims, and substitutions.

Taken together, the equations connect factor exposure with profitability. A pricing system therefore has to track cost deviations and, alongside them, their effect on the expected contract margin.

For non-overlapping resource groups, the multivariate scenario model is: $C_EAC = C_0 \times [1 + \Sigma(w_i \times r_i)]$ (6). The illustration uses cost weights of 45% for materials, 25% for labour, 10% for equipment, 10% for logistics and 10% for overhead, which sum to 100%. Observed price-index shocks and hypothetical group changes are not treated as equivalent evidence, and no category is counted twice.

3.6 Illustrative scenario assessment

To illustrate what published input-price observations mean in economic terms, we assume a HYPOTHETICAL fixed-price contract with a baseline cost of KZT 100 million and revenue of KZT 115 million. The notional baseline cost shares are 45% materials, 25% labour, 10% equipment, 10% logistics and 10% overhead. Only the September 2026 material index changes are observed BNS values [26]; all cost weights, non-material changes and price-transmission assumptions are hypothetical. The independent regional and material tests each apply a single observed shock. The combined tests rely on non-overlapping cost components and must not be added to the independent scenarios.

For the national materials case, $\Delta C = 100 \times 0.45 \times 0.040 =$ KZT 1.80 million. Expected cost is then KZT 101.80 million, and the

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expected sales margin is (115 − 101.80) / 115 × 100 = 11.48%. The Shymkent case gives ΔC = 100 × 0.45 × 0.070 = KZT 3.15 million and a margin of 10.30%. The scenarios are alternatives, so their index effects must not be summed.

Table 3. Single-factor and resource-weighted multi-factor sensitivity of hypothetical construction-contract margins

Scenario	Observed inputs / hypothetical assumptions	Cost (KZT m)	Margin % / change pp
Baseline (hypothetical)	No price/cost change	100.00	13.04 / 0.00
National materials only	Observed +4.0% [26] × assumed 45%	101.80	11.48 / -1.57
Almaty materials only	Observed +2.6% [26] × assumed 45%	101.17	12.03 / -1.02
Astana materials only	Observed +4.6% [26] × assumed 45%	102.07	11.24 / -1.80
Shymkent materials only	Observed +7.0% [26] × assumed 45%	103.15	10.30 / -2.74
Cement subgroup only	Observed +13.8% [26] × assumed 10%	101.38	11.84 / -1.20
Combined national scenario	Materials +4.0% observed [26]; other rates 6%, 3%, 5%, 2% assumed	104.30	9.30 / -3.74
Combined stressed scenario	Materials +7.0% observed [26]; other rates 10%, 5%, 8%, 4% assumed	107.35	6.65 / -6.39
Illustrative mitigation	40% of materials price-protected; other assumed rates 4%, 3%, 5%, 2%	103.08	10.37 / -2.68

The observed materials shocks come from the BNS September 2026 price release [26]. Resource shares, non-material shocks, cost levels and contract revenue are all hypothetical, and the resource categories do not overlap. Each row is a separate comparison against the same baseline, NOT an observed enterprise outcome; the change in sales margin is given in percentage points (pp).

Table 4. Risk-diagnosis-to-pricing-decision matrix (proposed management framework)

Determinant	Verifiable trigger / evidence	Managerial pricing response	Outcome to monitor
External material shocks	Resource index vs. locked purchase commitments	Reprice exposed packages; fix quotations where feasible	Estimated cost at completion; margin sensitivity
Estimating error	Baseline quantity vs. verified BIM/BOQ; WAPE	Independent quantity check; reconcile estimate revisions	Forecast accuracy; rework cost
Labour productivity loss	Actual/earned labour hours ratio	Revise staffing and activity sequencing	Labour cost per completed unit
Imported equipment / FX	Unhedged foreign-currency purchase commitments	Scenario-test FX and permitted contract adjustments	Cost variance by currency

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Design variations	Approved/unapproved variation cost register	Document change orders before expenditure	Unrecovered variation exposure
Cash-flow and financing	Forecast financing cost / project revenue	Update payment and cash schedules	Financing-cost deviation
Data fragmentation	Verified items linked across BIM, procurement, ERP	Validate cost codes and data refresh interval	Data-coverage and timeliness KPI

Source: authors' conceptual synthesis [4–16, 24–26]. The decision matrix is a proposal and has not been tested empirically; its responses are conditional options rather than documented cost savings.

Keeping the hypothetical 45% material share, the national single-factor material-price case reduces the expected margin by 1.57 percentage points, and the Shymkent case by 2.74 points. The combined national test starts from the observed +4.0% material index and adds hypothetical increases of +6% for labour, +3% for equipment, +5% for logistics and +2% for overhead. Expected project cost goes up by 45×0.04 + 25×0.06 + 10×0.03 + 10×0.05 + 10×0.02 = KZT 4.30 million. Since revenue is fixed, the margin falls from 13.04% to 9.30%, a decrease of 3.74 points.

The stressed combined scenario assumes +7.0% for materials (the Shymkent BNS index), +10% for labour, +5% for equipment, +8% for logistics and +4% for overhead. Forecast cost then reaches KZT 107.35 million and the margin 6.65%. Suppose instead that procurement shields 40% of the material budget from this price exposure and that labour costs grow more slowly. The national combined scenario now yields a cost of KZT 103.08 million and a margin of 10.37%. Nothing here shows how effective mitigation would be in real firms. In the first combined scenario, restoring the original nominal profit of KZT 15 million would take contract revenue of KZT 119.30 million, and restoring the original 13.04% sales margin about KZT 119.95 million; whether either adjustment is possible depends on contract provisions and commercial acceptance.

Figure 4 sets side by side the sales margins of the selected hypothetical contract scenarios.

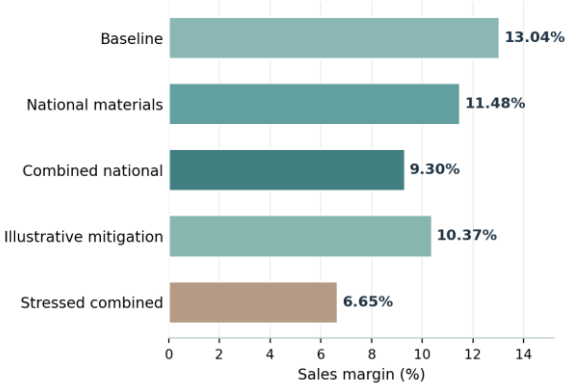


Fig. 4. Illustrative contract margins. Source: Table 3. Contract values, cost shares and non-material shocks are hypothetical; material-price changes use BNS observations [26].

3.7 Information modelling and digital monitoring

One way to put the framework into practice is to integrate BIM with cost management. Hwang and Choi [17] studied openBIM-based quantity takeoff and preliminary cost estimation. Vitásek and Macek [18] assessed how estimates can be compiled from BIM models at the design stage, and Marcellino et al. [19] mapped BIM properties onto price-list items. Their results make one point clear: geometric quantities alone are not enough to link models to costs. Elements and cost data also have to be classified consistently.

AI-assisted estimating opens further

ISSN 3134-8475 (Print)
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possibilities. Abdelsalam et al. [20] combined BIM with large language models to estimate construction costs. Even so, automated outputs require quality control, documented inputs and verification by professionals.

For Kazakhstan we propose implementation in four stages. Stage 1 (baseline data integration) links project elements, quantities, prices, contracts, procurement and actual expenses. Stage 2 (factor monitoring) keeps data on materials, labour, productivity, approved design changes and external risk exposure up to date. Stage 3 (cost and margin forecasting) recalculates estimated cost at completion and contractual profitability. Stage 4 (documented decision-making) compares the possible responses: procurement, productivity, contingency or a justified claim.

This structure follows the information-management principles of ISO 19650 [24, 25]. BIM is the enabling infrastructure here; contractual analysis and economic judgment are still needed. The proposed sequence from diagnosis to managerial response is shown in Figure 5.

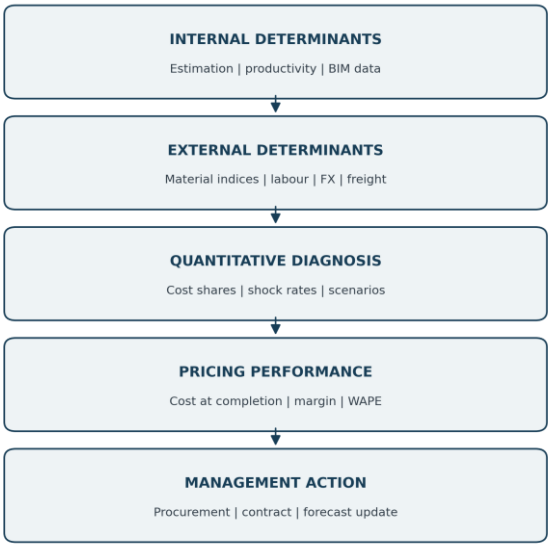


Fig. 5. Proposed pricing-diagnostic sequence. Source: authors' conceptual framework linking risk exposures, evidence, estimated cost, margin and managerial response; field validation has not yet been performed.

3.8 Relationship with lifecycle cost management

Pricing decisions may also depend on how alternative designs perform economically over the service life of the asset. Yousfi et al. [21] addressed information structures for whole-life costing and noted fragmented data and limited standardization. Such a perspective matters when materials, energy-efficiency measures, equipment systems and construction technologies are being chosen.

The lowest initial construction price is not necessarily the one that gives the owner the lowest lifecycle expenditure. Because contractor and client may pursue different financial objectives, the contractor's pricing system must keep apart contract revenue, expenditure during construction and the client's lifecycle evaluation. The reviewed 5D BIM studies [13, 14, 22, 23] offer a basis for comparing designs more transparently, though they also point to interoperability limitations.

3.9 Kazakhstan-specific implications and limitations

First, the official price release for September 2026 records a 10.4% year-on-year increase in Kazakhstan's overall construction-price index and a 4.0% increase for purchased construction materials, with marked differences between cities [26]. Construction output, which is a separate measure, amounted to KZT 7,812.3 billion in January–September 2026, up 11.5% in real terms [27]. None of these numbers demonstrates that enterprise

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production costs, selling prices or profits rose in the same proportion. For that, contract-specific quotations and actual expenditures are needed.

Second, the construction digitalization policy makes it possible to link information models with economic data [3]. This does not happen by itself: it takes classification rules, reliable data exchange, trained staff and organizational capacity.

Third, regional and contractual differences make localization necessary. A diagnostic system designed for urban housing cannot simply be applied to remote infrastructure or to specialized industrial facilities.

The principal limitation is that the framework has not been validated on enterprise-level project data, and indicator priorities and thresholds for Kazakhstan have not been estimated statistically. Future work should compare baseline estimates, procurement records, progress measurements, final costs, contract variations and realized margins. Quantitative models built on such data could then show which factors explain forecasting errors and margin deterioration under particular procurement and contractual conditions.

A practical validation design could compare forecasts made at successive dates (tender, procurement, mid-project, completion), calculate WAPE and realized sales margins, and test whether risk triggers appear before forecasts worsen. Contracts would need to be stratified into residential, non-residential and infrastructure work, because resource shares and adjustment provisions may differ among them. The index-calibrated illustrations in this paper cannot measure the effect of BIM adoption or supplier hedging. Causal effects of that kind require matched projects or longitudinal firm records.

4 CONCLUSION

From the structured review, the observed national statistics and the transparent illustrative scenarios we draw the following conclusions:

1. Internal estimating, procurement, productivity, design coordination, finance and data quality interact with external prices, logistics, regulation and contract risk. Cost overruns alone are therefore not enough to judge pricing effectiveness.

2. We propose 12 diagnostic indicators, six internal and six external, and assess pricing effectiveness along four dimensions: estimation accuracy, margin stability, responsiveness to changing conditions, and transparency and traceability of cost and price information. The framework is conceptual; it has yet to be validated with enterprise-level observations.

3. According to the official indices for September 2026, overall construction prices in Kazakhstan rose by 10.4% year on year and purchased construction materials by 4.0% [26]. The approximate 2025 point in the chart is a reconstruction from rounded indices [28, 29]. None of these figures measures the cost or profit of an individual contractor.

4. With a hypothetical cost base of KZT 100 million and fixed revenue of KZT 115 million, the combined national scenario lifts expected cost to KZT 104.30 million and reduces the sales margin from 13.04% to 9.30%. Under the stressed scenario the margin falls to 6.65%. These are scenario results, neither observed enterprise performance nor proven savings.

5. An operational pricing system needs to connect verified quantities, procurement, contract terms, estimated cost at completion and documented decisions. Before any causal benefit of 5D BIM or digital monitoring can be claimed, project-level research must test predictive accuracy, risk responses and realized margins.

Figure 6 places the observed evidence, the proposed diagnostic model and the empirical validation still required side by side.

ISSN 3134-8475 (Print)
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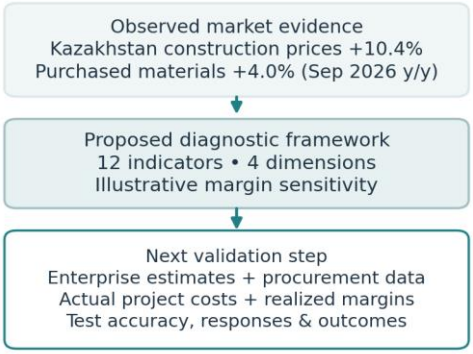


Fig. 6. Evidence and validation priorities. Sources: observed indices [26], proposed framework and hypothetical scenarios in this study. No enterprise-level validation.

REFERENCES

1. Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan. Construction price indices: dynamic tables [Internet]. Astana: Bureau of National Statistics; 2026 [cited 2026 Nov 2]. Available from: https://stat.gov.kz/ru/industries/economy/prices/dynamic-tables/ (In Russ.)

2. Committee on Statistics of the Ministry of National Economy of the Republic of Kazakhstan. On approval of the methodology for compiling construction price indices: Order No. 315 of 14 December 2016 [Internet]. 2016 Dec 14 [updated 2025 Jan 17; cited 2026 Nov 2]. Available from: https://adilet.zan.kz/rus/docs/V1600014694 (In Russ.)

3. Official Information Source of the Prime Minister of the Republic of Kazakhstan. Kazakhstan approves construction industry digitalization plan for 2026–2027 [Internet]. 2026 Jan 9 [cited 2026 Nov 2]. Available from: https://primeminister.kz/ru/news/v-kazaxstane-utverzden-plan-cifrovizacii-stroitelnoi-otrasli-30942 (In Russ.)

4. Afana, O., Al Zubaidi, R., Abu Dabous, S., Ibrahim, F. Categories and factors of cost overrun in construction projects: a systematic review. Engineering, Technology & Applied Science Research. 2024; 14(6): 18330–18347. https://doi.org/10.48084/etasr.9006

5. Abdelalim, A.M., Salem, M., Salem, M., Al-Adwani, M., Tantawy, M. An analysis of factors contributing to cost overruns in the global construction industry. Buildings. 2025; 15(1): 18. https://doi.org/10.3390/buildings15010018

6. Alnaser, A.A., Al-Gahtani, K.S., Alsanabani, N.M. Building information modeling impact on cost overrun risk factors and interrelationships. Applied Sciences. 2024; 14(22): 10711. https://doi.org/10.3390/app142210711

7. Alhammadi, Y., Al-Mohammad, M.S., Rahman, R.A. Modeling the causes and mitigation measures for cost overruns in building construction: the case of higher education projects. Buildings. 2024; 14(2): 487. https://doi.org/10.3390/buildings14020487

8. Turkyilmaz, A.H., Polat, G. Risk-based completion cost overrun ratio estimation in construction projects using machine learning classification algorithms: a case study. Buildings. 2024; 14(11): 3541. https://doi.org/10.3390/buildings14113541

9. Al Ahmad, M.H., Arifuddin, R., Abdurrahman, M.A. Cost overrun factors in construction projects: a BIM and SEM analysis. Engineering, Technology & Applied Science Research. 2026; 16(2): 33365–33374. https://doi.org/10.48084/etasr.14744

10. Castro Miranda, S.L., Del Rey Castillo, E., Gonzalez, V., Adafin, J. Predictive analytics for early-stage construction costs estimation. Buildings. 2022; 12(7): 1043.

ISSN 3134-8475 (Print)
ISSN 3134-8483 (Online)

https://doi.org/10.3390/buildings12071043

11. Yalçın, G., Bayram, S., Çıtakoğlu, H. Evaluation of earned value management-based cost estimation via machine learning. Buildings. 2024; 14(12): 3772. https://doi.org/10.3390/buildings14123772

12. Liu, Q., He, P., Peng, S., Wang, T., Ma, J. A survey of data-driven construction materials price forecasting. Buildings. 2024; 14(10): 3156. https://doi.org/10.3390/buildings14103156

13. Cassandro, J., Mirarchi, C., Pavan, A. A comprehensive literature review of 5D building information modelling using latent Dirichlet allocation analysis. Construction Innovation. 2025; 25(7): 331–357. https://doi.org/10.1108/CI-07-2024-0209

14. Ali, F.H., Abdullah Habib, S.N.H. Mapping the nexus of 5D BIM and big data in project cost management: a systematic review. Journal of Project Management Practice. 2025; 5(1): 1–19. https://doi.org/10.22452/jpmp.vol5no1.1

15. Zabin, A., González, V.A., Zou, Y., Amor, R. Applications of machine learning to BIM: a systematic literature review. Advanced Engineering Informatics. 2022; 51: 101474. https://doi.org/10.1016/j.aei.2021.101474

16. Jafary, P., Shojaei, D., Rajabifard, A., Ngo, T. Artificial intelligence (AI) and machine learning in building information modeling (BIM)-based construction cost estimation: a systematic review. Geo-spatial Information Science. 2026. https://doi.org/10.1080/10095020.2026.2651578

17. Hwang, H., Choi, J. An openBIM-based integrated process for quantity take-off and schematic cost estimation to support schematic and preliminary design decision making. Buildings. 2026; 16(12): 2307. https://doi.org/10.3390/buildings16122307

18. Vitásek, S., Macek, D. Current possibilities of using BIM models for compiling cost estimates in the design phase of residential buildings. Buildings. 2026; 16(1): 203. https://doi.org/10.3390/buildings16010203

19. Marcellino, G., Magalhães, P.M., Zanchetta, C. Structuring cost information in BIM: a property-based mapping between regional price lists and IFC. Buildings. 2026; 16(13): 2677. https://doi.org/10.3390/buildings16132677

20. Abdelsalam, M., Ashmawi, A., Nguyen, P.H.D. AI-driven automation of construction cost estimation: integrating BIM with large language models. Buildings. 2026; 16(3): 485. https://doi.org/10.3390/buildings16030485

21. Yousfi, A., Poirier, É.A., Forgues, D. A core ontology for whole life costing in construction projects. Buildings. 2025; 15(14): 2381. https://doi.org/10.3390/buildings15142381

22. Ahmad, A., Fathi, M.S. 5D BIM implementation to overcome cost management issues in upstream oil and gas projects in Malaysia: a review. Journal of Technology Management and Business. 2024; 11(1): 111–121. https://doi.org/10.30880/jtmb.2024.11.01.007

23. Widiasanti, I., Fikri, Y., Wibisono, M.A., Wijaya, A., Hasanah, N.H. Systematic review of 5D BIM implementation in construction projects. International Journal of Science and Environment. 2026; 6(1): 692–697. https://doi.org/10.51601/ijse.v6i1.371

24. International Organization for Standardization. ISO 19650-1:2018. Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 1: Concepts and principles [Internet]. Geneva: ISO; 2018 [cited 2026 Nov 2]. Available from: https://www.iso.org/standard/68078.html

25. International Organization for Standardization. ISO 19650-2:2018. Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 2: Delivery phase of the assets [Internet]. Geneva: ISO; 2018 [cited 2026 Nov 2]. Available from: https://www.iso.org/standard/68080.html

26. Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the

ISSN 3134-8475 (Print)
ISSN 3134-8483 (Online)

Republic of Kazakhstan. Price indices and prices in construction in the Republic of Kazakhstan (September 2026) [Internet]. Astana: Bureau of National Statistics; 2026 Oct 5 [cited 2026 Nov 2]. Available from: https://stat.gov.kz/ru/industries/economy/prices/spreadsheets/?name=19094 (In Russ.)

27. Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan. Construction works and commissioning of facilities in the Republic of Kazakhstan (January–September 2026) [Internet]. Astana: Bureau of National Statistics; 2026 Oct 16 [cited 2026 Nov 2]. Available from: https://stat.gov.kz/ru/industries/business-statistics/stat-inno-build/publications/348860/ (In Russ.)

28. Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan. Socio-economic development of the Republic of Kazakhstan, January–September 2024 [Internet]. Astana: Bureau of National Statistics; 2024 Oct 15 [cited 2026 Nov 2]. Available from: https://stat.gov.kz/upload/iblock/d8d/jxhcqdhn8tvb95omdmh1lso2o5u533i3/%D0%96-01-%D0%9C%2009%202024%20%28%D1%80%D1%83%D1%81%29.pdf (In Russ.)

29. National Bank of Kazakhstan. Statistical Bulletin No. 04 (377): Price indices, section 1.2 [Internet]. Almaty: National Bank of Kazakhstan; 2026 Apr [cited 2026 Nov 2]. Available from: https://nationalbank.kz/file/download/127844 (In Russ.)

ISSN 3134-8475 (Print)
ISSN 3134-8483 (Online)

FUNDING

This research received no external funding.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ARTIFICIAL INTELLIGENCE STATEMENT

During preparation of this manuscript, the authors used OpenAI ChatGPT (GPT-6) to systematize source materials, assist with drafting and organizing the initial manuscript, correct language and editorial errors, and support preparation of illustrative calculation. The authors are responsible for verifying the final scientific content, references, calculations, interpretations and conclusions.

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The article was submitted 18 July 2026; approved after reviewing 08 August 2026; accepted for publication 28 August 2026.