LOGIC

INSIGHTS

The Role of AI in the Construction Industry

From Fragmented Delivery to Predictive Construction

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Construction is entering a more demanding operating environment, where project scale is expanding faster than the sector's ability to improve delivery performance. Global construction spending is projected to rise from USD 13 trillion in 2023 to USD 22 trillion by 2040, while global construction productivity grew by only 0.4% annually between 2000 and 2022, compared with around 2% for the total economy[1].

A major constraint lies in how construction projects are planned, monitored, and controlled. Project teams often rely on information that is inaccurate, incomplete, inaccessible, inconsistent, or delayed, weakening decisions across tendering, procurement, execution, and financial control. **Rework can account for 3–11% of total construction project costs[2],** with poor document management and weak quality controls identified among the main causes. However, **digitalizing project documentation and quality processes can help reduce these costs by more than 50%[2]** by improving visibility, consistency, and control across project delivery.

The sector is also under growing environmental pressure. **Buildings and construction account for 32% of global energy consumption and 34% of global CO_2 emissions, while cement and steel are responsible for 18% of global emissions[3].** Construction performance is therefore no longer judged only by cost, schedule, and quality, but also by resource efficiency, waste reduction, and lower-carbon delivery.

In this context, AI is becoming increasingly relevant as a decision-support capability across the project lifecycle. Its applications in construction project management cover:

- Cost estimation
- Cost control
- Planning & scheduling
- Delay-risk prediction
- Risk assessment
- Hazard identification
- PPE detection
- Resource allocation
- Safety monitoring

Adoption among construction companies, however, remains uneven. In 2025:

- **~45%** reported no AI implementation
- **34%** were still in early pilot phases
- Only **1.5%** used AI across multiple processes
- Less than **1%** had fully embedded AI across the organization

The main barriers are operational rather than conceptual, including shortage of skilled personnel, system integration challenges, and poor data quality.

[1] RICS Construction Productivity Report 2026 - RICS
[2] The Cost of Rework in Global Construction – Plan Radar
[3] Global Status Report for Buildings and Construction 2024/2025 – UN Environment Programme

AI's role in construction should therefore be understood less as a move toward fully automated construction and more as a shift toward predictive construction: earlier risk visibility, data-supported pricing, better material planning, and more integrated decisions across cost, schedule, resources, safety, and commercial exposure.

I. The Predictability Gap in Construction Delivery

A. | Inconsistent Measurement Limits Performance Improvement

Across nearly 3,000 construction professionals in the UK, Europe, the Americas, Asia-Pacific, and the Middle East & Africa, construction firms still lack a common way to define and measure productivity. In practice, this means firms may be tracking different things under the same productivity label: output per worker, output per hour, cost per unit, schedule performance, or progress against plan. **No single productivity definition is used by even 30% of firms in any region[1],** limiting the ability to compare performance consistently across projects, markets, or business units.

Benchmarking is also limited. **Only 5% of UK and European firms, 9% of Asia-Pacific firms, 14% of Middle East & Africa firms, and 16% of firms in the Americas use benchmarks.** The UK shows the weakest measurement discipline, with 22% of firms never measuring productivity, compared with 9% in the Middle East & Africa[1].

Without a shared measurement basis, firms struggle to identify whether delays come from labor productivity, design changes, procurement gaps, subcontractor performance, equipment utilization, or weak planning.

Improvement then depends on project-by-project experience rather than repeatable management practice.

B. | Interconnected Risks Weaken Project Control

Construction underperformance rarely comes from one isolated issue. A global review of construction cost-overrun literature identified 66 interconnected cost-overrun factors, including:

- Planning and scheduling weaknesses
- Inaccurate estimation
- Design inefficiencies
- Weak scope definition
- Contractual ambiguities
- Unforeseeable site condition

These risks often reinforce one another. For example, a design change can alter quantities, procurement timing, subcontractor sequencing, billing, and claims; and a procurement delay can reduce site productivity, disrupt the schedule, increase equipment idle time, and weaken margins. Stronger project control therefore depends on earlier visibility across design, procurement, resources, site progress, contract exposure, and cost movement.

C. | Fragmented Supply Chains Increase Delivery Uncertainty

Construction delivery depends on the coordination of materials, suppliers, subcontractors, logistics, site conditions, and changing timelines. Data-driven construction supply chain management can improve coordination, reduce inefficiencies, and support better collaboration, but adoption remains constrained by data integration, infrastructure, data quality, security, privacy, and stakeholder coordination.

AI cannot operate effectively as a standalone tool in this environment. It requires consistent measurement, reliable data, connected systems, leadership alignment, and adoption by project teams before it can become a true operating capability.

II. AI in Tendering and Procurement

Building Control Before Execution

A. | Smarter Opportunity Selection and Bid Preparation

Tendering is the first layer of project control because it defines the commercial and operational commitments that execution teams later inherit. In Saudi Arabia, 112 construction contractor professionals assessed 22 bid/no-bid factors across building and infrastructure projects. The highest-ranked factors were client ability to pay, clarity of scope, project cash flow, the need for work, and availability of qualified workforce, showing that the quality of an opportunity can be as important as its size.

AI can strengthen bid/no-bid decisions by moving them from informal judgment to structured opportunity scoring. New opportunities can be assessed against previous win and loss patterns, delivery capacity, client payment history, scope clarity, expected cash flow, project risk, and workforce availability.

This helps contractors reduce wasted tendering effort and focus on opportunities with stronger strategic fit, margin potential, and execution feasibility.

B. | Faster Quantity Takeoff and More Reliable Cost Estimation

Quantity takeoff is a high-impact pre-construction activity because it translates design information into the quantities and cost items that shape the bid. Traditional takeoff from 2D drawings is time-consuming and exposed to human error, while BIM enables more automated quantity extraction from information-rich models. AI-enabled workflows can connect BIM platforms with cost databases to extract model elements, classify components, validate completeness, and produce structured estimate outputs.

Coastal CONSTRUCTION

The practical impact is already visible. **Coastal Construction,** a Florida-based general contractor, **used machine-learning-based takeoff technology to automate square-foot analysis and full takeoffs, cutting nearly 14,000 hours of work and saving close to USD 1 million in the first year of use.**

C. | Predictive Procurement and Margin Protection

Procurement extends the same commercial discipline after award. Material costs can represent up to 60–70% of total cost in large construction projects[4], while prices for steel, cement, asphalt, gravel, sand, and concrete are shaped by raw material prices, energy costs, and wider market conditions.

AI-enabled forecasting can connect quantities, historical cost data, procurement records, commodity trends, supplier pricing, inflation assumptions, and project timelines.

AI can also structure supplier intelligence by combining price, delivery reliability, quality, performance history, and project fit. When connected to demand forecasts and logistics planning, procurement shifts from reactive purchasing to margin protection before cost exposure becomes embedded.

III. AI in Project Management and Control

From Delayed Reporting to Real-Time Visibility

A. | AI-Enabled Progress Monitoring

Once a project moves into execution, performance depends on whether cost, schedule, resources, procurement, site progress, quality, and safety can be managed as one connected system. AI applications in construction project management are increasingly concentrated across cost, time, and safety management.

Progress monitoring is one of the clearest applications. Traditional monitoring often depends on manual inspections, site walks, photographs, and progress logs, which can delay visibility and introduce subjective interpretation. Computer vision can identify and track construction elements in site images and videos, creating a more reliable basis for comparing actual progress against the planned schedule or BIM model.

Intel's semiconductor construction projects show the potential value of AI-enabled progress control. **AI-powered progress tracking contributed to a 4.3% reduction in rework costs per fabrication facility and helped avoid around six weeks of delay per facility[5] by using Buildots'** AI to detect issues early and improve alignment between the BIM model and actual construction.

[4] A Survey of Data-Driven Construction Materials Price Forecasting - MDPI
[5] Intel uses Buildots' AI to boost efficiency and reduce costs in fab construction - Buildots

B. Dynamic Scheduling and Cost Control

Construction schedules rarely follow their baseline exactly. Projects face resource constraints, sequencing conflicts, subcontractor delays, procurement disruptions, weather conditions, access limitations, and design changes.

AI can help teams simulate execution scenarios, test resource constraints, compare time-cost trade-offs, and identify recovery options when projects deviate from plan.

AI also strengthens cost control by detecting emerging overruns, forecasting cost-to-complete, identifying margin drift, and linking financial signals with productivity, procurement timing, and schedule movement.

C. Stronger Documentation, Equipment, and Safety Oversight

The same project data can support billing, equipment management, and safety. AI-supported documentation can create objective visual records of progress, validate work-in-place, and support payment verification, claims evidence, subcontractor validation, owner reporting, and project governance.

AI and IoT can use sensor and activity data to understand equipment utilization, idle time, bottlenecks, productivity patterns, and maintenance needs. AI-enabled safety monitoring can also identify PPE issues, hazard patterns, and repeated site risks, expanding monitoring coverage while leaving interpretation, intervention, and accountability with safety teams.

These applications require reliable links between: BIM Models - Schedules - Cost Codes - Procurement Records - Field Documentation - Invoices - Site Imagery - Project Management Systems.

Without these foundations, AI risks creating dashboards without control. With them, it can support a more integrated view of progress, cost, schedule, safety, equipment, and commercial exposure.

IV. AI in Support Functions

Connecting Project Signals to Enterprise Decisions

A. | Predictive Finance and Workforce Planning

Construction performance is often judged at the project level, but many of the decisions that shape project outcomes sit in support functions. Cash flow, workforce allocation, financial planning, data governance, and enterprise reporting all influence whether projects can be delivered with stability and control.

Cash flow is one of the clearest examples. **In 2025, 43% of subcontractors reported not having enough working capital to cover unexpected expenses or project delays[6],** while delayed payments continued to place pressure on construction cash flow. AI can support finance teams by moving from periodic forecasting to rolling predictive visibility, combining schedules, payment milestones, procurement commitments, expected inflows, risk events, and actual progress to estimate future liquidity exposure. In effect this could also help in designing more conducive payment terms for sub-contractors and material suppliers.

Workforce planning faces similar pressure. **In the United States, the construction industry needed to attract 439,000 net new workers in 2025 to meet anticipated demand.** Workforce shortages are already affecting delivery, with:

- **92% of construction firms reporting difficulty finding workers[7]**
- **45% reporting project delays linked to labor shortages[7]**

AI can help forecast manpower needs based on project pipeline, active schedules, work packages, skill requirements, site progress, and upcoming milestones, allowing firms to balance utilization, availability, location, skill fit, and project priority.

B. | Capability Building and Knowledge Reuse

AI adoption depends on people as much as systems.

- Estimators need to understand AI-assisted takeoff and cost models
- Planners need to interpret schedule-risk outputs
- Project managers need to act on progress deviations
- Procurement teams need supplier and price intelligence
- Finance teams need to interpret predictive cash-flow signals
- Site teams need to understand how AI-supported monitoring affects daily control

AI can also help firms reuse institutional knowledge. Across projects, construction firms accumulate tenders, contracts, method statements, claims, safety reports, lessons learned, supplier evaluations, close-out documents, and technical correspondence but this information is often scattered across systems and teams. Generative AI can make it easier to retrieve relevant clauses, compare similar past cases, summarize lessons learned, and support faster document review. **Retrieval-augmented generation improves a baseline large language model by 5.2% in quality, 9.4% in relevance, and 4.8% in reproducibility[8] when used for querying contract documents.** Support functions therefore become the scaling layer for AI.

[6] Cash flow problems continue to plague subcontractors: report – Construction Dive
[7] Construction Workforce Shortages Are Leading Cause Of Project Delays As Immigration Enforcement Affects Nearly 1/3 Of Firms – AGC - The Construction Association
[8] Generative AI in the Construction Industry: A State-of-the-art Analysis – Cornell University

V. Scaling AI in Construction

From Pilots to Operating Capability

Scaling AI in construction requires more than introducing new tools. It requires a structured adoption approach that links priority use cases to reliable data, embeds AI into existing project workflows, defines clear governance, and measures value through operational outcomes to move AI from isolated pilots to scalable construction capability.

Adoption Requirement	Construction Application
Prioritize Use Cases	**AI should begin with clearly defined business constraints,** not broad technology ambition. Priority use cases include bid/no-bid decisions, quantity takeoff, material price forecasting, supplier evaluation, progress tracking, schedule risk, cost control, manpower planning, and financial forecasting.
Build the Data Foundation	**AI requires standardized, connected data across projects and functions.** This includes cost codes, material codes, supplier records, purchase orders, schedules, BIM models, progress updates, invoices, variation orders, workforce data, and financial information. **Poor data quality and system integration remain major barriers, cited by 30% and 37% of construction organizations respectively[9].**
Embed AI into Workflows	**AI should connect to daily project routines:** progress tools with schedules and BIM, cost-risk models with budgets, invoices, and forecasts, procurement tools with supplier records and material demand, and manpower tools with HR data and project schedules.
Define Governance	AI outputs can influence pricing, contracts, schedules, safety, cost control, workforce allocation, and financial planning. **Governance should cover responsibilities, risk assessment, data quality, performance monitoring, lifecycle oversight, and human approval points.**
Measure Outcomes & Scale	AI should be measured through construction outcomes such as tender cycle time, estimating accuracy, bid conversion, material cost variation, supplier performance, schedule adherence, rework reduction, cost-to-complete accuracy, cash-flow visibility, equipment utilization, safety observations, and manpower utilization. **Scaling should follow a phased roadmap from readiness assessment to proven deployment across projects.**

[9] Optimism high for AI in construction – new report – Build in Digital

Building with Foresight

AI's role in construction is not to remove the complexity of the industry, but to help firms manage that complexity with greater foresight. **Its value lies in helping construction firms move from fragmented delivery to predictive control:** better decisions before bids are submitted, materials are procured, delays become irreversible, margins erode, cash-flow pressure escalates, and safety risks turn into incidents.

The firms that benefit most will be those that use AI to strengthen, not replace, construction expertise. By connecting reliable data, integrated systems, responsible governance, and human judgment, **AI can become a practical management capability for building with greater predictability, discipline, and foresight.**

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