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While artificial intelligence (AI) continues to dominate headlines, the construction industry seems, at first glance, an unlikely candidate for AI-driven transformation. The field is highly physical and rooted in tangible processes — placing AI in this environment may seem like a "square peg in a round hole." However, as learned in chemistry class, opposites often attract.

As architecture, engineering, and construction firms face increasing challenges — labor shortages, rising costs, and supply-chain disruptions — AI presents a timely opportunity. Yet, its adoption within the industry has been measured, at best.

For firms willing to embrace AI's potential, the benefits can be substantial: optimizing operations, enhancing safety, and driving financial growth. AI's predictive capabilities, cost efficiencies, and safety enhancements offer a road map for construction firms of all sizes to improve performance and profitability. However, firms must also navigate the associated costs and barriers to entry to ensure strategic, targeted implementation.

### AI-POWERED PREDICTIVE CAPABILITIES

One of AI's most transformative abilities in construction is prediction. AI can analyze vast historical datasets to identify trends, anticipate resource needs, and improve planning accuracy. Predictive analytics can inform staffing requirements, risk management strategies, and financial forecasting.



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For example, AI-driven supply-chain forecasting enables firms to anticipate potential disruptions, ensuring materials are available when needed and preventing costly delays. AI tools can also optimize project scheduling by analyzing past performance and predicting workflow bottlenecks, helping firms manage labor more efficiently. The construction industry thrives on precision — bad estimates can derail entire projects. AI-enhanced estimating tools can refine cost projections, reducing the risk of over- or underbidding and increasing profitability.

# **AI-DRIVEN COST EFFICIENCY**

Construction firms continually seek ways to improve efficiency and reduce waste. Al provides the capability to streamline operations in ways previously unattainable.

Consider modular construction – where rooms or entire

floors are built offsite in controlled environments and then assembled onsite. This process has long been heralded for its efficiency, but AI takes it further by optimizing material use, reducing waste, and improving labor allocation. Robotics, guided by AI, are expected to increasingly make their way onto jobsites, enhancing efficiency by automating repetitive tasks and reducing reliance on manual labor.

Al-powered project management software allows firms to minimize rework, improve coordination between teams, and enhance overall jobsite productivity. Predictive modeling can ensure that the right materials and labor are allocated precisely where and when needed, minimizing downtime and inefficiencies. For firms willing to embrace AI, these efficiencies can translate into significant cost savings and competitive advantages.

#### **AI'S ROLE IN SAFETY**

Safety remains a top concern in construction, one of the most hazardous industries. Unlike accounting or finance – where the risks are primarily financial – construction workers face daily dangers onsite.

Unfortunately, many firms have experienced the tragedy of losing workers to jobsite accidents. AI has the potential to revolutionize safety standards, reducing risks and saving lives.

Al-driven safety monitoring tools, such as wearable sensors and computer vision-based site surveillance, provide 360-degree visibility, helping prevent accidents before they occur. Al can analyze patterns and predict potential hazards, alerting supervisors to dangerous conditions in real time.

Drones equipped with AI can survey jobsites, identifying structural weaknesses or compliance issues before they become critical problems. AI-powered image recognition can detect whether workers are wearing proper safety equipment or if hazardous materials are improperly stored. These innovations are already gaining traction, as firms recognize that investing in AI-driven safety measures not only protects workers but also reduces liability and downtime due to accidents.

#### **BARRIERS TO AI ADOPTION**

While AI offers compelling advantages, there are barriers to widespread adoption, particularly for smaller firms.

Cost is a primary concern. AI implementation requires significant investment in both technology and training. Larger firms have been ahead of the curve in incorporating large-scale data collection into major developments, such as Hudson Yards – one of the most technologically advanced and sustainable projects in the country. This data, collected from sensors throughout the development, allows AI to optimize energy use and predict resource needs.

For smaller firms, the key to AI adoption lies in targeting specific pain points rather than implementing sweeping changes. A firm does not need to adopt AI across all operations at once. Instead, AI can be introduced incrementally to address critical needs — such as automating administrative processes, improving estimating accuracy, or implementing AI-driven safety measures. As AI technology becomes more accessible and cost-effective, smaller firms will have more opportunities to integrate these tools without overextending resources.

## A BALANCING ACT

The AEC industry must balance embracing AI's efficiencies while maintaining control over its implementation. AI-powered chatbots and virtual assistants can streamline communications and automate tasks, but firms must remain mindful that AIgenerated outputs still require human oversight.

Additionally, while some fear AI may displace jobs, the reality is more nuanced. The construction sector faces a significant labor shortage, and AI can help bridge gaps by augmenting human workers rather than replacing them. In particular, AI can support high-value roles such as estimators, whose expertise in bid accuracy remains invaluable.

Despite concerns, the construction industry is unlikely to see a net loss of jobs due to AI. Construction demand continues to rise annually, and AI's role will be to enhance productivity, improve safety, and optimize processes rather than eliminate the need for skilled workers.

Al is no longer just a futuristic concept — it is already reshaping the construction industry in meaningful ways. From predictive analytics that optimize cost and labor efficiency to Al-driven safety enhancements that protect workers, the benefits are undeniable. However, firms must approach Al strategically, ensuring that adoption aligns with their unique challenges and operational scale. For larger firms, AI presents an opportunity to revolutionize how construction projects are planned, executed, and managed. For smaller firms, AI can be a targeted solution to enhance efficiency in specific areas. While cost remains a barrier to entry, incremental adoption allows firms to gradually integrate AI technologies in a way that delivers tangible value without overextending resources.

Ultimately, the firms that successfully harness AI will not only optimize their operations but also position themselves for sustained growth in an increasingly competitive industry. In construction, as in chemistry, when opposites attract, innovation happens.  $\rho$ 

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# **About the Author**

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