Seizing Growth in Architecture, Engineering & Construction: Trends, Technology, and Winning Strategies

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Executive Summary

The architecture, engineering, and construction (AEC) industry is undergoing significant changes driven by sustainability, technological advancements, and evolving business practices. Despite challenges posed by the COVID-19 pandemic, the industry is expected to see growth in 2024 and 2025, fueled by infrastructure investments, digital transformation, and the global green economy.

Key trends shaping the AEC industry include:

1. **Sustainability and green construction**: Firms are adapting to environmental regulations and client demands for greener buildings, focusing on embodied carbon reduction, energy efficiency, and reduced environmental impact.

2. **Digital first transformation**: AEC firms are embracing technologies like BIM, AI, robotics, IoT, AR/VR, and cloud-based collaboration platforms to improve efficiency, reduce errors, and enhance project outcomes.

3. **Labor shortages**: The industry faces a shortage of skilled workers due to an aging workforce and lack of younger talent. Firms are leveraging digital tools and automation to maintain efficiency and investing in initiatives to attract a more diverse workforce.

4. **Supply chain resilience**: Effective supply chain management, risk assessment, and diversified vendor relationships are crucial for timely project delivery and cost management in the face of rising political tensions and logistical challenges.

5. **Shift to early design-construction collaboration**: Design-Build (DB) and Integrated Project Delivery (IPD) methodologies are gaining traction, emphasizing collaboration among stakeholders from the project's inception to completion.

Sustainability and Green Construction	• Compliance management solutions • Sustainable construction technologies • Smart construction equipment, IoT sensors • Intelligent energy sourcing
Digital First Transformation	• Executive sponsorship • Change management • AI enabled training and development • Technology enabled business processes

Labor Shortages	• Productivity enhancing technologies
	• Cloud-based HR Systems
	• AI and automation to increase recruiting effectiveness
	• Skills based organization with AI to improve onboarding, training / talent development and re-skilling the workforce.
	• Improved health and safety -
	  ◦ Wearable tech (intelligent hardhats, exoskeleton suits, AR overlays, smart watches, etc.)
	  ◦ Worksite sensors (IoT), remote monitoring, geo fencing / location tracking, drones and robotics

Supply Chain Resilience	• Cloud-based supply chain optimization solutions • PPM solutions for more effective project planning and execution • IDP platforms
Shift to early design-construction collaboration	• BIM creates intelligent 3D models of buildings and infrastructure projects • Cloud-based project collaboration solutions • Cloud-based document team collaboration solutions • Use of advanced tech - digital twins, AR / VR, laser scanning, smart construction equipment and IoT s

Recommendations

CEO

- Gain competitive advantage with a digital first strategy.
- Foster a culture of innovation to maximize limited resources.
- Invest in advanced technology to increase productivity, margin and revenue while mitigating labor shortages and improving safety.
- Implement a fully integrated customer experience (CX) strategy supported by technology.
- Explore new business models to increase revenue and competitiveness

CFO

- Increase revenue, profit and project performance while mitigating project execution risks with a fully integrated project and portfolio management (PPM) solution.
- Increase revenue, forecast accuracy, and resource management while increasing firm-wide financial visibility with a cloud-based ERP system tailored for the AEC industry.
- Increase productivity and margin by implementing automation and AI that automates repetitive tasks freeing up scarce resources for higher value tasks.
- Improve strategic planning, business decisions, financial reporting, project performance and resource utilization with advanced data analytics, BI and generative AI.

CTO/CIO

- The foundation of a digital first strategy starts with an integrated data model and data cloud that is unified across the entire set of business applications.
- Data quality can be greatly enhanced using AI/ML and automation tools.
- Collaboration tools are mission critical, particularly for firms shifting to early design-construction collaboration.
- Purpose built cloud-based enterprise applications for AEC can greatly increase adoption and improve business performance.
- Cybersecurity is a non-negotiable as your digital footprint expands.
- Focus on intuitive interfaces for customers and employees alike. Design with the user in mind.
- Prepare employees for new technologies, work methods, and evolving company culture with change management.

To address these trends and overcome challenges, AEC firms need to adopt a range of technologies, including **cloud-based ERP systems, construction management software**, **BIM, digital twins, AR/VR, IoT sensors**, and **advanced analytics**. Investing in **talent management platforms, automation,** and **robotics** can help mitigate labor shortages, while **wearable technology** and **predictive analytics** can enhance worker safety.

Successful implementation of a digital first strategy requires defining clear goals, assessing digital maturity, fostering a culture of innovation, and investing in force-multiplying technologies. By strategically adopting these technologies and approaches, AEC firms can position themselves for future growth and success in an increasingly competitive and dynamic industry.

Introduction

The architecture, engineering and construction (AEC) industry is made up of a wide array of activities and disciplines focused on the design, planning, managing, and execution of projects ranging from infrastructure like bridges and roads, to commercial buildings. AEC integrates a diverse range of disciplines, including civil, mechanical, electrical, and environmental engineering, architecture, project management, construction management and trades, among others.

The COVID-19 pandemic sent shockwaves through the AEC industry, leading to unprecedented challenges and long-lasting effects. Project delays and cancellations became rampant due to government-mandated shutdowns, labor shortages spurred by health concerns, and severe disruptions within global supply chains. The crisis exposed vulnerabilities in traditional construction practices, pushing companies to reevaluate their operations. Increased costs of materials and safety measures put tremendous strain on budgets. Despite these hurdles, the pandemic also acted as a catalyst for innovation, accelerating the adoption of digital technologies and remote collaboration tools to enable greater project efficiency and resilience within the industry.

AEC is a significant contributor to the global economy, providing employment to millions and being a critical factor in the economic development of countries. This industry is highly dynamic, constantly evolving with technological advancements and changing environmental and economic landscapes. AEC is a vital and multifaceted discipline that blends scientific knowledge, creative problem-solving, and practical skills to shape the world's physical and infrastructural landscape.

High Level Growth Drivers

The main drivers of growth in the engineering and construction industry in 2024 and 2025 are expected to be:

Infrastructure Investments: In the United States the Infrastructure Investment and Jobs Act (IIJA) has earmarked substantial funding for a vast array of infrastructure projects well into 2025. China's Belt and Road Initiative (BRI) remains a massive global infrastructure program, with projects spanning transportation networks, ports, and energy development. India has ambitious infrastructure plans to support its rapidly growing economy and population. Large investments are targeted in transportation, energy, and urban development. The EU has various funding mechanisms for infrastructure development, including the Connecting Europe Facility and the European Fund for Strategic Investments, promoting transportation, energy, and digital infrastructure projects. Many governments in emerging markets are prioritizing infrastructure spending as a means to drive economic growth and improve living standards.

> Total construction spending stood at US$1.98 trillion in August 2023, a 7.4% increase since the previous year. This total spending was primarily driven by nonresidential construction spending, which recorded growth at 17.6% year-over-year increase in August 2023. (Deloitte, 2023)

- **Technological Advancements:** The industry is increasingly adopting new technologies, including the virtual construction market, traditional AI, machine learning (ML), generative AI, cloud-based systems, automation, robotics, AR/VR, drones, intelligent hardhats, exoskeleton suits, IoT, and BIM. These technologies are enhancing novel methods of building and improving efficiency, safety and productivity across the industry.
- **Sustainability**: The global green economy is driving growth in the construction industry. The projected revenue from the global green construction market in 2025 shows significant growth. According to Acumen Research, the market, which accounted for around USD 290 billion in 2021, is estimated to reach approximately USD 774 billion by 2030. This suggests a compound annual growth rate (CAGR) of about 11.8% from 2022 to 2030. The growth drivers for this market include the rising popularity of sustainable architecture, growing environmental concerns, and the reduced operational and maintenance costs associated with green buildings. Additionally, the increasing demand for reduced energy consumption in buildings, the rise in infrastructure projects, and increased industrial and commercial spending are propelling market growth.

The construction industry is expected to undergo significant changes in 2024. According to a recent report by Deloitte Insights, sustainable practices and technology advancements are likely to shape the industry in 2024. The report also highlights that the construction industry entered 2023 with a 7% increase in value added and a 6% increase in gross output compared to 2022. As of the third quarter of 2023, construction spending maintained a steady upward path. However, if trends in real GDP data continue from 2022, it is possible that much of the topline growth is being driven by inflation instead of increasing volume. In addition to ongoing inflation, the industry will see volatility in material prices and increasing labor costs as well as the ongoing shortage of skilled labor. Despite these challenges, construction confidence remains high, with the Associated Builders and Contractors (ABC) identifying expectations for an increase in profit margins and staffing levels, particularly in the first half of 2024.

The American Institute of Architects (AIA) predicts that spending on nonresidential buildings will increase by 4% in 2024, at a pace that will slow to just over 1% growth in 2025.
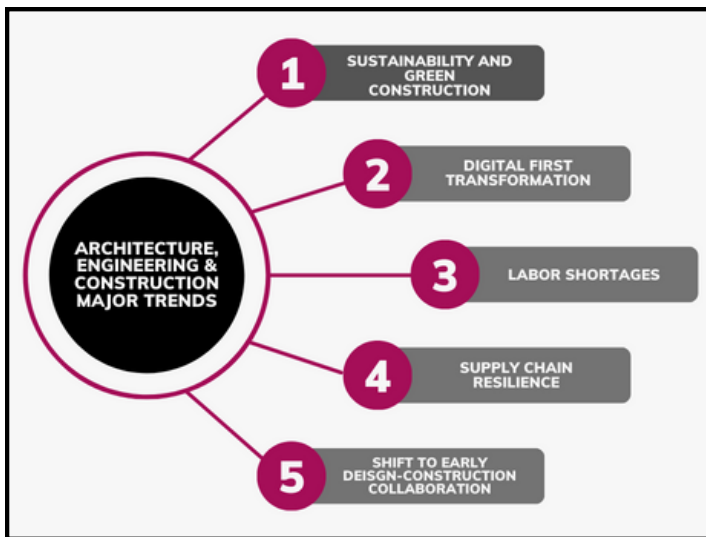
Considerations:
- All five trends are interconnected.
- Sustainability goals drive advances in technology and off-site construction.
- Regulatory mandates and public demand accelerate specific trends, which vary slightly between regions.
- Economic shifts may influence the intensity of investments in particular sectors.

Sustainability and Green Construction

International Energy Agency: buildings account for 30% of global energy consumption and 26% of global energy-related emissions.

There's a heightened focus on sustainability, with firms adapting to environmental regulations and demands for greener buildings. This includes using efficient building materials and sustainable construction practices to reduce carbon emissions.

Key Elements:
- **Embodied Carbon Reduction**: A defining element in green construction. It involves material selection and construction methods.
- **Energy Efficiency and Renewables**: High-performance design and onsite renewable generation.
- **Water Conservation**: Efficient systems and recycling where possible.
- **Reduced Environmental Impact**: Site selection, pollution reduction, promoting health and well-being by improving indoor air quality, natural light and biophilia.

Driving Forces:

- **Regulations and Incentives**: Stricter energy codes, tax incentives, and green building certifications (like LEED, BREEAM, WELL) strongly push this trend.
- **Client Demand**: Increased awareness of the environmental impact of buildings fuels desire for eco-friendly constructions among occupants and investors.
- **Cost Considerations**: While there may be higher upfront costs, lifecycle costing shows longer-term cost savings, making green construction increasingly financially viable.

Digital First Transformation

Advancements in digitalization and the use of AI are prominent. This includes embracing technologies like BIM, which facilitates more collaborative and efficient processes, and AI for predictive analytics and automated design processes. Robotics, IoT, augmented reality (AR) and virtual reality (VR) are becoming mainstream tools in the AEC industry, enhancing project visualization and client satisfaction, increasing productivity, improving safety and improving collaboration among teams.

Key Elements:

A digital-first strategy means prioritizing digital tools and technologies for nearly every aspect of an architecture, engineering and construction project. It encompasses:

- **Data-Centric Approach**: Centralized data management for all project information, accessible in real-time by all stakeholders.
- **Cloud-Based Collaboration Platforms**: Cloud solutions allow teams across different locations to seamlessly share documents, plans, and insights, replacing outdated siloed work styles.
- **Connected Technologies and Systems**: Integration of IoT sensors, drones, and robotics into the workflow for continuous data gathering and analysis. Integrated end-to-end cloud-based business and project systems are critical for optimizing business performance and supporting data-driven decisions.

Driving Forces:

- **Improved Efficiency and Reduced Errors**: Automated workflows, centralized data repositories, and predictive analytics streamline tasks and minimize mistakes.
- **Enhanced Collaboration**: Cloud-based solutions support better communication across disciplines, locations and project phases.

> Successfully implementing a digital first transformation requires upskilling your workforce and focusing on technology implementation and adoption in addition to its development.

- **Improved Project Outcomes**: Increased transparency and early problem identification lead to more precise budget management and on-time project completion.
- **Worker Safety**: Simulation-based training and AR/VR applications promote safer worksites.

Labor Shortages
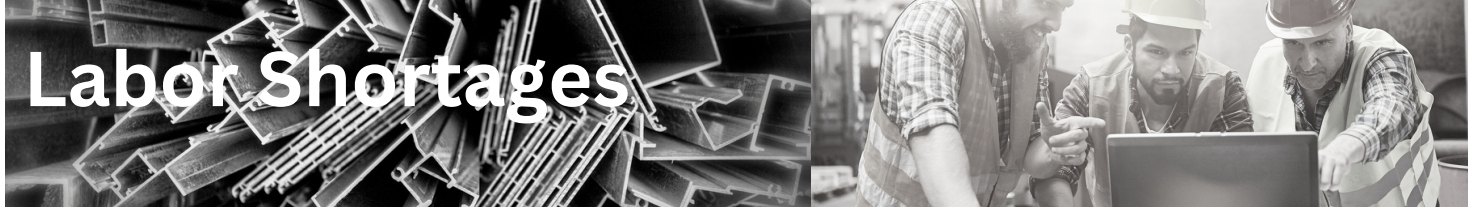
Addressing talent shortages and changing workforce norms is critical, with firms increasingly relying on digital tools and automation to maintain efficiency and support staff. Initiatives targeting a more diverse workforce, including attracting women and younger generations, will be essential. Investments in worker training for technology adoption and specialized skills remain crucial. In general shifting focus from talent retention to attraction.

> **Associated Builders and Contractors**: "The industry will need to attract about 501,000 additional workers on top of the normal pace of hiring in 2024 to meet the demand for labor."

Key Elements

- **Aging Workforce**: A sizable portion of the skilled trades workforce is approaching retirement, with insufficient younger workers available to take their place. According to Deloitte over 1/5 of the workforce is over 55 and often are the most skilled workers on the job site.
- **Recruitment of Younger Workforce**: Attracting younger workers from diverse backgrounds is vital. In a recent survey, two in three construction firms surveyed agree that the use of cutting-edge tools helps them recruit talent.
- **Negative Perceptions**: Skilled trade careers are often less prestigious than traditional university paths, resulting in a lack of awareness and negative stereotypes.
- **Gap in Skills**: Technological advancements often mean workers require newer, and increasingly specialized skills.
- **Lack of Educational Pathways**: There has been a reduction in vocational training programs in schools, reducing accessibility for younger generations.
- **Competition from Other Industries**: Many of the transferable skills found in construction workers are attractive to other growing industries.

Driving Forces

- **Economic Costs**: Project delays, cost overruns, and a diminished ability to handle construction demand negatively impact economic growth.
- **Increasing Labor Costs**: Construction wages are forecast to rise 5% to 7% over the next year (Ken Simonson, chief economist, Associated General Contractors of America) as labor demand continues to outpace supply.
- **Safety Concerns**: Inexperienced workers have a higher risk of on-site accidents.

Supply Chain Resilience

With rising political tensions and logistical challenges, effective supply chain management and diversified vendor relationships are crucial for timely project delivery and cost management. The volatility of material costs and availability makes strategies for alternative sourcing and risk management crucial. A potential shift towards more localized supply chains will increase resilience and support regional economies.

Key Elements

- **Visibility and Transparency**: This starts with a deep understanding of your entire supply network.
- **Risk Assessment and Mitigation**: Proactive identification of risks is essential.
- **Flexibility and Adaptability**: Supply chains cannot remain rigid in today's climate.
- **Collaboration and Information Sharing**: Moving away from isolated relationships.

Driving Forces
- **Globalization**: Globalized supply chains create interdependencies which increase vulnerability. A disruption in one location can cascade widely.
- **Increasing Frequency of Disruptions**: Caused by natural disasters (exacerbated by climate change), geopolitical conflict, and pandemics and health crises
- **Just-in-Time Inventories**: Focus on lean cost efficiency without built-in buffers often led to fragility
- **Customer Expectations**: Clients and the public expect timely delivery and resilience to disruption.

> Construction delays (37%), energy or other service interruptions (36%), raw material shortages (34%) and logistics and warehousing shortages (34%) were all among the risk factors thought to have the greatest impact in the next two years. (WTW, Jul 2023)

The Shift to Early Design-Construction Collaboration

The Design-Build (DB) methodology and Integrated Project Delivery (IPD) are collaborative project delivery methods. IPD takes a more holistic and integrated approach, with all key stakeholders closely involved from the outset and sharing risks and rewards. DB, on the other hand, primarily focuses on the collaboration between the design and construction entities within the DB team. These methods contrast with traditional project delivery methods, where separate contracts are used for design and construction services. In DB, the owner contracts with a single entity (the DB team) that is responsible for both the design and construction of the project.

Design-Build (DB):
- In DB, the owner contracts with a single entity (the DB team) that is responsible for both the design and construction of the project.
- The DB team typically consists of an architect/engineer and a general contractor working together from the beginning of the project.
- The DB team assumes the risk for both the design and construction phases, providing a single point of responsibility for the owner.
- The level of collaboration and integration between the design and construction teams may vary depending on the specific project and the DB team's approach.

Integrated Project Delivery (IPD):
- IPD is a more comprehensive and collaborative approach that involves the owner, architect, engineers, contractor, and other key stakeholders from the very beginning of the project.
- All parties sign a multi-party contract, sharing risks and rewards and committing to work together in the best interest of the project.
- IPD emphasizes early involvement of all stakeholders, open communication, and a collaborative decision-making process throughout the project lifecycle.
- IPD relies heavily on the use of Building Information Modeling (BIM) and other collaborative technologies to facilitate coordination, information sharing, and decision-making.

AEC Technology Needs

The technology needs for businesses in the AEC industry undergoing a digital first transformation encompass a wide range of areas from operational efficiency, IoT, predictive analytics, data-driven decision processes, and BIM to safety technologies, workforce attraction / onboarding / upskilling / retention, and sustainable practices. These technologies not only enhance operational efficiency and safety but also help in attracting a younger workforce and meeting environmental sustainability goals. A digital first approach considers three groups of technology:

AEC Technology Groups

- PROJECT EXECUTION
- BUSINESS MGT
- FOUNDATION

Digital Foundation

Cloud Infrastructure

- COLLABORATION
- AI - ML
- COMPLIANCE
- SECURITY & ID MANAGEMENT
- DATA
- CLOUD - COMPUTE - NETWORKING

AEC firms are facing a multitude of business challenges, including complex project management, sustainability, risk management, digital transformation, labor shortages, collaboration, data-driven decisions, health and safety, supply chain disruptions, and a shift to a design-build methodology. To overcome these challenges, AEC firms need to implement a variety of key technologies and strategies. Below is a list of technologies and approaches that address these specific challenges and market trends:

AEC MAJOR TRENDS — DIGITAL FIRST TRANSFORMATION — SUPPLY CHAIN RESILIENCE — SHIFT TO EARLY DEISGN-CONSTRUCTION COLLABORATION

Enterprise Resource Planning (ERP) Cloud:

- Used throughout construction for various purposes including financial management, scheduling, budget and cost management, and resource allocation.
- Supply Chain Management Software: Implementing advanced software solutions to manage supply chains more effectively, reducing the risk of disruptions and ensuring timely project delivery.
- Enhanced Decision-making: By providing real-time visibility into project costs, budgets, and other critical data, cloud ERP systems enable AEC firms to make more informed decisions. This can lead to improved project outcomes and business growth.

Full AEC Stack

Project Execution

- DESIGN
- ASSET MANAGEMENT
- RESOURCE MANAGEMENT
- RISK AND SAFETY
- CONTRACTOR MANAGEMENT
- PROJECT MANAGEMENT

Business Management

- FINANCIAL MANAGEMENT
- HUMAN RESOURCES
- SUPPLY CHAIN
- CUSTOMER EXPERIENCE
- STRATEGIC PLANNING

IOT - AI/ML - VR/AR - ANALYTICS

FOUNDATION

Enterprise Resource Planning (ERP) Cloud (continued):

- Future Proofing: Cloud ERP systems are designed to adapt to the evolving needs of AEC firms. They support digital transformation by integrating with new technologies and providing a platform for continuous improvement

AEC MAJOR TRENDS | **DIGITAL FIRST TRANSFORMATION** | **SHIFT TO EARLY DEISGN-CONSTRUCTION COLLABORATION**
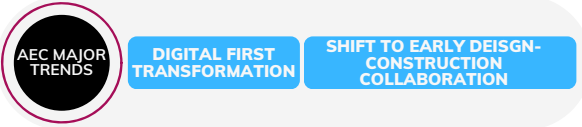
Construction Project Management

- Construction Management Software: Cloud-based platforms for all aspects of construction project management.
- Drones: Aerial capture of site progress, surveying, and inspection, streamlining data collection.
- Smart Construction Equipment and IoT Sensors: Connected equipment and on-site sensors gather data on fuel consumption, equipment idling, material usage, and site conditions.
- Budgeting and forecasting: Accurately build project budgets, manage ongoing execution and reporting to optimize project financials.
- Project Staffing, Scheduling and Resource Management: Effectively find and reserve resources, support requisitions to augment staffing for proposals and projects, manage ongoing project staffing and resource allocation. Automation can provide more intelligent bidding and ongoing resource management.
- Integrated Project Delivery (IPD) Platforms: Facilitating the shift to a design-build methodology through platforms that support IPD, enhancing collaboration among all stakeholders from the project's inception to completion.

AEC MAJOR TRENDS | **DIGITAL FIRST TRANSFORMATION** | **LABOR SHORTAGES** | **SHIFT TO EARLY DEISGN-CONSTRUCTION COLLABORATION**

Design and Collaboration

- BIM: BIM creates intelligent 3D models of buildings and infrastructure projects. It encompasses the whole lifecycle of a project, from design to demolition. It boosts sustainability with material optimization, energy simulations, clash detection, and lifecycle assessments
- Digital Twins: A virtual replica of a physical asset, building, or even an entire city, continuously updated with real-world data from sensors and IoT devices. It boosts sustainability through commissioning and optimization, predictive maintenance, and data-driven decision-making.
- Collaborative Document Management: Tools that allow AEC companies to upload documents, track changes, and record all decisions, facilitating better project management and collaboration. Maintain seamless data exchange, version control, and real-time collaboration on documents.
- Computer-Aided Design (CAD) Software: Versatile tools for the creation of precise 2D and 3D drawings.
- Virtual Reality (VR) and Augmented Reality (AR): Immersive visualization of structures prior to construction. Helps identify potential issues and improves client presentations.
- Cloud-Based Project Collaboration Platforms: Centralized hubs allowing efficient data sharing, video, review cycles, task management, project updates and communication among diverse stakeholders.
- Laser Scanning: Precise point-cloud data to capture complex as-built conditions and enable prefabrication or renovation with increased precision.
- Smart Construction Equipment and IoT Sensors: Connected equipment and on-site sensors gather data on fuel consumption, equipment idling, material usage, and site conditions.

AEC Technology Needs

AEC MAJOR TRENDS | SUSTAINABILITY AND GREEN CONSTRUCTION | DIGITAL FIRST TRANSFORMATION
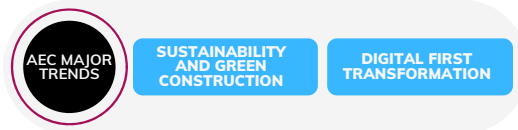
Sustainability

- Sustainable Construction Technologies: Technologies that reduce the embodied carbon of materials and incorporate passive design principles are essential. This includes high-performance facades, energy-efficient systems, and green roofs.
- Generative AI: Can be used to optimize designs for sustainability and efficiency, providing a competitive advantage.
- Sustainability Compliance Management System: System to monitor, track and report on ESG/sustainability initiatives. It boost sustainability by measuring and tracking carbon and other ESG initiatives and to meet environmental and sustainability standards.
- Smart Construction Equipment and IoT Sensors: Boosts sustainability through equipment optimization, resource monitoring, and predictive analytics.
- Risk Management Oriented Solutions for Energy Sourcing: AEC firms are applying risk management strategies to energy procurement to stabilize budgets and take advantage of market opportunities.

AEC MAJOR TRENDS | SUSTAINABILITY AND GREEN CONSTRUCTION | DIGITAL FIRST TRANSFORMATION | LABOR SHORTAGES | SUPPLY CHAIN RESILIENCE | SHIFT TO EARLY DEISGN-CONSTRUCTION COLLABORATION

Data-Driven Decisions

- Advanced Analytics and Visualization: Utilizing big data and analytics to predict risk and inform decision-making processes, ensuring that strategies are based on accurate and comprehensive data insights.
- Automation and AI: Automation of construction sites and the use of AI in various processes can significantly enhance efficiency and innovation. Predictive algorithms with AI can significantly enhance decision quality.
- Integrated Data Cloud: Provide a consolidated view of all firm data, including automated data quality tools and data prep tools to ensure the usability of the data.
- Predictive Analytics and ML: These technologies optimize decision-making by analyzing structured and unstructured data to minimize inefficiencies and manage staffing levels.

AEC MAJOR TRENDS | DIGITAL FIRST TRANSFORMATION | LABOR SHORTAGES | SHIFT TO EARLY DEISGN-CONSTRUCTION COLLABORATION

Talent Management

- Talent Development Platforms: Leveraging digital platforms to tap into and develop a broader workforce, addressing the labor shortage by improving talent management. Personalized skills development and learning can accelerate efforts to upskill existing employees using AI enabled intelligent chatbots.
- HR Cloud and Workforce Management Platforms: Streamline hiring, onboarding, skill tracking, and scheduling, maximizing the talent potential of the existing workforce and improve retention. The tools can efficiently match the right workers with the right jobs based on their skills and qualifications, track productivity and areas for improvement, promoting efficient staff deployment, and identify skills gaps for targeted training to upskill your existing employees. AI / ML /generative AI all can enhance these capabilities.

Talent Management (continued)

- Automation and Robotics: Machines tackle dangerous or repetitive tasks, increasing safety and worker productivity. Robots can handle tasks like bricklaying, demolition, or welding consistently and tirelessly which frees up workers for more challenging or value-added jobs and addresses physical limitations and safety hazards common on construction sites.
- Drones: The use of drones can mitigate some labor shortage issues.
- Smart Construction Equipment and IoT Sensors: Remote monitoring capabilities can assist in mitigating challenges associated with labor shortages.

AEC MAJOR TRENDS | **DIGITAL FIRST TRANSFORMATION** | **LABOR SHORTAGES** | **SHIFT TO EARLY DEISGN-CONSTRUCTION COLLABORATION**

Health and Safety

- Wearable Technology: Smartwatches, hardhat sensors, safety vests to provide real-time monitoring of worker vitals (heart rate, body temperature), location tracking, fall detection, and proximity alerts for hazardous zones.
- Virtual and Augmented Reality (VR/AR): Conducting regular safety training simulations that are immersive environments for hazard identification, equipment operation, and emergency response practice. Facilitate on-site hazard visualization that overlays potential dangers onto real-world job sites for better worker awareness.
- Drones and Robotics: Conduct site surveys and inspections to identify hazards in high-risk or difficult-to-access areas. Remote equipment operation that reduces workers' exposure to dangerous tasks.
- Predictive Analytics and AI: Using integrated data to predict and mitigate risks based on historical and ongoing project data.

AEC firms that strategically invest in these technologies and approaches can not only overcome current business challenges but also position themselves for future growth and success. It's crucial for these firms to stay agile, continuously evaluate the effectiveness of implemented technologies, and remain open to adopting new innovations as they emerge.

Digital First Challenges

AEC firms face several key challenges when implementing digital technology:

- **Difficulties with Technology Adoption**
- **Lack of Dedicated IT Departments**
- **Non-Integrated Software**
- **Data Infrastructure**
- **Cost and Implementation Concerns**
- **Cybersecurity**
- **Skilled Resources**

To overcome these challenges, AEC firms need to focus on addressing pain points rather than just installing IT solutions, promote collaboration through digital use cases, reskill and restructure teams, adjust project baselines to capture value, and connect projects to unlock enterprise-wide impact.

Before Launching a Digital First Strategy

Clearly define goals: What specific gains are sought from digitization (efficiency, cost-saving, risk mitigation, etc.)? Goals should be aligned with the overarching business strategy.

Assess baseline digital maturity: Perform an honest assessment of existing technologies, skill levels, and current adoption rate to tailor a phased implementation plan.

Unified Data: All firm data integrated and unified on one platform to enable scalable operations that can adapt to changing market conditions and diverse projects as well as provide client and employee experiences.

Recommendations

CEO

- **Gain competitive advantage**: Adopt a digital first strategy to gain the greatest advantage from modern technologies.
- **Foster a culture of innovation to maximize limited resources**: Encourage a company culture that embraces technology adoption, continuous learning, and experimentation.
- **Invest in advanced technology to increase productivity, margin and revenue while mitigating labor shortages and improving safety** (automation, robotics, drones, intelligent hardhats, exoskeleton suits, IoT, generative AI, traditional AI, AR / VR, etc.)
- **Implement a fully integrated customer experience (CX) strategy** supported by technology to improve the CX, increase repeat engagements and referrals, and increase sales and marketing performance and effectiveness.
- **Explore new business models to increase revenue and competitiveness**: Investigate how technology can enable new revenue streams or business models, such as offering digital twin services, performance-based contracts, or data-driven consulting services.

CFO

- **Increase revenue, profit and project performance while mitigating project execution risks**: a fully integrated project and portfolio management (PPM) solution provides necessary visibility into project financials, execution and risks.
- **Increase revenue, forecast accuracy, and resource management while increasing firm-wide financial visibility with a cloud-based ERP system tailored for the AEC industry.**
- **Increase productivity and margin by implementing automation and AI** that automates repetitive tasks such as invoicing, document management, and resource scheduling; freeing up scarce resources for higher value tasks.
- **Improve strategic planning, business decisions, financial reporting, project performance and resource utilization** with advanced data analytics, BI and generative AI.

CHRO

- An overhaul to existing employee systems is essential to fight the effects of the current labor shortage. That overhaul should include cloud-based solutions like:
    - Integrated AI enabled HR system
    - Intelligent Applicant Tracking System (ATS)
    - Talent Development Platform that utilizes personalize learning paths and enable a skills-based organization
    - Advanced safety systems

CTO/ CIO

- The foundation of a digital first strategy starts with an **integrated data model and data cloud that is unified across the entire set of business applications.**
- **Data quality** can be greatly enhanced using AI/ML and automation tools. For AI/ML to provide value your data quality must be high. A data operations function can benefit all your AI/ML, generative AI and automation efforts.
- **Collaboration tools** are mission critical, particularly for firms shifting to early design-construction collaboration.
- **Purpose built cloud-based enterprise applications for AEC** can greatly increase adoption and improve business performance while reducing or eliminating customizations that limit your ability to keep technology current.
- **Cybersecurity**: A non-negotiable as your digital footprint expands. Invest in firewalls, encryption, intrusion detection, and employee training.
- **User Experience (UX) Design**: Focus on intuitive interfaces for customers and employees alike. Design with the user in mind.
- **Change Management**: Prepare employees for new technologies, work methods, and evolving company culture.

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