Mindtree NxT

Realizing Connected Construction Promises: Unlocking Growth through Value Chain Digitization and Efficiency Monitoring

Welcome to possible

Healthy growth despite less-than-healthy vital signs

Construction remains the world's largest industry, with $10.5 trillion in value representing 13% of global GDP. Despite the ongoing supply chain disruptions, labor shortages and broader economic headwinds challenging nearly every industry, the global construction segment is projected to grow steadily over the next five to ten years. Simple demand will drive the bulk of this growth, as Deloitte estimates that sum of all global infrastructure today represents just 25% of the infrastructure that will be needed to support the world population by 2050.

Yet, other vital signs in the construction segment look less healthy. The industry remains plagued by productivity issues, cost overruns, high risks and comparatively small margins. While productivity grew nearly 3% for the global economy over the last two decades — and a whopping 3.6% in manufacturing — productivity has grown just 1% in construction over the same period. Projects in construction take 20% longer to finish, and the segment averages 33% less value added, when compared to the global economy. These stunted figures all add up to earnings before interest and taxes (EBIT) stagnating around 3-5%, according to a 2020 McKinsey report.

Construction industry ripe for digital disruption

Engineering and construction (E&C) companies have traditionally accepted this volatility as a result of the inherent complexity of jobs: Construction projects bring together contractors, suppliers, equipment, labor, and global supply chains that are more precarious than ever. But one root problem is that most E&C companies are still trying to juggle this high level of complexity with a relatively low level of technology adoption. The construction industry lags far behind nearly all others in digitization, spending less than 2% of revenue on Information Technology (IT) and less than 1% on innovation, research and development, according to McKinsey research.

These conditions make the construction industry ripe for the digital disruption that has already transformed many other sectors. McKinsey estimates that surging tech adoption in the construction segment will improve overall productivity in the industry by 50-60%, generating $1.6 trillion annually in incremental global value.

Accelerated by the growing pressures and market forces that have emerged out of the pandemic period — unprecedented labor shortages, inflating materials costs, persistent supply chain volatility — forward-thinking E&C companies are investing in digital transformation as the foundation of their future competitive advantage. They're creating connected construction ecosystems that leverage the proliferation of IoT devices and integrated sensors with sophisticated AI-powered analytics to gain real-time visibility, resolve complexities and harness insights to drive productivity and performance across their business operations.

What is connected construction?

According to Deloitte, the emerging paradigm of connected construction represents "an ecosystem of connected job sites, machines, and workers that enhances operational effectiveness and safety" to enable the "smart, connected job sites of the future.

Four key elements define this new connected construction ecosystem:

1. Connected Materials, Connected Assets & Connected Workers - Internet of Things (IoT) technologies

As sensors get smaller, smarter and more connected, they're being integrated into every facet and every asset along the construction value chain: machinery, equipment, workers, elements of the job site and the building itself. These connected IoT technologies collect a trove of real-time data on utilization, environmental and work conditions, worker behaviors and more.

2. Connected Geographies – Geospatial monitoring technologies

Technologies for understanding geographic spaces are integrating to enable powerful visualization and analysis. 3D mapping and scanning, drone-based geospatial monitoring, indoor scanning and even subsurface investigation technologies are coming together in centralized platforms that can host these diverse spatial data sets. These platforms enable visualization, correlation and navigation across data layers, enabling digital twinning of geographic areas and site visualization in digital replica environments. Embedded analytics tools mine this robust geospatial data to deliver GeoIntelligence and ultimately power smarter field operations.

3. Connected Projects – Purpose-built platform solutions

Many E&C companies are already using a wide range of software and mobile apps to manage various elements of their projects, from design and scheduling to project management and field reporting. But this has created a growing burden around juggling a patchwork of point solutions — and a bigger problem: siloed data that makes it hard to get a big-picture view of a project. New, purpose-built connected project solutions are solving this challenge, providing a centralized platform that automatically integrates data from every aspect of a project — materials, workers, job progress and costs — to provide real-time visibility and control. This gives all stakeholders a central source of truth for collaboration and confident decision-making — from knowing precisely when materials will be delivered, to deploying workers at just the right moment and tracking the costs and progress of every project to increase control and improve your profitability.

4. Connected Intelligence: AI-powered analytics

Leading technologies now deliver a centralized, AI-powered platform that aggregates all relevant project and operations data in one place and leverages next-generation analytics tools embedded within the platform to solve the Big Data problem: Making sense of the torrent of IoT data generated by a connected construction ecosystem. Today's AI and sophisticated machine learning (ML) technologies can crunch huge volumes of data instantly, identifying patterns and trends, automatically extracting relevant insights, and even delivering prescriptive actions and triggering automatic corrective actions.

Digital interventions across the construction cycle

The four key elements outlined above comprise a new connected construction paradigm that powers digitization and digital interventions across the entire construction value chain:

Pre-construction

- **Pre-bid activities:** E&C companies are conducting hi-engineering surveys using advanced 3D scanning and mapping geospatial technologies to get informed about their site conditions during the pre-bid phase. They're using data collected from these surveys to create virtualized digital twin environments for forecasting and planning purposes, helping to enhance bid valuations by increasing the accuracy of planning and estimating from a budget, time and risk perspective.

- **Engineering design:** In the initial design phases, E&C companies are conducting geospatial analysis through 3D models like digital twins created using aerial, terrestrial and sub-surface mapping and investigation technologies. This also enables engineering and design teams to move from 3D to 4D (time) and 5D (time + cost) building information modeling (BIM) — and to test and validate design plans in a fully simulated, risk- and cost-free virtual environment.

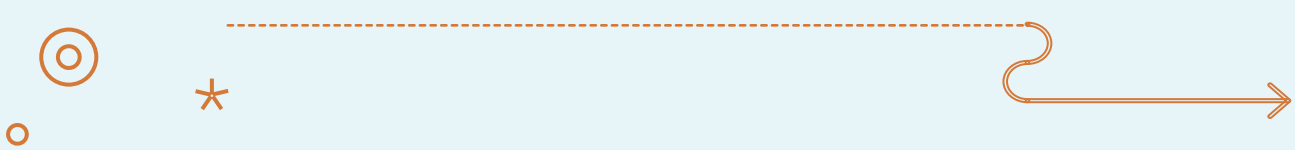
During construction

- **Supply chain management:** IoT sensors give E&C companies the ability to identify materials uniquely and track and trace them throughout their journey. From a broader perspective, this material tracking is providing exhaustive site inventory management visibility, from inbound and outbound materials, to picking, putaway, inspection and cycle counting insights. Connected materials solutions also make it easy to integrate this real-time tracking data with ERP and logistics platforms, enhancing supplier management and inventory optimization to alleviate supply chain pressures that continue plaguing and impeding construction jobs.

- **Worker availability and safety:** Wearables and other connected sensors are creating safer work environments at construction job sites. Tech-enabled onboarding and training leverages AR and VR technologies, enabling workers to do initial training, ongoing learning and certifications in a completely safe, risk-free virtual environment.

  On the job site, worker tracking and safety compliance monitoring enables the creation of geofenced zones, triggers automatic incident reporting when policies are breached, and enables digital workplace safety and compliance inspections. Those same connected worker technologies deliver powerful insights on labor utilization and productivity, empowering E&C companies to re-deploy labor and re-allocate resources to optimize labor efficiency.

- **Real-time asset performance:** Real-time monitoring of nearly every piece of equipment, machinery and other assets on a job site offer many beneficial use cases similar to worker monitoring. Geo-tracking and geo-fencing can ensure safety compliance. Real-time KPI tracking will rapidly deliver insights on asset utilization, productivity, and even fuel consumption.



These insights can also power predictive and preventive maintenance to optimize performance and protect these high-value assets — including smart fuel dispensing and connected utilities — so equipment downtime is not a limiting factor in job progress. Analytics engines can aggregate and digest real-time and historical asset utilization and performance data, providing actionable insights for optimizing utilization, identifying potential utilization, productivity or maintenance issues, and delivering prescriptive recommendations on how to re-deploy assets to improve productivity and utilization rates.

- **Broader project management:** Purpose-built connected construction platforms bring all the data and insights discussed above together within one centralized platform. This creates a single source of comprehensive and real-time truth for project management. Leaders can generate on-demand reports such as daily progress, cumulative progress, S-Curve, etc. They can enable smart field progress monitoring through analysis of drone-based scanning, imaging and video technologies, as well as quality assurance and control functions including scheduled inspections.

  Leading project management platforms integrate seamlessly with scheduling and budget/financial management systems, providing valuable contract and change order management capabilities and direct visibility to digital payments and claims management information to help keep jobs on-schedule and on-budget.

Post-construction

- **Smarter operations and maintenance:** The range of advanced scanning technologies that are used in initial site surveys, engineering design, and ongoing progress monitoring can also automatically generate extremely detailed and accurate as-built documentation. Leveraging 3D mapping and scanning, indoor scanning, drones, LiDAR, etc., E&C companies can maintain a full digital replica of the built environment. This digital twin has tremendous value for continued asset maintenance monitoring and optimization. Field operations managers can also leverage geographic information systems that use drone-gathered geospatial data to create a digital replica environment to monitor conditions, optimize energy and utilities usage, and more.

Integrating the connected construction ecosystem

The use cases discussed in this paper are not a future state . The next-generation connected technologies that make these use cases possible already exist. Moreover, they're already in action at job sites across the globe.

Data silos remain a sticking point in building a truly connected construction ecosystem. But leading vendors are now effectively addressing the point solution problem with solutions and platforms that are designed to integrate specific areas of connected construction, from the day-to-day project management, to the people, materials and equipment working on your site, to the geospatial and analytical data collected and utilized for better decision-making. But the full potential in connected construction lies in bringing all these use cases, all these connected technologies, and all this digital insight together under one umbrella.

Mindtree NxT: Built to enable the future of connected construction

The Mindtree NxT platform is purpose-built to layer on top of the myriad other connected construction technologies, providing a single platform that harnesses and synthesizes intelligence across the entire ecosystem and value chain. Flexible infrastructure is critical to Mindtree NxT's value. The vendor- and cloud-agnostic platform comes with pre-built integrations and plug-and-play modules for Connected Assets, Connected Workers, Connected Projects, Connected Geographies and Connected Intelligence — each providing a full data science toolbox with highly customizable workflows and dashboards.

Perhaps more importantly, the expertise behind the Mindtree NxT platform supports E&C companies in building and optimizing this connected construction ecosystem. This expert support ranges from resolving device connectivity and device management issues, to solving the Big Data challenge with data lake management and data hygiene services to help aggregate and assimilate data from different sources, objects, formats, etc.

The connected intelligence and analytics technologies embedded within Mindtree NxT turn Big Data into relevant, actionable insights. On-demand custom reporting and data visualization make it easy for all stakeholders to understand KPIs and other critical information, as well as recognize and respond to patterns and trends. And advanced machine learning algorithms, including customized deep-learning models, deliver predictive and prescriptive intelligence to improve asset availability and productivity.

The time is now: $265 billion opportunity awaits early adopters

One reason that the construction sector has lagged behind in technology adoption is the proudly conservative or "old school" mentality that defines many E&C companies — and the people that drive them. So, even with clearly achievable use cases and increasingly easy-to-adopt technologies, it's not surprising that many E&C companies hope to take the "wait and see" approach — preferring to be fast followers instead of innovative leaders. But the unforeseen events and unprecedented challenges of the last several years have made it clear that businesses must be ready to embrace rapid transformation if they want to survive the accelerating pace of change.

Yet, unlike the many changes businesses (and entire sectors) have been forced to make in the past few years, the move to connected construction should not be viewed as a matter of risk mitigation. Rather, E&C companies should look at early adoption as a once-in-a-generation opportunity to grab a tremendous new piece of the pie: McKinsey estimates that connected construction could create more than $1.6 trillion in incremental global value annually in the coming years. And those same analysts suggest those that move faster than the competition will likely see EBIT double to 10% or more as they grab their share of an estimated $265 billion in new profits.

About Mindtree

Mindtree [NSE: MINDTREE] is a global technology consulting and IT services company that enables enterprises across industries to drive superior competitive advantage, customer experiences and business outcomes by harnessing digital and cloud technologies. A digital transformation partner to more than 275 of the world's most pioneering enterprises, Mindtree brings extensive domain, technology and consulting expertise to help reimagine business models, accelerate innovation and maximize growth. As a socially and environmentally responsible business, Mindtree is focused on growth as well as sustainability in building long-term stakeholder value. Powered by more than 35,000 talented and entrepreneurial professionals across 24 countries, Mindtree — a Larsen & Toubro Group company — is consistently recognized among the best places to work.