Building and Infrastructure Owners Hold the Keys to Connected Data

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THE NEXT WAVE OF DIGITAL TRANSFORMATION IS CONNECTED DATA FOR OWNERS OF BUILDINGS AND INFRASTRUCTURE. INSIGHTS GATHERED FROM DATA CAN HELP BUILD RESILIENCY.

When the owners of Empire State, Inc. wanted to build a skyscraper, they asked the architects to revise the design 15 times to ensure it'd be the world's tallest. The ambitious project had an even more ambitious timeline, with owners requiring completion within 18 months—from start to finish. And on May 1, 1931, the Empire State Building's lights shone 1,454 feet above New York City, a feat of engineering made possible through collaboration among architects, engineers, contractors, and owners.

Fast-forward 90 years: Architecture, engineering, and construction (AEC) is a digital industry in which 15 revisions can happen in minutes. And owners are again playing a pivotal role in driving industry-wide transformation.

In the first major transformation, personal computers ushered in computer-assisted design (CAD). Next came BIM (Building Information Modeling), enabling cross-functional collaboration. Then, the industry moved to the cloud. Each transformation happened faster than the last, following the same trajectory: Innovators see a need for change, they ignite transformation, and the industry follows in waves.

Now, amid a global pandemic and a rapidly changing planet, AEC is ready for its fourth incarnation: a data-driven industry

powered by platforms, machine learning, and automation. The next generation of innovation is about gathering and analyzing data to design, build, and operate structures for a resilient future.

CATALYSTS FOR A FOURTH TRANSFORMATION

Natural disasters are increasing, and the global population is expected to reach 10 billion by 2050. Add a global pandemic, urbanization, labor shortages, diminishing resources, and vulnerable supply chains, and there's a perfect storm brewing.

The built environment is unprepared to handle what's to come. Right now:

» Infrastructure is aging, and climate change is accelerating wear and tear.

» Buildings produce 40% of the world's greenhouse-gas emissions.

- » Supply chains are vulnerable, with 60% of construction companies reporting continued disruptions from the pandemic.
- » Many construction projects run 80% over budget and 20% over schedule.
- » By 2025, there will be 2.2 billion tons of construction waste every year.

The way companies build and operate structures needs to change. Despite AEC's strides in digitalization during the past 40 years, it's time to disrupt the industry again.

The cloud can make this transition seamless. It's been five years since the cloud became an industry norm, but it's still a relatively new phenomenon. Many AEC firms just started to adopt it before the pandemic, but COVID-19 upped the ante. Before the pandemic, 20% of people worked remotely. Now, 71% do. The cloud is a must-have for companies to remain productive, and it sets the stage for data connectivity.

CORRALLING MOUNTAINS OF DATA

Statista projects that data creation will grow to 181 zettabytes by 2025. For context, a single zettabyte is enough storage for 30 billion 4K movies.

As the AEC industry continues to digitalize, it creates massive amounts of new data, including measurements, materials, paint colors, and fixtures, as well as contextual project information collected through reality capture, drones, sensors, and artificial intelligence (AI).

With the addition of the Internet of Things (IoT), billions of data points collected from sensors illustrate how built assets perform once they're operating and can help optimize performance, sustainability, and automation, as well as inform future construction.

But to unlock data's real value, it must be managed and analyzed. That doesn't work well if it's siloed in different software programs or stored on local devices.

When data is connected, it's a game-changer for innovation. But more important, it's critical to help mitigate global challenges such as climate change, population growth, and dwindling resources. Owners ultimately bear the burden of these challenges and see how data can drive the industry to change. A dedicated platform can connect all of the data so owners and AEC stakeholders have the information they need when they need it.

Platforms connect people, processes, and insights with data flowing through a continuous loop of design, build, operate, monitor, and plan.

OWNERS DRIVING INNOVATION

On average, 80%–90% of a facility's lifetime costs occur during its operation. Historically, information was documented on paper and then filed away in storage boxes. With a cloud-based platform, owners can digitally store all operational data and merge it with design and construction data to create a digital twin that they can access anytime.

Many governments, as owners of public infrastructure, are transitioning to a data-driven approach. In 2016, the United Kingdom created a baseline of data interoperability by implementing a BIM Level 2 mandate for all public projects. It's paid off: Leveraging connected data has led to 33% lower lifecycle costs.

When construction is complete, owners want more than just the keys—they want digital information for better outcomes. They want:

1. Digital Twins

A digital twin—a virtual replica of a structure replete with data—should be handed over to owners after construction. Digital-twin technology creates a thread of information for the lifecycle, from design to decommission. Owners can link operational data from building control systems to the digital twin for real-time performance analytics. This connected data helps owners make better decisions for planning and renovations and enables predictive maintenance to limit disruptions.
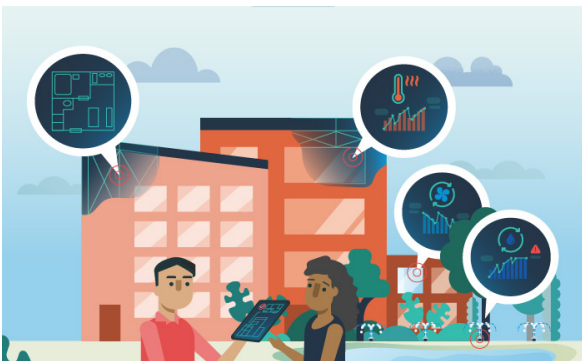
2. Insights to Optimize Operations

Owners want more than static facts and figures. They want actionable insights to inform better decisions. Technology grants access to real-time, granular information to monitor data sets, such as how occupants and air circulation move throughout a building. At NASA's Ames Research Center, the 50,000-square-foot Sustainability Base facility's sensors monitor things such as room temperatures and landscape water usage, allowing an interactive approach to building lifecycle management.

3. Automation to Plan the Next Project

Data can also support automated environments. Machine learning and AI ingest existing information to simulate possible scenarios. Generative-design software creates thousands of options for monitoring and analyzing current assets, redesigning spaces, or planning the next project. At one Airbus manufacturing facility, an inefficient layout forced workers to walk long distances to fetch tools and materials. For greater workflow efficiency, Airbus digitally tracked human movement, using generative design to reconfigure the factory. By plugging in existing data and desired outcomes, the company created a better design that used more renewable materials, such as net-zero concrete.

The benefits of a data-powered future extend to every stakeholder in the AEC industry and include:

» A common data environment with a cloud-based platform gives owners a snapshot of the asset for informed decisions and reduced lifecycle costs.

» IoT-equipped buildings deliver real-time performance analytics so owners can manage individual elements to improve overall function and reduce operational costs.

» Connected data—enabled through platforms—allow for greater automation to streamline processes, reduce errors and rework, and eliminate redundancies.

» Connected data support sustainability by helping owners make choices to reduce the carbon footprint of a built asset.

» Platforms support granular data so owners can access subsets of information for greater agility and faster problem-solving.

USING DATA FOR RESILIENT OUTCOMES

More owners worldwide are leveraging data-driven approaches for a changing world. Here are two examples of ways this next transformation is taking shape:

1. Rebuilding Notre Dame With Data

When a fire destroyed much of Notre Dame in April 2019, the French government wanted to preserve the architectural integrity of the 1,000-year-old cathedral. Using BIM processes, the AEC team combined data-driven design with traditional construction methods, such as hand-carving stones, to bring the building back to life in meticulous detail. The owner of Notre Dame is looking to take data beyond the reconstruction phase, aiming to install IoT sensors to predict future failures and avert another disaster.

2. Managing a Natural Resource

As the world becomes hotter and drier, water becomes more precious. Water infrastructure is long overdue for an upgrade: Every two minutes, there's a water-main break in the United States, wasting 6 billion gallons of treated water every day. Innovyze is a software company that creates digital twins for hydraulic systems. It gives utility owners real-time insights to manage daily operations, using AI to identify potential risks, avoid service disruptions, and reduce waste.

Connected data—driven by the AEC platform economy—is crucial to develop infrastructure and building projects that contribute to a more resilient and sustainable future. Owners are at the forefront of driving this change and are demanding to be part of the platform economy, but they can't build it alone. They need all AEC industry hands on deck to make it happen—and reap the rewards for everyone.

About the Author

Nicolas Mangon, vice president of AEC, Business Strategy and Marketing for Autodesk, is a leader of the global advancement of Building Information Modeling (BIM) across the architecture, engineering, and construction (AEC) industries. Mangon's mission is to lead the industry transformation to BIM and the cloud. Educated at the world-renowned Ecole Spéciale des Travaux Public's Institution for Civil and Structural Engineering, Mangon brings deep industry expertise to the continued development of innovative solutions that address the AEC industry.

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