Technology: Construction's Next Frontier

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While construction remains the largest industry in the global economy, accounting for 13% of the world's gross domestic product (GDP), the annual productivity growth has been relatively flat. The profitability is low, with around a 3-5% earnings before interest and taxes margin, with 98% of all megaprojects running over budget and over schedule.

The building construction sector is rarely perceived as innovative regarding materials use or technology adoption. There are various reasons that contribute to this common perspective — or prejudice — towards the industry: each project is unique and tends to get increasingly complex as it progresses; construction companies are confronted with extensive regulations; and contracts between clients, contractors, and subcontractors are often not properly aligned, harming collaboration. Moreover, transferal of risk to others in the supply chain, inefficient planning, traditionally limited standardization in processes, and a lack of qualified workers are common industry pain points.

Having said this, a traditionally technophobic and carbon-intensive industry is experiencing significant change in response to a number of key factors. The market environment is changing, technology is progressing, enviromental social governance concerns are ever more prevalent, and digitization and automation are becoming more affordable and accessible, encouraging contractors and clients to rethink working methods, tools, and construction materials and address sustainability factors.

An indicator of the changing times emerges from a recent study by Hexagon, which surveyed more than 1,000 tech

decision makers from contracting firms across North America, the United Kingdom, and Australia and found that 84% of firms have already adopted autonomous technology at some level. And the majority of those firms are reporting clear benefits, ranging from sustainability improvements and waste reduction to improved safety compliance. Some of the factors and business challenges that are driving this apparently significant change in outlook are as follows:

Sustainability

Sustainability regulations constantly evolve and target different aspects of the construction industry. Construction companies evaluate themselves to comply with new regulations, many of which require reducing greenhouse gas emissions and waste in factories and offices or reducing the stress exerted by impure water and air quality from operations.

The supply chain is also analyzed to ensure that all suppliers adhere to specific standards. The reuse of buildings and their materials and prefabrication have experienced a renaissance in recent years because of the positive environmental impact. The availability of new materials and technologies has a double advantage of contributing to sustainability and productivity goals.

Implementing action for a more sustainable future must be a common objective lived through the behavior of companies, organizations, and value chains in order to be truly sustainable.

Automation

As buildings become more complex, the pressure on construction companies to meet the schedule and budget targets increases. One way to address this demand is to adopt new technologies and processes that enable field crews to automate certain tasks.

Robotic solutions that can be programmed to patrol certain areas and generate scans uploaded directly to the cloud already widely exist and are starting to be more widely implemented. A cloud solution that utilizes artificial intelligence (AI) can analyze issues detected automatically. The results are interpretable by other stakeholders, ensuring that the latest data is used as the basis for all decisions. This allows those stakeholders to identify issues early and take immediate action to save money, time, and resources later.

With new technologies and increasing automation, the roles and responsibilities for construction professionals are beginning to shift. Capturing information, as-built verification tasks and data interpretation becomes easier, meaning fewer individuals are required for completion and those individuals can then be utilized for other projects. Workplaces are safer, too, because technologies can be employed in place of humans for many tasks — both mundane and difficult. This shift cultivates a tech-savvy workforce familiar with steering, monitoring, and maintaining new technologies.

Visibility

Construction project-related data is often kept in data silos and not regularly updated or shared with stakeholders. Although much data is generated before and during construction, it is often not digitized or used afterward. This increases the risk of error from working with outdated information. Without the latest revisions available, important changes might be overlooked, leading to costly reworks later.

However, the most popular automation implementations are project-management tools, and more companies are investing in these tools to digitize their data and collaboration tools to increase efficiency and productivity and reduce costs. Readily available data leads to better collaboration between stakeholders and improves transparency.

Efficiency and Productivity

All the above technology and digital trends aim to solve efficiency and productivity issues. With easy-to-use integrated hardware and software solutions, coordination and workflows are improved.

Talent shortages also make it necessary to compensate with simplified digital interactions. Today's technologies are advancing, making it possible to train for and adopt them sooner and operate them more quickly. In the future, efficiency and productivity will steadily increase as technology becomes more sophisticated and requires less human intervention.

Collaboration

Throughout the construction process, from design to maintenance, technologies are available to improve connectivity and productivity. During the design phase, a scan-to-BIM workflow using a 3D laser scanner is used to determine the status of a project. Combined with a mobile-device app, the captured-point cloud is preregistered in the field to verify that everything was scanned correctly and to create final deliverables. All the generated data is then shared with the office for further processing with the most common design software, which utilizes AI for point-cloud classification.

Once the office completes the plan or model, the model is ready to be uploaded to a common data environment (CDE). In the CDE, stakeholders can access the latest relevant

information, improving trade coordination, and decision making throughout the workflow process.

Sharing the data from the office with the field crews has become easier with digital tools enabling digital layout. Teams in the office can prepare the layout data in a design software and make it accessible for site crews in an integrated cloud solution. To avoid costly reworks, these tools can perform as-built verifications so that issues can be identified as they arise and before expenses mount.

There are software solutions that provide virtual design construction (VDC) teams with extensive options to utilize point clouds for as-built model creation, progress monitoring, and office verifications to ensure everything is kept up to date. At the end of the project, the data can be utilized for a digital handover.

There are various progress monitoring solutions that continuously provide updates to stakeholders, from construction photo and video documentation to solutions with livestreaming construction cameras. Autonomous laser-scanning modules designed for robotic carriers allow construction workers to set mission paths based on existing drawings or BIM models in complex and challenging environments. This saves time, reduces human intervention, and dramatically enhances worker safety. Once the autonomous scanning mission is complete, captured 3D data is ready for further processing and visualization. This allows construction workers to visualize structural repairs and make better-informed decisions for future renovations.

To further drive digitalization in construction, new methods and processes must be applied to manage information and collaborate effectively. Standardized definitions will help to accelerate this.

Building information modelling (BIM) committees, organizations, and initiatives such as buildingSMART International, Open Design Alliance (ODA), OGC, or local initiatives like openBIM are driving the adoption of BIM standards for construction projects. To support and encourage the use of BIM, solution providers apply these standards to their solutions while also helping to educate the market in adopting and benefitting from new methods and solutions.

Although companies may use BIM, not every company works with the same software; they, therefore, face time-consuming import and export workflows, risking the loss of information. For an interoperable construction process to work effortlessly, a standard data format for everyone within and without the company is necessary.

Digitization Is a Necessity

With a connected and automated digital workflow, accurate data can be gathered and shared with stakeholders, who can then access that data throughout the entire construction process. More construction companies are investing in and establishing VDC and innovation technology departments within their organizations. These departments focus on digitizing processes, utilizing new technologies, and establishing partnerships with industry-relevant manufacturers to investigate and develop methods to reduce waste and errors throughout the construction process.

Adopting new technologies is a financial and time investment, but will benefit companies in the long run, ensuring their ongoing market competitiveness and attractiveness as an employer for a workforce with changing expectations. The willingness to adopt new technologies will be a key factor for the survival and prosperity of construction companies.

About the Author

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