Digital transformation in construction

Why general contractors must adapt, or get left behind.

In a public address in June 1963, John F. Kennedy called change "the law of life," adding that "those who look only to the past or present are certain to miss the future."

It's well known that the US construction industry has, for some time, had a resistive relationship to change. And, in particular, this is true of its digital transformation. Despite positive movements towards more digital ways of working over the last few years, change of this kind continues to happen too slowly and too fragmentedly.

Slow digital transformation sits alongside many other construction industry challenges: Labor shortages, spiraling costs, calls for more sustainable ways of working, and more, continue to hamper construction companies' ability to deliver projects on time and on budget, which threatens their growth potential. For general contractors, it's time to adapt. And for this, digital transformation in construction must be viewed as a business discipline and company philosophy, rather than simply a project.

McKinsey Global Institute estimates that the world will need to spend $57 trillion on infrastructure by 2030 to keep up with global GDP growth.[1] Construction companies looking to win more contracts—now and in the future—must find ways to overcome the challenges facing them. Without doing so, it's their growth potential they're sacrificing. As Eddie Tuttle, Director of Policy, Research, and Public Affairs at the Chartered Institute of Building, tells us: "There's a huge opportunity for the industry to grab the bull by the horns here. Digital will be one of the big drivers of change." For construction companies, it's time to adapt–or get left behind.

So, what can field ops leaders do to stabilize costs and forecast with more accuracy?

In this whitepaper, we'll cover:

- Why now is the time for the US construction industry to fast-track digital transformation
- Why the industry's digital transformation is still happening too slowly
- How general contractors can adapt, now

Why now is the time for construction to fast-track digital transformation

The US construction industry began last year on a bright note, achieving strong growth of 8%.[2] Nevertheless, as the year went on, certain challenges became more pervasive and more problematic. This looks set to continue.

The extent to which digital transformation is the 'silver bullet' to construction's challenges is debated. The industry is a complex, often disconnected, one while its challenges are similarly complex and nuanced. But digital transformation in construction undoubtedly presents an opportunity: one that's currently underexplored and underutilized by key decision makers across the construction value chain.

Here are four of the US construction industry trends and key challenges—and how each one can be minimized—if general contractors choose to fast-track digital transformation.

1. A lack of skilled labor

Continuing to plague the US construction industry's long-term health and profitability, a lack of skilled labor is a sizeable challenge that has to be addressed if companies want to deliver projects on time and drive growth.

Statistics show that, currently, the industry appears to be aging faster than it can replace old workers. The median age of a construction industry worker is 43 years old and roughly 40% of all workers in the industry are aged between 45 and 64.[3] Workers under the age of 25 make up 12.3% of the overall US labor force yet, in the construction industry, they represent just 9%.[4] If the industry doesn't find a way to attract new workers, productivity is set to decline rapidly.

Part of the problem is that the construction industry's reputation doesn't align with the career ambitions that Gen Z and millennial workers are looking for. Younger workers want flexibility, economic stability and—perhaps unsurprisingly—a job just as technology-led as their lives are.

On attracting younger workers to construction, Donald "Bo" McNabb, Senior Instructor in Construction Management at Indiana State University's College of Technology, quips: "If you put a hammer in their hands before an iPhone, you might have a chance." But, what if it wasn't an either/or? What if the construction industry was in a place to demonstrate to these younger workers that technology played an essential part in a career in construction? And prove to them that this was an industry just as exciting as any other?

This is an approach that David Barnes, Policy & Public Affairs Manager at the Chartered Institute of Building, believes to be a necessity. "If you want to attract the next new breed of worker," he says, "you're going to have to really start thinking about incorporating technology into your business. Technology appeals to younger people. We've promoted things like Minecraft education in schools. So many kids play this, without realizing that a lot of it involves very similar skills to construction."

The lack of skilled labor won't be overcome with short-term solutions—it'll take investment, new strategies, and planning. But Eddie Tuttle is forthright in the importance of digital transformation in addressing this challenge: "Technology is a big enabler for getting the right people into the sector," he says.

> "We've got economic challenges, issues with labor shortages, but probably the biggest challenge is: we're doing all this against the backdrop of a climate emergency."
>
> —DAVID PHILIP, CHIEF VALUE OFFICER, AT THE COHESIVE GROUP

2. Sustainability

Like every industry, the US construction industry is under a lot of pressure to deliver projects more sustainably. Not only by governments and contractors, but by the public and—of course—the planet.

On April 4, 2022, Hoesung Lee, Chair of the UN's Intergovernmental Panel on Climate Change (IPCC), gave a speech where he noted, "We are at a crossroads. The decisions we make now can secure a livable future. We have the tools and the know-how required to limit warming." What's more, the IPCC has stated directly that cities, urban areas, and buildings offer key opportunities to reduce carbon emissions. "We see examples of zero-energy or zero-carbon building in almost all climates," said Jim Skea, Co-Chair of IPCC Working Group III. "Action in this decade is critical to capture the mitigation potential of buildings."[5]

It's no wonder that there's pressure on the construction industry to become more sustainable. Buildings are responsible for around 40% of global energy consumption, a quarter of global water usage, and a third of greenhouse gas emissions.[6] David Philip, Chief Value Officer at The Cohesive Group reiterates the enormity of this challenge: "We've got economic challenges, issues with labor shortages, but probably the biggest challenge is: we're doing all this against the backdrop of a climate emergency." So, to what extent can digital transformation support more sustainable ways of working?

Largely, the power of technology here lies in its ability to track sustainability metrics more accurately via data and more precisely expose where operations could be more eco-conscious.

One example of this is Building Information Modeling (BIM). By creating a virtual 3D model with data, this digital tool helps construction companies:

- Perform energy-usage calculations
- Compare building materials to find what best fulfils sustainable requirements
- Develop and test site logistic plans
- Analyze water and lighting for best optimization
- Grant access to all components used in a completed building, which can ensure better management of building lifecycles and significantly reduce carbon footprints
- Allow informed choices to reduce the amount of material waste[7]

As calls for sustainability action across the construction industry only look to grow in 2023, digital transformation in construction provides a way for companies to achieve their aims.

> "The construction industry's motto used to be: cash is king. Now I'd say it's more like: carbon is king."
>
> –DAVID PHILIP, CHIEF VALUE OFFICER, AT THE COHESIVE GROUP

3. Spiraling costs

The price of construction materials has surged, supply chain bottlenecks have heavily disrupted deliveries to worksites, and the impact of the coronavirus on construction companies' owners and workers is still being felt. All this has meant one thing: costs within construction continue to increase. In fact, staggeringly, three in four sector experts said they'd seen a price rise of at least 15% in 2022, with none reporting an increase of less than 5%.[8]

Clearly, with volatile and spiraling construction costs, the knock-on effects are hugely damaging for the companies involved: inability to deliver projects on time, inefficient budgeting and profit losses, increased difficulty to win bids, and, ultimately, a loss in reputation and loss in growth.

Just like the challenges before it, it's an overstatement to claim that digital transformation—on its own—holds the key to remedying the impact of spiraling costs. But there's already evidence that it can be used to stabilize some of the costs that construction companies are currently losing control of.

The example David gives is digital technology's ability to de-risk projects. "There's a lot of costs to do with risks. If we can use digital technologies to program schedules, it's going to save costs in the long run."

Construction projects are risky by their very nature—with long lifespans, vulnerability to weather conditions, unexpected ground conditions, and more—which might explain why 69% of projects go over budget by more than 10%.[9] This is a problem that, once you throw the current increase in spiraling costs into the mix, takes on the potential to be highly destructive to the industry and its workers.

Perhaps the biggest value digital technologies offer in reducing the risk, and subsequent cost inefficiencies, of projects is the collection and utilization of data. Data is essential to properly modeling project risk and developing risk-driven cost and schedule contingency amounts. Currently, however, this isn't something enough construction companies are taking advantage of. In fact, according to one study, as much as 95% of construction data is thrown away, or not even collected in the first place.[10] Digital transformation brings with it the opportunity to collect data during every stage of the project, analyze it, and look for more opportunities to reduce and stabilize costs going forward. With this, construction firms are in a better place to forecast and deliver projects on budget and on time.

4. Legislation

Currently, there are more legislative and accountability demands within the construction industry than there have ever been. A company's ability to comply with this new legislation will directly affect their contract bids and growth. It's here, again, that the data collection inherent in digital transformation can play a big part in ensuring compliance.

David comments that, "You'll find, in most cases, that technology doesn't deliver impact—it's better data. Technology is the enabler, rather than the creator, of value." And this is particularly true when it comes to legislative demands. To stay compliant, companies must deliver the right information to the right organizations, governments, and regulatory bodies in the right way. The only way to do this is by having a firm grasp on all data—building information models, documents, designs, drawings, supply chain databases, and personal.

For all these challenges, although digital transformation in construction might not be the silver bullet, it nonetheless offers benefits that are going underexplored and underutilized. But a lot of these digital solutions and technologies aren't new; there are reasons for construction's resistance—reasons both in and out of general contractors' control—that continue to obstruct digital transformation in the construction industry.

Why is construction's digital transformation still happening too slowly?

"If technology was a panacea, it would've happened by now," says David Barnes, recognizing that if construction's digital transformation was obviously and immediately valuable and actionable, the obstacles currently standing in its way would have been addressed. And currently, that isn't happening.

Despite the obvious benefits digital transformation has to offer construction, the industry remains prematurely transformed. Here, the statistics speak for themselves. According to PWC, 77% of high-performing construction projects globally use project management software, even though 44% of project managers don't believe in the use of software to manage projects.[11] Furthermore, even when contractors pursue digital transformation, their efforts are often delayed due to the lack of people. According to JB Knowledge, "35.2% of construction firms state lack of staff to support the technology as the primary limiting factor to adopting new technology."[11]

But while this might be true, people aren't the only thing standing in the way of digital transformation in construction. The truth, like the industry itself, is more complex and more nuanced than that.

A fragmented industry slows technology adoption

In many ways, what we refer to as the construction industry is actually a number of industries. Even the simplest construction projects include several distinct stages, each of which contains its own set of objectives, requirements, skills, workers, and stakeholders. There's little that connects the separate bodies across the construction value chain, which makes holistic digital transformation difficult to enact and achieve.

According to McKinsey, a construction project has a multitude of different employees, self-employed workers, and suppliers that may not embrace new digital methods when they're on the job.[12] Not to mention that, unlike other industries, it has no effective forum where all the constituent parts come together to discuss the issues of the day and share their concerns. Implementing digital solutions across a project thus requires coordinating changes among organizations—a task that's especially hard given the short-term and often adversarial nature of construction contracts.

According to GlobalData's 'Trend Insight: Technology in Construction' report, barriers construction companies face are:

36%, a lack of financial resources allotted for technological innovation

34%, a lack of sufficiently skilled labor

28%. and a lack of awareness of new technology[13]

Employees either don't have the appetite, or don't have the training

David comments that, in the construction industry, "There's some kind of suspicion around technology. A lot of people in the more senior positions have worked their way up from tools and trade and see it like: we do it how it's always been done." This is a neat summation of construction worker's historic resistance to technology—partly a result of an ageing workforce, but similarly a result of lack of investment in reskilling and retraining.

Reskilling is an essential part of business. In 2019, the ILO Global Commission on the Future of Work stated, "Today's skills will not match the jobs of tomorrow, and newly acquired skills may quickly become obsolete."[14] In any sector, keeping your employees up to date with new tools and technologies will allow your organization to keep growing. Unfortunately, in the construction industry, as these new technologies and digital tools develop, many companies aren't investing in the reskilling required to reap the rewards.

This leads to another problem: when benefits aren't realized, digital transformation efforts fall short, demotivating companies to continue with them. "I think with things like automation," Barnes continues, "there is a big issue with skills in the sector." If employees are without the appetite and training for digital transformation, it's unlikely to happen in any holistic and meaningful way."

> "Many of the reasons why digital transformations, strategic transformations, and cultural transformations sputter, stall, or fail entirely is because they meet with human resistance to change on a personal level."[15]
>
> —KATE O'NEILL, A FUTURE SO BRIGHT: HOW STRATEGIC OPTIMISM AND MEANINGFUL INNOVATION CAN RESTORE OUR HUMANITY AND SAVE THE WORLD

There's not enough governance

In some countries, governments have driven digital transformation in the construction industry via new legislation and regulations. Although this is still not happening as quickly as it should be, it's instigated a more holistic shift towards digital transformation. In the US, however, this isn't happening.

Examples from the UK show how government initiatives can effectively drive industry to change. The transition to a BIM oriented environment received a major boost in 2011 with the specification of Level 2 BIM requirements in the Government Construction Strategy. By 2025, the program is estimated to have saved £2.2 billion across government.[16] Likewise, Finland is attempting to standardize construction's digital transformation with new regulations and have seen successes; international standards are estimated to improve the efficiency of information management in the built environment by up to 50%.[16]

Currently, no US government initiatives exist to drive digital transformation in the construction industry. And without a forum or central body to create discussion and legislation, holistic digital transformation becomes problematic.

The demotivating nature of construction project lifespans

Construction projects span years and, often, decades. This makes it hard to implement new digital technologies and see the benefits immediately, in turn affecting companies' appetites to do so.

It's been said that the inability to experiment quickly negatively impacts every business's digital adoption.[17] This is greatly linked to a company's reluctance to stop doing things the way they've been done for years. A sudden change of lane seems like a huge risk. And because it may take slightly longer to see whether the decision to digitally transform has paid off, the risk appears far greater.

Despite these challenges, the construction industry overwhelmingly sees the worth in digital transformation, with 87% of construction executives and managers accepting that it gives construction firms a competitive advantage.[19] However, just under half of construction firms are still at a beginner or intermediate stage of their digital capabilities. A clear majority still use outdated methods for 25-100% of their business processes.[20]

In the words of Eddie Tuttle: "(The construction industry) needs some disruptors. It's all a bit safe. That's why we're struggling to get productivity increased in the sector." So, what can general contractors do to start this disruption, and realize more efficient ways of working?

45%

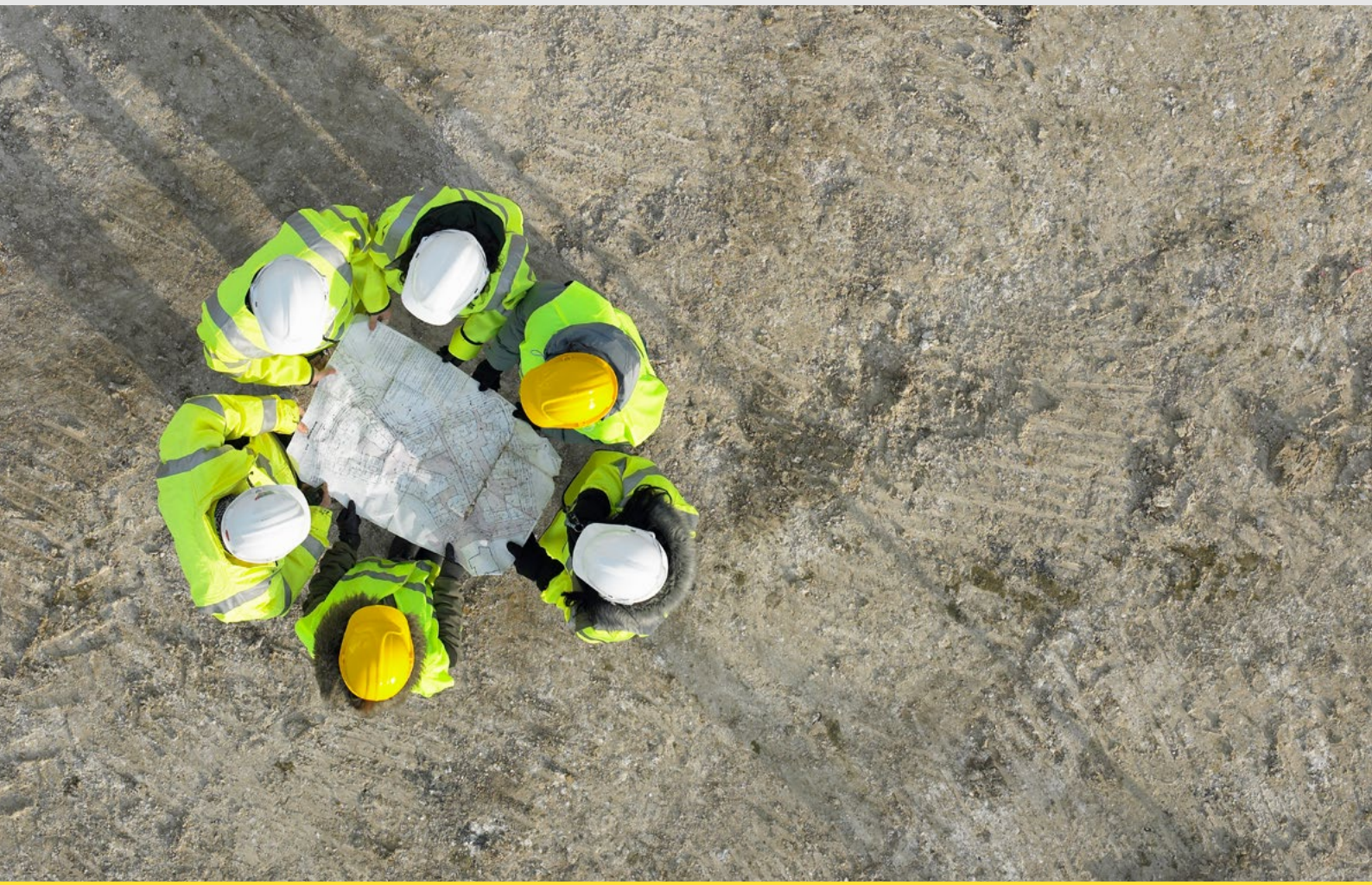
of respondents to a GlobalData Construction survey identified limited financial gain in the short-term as a barrier to investment in new technology.[18]

How general contractors can adapt, now

So, construction companies realize the value of digital transformation, yet still remain digitally immature; they understand its ability to help solve long-term challenges, yet abandon efforts because they don't see gains in the short-term; and attitudes to digital change remain—for the most part—overly conservative.

But the opportunity to adapt now, digitally transform, and gain a competitive advantage is far from out of reach for general contractors and construction firms. There are practical ways companies can begin to assimilate digital tools into their working processes and there are simple solutions to help shift attitudes and increase education around digital transformation.

Here's how general contractors can adapt, now.



Focus on fixing pain points, not installing IT solutions

When thinking about digital transformation, construction companies can focus too much on IT solutions and not enough on current procedural pain points. This results in pursuing improvements to systems and software as ends in themselves. For example, McKinsey reports that companies deploy cutting-edge technology tools before they've figured out whether and how those tools can improve their operations.[21] This tech-first approach can lead to digital "organ rejection", whereby a solution fails to deliver visible benefits, and the workforce—noticing this—doesn't adopt it.

General contractors can increase the likelihood that digital technologies will make a positive difference by first identifying operational pain points, then defining digital use cases that'll enable those operational changes. This process-centered approach helps focus each use case on a real business need while minimizing the impulse to chase technology trends. It's also been shown that use cases defined in this way deliver greater benefits[22] while building the understanding and conviction of the workforce. Such use cases are also easier to replicate on multiple projects and to introduce to new workers.

> "We need to analyze the daily activities and problems of the owners and operators in detail before we can understand the specific value of technology."[23]
>
> —DR ARTO KIVINIEMI, HONORARY RESEARCH SENIOR FELLOW AT THE UNIVERSITY OF LIVERPOOL

Implement digital use cases that promote collaboration

If construction firms cherry-pick use cases that apply to just one activity or trade, they risk missing out on a valuable opportunity: digital transformation's ability to unite processes, data, and risk management more holistically.

For this reason, it's good to devote special attention to activities that involve multiple disciplines and groups, and digital tools and use cases that smooth the interaction between them.

McKinsey reports that one contractor's experience showed why it's so important to implement digital solutions for collaboration. Historically, site workers hadn't sent feedback to a supplier on all defects in the elements that the supplier was making. When they did send feedback, it was anecdotal, unstructured, and difficult to action. Defects persisted, so workers needed either to fix defective products or wait for replacements. This unplanned rework increased labor costs and caused delays.

The company saw an opportunity to correct the problem by improving the mechanism for passing feedback between the site team and the supplier. The site team used a mobile app to tag defects against specific elements in the BIM model and store them in a common data environment (CDE), a single repository for information about the project.[24] The supplier monitored defect reports in the CDE, then ran root-cause analyses with its factory team to diagnose and reduce defects. The resulting improvement? A 12% reduction in rework hours at the contractor's job site, demonstrating the benefit of smoothing communication between these previously disconnected organizations.[25]

62%

of construction executives say project delays are mainly caused by lack of team collaboration.[26]

Reskill and restructure teams

As discussed in the first chapter, employees' lack of appetite for digital transformation is—in many cases—the result of a lack of education and training. For general contractors, reskilling and restructuring teams plays a key part in smoothing digital transformation and reassuring resistant workers that, although their jobs might be changing, they aren't being replaced by digital technologies. Instead, they're being upskilled.

David Philip comments on the importance of reskilling workers to adequately prepare for digital transformation. He says: "Putting technology in place doesn't solve things unless you put the right education and processes in place." Not only will reskilling and restructuring help general contracts get resistant workers on side, but it'll also mean the entire company can maximize its impact.

Use digital technologies to improve safety measures

One of the biggest risks to the building and construction industry is workplace safety and worker injuries. With the historic worker resistance to digitization, perhaps general contractors should consider first implementing technology that clearly demonstrates its ability to protect and support workers, first. Research in 2022 revealed that a massive 92% of US construction workers name safety as their most important consideration.[27] Technology can create significant improvements in safety processes across the construction industry through automation, data trending, monitoring tools, and various on-site digital tools. By focusing on technology that helps solve safety challenges, general contractors can reduce injury rates but also reassure their workers that they come first.

Adjust project baselines to capture value

Although construction companies do report seeing some productivity gains from digitization, they also report seeing little impact on the bottom line. This is because the savings from added productivity don't make up for the cost of implementing new software and systems.[28] To realize the full bottom-line benefit from digital use cases, general contractors should look at adjusting baselines to eliminate unproductive time and generate value.

For example, there's little to gain from compressing the time taken to survey a site, if excavators aren't in place for employees to start earthworks as soon as the survey is complete. Similarly, digital tools can help accelerate construction by reducing defects and thereby reducing rework. But if the labor force isn't streamlined or reassigned to other activities, then true value won't be achieved.[29]

Connect projects and teams to unlock more opportunities and impact across the value chain

An assessment of construction companies' digital transformations revealed that, in general, companies 'spray and pray' their investments across a wide array of digital technologies. What's missing, is connectivity. And with connectivity comes faster, more meaningful results.

If general contractors can connect projects and teams via digital tools, as a first step, more opportunities for holistic digital transformation arise; the potential for more impact is realized; and the appetite for digital adoption increases.

Skanska, for example, has invested significantly in IoT, smart sensor technologies, robust wireless networks, and real-time location tracking systems (RTLS) to transform its construction sites into digital workspaces. The results? Real-time information flows, increased worker safety, and enhanced jobsite visibility, which allows teams and owners to make informed decisions while reducing misinformation risks.[30]

Another part of Skanska's journey towards more digital ways of working was their use of HP SitePrint: a robotic solution for autonomous layout, able to support construction workers to complete the same quality of work in a fraction of the time.

Skanska's test of HP SitePrint

Watch now

Leading construction firms, most notably those incumbents fast-tracking digital transformation and the newer ConTech players, have adopted a structured approach to innovation and exploring emerging technologies. By doing so, they seek to mitigate some of the risks and challenges we looked at in Chapter 2:

- Investing incorrectly in technologies that won't solve pain points and deliver value.
- Creating a burden on talent, or alienating their workforce, via siloed adoption, lack of defined impact measures, and lack of technology readiness frameworks.
- Implementing technologies at the wrong time in the construction phase—often too late—so failing to see results as the project progresses.

What will 2023 bring?

Both established providers and start ups went into 2023 looking to minimize these risks via bringing innovative solutions of different maturity and readiness.[31] In fact, digital transformation is now a priority for 72% of construction firms worldwide,[32] with Deloitte reporting that, in 2023, companies will likely increase the adoption of structured approaches to emerging technologies across the construction industry.[33] A focus on practical value and return on investment will further expedite these efforts and potentially achieve significant gains for organizations. ConTech firms, in particular, are spearheading this. Henry D'Esposito, Senior Analyst for Construction Research At Jll, comments that: "In the years after the pandemic, with labor shortages expected to worsen and wages expected to rise, the cost-benefit analysis for adding construction tech tools that can shorten schedules and use labor more efficiently will only tilt further toward the growing return on investment for new tech."[34]

Despite the barriers to digital transformation within the construction industry, it's possible for general contractors to start adapting. Promoting collaboration, educating themselves and their employees, and adequately researching the technology out there to better understand what can bring maximum value can all play a part in helping increase digital maturity. For such a large, fragmented industry, with deep-rooted established practices, this'll be no mean feat. But, with more and more companies recognizing that the opportunities outweigh the risk, it's time to adapt—or get left behind.

"The United Nations predicts that two-thirds of the world's population will live in cities by 2050, with the trend of smart cities accelerating. Construction companies wishing to seize these opportunities must go digital now. Digital transformation removes existing silos and simplifies the difficulty they face, juggling staff, plans, skills, and materials to meet a changing schedule, while improving their profitability and satisfaction of end customers."[35]

—FRANK LE TENDRE, CEO, FINALCAD

Learnings from the Rise of ConTech.

There's is a new sector of technology start-ups deciding to take on the construction industry's digital resistance. Recognizing that the industry is in the midst of a rapid technological shift, these companies are rooted in forward-thinking solutions such as digital twins, drones, virtual and augmented reality, and robotics.

For more traditional construction companies and general contractors looking to drive digital transformation, learnings from these ConTechs are highly valuable. Here are the top three.

1. Funds are needed for a breakthrough
   The start-ups and tech giants that successfully entered the construction industry were backed by big investments.
2. Identify the critical data elements to own
   Owning the data has proven critical in driving early financial returns for most SaaS start-ups. Look to avoid working with disparate and unstructured data.
3. Work fast
   Speed matters. Exponential growth techniques are rapidly evolving, requiring constant iterations. Construction firms must embed agility in their organization.

Conclusion

As one of the biggest industries in the world, construction plays an integral economic role. However, currently, too many challenges are colliding, preventing the industry from reaching its true potential. As a result, US construction output is lower than it should be,[36] a whopping 9 out of 10 projects experience cost overruns,[37] and nearly 60% of US construction businesses say that failing to complete a project on time and under budget results in lower payment for their work.[38]

For all of these challenges and damaging knock-on effects, Eddie Tuttle is transparent that: "The digital agenda is key to changing perceptions." General contractors must adapt: embracing digital tools, investing in their people, and strapping in for the seismic industry shift that's already underway.

The next tool in your digital transformation?

DISCOVER HP SITEPRINT

For general contractors and field ops leaders looking to drive cost and project length stability, on-site safety, and sustainability via digital transformation, the HP SitePrint can help. As a robotic solution for autonomous layout, SitePrint increases speed with printed, on-slab text helping deliver executions as per plan. It can also streamline project allocation with cloud-based, simple-to-use tools for fleet management, estimates, accounting, and job submissions.

Learn more

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