GlobalData.

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Connected Construction: A new technology mindset for a new era

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Contents

Introduction

In 2019, Colorado-based construction contractor, Encore Electric, was declared the safest construction company in America, securing the title of "Grand Winner" in the 2019 Construction Safety Excellence Awards (CSEA). Safety had long been an important priority for Encore.

Central to its ability to achieve such high safety standards is its use of a single cloud-based construction management solution for collaboration, compliance management, accounting, project management, and other key processes. This solution helps all of Encore's team members work better together, enhancing safety and reducing risks.

In 2021, the Swiss division of Austrian construction giant STRABAG won a major road renovation tender within the Swiss municipality of Küsnacht. The municipality tendered out the project as an all-digital Design & Build pilot project, encompassing everything from the initial surveying, through to the renovation of the road and sidewalk surfaces, the underlying services (including all drainage, gas and water pipes and electricity lines), and the final as-built surveying. Key to the project's success was the use of a common data environment, which underpinned the BIM model and formed the basis for everything from estimating, calculating, and planning the required materials and person hours, to the final settlement.[1]

Like Encore Electric and STRABAG Switzerland, successful business leaders in all industries understand that technology has a vital role to play in transforming their companies, giving them the agility and scalability they've never had before. Furthermore, successful business leaders recognize that more flexible ways of consuming technology – which include subscription-based cloud software models and pay-per-use equipment rentals – are essential for both the transformation and survival of their companies. The construction industry is no exception.

A growing number of civil and building construction firms know they need to modernize their business and transform existing processes, or risk falling behind their competitors. Faced with the prospect of shrinking profit margins, modernization cannot be avoided or postponed indefinitely. Project owners and clients, who now demand more flexible ways of consuming technology, are driving this imperative to change. These changes enable project owners, government agencies, and other clients to pay for resources as a service, rather than owning, operating, and maintaining the technology themselves.

1 STRABAG Switzerland Goes All-digital With Trimble Technology on Pilot Swiss Road Reconstruction Project. Trimble Heavy Industry.

To adapt to this new reality, it is essential that construction companies embrace the as-a-service model for consuming a breadth of hardware and software technologies, including cutting-edge field technologies such as virtual and augmented reality, robotics, machine control and drones, as well as pre-construction design, detailing, and estimating software, enterprise resource planning (ERP), project management, and collaboration solutions. Firms that fail to act on, or put off digital transformations, could soon find themselves struggling to compete with those that reap the benefits of a connected construction environment.

> It's a competitive advantage. We're a mid-size civil engineering contractor in our region, but we compete with larger companies with more resources for many civil projects. Technology is a differentiator for us, allowing our crews to do more work in less time with better quality. Our goal is to deliver the best finished product—and technology helps us do that."
>
> *– **SIMON DE ROSE**, GENERAL MANAGER, STRINGFELLOW CONTRACTS LTD, NEW ZEALAND*

However, it is not just the adoption of modern technology that determines the success of digital transformation initiatives. Also important is how that technology is implemented, managed, and consumed, and whether individual solutions are interoperable, and thereby provide users a holistic, connected experience across all phases of construction: designing, planning, building, and operating.

Many construction companies struggle with a host of challenges related to legacy systems, field equipment, siloed departments, and business processes. These difficulties include disjointed communication, inefficient paper records, and other forms of manual processing, data islands, poor project visibility, outdated bidding, and project estimating, and an inability to make accurate predictions about future project costs, timelines, and profitability. Furthermore, because some construction companies – especially subcontractors and civil contractors – take an early hit by investing their own money into the business, these hardships mean it can be years before a major construction project begins to be even remotely profitable, if at all.

> There's a litany of design software, so in the same token there's a litany of scheduling software, ERP platforms, etc. The ability to interact with all of those is going to be key because an organization's not going to change those just to be able to use another platform. So that's a key to success, it is removing all roadblocks for that type of stuff."
>
> *– DIRECTOR, ATWELL, UNITED STATES*

In addition, many construction firms continue to rely on a perpetual license model for consuming construction technology solutions, which means they miss out on important benefits related to flexibility, scalability, ease of use, enhanced cost management, and improved return on investment (ROI).

> There is significant cost avoidance to be had by looking at the data the construction industry already has and making [better] use of it."
>
> *– CIO, LARGE CONSTRUCTION ENGINEERING COMPANY, UNITED KINGDOM*

Construction technologies: reflections of real-world business challenges

These internal business challenges dovetail with a host of macroeconomic pressures, including supply chain challenges and a lack of skilled labor. In the United Kingdom, major projects, including those planned by Aberdeen City Council for example, are being reviewed and reprofiled in response to global supply chain issues. Disruptive factors include ongoing market impacts from COVID, Brexit, current inflation rates, and the 2022 war in Ukraine[2]. Supply chain issues have also been a challenge in North America, where in the United States construction input prices have jumped 41% since February 2020.

In Canada, meanwhile, ongoing labor disputes are also affecting construction industry supply chains; a month-long strike by nearly 300 workers in Vancouver, British Columbia, has shut down twelve different concrete operations, slashing the supply of concrete and stalling many projects[3].

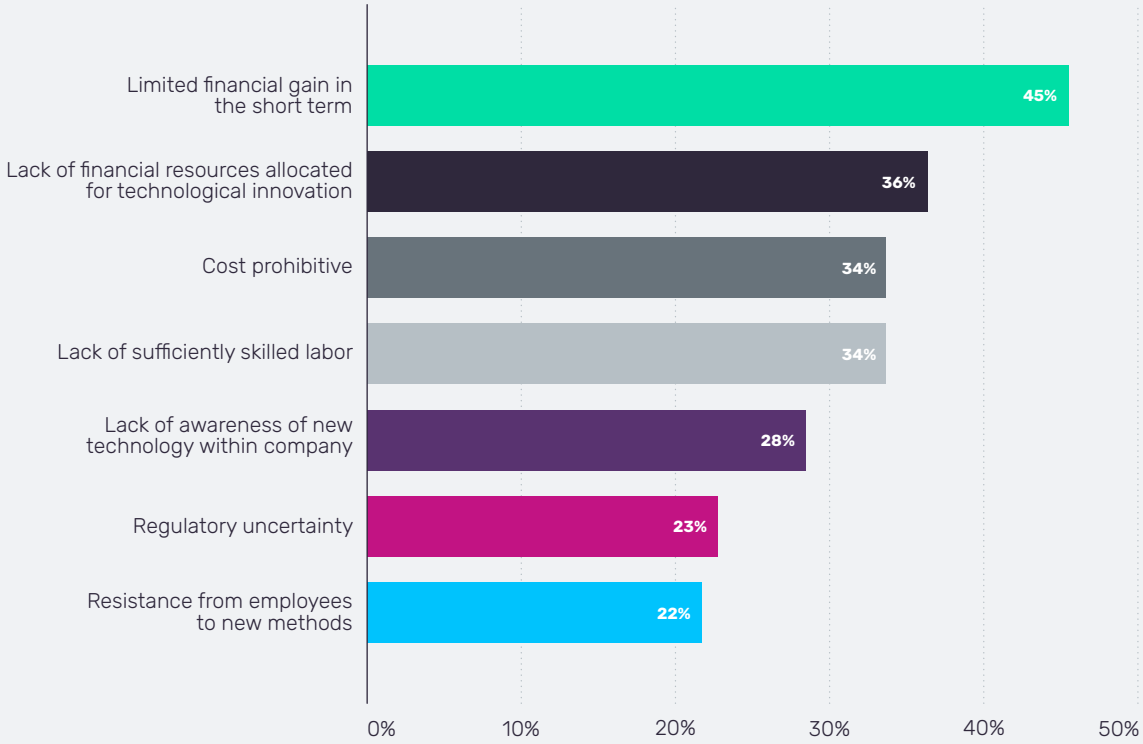
> For us, attracting and retaining talent is a continuous challenge. But we've found that technology really opens new doors of opportunity for our current operators. Clearly, there are advantages of technology to make us more efficient, but I think there are more advantages in retaining staff. We can see the future, when we will be able to share with operators and get live feedback to the entire crew—that's an exciting evolution."
>
> – ***SIMON DE ROSE**, GENERAL MANAGER, STRINGFELLOW CONTRACTS LTD, NEW ZEALAND*

A GlobalData survey carried out in December 2021, covering all global regions[4], found that 34% of construction companies see a lack of sufficiently skilled labor as a barrier to investing in new technology. A further 36% of construction firms cite a lack of financial resources allocated for technology innovation as an adoption barrier, while 45% of construction firms identify the prospect of limited short term financial gain as a barrier (see Figure 1).

Figure 1

Key barriers to adopting new technology

(% of Total, respondents selecting up to three drivers)



Source:
GlobalData

2 "Aberdeen Council to review major projects amidst global supply chain issues", Project Scotland: The Scottish Construction News Magazine (June 22, 2022)
3 "Greater Vancouver feeling significant impacts of concrete worker strike", Journal of Commerce (June 13, 2022)
4 GlobalData. Sector Research: Trend Insight, Technology in Construction (December 2021).

> There are inherent risks in construction work that can negatively impact overall net profitability."
>
> — ***TYLER PARÉ**, PARTNER AND PERFORMANCE PRACTICE LEADER, FMI CONSULTING, UNITED STATES*

Although these construction industry pressures have always been around, many of them became acute with the COVID-19 pandemic. During the pandemic, some companies had to rapidly scale tech stacks and software, which they were unable to easily do because they involved so many manual processes. Also, lack of connectivity often meant a difficult transition to more remote work.

The combined impact of these internal and external business challenges can be clearly seen on a company's profit margins. According to Tyler Paré, principal with FMI Corp., a construction-focused consulting and investment banking firm, general contractors had the lowest profit margin before tax of just over 4%[5].

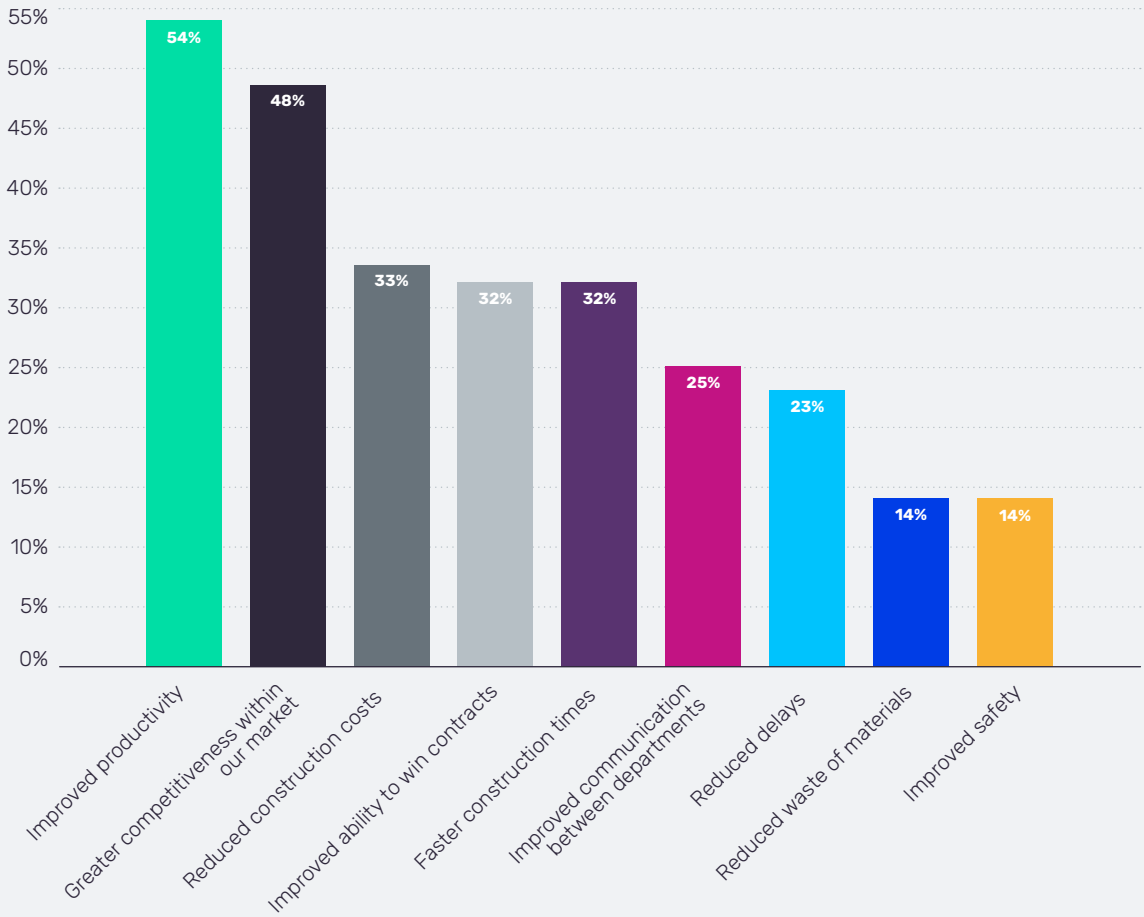
Therefore, within the construction industry, a growing number of firms are recognizing the importance of modern technology to help them address key business challenges, including project scheduling, budgeting, forecasting, and quality control.

According to the aforementioned GlobalData survey[2], 54% of construction firms cite improving productivity as a key driver for adopting new technologies, 48% identify increased competitiveness as a driver, while 33% want to leverage the benefits of new technology to reduce construction project costs. Other notable drivers include improving the ability to win projects (32%), speeding up construction times (32%), and improving communication between company departments (25%) (see Figure 2).

Figure 2

Key drivers to adopting new technology

(% of Total, respondents selecting up to three drivers)



Source:
GlobalData

2 "Aberdeen Council to review major projects amidst global supply chain issues", Project Scotland: The Scottish Construction News Magazine (June 22, 2022)

5 Paré, Tyler, Partner and Performance Practice Leader, FMI Consulting (2021). 5 Reasons for Low Contractor Profit Margin.

Connected construction – benefits and adoption barriers

By embracing modern technology, both building and civil construction firms can more effectively address project owners and other clients' key pain points and challenges – including constructing on budget, on schedule, and in ways that are sustainable – while also improving their own business efficiency, accuracy, sustainability, competitiveness, and profitability.

As mentioned, the barriers to investing in new technology are mainly finance-related, although further adoption barriers include concerns about data security, the existence of legacy processes, and a business culture that is resistant to change. Nevertheless, firms appear to be weighing-up financial and other adoption barriers against the potential for new technology to make them more competitive and to improve productivity. These two factors are the main drivers of investments by construction firms in new technology.

Many construction technology solutions already offer incremental function-specific benefits when using cloud and subscription-based licensing models. These capabilities include real-time data access, a central source of data from across the business, reduced chances for mistakes and errors, and enhanced security.

Leading contractors and engineering consultancy companies, including Skanska, AECOM, and Ramboll, have already started moving their operations to the cloud and integrated BIM platforms, to take advantage of these benefits and eliminate traditional construction roadblocks.

Some, including Balfour Beatty in the United Kingdom and Ireland, Blakely Construction in New Zealand, WSB in the United States, Strabag in Austria, and GA Smart Building in France, are also taking advantage of the latest field technologies, including robotics, machine control, and augmented reality, to modernize and transform the way they conduct construction projects.

WHAT IS CONNECTED CONSTRUCTION?

A connected construction experience is one in which construction firms have access to a common data environment with a standardized set of connected workflows across all stakeholders, departments, and disciplines of the construction process.

A connected construction experience facilitates better communication and collaboration among business silos, which have been a source of rising costs and inefficiencies. By enhancing project visibility and predictability, providing real-time access to business data, and enabling collaboration and integrated decision making, the connected construction experience can help owners, designers, engineers, and contractors realize more consistent, streamlined, and predictable project execution.

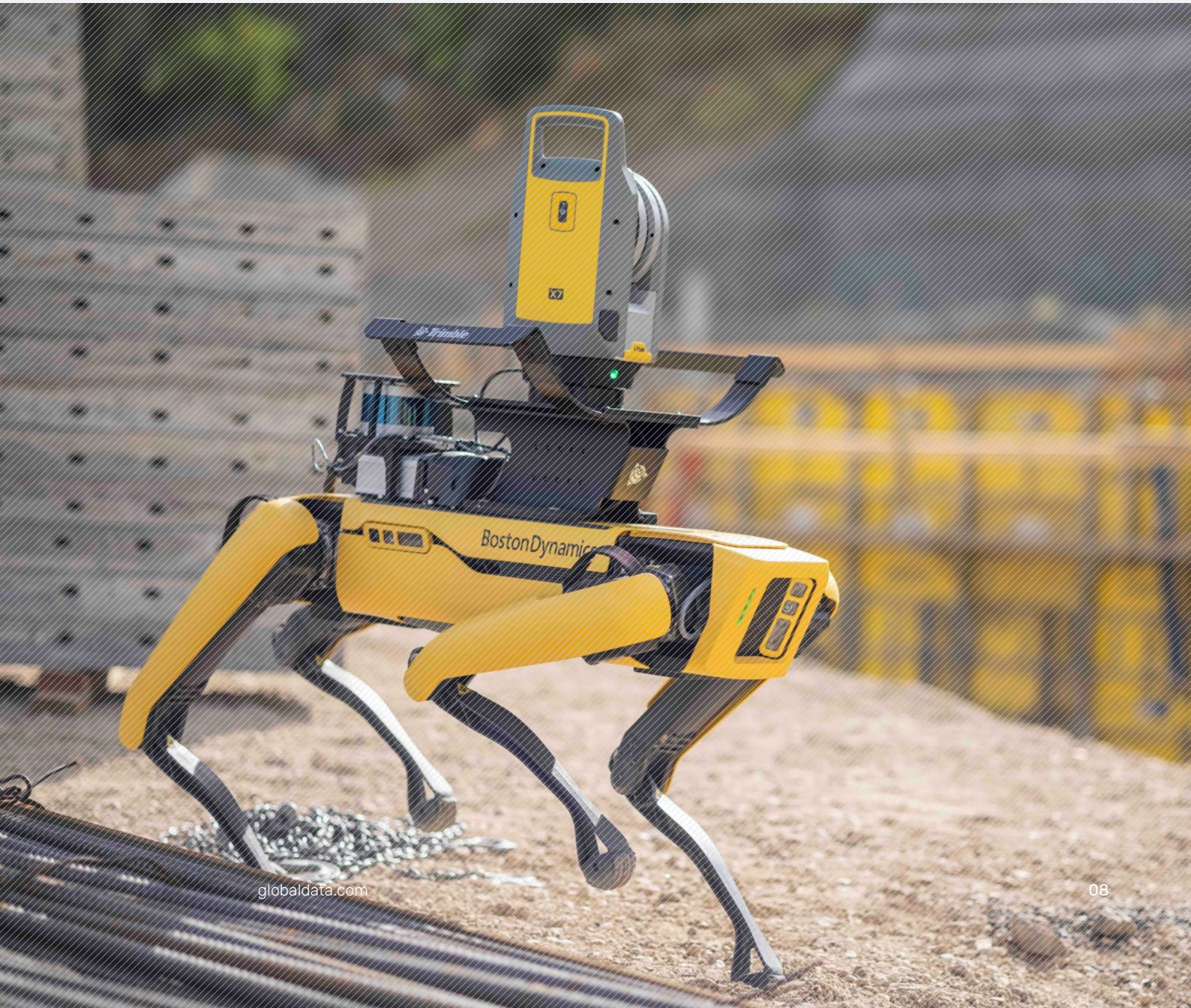
Better-managed projects and more streamlined processes – including the ability to process data in the field – can help firms achieve cost savings by reducing labor overheads and resource wastage, while also contributing to higher profit margins. The potential to help construction firms reduce resource waste can also help them with key sustainability targets related to environmental impact.

Construction firms have access to a growing range of cloud-based and other technology solutions to help them manage fundamental processes and activities, including procurement, scheduling, accounting, virtual design, and construction. Despite this access, a key challenge exists when those solutions have been procured from different vendors and adopted at different points in time.

> Our job costing was [previously] spreadsheet-based, and believe me, we had a lot of spreadsheets. Now the information is much more accessible and easy to obtain… Again, that goes to time and accuracy. Anything that costs you time, costs you money and anything that costs you money costs you profit."
>
> — ***BABETTE FREUND**, EXECUTIVE VICE PRESIDENT, DAVE STEEL COMPANY, UNITED STATES*

Construction companies can have technology solutions for all major business processes, and many or all of these can be used as a service, but they continue to be distinct solutions that don't integrate with one another and don't facilitate data sharing and communication among different teams and business stakeholders. Therefore, despite the use of multiple software and hardware solutions, too many firms continue to miss out on the benefits of a truly connected construction experience.

> Technology, when used correctly, makes everyone on site and in the office more efficient… If a $1,000 software solution saves a 10-person steel crew an hour on site, it has already paid for itself."
>
> — ***DALLAS WILLIAMS**, PROJECT MANAGER, SCOTT BUILDERS INC., CANADA*



SECTION

01 The digital transformation journey

WHAT IF...

Imagine for a moment, your ideal construction operating experience. You arrive at your office or work trailer and log into your entire construction management platform with one password. Within seconds, live, real-time data populates your screen and, thanks to several task alerts, you instantly know exactly what your key issues are for today, and which projects or areas need help. With just a few clicks, you turn that data into dozens of actionable decisions and workflows that spread from the back office to the field and to the entire extended project team and external stakeholders, all within seconds. And you've done it all before your first sip of coffee. This truly connected construction experience is powerful, and it's within your reach today.

> We believe in that. In fact, we started migrating to the cloud about a year ago, so actually right now, all documentation for the project management process and the design are already on the platform. I think data sharing provides you with a means to know that every single person involved in the process has the same information at the same time."
>
> *– COO, LEADING INDUSTRIAL DESIGN AND CONSTRUCTION COMPANY, MEXICO.*

Many construction companies continue to manage key business processes with a range of disparate technology solutions and, in some cases, manual processes. One consequence of this approach is that different business processes and departments and stakeholders end up working in ways that are siloed, each with access to different sources of data and information.

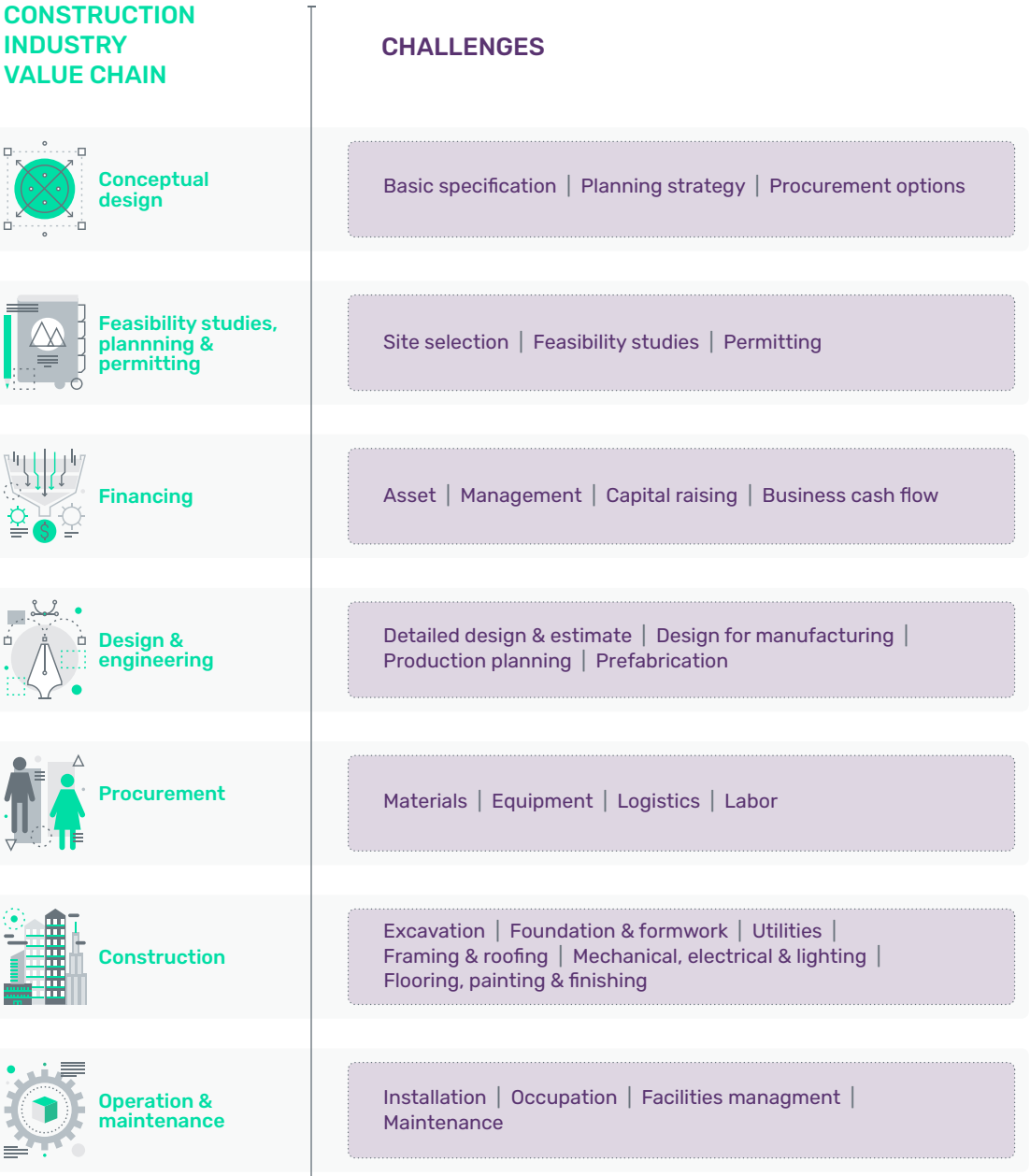
This disparity undermines the potential for collaboration and the ability for everyone to have a unified picture of individual construction projects. The complexity of many construction projects — each with their own demanding requirements and challenges — means that a disjointed approach to data sharing and project visibility can have negative consequences, both for the smooth running of projects and for a construction firm's bottom line.

By contrast, a connected construction experience is one where different stakeholders, business processes, and departments have access to a single source of shared data and information ("business intelligence") across the entire business. This common data environment (CDE) simplifies workflows, eliminates duplications, and increases the potential for information sharing and collaboration among different business processes and departments.

This deepened collaboration helps construction firms enhance their work process efficiencies, helping them run projects more smoothly and address key challenges across the construction value chain, ultimately contributing to improved profitability for the business (see Figure 3).

Figure 3

Technology connects key business processes



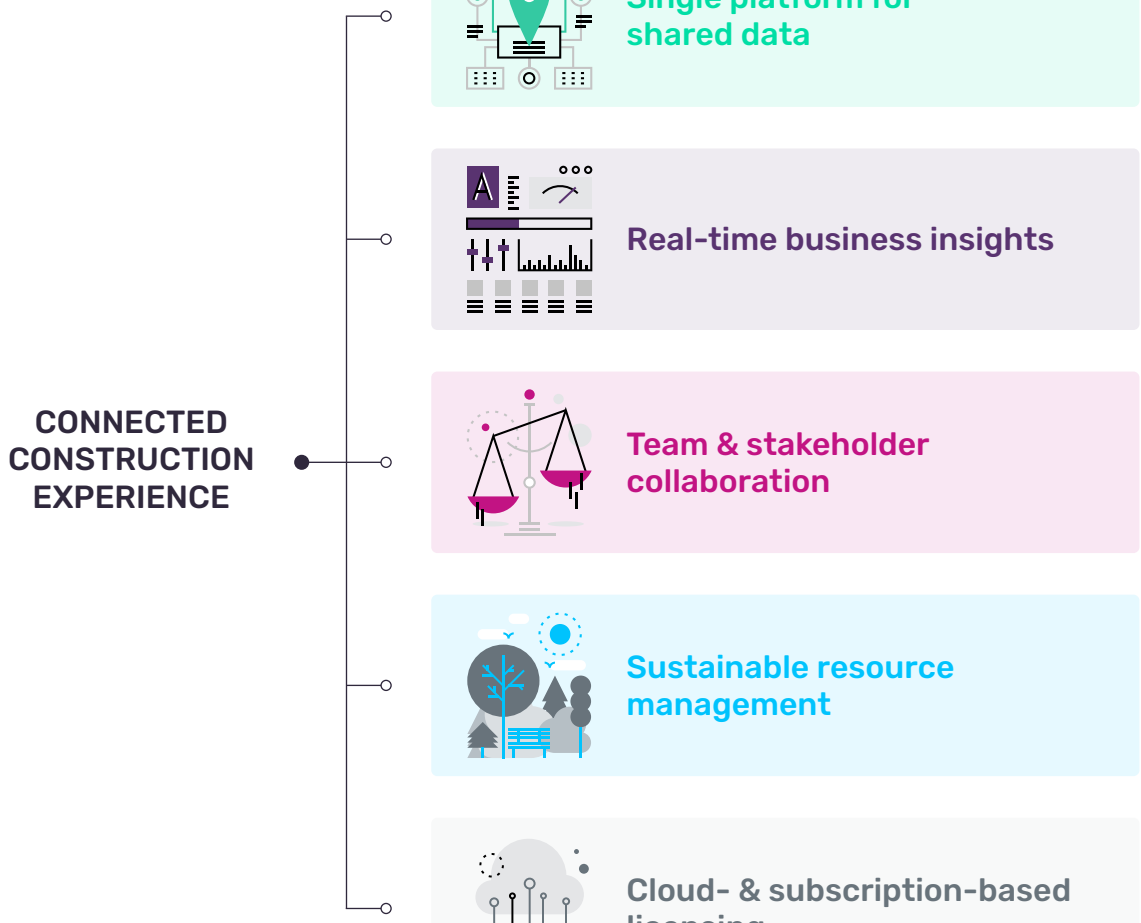
Source:
GlobalData

A connected construction experience includes the following capabilities (see Figure 4):

- A single platform that provides all construction company stakeholders access to the same set of shared data;
- Real-time business insight into every aspect of a construction project's status and progress, including real-time information on costs and resource use;
- Strengthened collaboration based on enhanced data sharing, more streamlined decision-making, and increased visibility into the status of projects;
- Sustainable resource management based on the use of data to monitor and manage the use of energy and other resources, and therefore a construction firm's environmental impact;
- Cloud- and subscription-based licensing, which removes ownership, management and maintenance burdens from the construction company and provides them with a range of financial benefits.

Figure 4

The connected construction experience



Source:
GlobalData

"Innovation and digital transformation, it's difficult but I've seen it happen, it just doesn't happen easily. It depends on the adaptation... and sometimes it can be client driven. It can happen either because it's proving a return on investment, or when it offers to complete tasks in a manner that requires less staff, or when it's possible to offshore something. So, I mean, for any of those reasons that save costs and increase profitability, I know, I could see it, something like that would be invaluable to the market but it wouldn't be an overnight process."

— Director, Atwell, United States

> Now that we have production software that communicates with the accounting software, we are able to better analyze, course correct and evaluate potential efficiencies."
>
> – ***BABETTE FREUND**, EXECUTIVE VICE PRESIDENT, DAVE STEEL COMPANY, UNITED STATES*

DAVE STEEL'S DATA TRANSFORMATION JOURNEY

North Carolina-based Dave Steel Company used a mix of disconnected software and external processes. But this technology stack made functions like job-costing and purchase orders time consuming. The company also lacked real-time insights into project data and the upkeep of on-premise systems took up valuable IT resources and incurred additional asset management costs.

Once Dave Steel leveraged construction management software to create a connected construction and fabrication process, implementing real-time data capabilities, automated workflows, and cross-functional collaboration between the back-office and the front-end departments, they began to benefit from a reduced internal IT footprint and gained the ability to use real-time data insights to boost productivity, address inefficiencies, and free-up resources across the company's various operations.

Single platform, standardized data

Many construction companies already use Salesforce (SFDC) to provide their sales, marketing, and finance teams with a single, unified picture of the organization's strategy in relation to specific customer relationships and projects, as well as the status of those relationships and projects.

In the same way, there are benefits to be gained from having a single, connected technology platform and a common, unified environment for all the data and information essential to a construction company's day-to-day operations - including procurement, finance, human resources, accounting, and project management.

Having a uniform, standardized set of data on a single platform means that, instead of data from different business divisions sitting in separate systems in disconnected silos, often with different processes for accessing and utilizing it, all of the data across the entire business can be accessed, analyzed, managed, and leveraged as part of a single, unified environment, supported by a common set of tools and capabilities. Today's leading construction management platforms further streamline contractors' data and workflows by providing simple, secure access to data virtually anywhere, anytime through online portals, mobile applications and single sign-on capabilities.

This uniform, integrated data environment results in simplified workflows and the elimination of duplicate data and information. It also provides different construction firm divisions and stakeholders with a clearer picture of the status and development of specific projects and other business processes and activities.

> Digital construction solutions have helped the project owner clearly and immediately know the on-site construction status, which is a first in Chinese airport construction projects."
>
> – ***LI QIANG**, CHIEF ENGINEER, BEIJING NATIONAL AIRPORT, CHINA*

Veit & Company, Inc. is a leading, technology-progressive site prep and civil construction specialty contractor with corporate offices in Rogers, Minnesota. The company specializes in site development including earthwork, foundations, demolition, dredging and utilities. With an annual revenue of more than $200 million and 100-120 projects running at any one time, about 85% of the company's earthwork projects rely on technology.

"One of our biggest business advantages is our ability to move information quickly, accurately and efficiently to our people and equipment," said Britton Lawson, director of construction technology at Veit. "We can push designs out to any machine on any jobsite anywhere in the world, which gives our crews the most current information. If our crews have questions about a culvert, fence line or some other project detail, we can add to the model and sync with ease. No more laptops or thumb drives."

Real-time business insights

Having all business information and workflows connected through a single technology platform and common data environment provides contractors with a modern toolkit for better business insights. Benefits include the ability for different departments, teams, and individuals to access and view real-time data and dashboards in ways that are relevant to them. They also include more streamlined and simplified workflows across the organization, which ensure accurate information at all times. Additional benefits include next-level reporting and analytical tools to parse data in new ways to uncover issues, trends, and more. Moreover, it includes not having to force disconnected software solutions to "talk" to each other through often unreliable third-party solutions or APIs. And, all this can be seamless to the user.

> We've used machine learning to look at new draft project plans and we've come up with predictions of which projects, and when projects are going to go over budget… when we've presented that to our contract leaders they've said: Blimey! look at what we can do if we have standardized data."
>
> *– CIO, LARGE CONSTRUCTION ENGINEERING COMPANY, UNITED KINGDOM*

Beyond contractors' own offices and teams, data and workflows can be viewed and shared in real-time among a wider ecosystem of stakeholders, partners, vendors, and extended project team members like owners, engineers, and architects. This creates a more connected, collaborative construction environment for all involved parties. Civil contractors, for instance, must collaborate with owners and civil engineers to streamline project delivery and reduce change orders, resulting in a project delivered on-time or ahead of schedule and more profitability.

A connected construction environment is especially beneficial with regard to subcontractor management. Near real-time data can enable safety and project management leaders to quickly identify and address issues such as unsafe work practices or potential compliance issues by a subcontractor. Subcontractor compliance issues such as human resources, union pay, insurance and bonding, which are not quickly identified and corrected by the lead contractor, can rapidly turn into larger issues that derail projects for months. So being able to streamline these processes by enabling digital forms, real-time alerts and more can reduce risk management burdens.

> Readily available data is going to be the key for any successful project going forward."
>
> *– HEAD OF DIGITAL TRANSFORMATION, LEADING CIVIL ENGINEERING COMPANY, UNITED KINGDOM*

Streamlined collaboration

Having a common, unified environment for accessing and sharing data across the entire construction business helps to ensure that collaboration among key business stakeholders is more synchronized and streamlined. Specific benefits include:

- Increased visibility and clarity into the status and progress of individual construction projects — information can be easily accessed, shared and passed along the construction lifecycle (e.g., from office to field, and vice versa);
- Increased accountability — the visibility into the status and progress of projects means there is greater responsibility for work to be completed on time, and to the required standard;
- Greater cross-business consistency in the way projects are managed and making it easier to define project's non-negotiables such as deadlines, budget, or equipment are communicated across the business;
- The ability to involve more relevant parties in decision-making processes, including subcontractors and general contractors who can get involved in projects earlier and have tangible knowledge of the work required prior to the start of specific projects.
- The potential to share ideas and skills and combine them in ways that bring new value to business operations and benefit overall project delivery.

A CDE is becoming increasingly important in modern construction practices, including public private partnerships. Contractors can have an up-to-date BIM model which can greatly increase the efficiency and quality of maintenance activities for the asset.

Project name:
Museum of the Future

Client:
Dubai Government

Engineering:
Buro Happold

Software Solution Provider:
Trimble

BIM implementation and coordination:
Eversendai

A pertinent example of a connected construction project is the futuristic 'Museum of the Future,' which was opened in Dubai in February 2022 as a unique representation of humanity, the planet Earth, and the limitless future. The engineering and design work required to build this 77-meter, seven-story building leveraged construction technology solutions to improve details and workflow in the design, fabrication, and coordinating stages of the project.

The Building Information Modeling (BIM) solution leveraged virtual reality and real-time data rendering programs to coordinate and detect potential clashes between the design and engineering disciplines. The design solutions were integrated with Tekla Structures software and Trimble's cloud-based solutions, enabling potential errors to be identified in advance during all stages of the construction journey, thereby saving valuable time and resources by resolving issues ahead of time. The use of Trimble Connect, an open collaboration tool, permitted the project execution team to provide the relevant personnel with access to the appropriate data at the right time, and thereby ensuring a seamless integrated construction process and saving substantial time and resources.

> Using a common data environment really makes our communication easy, because everyone has access to the same data, and the model is instantly updated with the latest information, there is no hesitation about what is the current version of any data. We also do surveying for as-built documentation, we scan the area regularly and make surveys of all new pipes when they are ready. We can add all this to the model and compare to the design, and also get a really good base for the as-built drawings we deliver at the end of the project."
>
> *– **NILS TEGEROT**, CHIEF SURVEYOR, VEIDEKKE, SWEDEN*

Sustainable resource management

Sustainability is becoming a top priority in the construction industry, with many construction firms looking for ways to innovate their operations to be more environmentally friendly. This includes introducing more responsible ways of using resources such as electricity, water, printing resources, and transportation fuel.

But disjointed, disconnected business processes frequently result in the wasteful use of construction firm's resources, whether they be money, materials, or people's time. When poorly managed, fuel consumption and energy use can also have negative implications for a construction firm's environmental impact and its carbon emissions.

By contrast, a joined-up, connected approach to running key business processes and supporting specific construction projects decreases the potential for wasteful resource use. This approach is based on the increased visibility, collaboration, and accountability created by the common, unified data environment. Enhanced visibility into the status of individual projects, together with more synchronized decision-making, means better and more efficient decisions are made with regard to resource allocation. While the increased accountability and consistency enabled by the CDE makes it less likely that projects will run past their expected timeframes.

The use of data to increase visibility into, and enhance the management of, company resources can have positive implications for construction firms' ability to achieve their sustainability goals. On the one hand, increased efficiency and productivity can help construction companies reduce their fuel consumption and more effectively manage their energy usage, therefore helping to reduce carbon emissions. On the other hand, data collection technologies can make it easier to collect information about emissions, and other environmental impact data, as well as help construction firms embrace sustainable building methods.

> A big benefit of moving anything to the cloud is that it requires less IT resources. Because now you're basically moving the responsibility of data from IT into the vendor, you know what I mean? … Obviously on-premise it's not taking up as many resources because there's no storage required or networking or anything, it's all moved up into the cloud, so there's less resources and I think that's a huge benefit."
>
> *– IT DIRECTOR, MEDIUM SIZE GENERAL CONTRACTOR, DESIGN & ENGINEERING COMPANY, UNITED STATES*

Cloud and subscription-based licensing

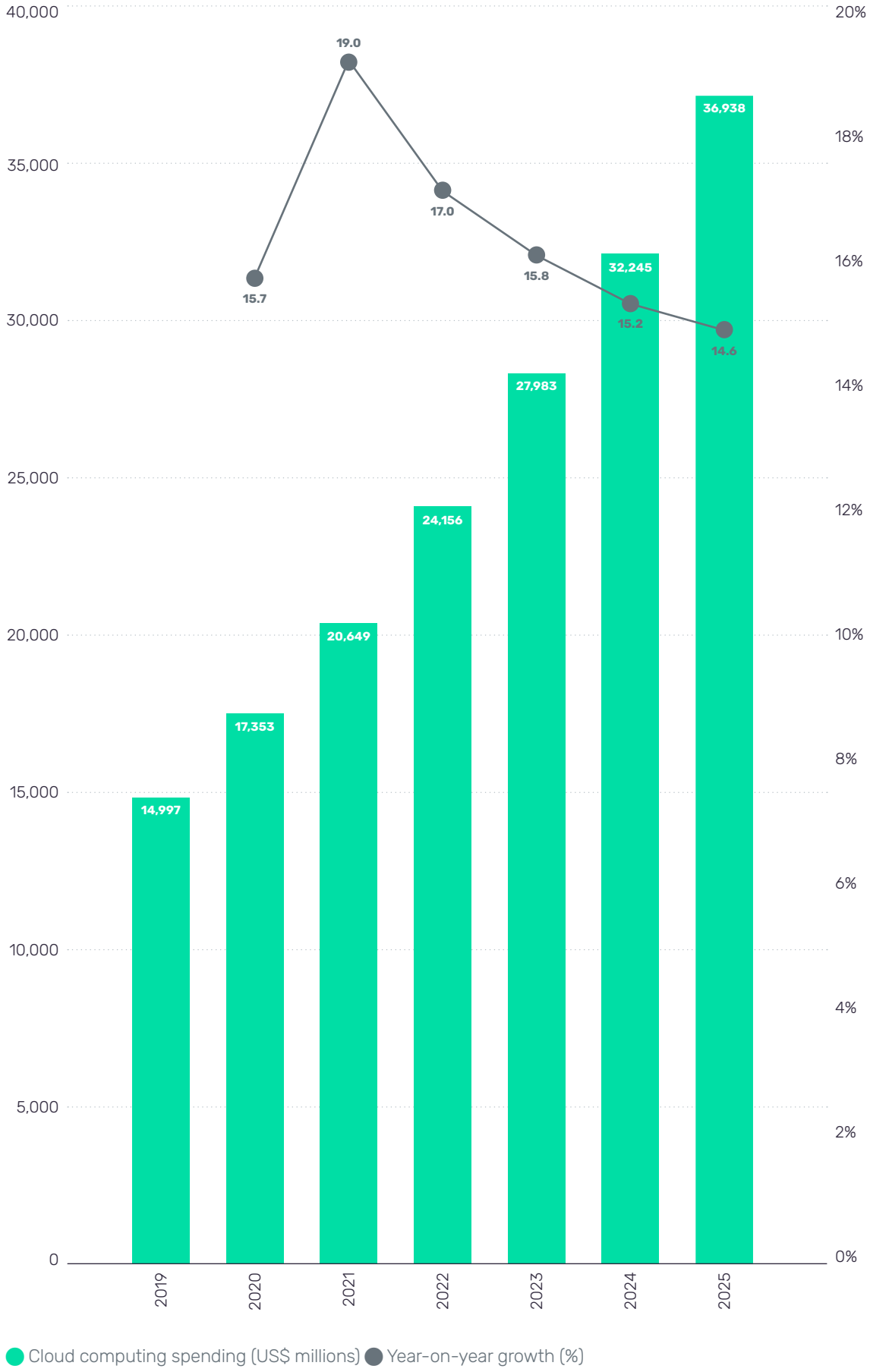
A further feature of the connected construction experience relates to the way construction companies access and consume hardware and software. Many businesses from diverse industries have already outsourced at least part of their technology procurement and consumption to the cloud in pursuit of various benefits. These include cost savings and more efficient resource management, as well as increased flexibility, enhanced scalability, and simplified management.

> The biggest thing we're seeing is construction companies going to the cloud… they're all slowly going with the times. If they don't, they're going to be left behind."
>
> *– HEAD OF DIGITAL TRANSFORMATION, LEADING CIVIL ENGINEERING COMPANY, UNITED KINGDOM*

GlobalData predicts that, by 2025, construction companies will spend US$36.9 billion globally on cloud services and solutions, up from US$17.4 billion in 2020 and reflecting a compound annual growth rate (CAGR) of 16.3% (see Figure 5).

Figure 5

Global spending by construction companies on cloud services and solutions, 2019-2025 (US$ million)



Source:
GlobalData

For a growing number of construction companies, using the cloud for their construction technology requirements means moving to a subscription-based licensing model. The software-as-a-service (SaaS) approach involves technology that is effectively leased rather than purchased, where vendors charge on a monthly, quarterly, or annual basis for services or equipment. This approach results in multiple benefits for construction firms:

- Lower cost of access to the latest construction technologies, making them more affordable to smaller firms and organizations.
- The ability to shift capital expenditure (CAPEX) to operating expenditure (OPEX), with little or no large initial capital outlay or investment. This shift means companies rarely have to invest in new hardware or software and always have the latest version of that technology.
- More predictable expenditure on software, hardware, hosting, and support. In addition, less ownership means less depreciation.
- Only needing to pay for what a firm consumes. In addition, services can be turned on and off quickly, and can be scaled up or down as required.
- Increased technology reliability and availability whereby services are provided 24/7 from highly resilient data centers with security, backup, and secondary systems that many firms cannot replicate.

> [SaaS] can lower the cost of ownership and grant users access to the up-to-date software at a predictable cost without the large upfront investment."
>
> *– **J. ZHANG & A. SEIDMANN**, 2009, PERPETUAL VS. SUBSCRIPTION LICENSING OF SOFTWARE WITH NETWORK EXTERNALITIES, UNITED STATES*[6]

6 Zhang, J and Seidmann, A, "Perpetual vs. subscription licensing of software with network externalities," 42nd Hawaii Internat. Conf. on System Sci., 2009.

"By moving to digital systems, we've saved a lot of paper and ink. Previously, we were printing a lot of paper and using a lot of ink and electricity to do that… we were destroying the environment. Also, the printers were not available on site. We were transporting the printers to the site, so also burning fuel. Now we are saving a lot of resources."

— Senior Project Manager, Turner & Townsend, India

SECTION

02 Identify and overcome challenges

Every new technology procurement and deployment project comes with its own adoption challenges and hurdles that need to be overcome to ensure success. These include concerns related to cost and the need to demonstrate return on investment (ROI) to key business stakeholders. They also include adoption challenges related to change management and business culture, as well as a company's organizational structures and decision-making processes.

Related to these difficulties are challenges that arise from a lack of strong sourcing management, benchmarking, and business case planning. A further potential adoption barrier relates to concerns about data security and fears that valuable data could get lost during the transition to a new technology platform. Finally, the move to adopt a new technology platform requires construction firms to choose from a range of possible solutions and solution providers. This decision making necessitates a process of due diligence and a comparative evaluation of different solutions that address key business challenges.

> "It's not only a matter of technology, but also the company culture, of seeing the process in the big picture."
>
> *– EDIZILIA CONSTRUCTION MANAGEMENT, CEO, ARGENTINA*

Overcoming cost barriers and demonstrating ROI

The costs involved in adopting new technology solutions can be one of the biggest barriers to construction firms looking to deploy a new solution. Sometimes the process of establishing the cost of a new solution is relatively straightforward, but more often, there are multiple costs, such as implementation and training fees, add-on feature costs, and more that need to be considered, some of which are not immediately apparent. Therefore, concerns about hidden and/or unpredictable costs are a major deterrent to construction companies considering the deployment of a new technology solution.

> "The main mistake that we've made in the industry is trying to make the whole chain involved in understanding the technology... But now, you need to manage things differently. They say - 'My electrician doesn't work with BIM so I can't do the job because my electrician works with 2D plans, manually'. And you say, - 'okay, no problem', but you need to hire someone to be the translator. This will be an additional cost for the project, but when you understand that you can make a more efficient approach by putting in the translators, that's when you invest in those kinds of resources."
>
> *– EDIZILIA CONSTRUCTION MANAGEMENT, CEO, ARGENTINA*

In addition, most construction firms will likely have already invested in different technologies for managing key business processes. Sometimes an existing solution may be seen to be doing a good enough job, and this assumption can undermine the case for exploring alternative options. However, even when a construction firm has reservations about the performance or sufficiency of an existing technology solution, budget constraints mean the company will prefer to get the most from that solution, therefore justifying their investment in the technology, before committing to new investments. Furthermore, many construction firms will need to justify to, and secure approval for new technology investments from multiple and specific stakeholders within the business. These approvals will include a need to demonstrate the potential return on investment (ROI) that a new solution will bring to the business.

Reorganizing internal structures and processes

For most construction firms, procurement processes vary according to the nature of a company's organization. In many firms, responsibilities are distributed across different teams, including architecture, design, detailing, estimating, project management, and contracting. In the case of international companies, responsibilities may also be further split by geography. The siloed nature of many corporate departments means that many construction firms are ill-prepared to oversee the deployment of technology solutions that transcend different sets of workflows.

Before adopting a new technology solution, construction firms may need to decide which individuals to appoint from their teams to oversee the procurement and implementation of a new solution. Often, internal technology champions or advocates are instrumental in leading discussions and fostering buy-in among management teams. Some firms may determine that the best way forward involves setting up a cross-team group to manage the implementation process.

Furthermore, for technology solutions that are intended to transform key processes and activities across the construction business, it is vital that solution selection and implementation is aligned with company strategy. The success of digital transformation projects often depends on the presence of strong governance that involves the CEO, the CFO, and the CIO, as well as the company's security and project management heads.

> "What ultimately makes me consider switching to an alternative provider is the CFO telling me because we've got a really good deal from an application standpoint or a cyber-event. It'll either be my CFO or one of our finance directors going: 'the time has come, we need a new finance system', or the HR director going: 'the time has come, we need a new HR system'."
>
> *– HEAD OF DIGITAL TRANSFORMATION, LEADING CIVIL ENGINEERING COMPANY, UNITED KINGDOM*

The implementation of a new technology solution across the business comes with its own set of challenges related to business organization. Other organizational challenges may include the presence of embedded processes that have been around for years but may no longer be productive or efficient. These include the use of paper invoices for suppliers and contractors, or preferred methods of organizing and presenting complex Excel data sets. Therefore, construction companies should be prepared to identify processes that may need to be dropped or adapted to fit the new technology solution rather than look for ways of adapting the new solution to existing business processes.

> "Yes, change is hard, and there will be challenges along the way with every technology implementation. However, the more technology advances, the more streamlined implementations are becoming. If you're worried about the time and effort involved, weigh that against the benefits that more modern solutions will provide."
>
> *– **CRAIG LUNDSKOG**, CHIEF FINANCIAL OFFICER, GREAT BASIN INDUSTRIAL, UNITED STATES*

Implementing a new solution also needs to consider the people within an organization who will use the new solution. The implementation process should include efforts to communicate that process and the changes the technology will bring to all those affected. For many construction firms, this will include direct employees, as well as contractors, subcontractors, partners, distributors, and manufacturers. Many construction firms will also need to ensure that proper training is provided.

"With how fast everything has gone, there is no way we could have worked as fast and accurately without the technology as we have with it. We probably would have had to quadruple the manpower to get the project done in the given timeline."

— **Jeff Buckley**, PreFab/BIM Program Manager at Aldridge Electric, United States

MANAGING CHANGE

A Leadership Manager at Constain's Water Division made the case for introducing new on-site hardware that would allow the status and progress of construction projects to be captured in a 360-degree digital format and viewed remotely.

The first thing he had to do was get all of the senior leadership team on board by presenting the business case and convincing them that the new technology would reduce costs and carbon emissions by cutting the amount of on-site travel. He also had to get their supply chain on board and ensure that they understood the goals.

One novel initiative involved the use of bite-sized lunchtime training sessions to ensure employees understood the plan to introduce the new technology and the benefits it would bring. Furthermore, those who were perceived as being potentially the most resistant to change were appointed as project ambassadors to get them fully on board.

Adapting and changing the business culture

When procuring or implementing new technologies, many construction firms also face adoption barriers related to change management. Change management refers to the management of change and development within a company or organization. A company's approach to change management is shaped by several factors, including the extent to which companies recognize and understand the need for change, as well as how they plan for change, implement changes, and communicate change throughout their organization.

> "Change management is one of the biggest adoption barriers… trying to change the mindset. If you're going to introduce a piece of software, it's about getting everyone on board, and the only way you're going to be able to do that is with a lot of interaction and training."
>
> *– HEAD OF DIGITAL TRANSFORMATION, LEADING CIVIL ENGINEERING COMPANY, UNITED KINGDOM*

Older companies in particular often have ways of doing business that are deeply established among both management and employees. These entrenched methods can make it extremely challenging to deploy a new cross-company technology platform, especially one which promises to fundamentally change existing processes. To succeed, construction firms need to find ways to get different business areas involved in the planning and implementation phases, demonstrating how the newly proposed solution will benefit them directly and highlighting the potential for improving existing processes and business processes.

In some construction firms, the management and leadership culture can act as a barrier to change. Specific challenges can include a lack of long-term vision and a tendency to prioritize a piecemeal approach to change over a longer-term coherent plan. Other barriers may also include a lack of strong leadership and/or awareness of key business challenges, problems, and efficiencies among senior management. This lack of awareness can extend to an understanding of, or willingness to engage with, potential solutions to their challenges, including technology solutions.

> Normally when you change… once you are changing the platform that is normally in use, it's human to try to reject the change, you don't want to change, you want to stay on what you already know, you don't want to learn a new tool or new software that is really going to help you, even if it's better or is going to improve your life, but you don't want it. You just want to reject the change. I think that's the biggest challenge a company will face, and the solution really needs to be as friendly as it can, so the people that are going to implement the change don't feel sabotaged."
>
> *– COO, LEADING INDUSTRIAL DESIGN AND CONSTRUCTION COMPANY, MEXICO.*

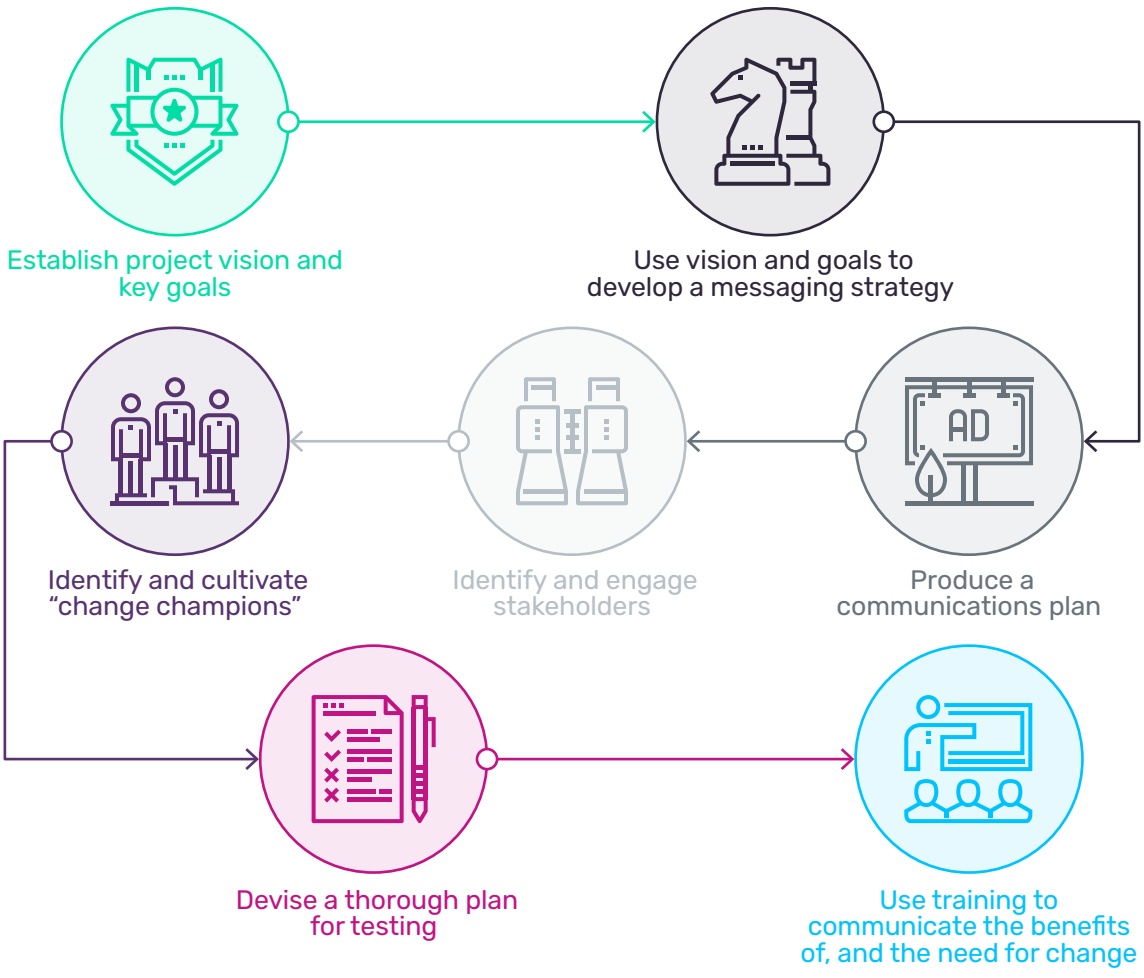
Resistance to change and the adoption of new technologies can be a major challenge for many construction firms. Resistance to change can be found at both a management level and among employees and can even extend to a company's partners and suppliers.

Tackling resistance to change often requires a focused and sustained effort to communicate the need for change and the benefits of change to all business stakeholders. This could include an emphasis on training and skilling, especially with regard to new technologies. It may also require efforts to incentivize employees, partners and other stakeholders to engage with new technology. These tactics could include using financial incentives for partners and the inclusion of technology engagement as part of employee reviews and appraisals.

> I witnessed first-hand just the resistance to change in the industry. I think people just are so used to how they do things… and then, the moment you introduce change, it's tough for them to adapt, even if they understand the benefit and the value of it, they still just don't want to do it. We call those guys the laggards."
>
> *– IT DIRECTOR, MEDIUM SIZE GENERAL CONTRACTOR, DESIGN & ENGINEERING COMPANY, UNITED STATES*

Figure 6

Change Management Task Process



Source:
GlobalData

Addressing data security concerns

According to a 2021 GlobalData survey, more than half of all construction executives believe their firms will be hit by a cyberattack in the future, yet 68% of firms have no security measures in place, or minimal security.

> I think human error can be overcome if you make the software really intuitive and easy to use."
>
> *– COO, LEADING INDUSTRIAL DESIGN AND CONSTRUCTION COMPANY, MEXICO.*

An additional concern facing many construction companies looking to adopt new technology is the possibility that valuable business data could become lost, or the security or their data compromised during or after the transition to a new technology platform. This concern includes the adoption of a new cloud solution and the migration of data to the cloud. When transitioning to a new technology platform or deploying a new solution, the security of data can be compromised for different reasons. One of the biggest is human error, and it is common for mistakes to be made during the installation process, sometimes as a result of inadequate supervision and monitoring.

> One of the best things contractors can do, aside from modernizing, is to have robust construction cybersecurity and disaster recovery plans in place… trusting our data in the cloud is an insurance policy and mitigates a lot of risk."
>
> *– VICE PRESIDENT OF TECHNOLOGY, E.R. SNELL, UNITED STATES*

It is important to remember that the cloud provides significantly more data protections than on-premises software and hardware, which needs to be updated and maintained by firm personnel. In hosted cloud environments, cloud service providers largely manage the data storage and cybersecurity protections and are typically much more up to speed on the latest cyber threats compared with most of their customers. Cloud providers can also quickly put into place the right protections before users succumb to them, leveraging tools such as multi-factor authentication and detailed user permissions to shut down potential breach points.

Data security is often wrongly seen as an issue that concerns the IT department alone. This assumption can further increase the risk of a security breach, especially when a technology solution is intended to span different business areas, such as design, detailing, estimating, procurement, accounting, and finance, and different contracting agencies, distributors, and manufacturers. When adopting a new technology solution, construction firms therefore need to find ways of fostering and encouraging a more holistic way of thinking about data security across their organization. This approach requires all employees to understand the different types of security breaches that can arise, and understand their own role in recognizing and helping to stop specific cybersecurity attacks from being successful.

> In terms of disaster recovery, using the cloud takes that responsibility away from IT as well, and so there's business continuity and disaster recovery. I think we're better covered because all the stuff is up in the cloud."
>
> *– IT DIRECTOR, MEDIUM SIZE GENERAL CONTRACTOR, DESIGN & ENGINEERING COMPANY, UNITED STATES*

Determining evaluation criteria

When adopting any new technology, one of the biggest challenges construction companies often face is selecting the right technology solution and the right solution provider for their specific requirements. Construction firms have many options available to them and therefore need to do due diligence by thoroughly researching their options before making a decision. The need to explore different solutions and vendor options and decide among multiple competing solutions can, in itself, be a major barrier to adopting new technology. The research and due diligence process can be time-intensive, and companies need to make decisions about who to involve in the selection process and who to supervise it.

When researching new technologies and their providers, it may be helpful to follow a checklist of things to consider, including cost, the type of service and the type of support offered by the solution provider, and the manageability, flexibility, and scalability of a particular solution. Nevertheless, the challenge for many construction firms is knowing where to begin.

> If you want to move to the cloud right away, you'll want to get everything set up ahead of time. That means getting everything -- your data, processes, etc. -- ready to move to the cloud. Prepare your employees and provide a timeline."
>
> – ***CRAIG LUNDSKOG**, CHIEF FINANCIAL OFFICER, GREAT BASIN INDUSTRIAL, UNITED STATES*

One important factor to consider is the type of licensing model that will best serve the construction firm's needs. Among construction companies that are already using modern technologies to manage key business processes, many of these involve fixed investments in solutions that are owned, managed, and maintained by the construction firm. A much smaller number of construction firms rely on the cloud delivery model for their technology requirements in any substantive way, if at all. Even when a construction firm already recognizes the potential benefits of a subscription- or cloud-based approach to consuming technology, the decision to move to a new consumption model can still be challenging for companies that have yet to experience its benefits.

E.R Snell, a major contractor for road and bridge construction, was the target of a ransomware attack in September 2020. The hackers gained administrative access via an employee's email account and went on to demand a ransomware payment. After resolving this attack E.R. Snell was determined to not have this experience ever again. Therefore, they moved key processes to a hosted cloud environment through its connected construction management suite vendor. The company now has peace of mind, knowing its data is more secure in the cloud with encrypted, user-level permission controls, multi-factor identification, and single sign-on features.

SECTION

03 Making the move to connected construction

The implementation of any new technology will benefit from a roadmap that sets out the vision and plan for the use of the technology within your construction business. A roadmap can help you visualize and better understand the implications of the implementation plan, helping you address questions such as:

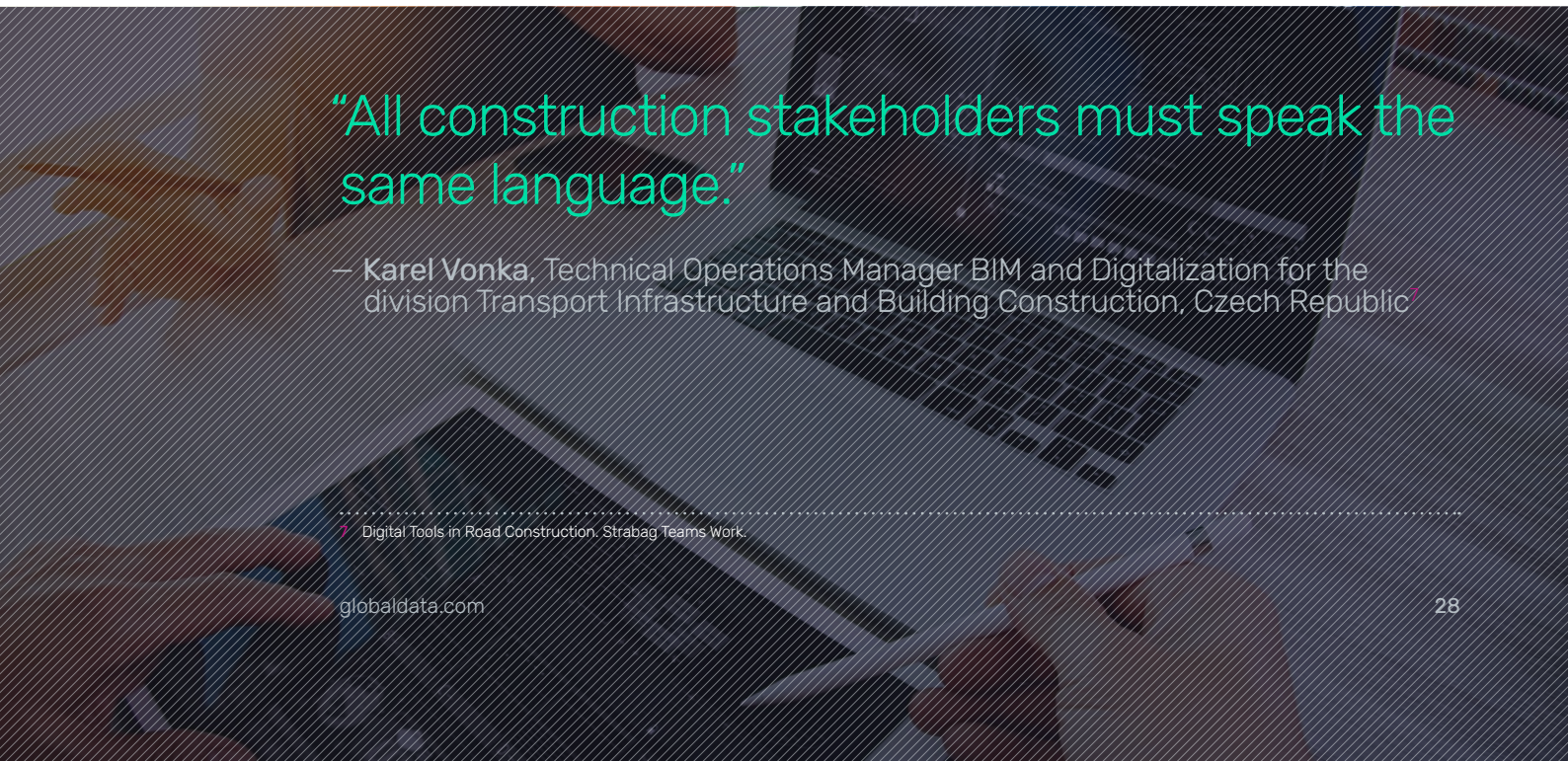
- How disruptive will this technology be for existing business practices?
- How will the migration of your data to a new platform affect existing work patterns and processes?
- What are the security and regulatory implications of adopting this new technology?
- What does a new technology mean for existing technology solutions?

In addition, an implementation roadmap enables you to plan and manage the implementation process, helping you keep track of the process and keep the process on track. When unexpected challenges and setbacks arise, a roadmap can help you take stock, reassess your priorities, and make new decisions about scheduling.

Finally, an implementation roadmap can help you communicate your objectives and vision for the new technology to different stakeholders within your construction business, as well as helping you communicate the benefits of the new technology.

> Our migration to the cloud occurred over a weekend. It started on Friday and when everyone came back Monday morning, we were in the cloud. For the end user, there was very little difference."
>
> – ***BABETTE FREUND**, EXECUTIVE VICE PRESIDENT, DAVE STEEL COMPANY, UNITED STATES*

A technology implementation roadmap has a number of important elements, which include making the necessary preparations for implementation, selecting the right technology solution and solution provider for your needs, mapping and visualizing the implementation process, and monitoring (and revising if necessary) your KPIs as the implementation takes place. It also includes the identification of on-going focus areas to ensure maximum value for your new solution (see Figure 7).



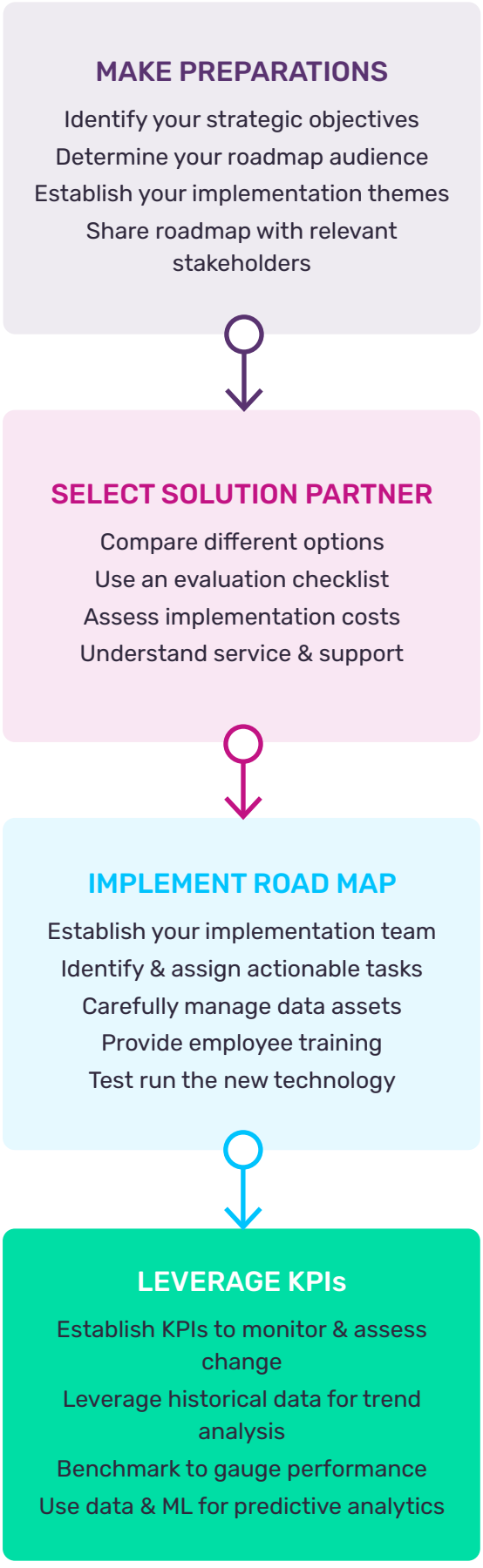
"All construction stakeholders must speak the same language."

– **Karel Vonka**, Technical Operations Manager BIM and Digitalization for the division Transport Infrastructure and Building Construction, Czech Republic[7]

7 Digital Tools in Road Construction. Strabag Teams Work.

Figure 7

Technology connects key business processes



Source:
GlobalData

Making the necessary preparations

Developing a roadmap for implementing a new technology requires a number of important preparations:

First, identify your strategic objectives and the benefits you expect the new technology to bring to your construction business. A key question to ask is: Why are you doing what you're doing and what do you want to achieve? It is also important to consider how the new technology will benefit your business in the short-, medium-, and long-term. Among other things, these questions will feed into the process of selecting the right technology solution and partner (see next section).

Second, determine the audience of the implementation roadmap. The audience comprises anyone within your construction business who needs to understand the benefits and implications of the new technology. The language of the roadmap should reflect the nature of the audience, and this may necessitate different versions of the roadmap, such as a technical and a strategic one. The roadmap should emphasize the benefits of implementation over implementation tactics and should leverage supporting evidence wherever possible.

> "Technology allows us to deliver a product that is not just built "as planned," but is delivered "as intended," often allowing us to make recommendations and deliver a final outcome that exceeds original expectations."
>
> – ***JEFF BUCKLEY**, PREFAB/BIM PROGRAM MANAGER AT ALDRIDGE ELECTRIC, UNITED STATES*

Third, establish and address each of the major themes associated with implementation. The themes are the top-level, strategic building blocks of the roadmap, and include time frame, training, testing, technical deployment, and the implications for security and compliance. The roadmap themes will allow you to organize and sequence the implementation process.

Fourth, share the implementation roadmap with all relevant stakeholders within your construction business. This part of the process should include preparing to address any questions they have about the impact of the

new technology on your business organization and the benefits it will bring. Also be prepared to share the roadmap multiple times with the same people - it can take a few rounds for everyone to understand everything.

Selecting the right solution partner

The process of selecting the right solution and vendor for your specific business needs is one of the biggest challenges you will need to address. Selection should involve a thorough due diligence process and a careful evaluation of different possible options. It may be helpful to use a checklist of considerations that can be used to comparatively evaluate different solutions and solution providers.

Key considerations should include things such as the flexibility and manageability of a specific solution and, where relevant, the scalability of a solution and the ease and speed by which it can be expanded to other stakeholders and other parts of your business. Additional considerations should include the costs involved in adopting a new technology and, with this in mind, it is important to think about the type of consumption and payment model that will best suit your needs. Consider the relative benefits of a cloud or subscription-based licensing model.

> Make sure you're researching your vendor in addition to the software you're considering and pick a vendor that is going to work with you and have a vested interest in your long-term success."
>
> – ***CRAIG LUNDSKOG**, CHIEF FINANCIAL OFFICER, GREAT BASIN INDUSTRIAL, UNITED STATES*

When selecting from different solution providers, a further consideration should be the type of service and support offered by individual providers. An evaluation of service levels and support should consider the support that is offered during the implementation process, as well as ongoing service and support.

It is important to think long-term and invest in a technology solution that supports both your immediate and future business requirements. Beware of solutions that are expensive to deploy and maintain, or those that offer more than you require.

> Maintaining similar platforms that can work together not only helps with the workflow, but the consistency of expectations and the end product, from both the field and office. Using a leader in this regard can lower the training curve for various piecemeal software and hardware packages and integration."
>
> – ***DON CAMPBELL**, PROJECT MANAGER, RIPA & ASSOCIATES, UNITED STATES*

THE VENDOR JOURNEY FOR NMCN

NMCN, a United Kingdom-based construction engineering firm, went through a vigorous decision-making process when deciding on its common data environment (CDE) of choice. NMCN went through multiple stages in their decision-making process such as interviews, trials, experience and peer help.

NMCN started its process by identifying all the CDE vendors in the market and then created a list of 70 plus items that were listed as required, functional, critical or desirable and then a score was attributed against each vendor.

The company went through a process of categorizing all the different features they highlighted and evaluated how vendors performed against these categories. The chosen CDE solution was selected after delivering on 70 out of 72 of the factors identified by NMCN as being important.

Mapping the implementation process

The process of implementing a new technology should broadly follow the major themes of the implementation roadmap.

One of the first steps in the implementation process should be to identify those individuals who will be directly involved in rolling out the new technology within your organization. Your implementation team should include individuals from your IT department, as well as from operations, engineering, design, detailing, estimating, accounting, and project management, with a project manager appointed to oversee the implementation process. Having an implementation team made up of individuals from different departments should help to strengthen any communication related to the new technology and its implementation, ensuring that all parts of the business understand the objectives and benefits.

> Communication is one of the most essential things in the construction industry, especially in project management. When working at Saudi Aramco, the introduction of new construction process management technologies increased business efficiencies by way more than 10%."
>
> *– SENIOR ROAD & INFRASTRUCTURE ENGINEER, EGIS, SAUDI ARABIA*

Second, the objectives and implementation themes, as established in your roadmap, need to be translated into actionable tasks that can be managed by your implementation team. When necessary or appropriate, your implementation team members will delegate specific tasks. Tasks will also need to be given specific timeframes for completion. Consider developing a project management calendar, which can be used to visualize implementation milestones and progress points and ensure that employees, managers, subcontractors, and other stakeholders are on the same page.

Third, implementing a new technology will often require careful management of your existing data resources. This includes taking adequate measures to address data integration, conversion and history. Any new technology platform is only as effective as the data it contains, and the way that data is managed is central to successful implementation. Key steps to effective data management include cleansing existing data, re-aligning data for future use, integrating to other legacy systems (both internal and external) and migrating any data that is currently stored outside of the system to a new technology platform.

Fourth, implementing a new technology can be highly disruptive to employee roles and responsibilities, as well as existing business systems and processes. Therefore, as part of an effective change management process, you should establish an adequate and well-defined training program that includes sufficient time for knowledge transfer. It is also essential that you have clear communication to all end users of the technology throughout the implementation process. However, instead of paper manuals or face-to-face tutorials and presentations consider the use of a software-based training or onboarding program with interactive elements that include ways of collecting employee feedback. It is also important to train with field and civil technologies, including BIM software and AR/VR solutions.

Finally, you should run a pilot program to test run the new technology with one or two departments for a period of one to two months. The pilot program can be helpful for identifying any technical issues or operational challenges and provide an ideal time for collecting end user feedback.

Using tech transformations to revise KPIs and benchmarks

Adopting a new technology is a perfect time for construction companies to review, update, or even create new key performance indicators (KPIs) and benchmarks. KPIs can help illustrate the benefits of a new technology and justify the need for it. However, identifying the right KPIs for a construction business to monitor can be a challenge, partly because construction is based on bids and projects, rather than on production or products.

> 95.5% of all data captured goes unused in the Engineering and Construction industry."
>
> *– XPERA RISK MITIGATION AND INVESTIGATION, CANADA*

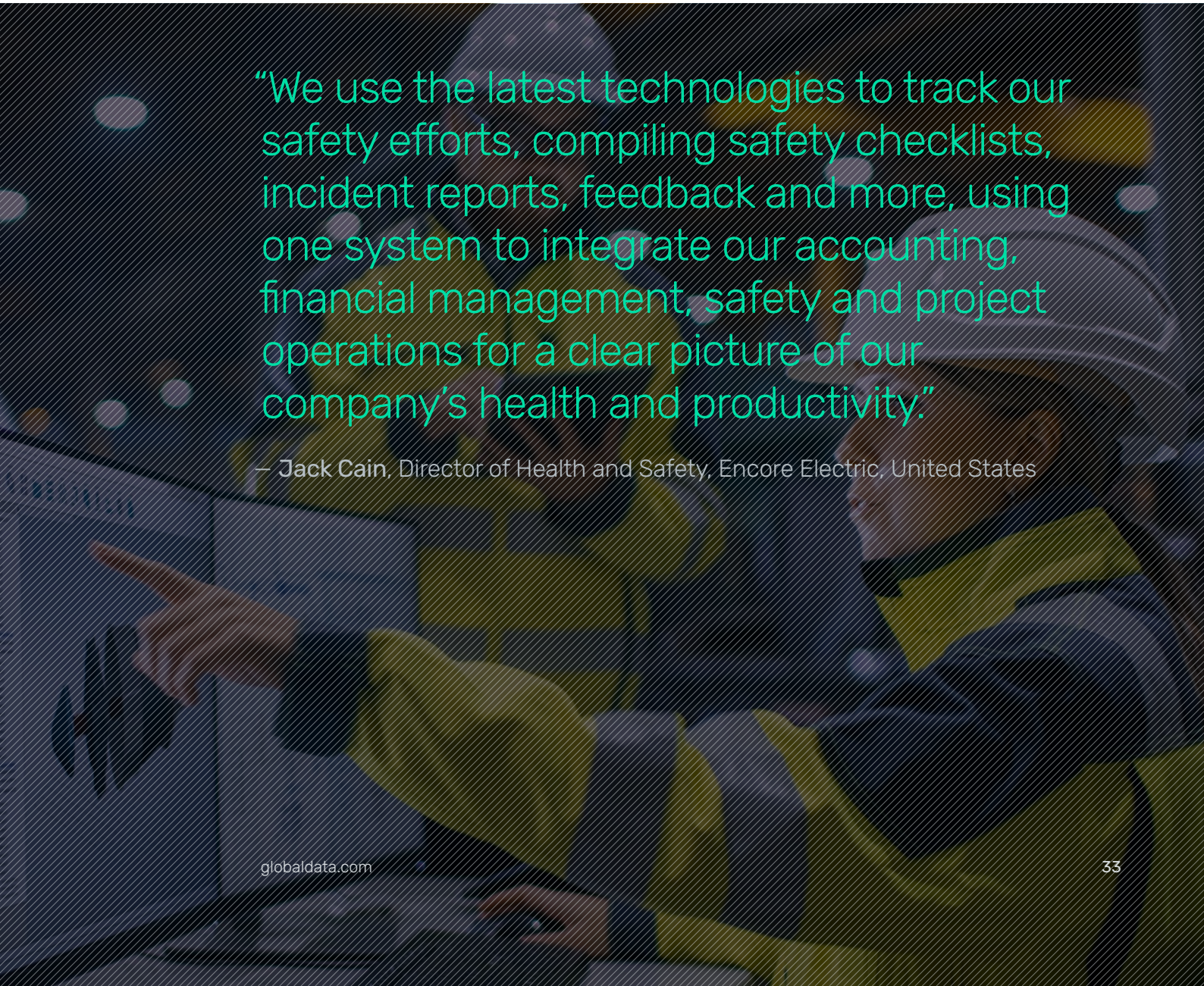
"Each piece of surveyor equipment tends to come with its own software, which I don't have a problem with. The issue is that nothing integrates very well together, so when we are trying to pull in survey information from different software packages, it doesn't always bring in all the information we need. For example, it might pull in certain data points but leave behind relevant metadata. If all the different software talked to each other, if we could have a centralized solution that could integrate all the different technologies used for surveyors, that would be ideal, but for me that's a sort of a utopian vision."

— Surveyor, Myleasehold Ltd, United Kingdom

Nevertheless, several KPIs can be considered for particular attention, including cash flow, the number and value of contracts won, and the contract price per project. They also include KPIs related to labor and employment, including new net hires, employee churn and termination rates, productivity, and the average employee tenure. Other KPIs can help construction firms identify project backlog and the balance of net new jobs versus pending and closed jobs. Others still include requests for information (RFIs) and responses, the number of change orders, environmental indicators, and safety inspections.

However, measuring data is not enough. KPI metrics should be analyzed to provide correlations between activities and provide better insights into projects. One important goal should be to make better use of historical data to enable long-term trend analysis. Technology can also be used to make data more visible and available within a construction business. Both historical and real-time data can be combined with machine learning to enable predictive analytics. This can be applied to a range of things, including related to things such as construction site safety or the potential cost and profitability of construction projects.

Benchmarking can help contractors set long-term goals and measure themselves against other contractors or industry standards. Using stronger reporting or analytical tools that cloud construction suites can provide, understanding, setting, and achieving these benchmarks can be a simpler practice yielding deeper results. Identifying and hitting strong benchmarks can also help build better brand reputation and open up potential new business and growth channels. In the long term, prospective clients could come to expect access to KPI-based performance data and use that information to make hiring and contract decisions.



"We use the latest technologies to track our safety efforts, compiling safety checklists, incident reports, feedback and more, using one system to integrate our accounting, financial management, safety and project operations for a clear picture of our company's health and productivity."

— **Jack Cain**, Director of Health and Safety, Encore Electric, United States

The path to more profit

> We all have access to the same data regardless of where we are. Let me share this with you, we have more expertise in Singapore than France, let alone Nigeria. In Singapore they run very large simulations that could do incremental timestamp, that takes a lot of days on normal computers. So, we work with them and ensure that it should be able to run those simulations in a couple of minutes. It's not the same with Nigeria. Basically, in Nigeria, we have only engineers who probably work on normal design software, and they don't run very large simulations like the guys in Singapore, but indirectly, we all still use it, and we all benefit, because it's still on the cloud."
>
> *– PROJECT MANAGER, OFFSHORE ENERGY COMPANY, NORWAY*

A truly interconnected technology stack, which ties together all the company's data and business intelligence on a single platform, and which is consumed as a cloud or usage-based service, enables construction companies to achieve greater operational efficiencies across their business. These efficiencies, in turn, can help firms achieve their ultimate goal of increasing revenues and improving profit margins.

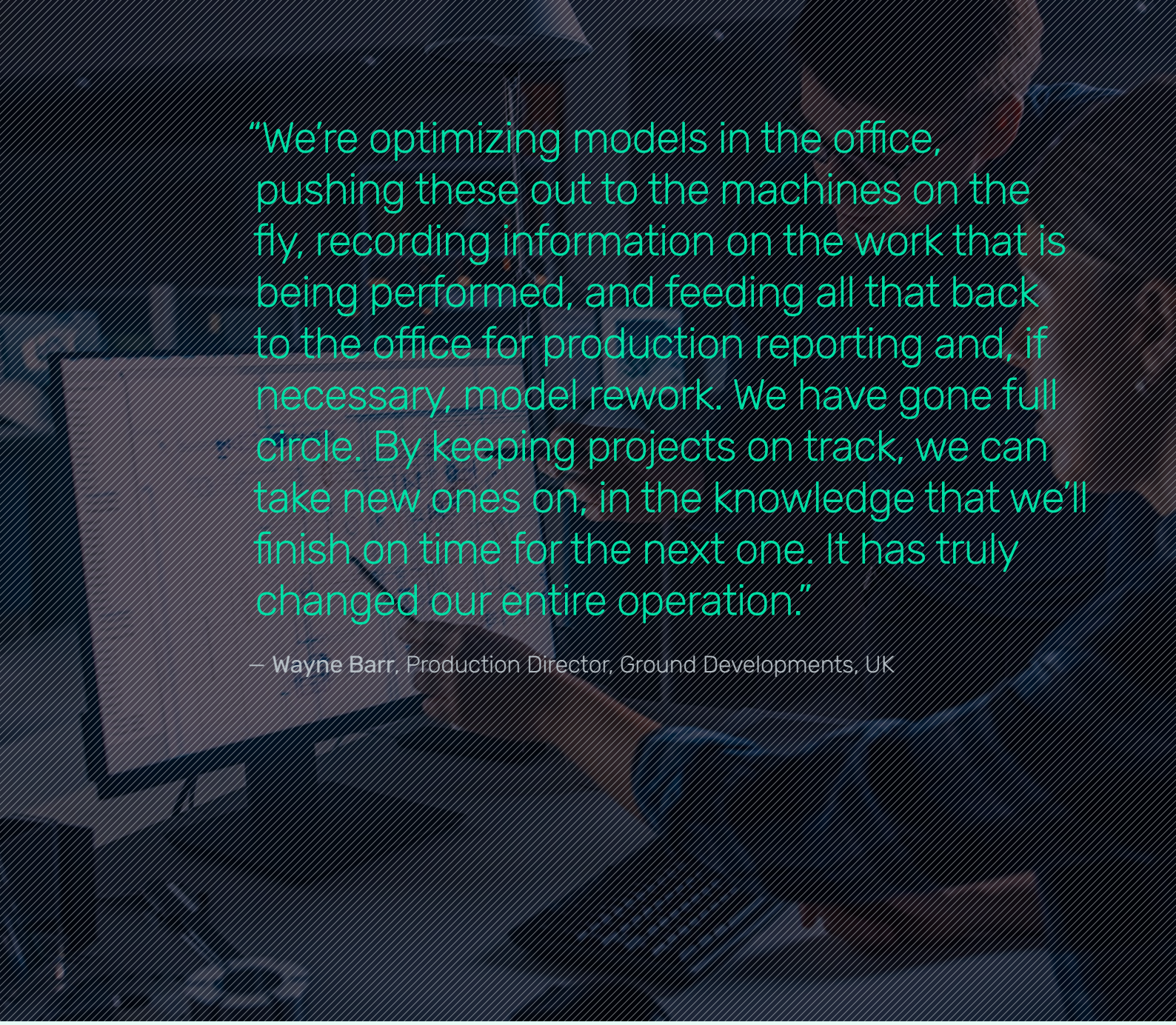
> An integrated solution would be a good tool, it will allow us to monitor the construction work whilst it will allow the finance guy to do his work monitoring all the budgeting and then do the time writing and everything."
>
> *– PROJECT MANAGER, OFFSHORE ENERGY COMPANY, NORWAY*

Legacy and disconnected technology platforms that are unable to interact effectively with one another, together with manual business processes, do not just slow companies and projects down; they also eat into a company's profit margins. In contrast, having a connected approach to your construction business via a single technology platform provides real-time data, enhances collaboration, and reduces costs from rework, project delays and material waste – all which contributes to profit fade.

> Integrated solutions surely increase efficiency, you know, you change something in your CAD model, and then it changes your bill of materials and that notifies you, that updates on your schedule, that updates in your procurement and your system without any issues, and it gets notifications and communicates… yeah that's a no brainer. I'm surprised nothing like that already exists on the market, I haven't seen it."
>
> *– DIRECTOR, ATWELL, UNITED STATES*

The increased visibility, clarity, accuracy, and collaboration made possible by having a common, shared data environment for an entire business will ultimately improve workflow efficiencies and ensure higher rates of successful, timely project completion. A connected construction experience in which different business processes and departments have access to a single source of business intelligence can help manage business resources more effectively and reduce resource waste. It can also help avoid unnecessary rework, which can account for a significant share of the total average project cost, and usually results from departments or individuals not having the right information they need, when they need it.

A connected construction experience has potential to deliver more projects in full, on time, in spec, and within budget, resulting in increased revenues and improved profit margins for your business.



"We're optimizing models in the office, pushing these out to the machines on the fly, recording information on the work that is being performed, and feeding all that back to the office for production reporting and, if necessary, model rework. We have gone full circle. By keeping projects on track, we can take new ones on, in the knowledge that we'll finish on time for the next one. It has truly changed our entire operation."

— Wayne Barr, Production Director, Ground Developments, UK

Your definitive guide to adding new construction technology

Considering a construction software or technology upgrade? This 'buyers' guide' has everything you need to know to ensure your technology transformation goes as smoothly as possible:

PRACTICAL GUIDE TO SELECTING CONSTRUCTION SOFTWARE

https://www.viewpoint.com/resource-library/ebooks/practical-guide-to-selecting-construction-software

One important factor to consider is the type of licensing model that will best serve the construction firm's needs. Among construction companies that are already using modern technologies to manage key business processes, many of these involve fixed investments in solutions that are owned, managed, and maintained by the construction firm. A much smaller number of construction firms rely on the cloud delivery model for their technology requirements in any substantive way, if at all. Even when a construction firm already recognizes the potential benefits of a subscription- or cloud-based approach to consuming technology, the decision to move to a new consumption model can still be challenging for companies that have yet to experience its benefits.

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