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Construction
and Engineering

The State of Construction Project Management Technology

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THE CONSTRUCTION INDUSTRY IS RIPE FOR DISRUPTION

Today, the construction industry faces both great opportunities and great risk. Oxford Economics' Global 2030 forecast predicts that construction will grow more than 4 percent annually over the next 15 years. In the US, the news is even better: the construction market is projected to grow 6 percent per year, reaching US$1.5 trillion by 2020.

At the same time, however, big construction projects are taking longer to complete and exceeding their original budgets more than ever before. According to the McKinsey Global Institute, capital projects take up to 20 percent longer to finish than scheduled and run as much as 80 percent more over budget.

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A key reason is that construction firms are often slow to adopt technologies that would enable them to cash in on this growth. Through their failure to optimize project portfolios and streamline delivery techniques, global firms leave more than US$1 trillion on the table every year, according to McKinsey.

CHALLENGE AND PROMISE IN THE CONSTRUCTION INDUSTRY

A 2016 survey by Aconex (acquired by Oracle in June 2018) reveals that similar patterns hold true across US construction firms. The survey polled more than 70 US-based firms that handle projects ranging from under $10 million to just over $100 million. It revealed that organizations face three key challenges:

- **Establishing a single source of truth,** or a reliable source of information all project partners can draw from

- **Ensuring solution flexibility** by integrating technology into day-to-day processes

- **Standardizing portfolio management and reporting** by applying standardized processes and measuring performance across a portfolio of projects

Similarly, the greatest promise lies in technologies that are just beginning to take hold, such as:

- **Cloud-based project management platforms** that give you instant access to all project information from any device, so you can take action much faster.

- **3D building information modeling (BIM)** that enables you to construct a building as a computerized 3D model before a single piece of rebar is placed, so you can make changes and correct mistakes without wasting labor or materials.

- **Big data analytics** that give you a high-altitude view of your projects, so you can anticipate potential problems and make better decisions.

Construction firms are embracing these new technologies, but at different speeds and levels of sophistication. Understanding and evaluating your own organization's technological maturity is the first step toward digital transformation.

Using data from the 2016 survey, this white paper outlines the three biggest challenges construction firms face today and the greatest opportunities for transformation. It also includes the top eight questions to be answered when evaluating construction management technology.

TOP TECHNOLOGY CHALLENGES

Challenge #1: Create a Reliable Single Source of Truth Across Organizations

From back-office management platforms to mobile apps to equipment sensors, construction is increasingly a data-driven business. Whether you are a subcontractor submitting payment applications or an owner of a billion-dollar infrastructure project pushing RFIs downstream, there are two constants: the rate at which project changes occur and the rate at which information is captured. But that information is rarely shared effectively among project participants, leading to delays, legal disputes, and financial losses.

Survey data bears this out. More than 90 percent of construction professionals responding to the survey believe it's important to maintain secure and undisputed records between project members, but 66 percent of them have yet to achieve this.

More than 40 percent report difficulty finding information, tracking issues, and holding subcontractors and partners accountable. Nearly 60 percent are challenged by poor communication and collaboration between project owners, contractors, and consultants. For over 33 percent, a lack of correct information leads to mistakes, delays, and rework that end up costing money.

Firms can mitigate these difficulties and do a better job of keeping projects on track if they establish a single source of truth across key contractor processes such as budgeting and forecasting, contract change management, site inspections, and scheduling. But according to KPMG's 2016 Global Construction report, only one in five contractors uses a single, fully integrated project management information system (PMIS) across their entire organization. Per the June 2016 report by McKinsey & Co, "the industry still relies on bespoke software tools. In addition, project owners and contractors often use different platforms that do not sync with one another. As a result, there is no single source that provides an integrated, real-time view of project design, cost, and schedule."

The Bottom Line

Digitization is unavoidable, but US construction firms need to take the lead in adopting an integrated construction management platform to streamline project communication, increase efficiencies, and create a single source of truth.

Thirty-seven percent of firms use point solutions whose data must be integrated. That takes significant time and IT resources, and it may take years to recoup that in increased productivity.

Challenge #2: Align New Technology Tools with Existing Processes

The survey respondents understand the benefits of adopting technology: nearly 75 percent want technology to improve budget management, cost cutting, and contract handling. But they also want it to work the way they do.

An overwhelming 96 percent say new technology tools need to be flexible enough to work with their own internal processes.

Problematically, less technologically mature contractors still rely on a hodgepodge of off-the-shelf solutions that don't communicate with each other. According to JB Knowledge's 2016 Technology Construction report, 25 percent of construction organizations use five or more software tools to manage their business. More than a third of these applications don't integrate with any others. Half the time, project managers must manually move data between them, using email or paper. The resulting

administrative overhead saps profits without contributing to design and construction processes.

More technologically mature organizations using a construction management platform face a different issue. In seeking a turnkey solution, contractors sacrifice the ability to configure the software to their unique workflows. Unfortunately, the majority of today's technology vendors do not offer both.

Challenge #3: Driving Standardization Across a Portfolio of Projects

Contractors almost never work on one project at a time. Nine out of ten contractors surveyed say managing a portfolio of projects is critical to their success, and more than three quarters of them say this is a significant concern.

One big benefit of adopting a portfolio view is taking the lessons learned from completing one project and applying them to the next; this saves time and avoids mistakes that arise from having to reinvent the wheel on every new project. Applying standard processes and procedures across projects introduces immediate control and delivery discipline, improves efficiency, and reduces costs.

Unfortunately, construction lags behind other industries in standardization. According to PM Solutions Research, only 34 percent of construction firms have a project portfolio management (PPM) process in place—lagging behind telecommunications (55 percent), manufacturing (66 percent), and healthcare (76 percent). One key challenge of portfolio management is maintaining consistency across project reports, especially when using multiple tools to manage projects. The tools might be designed for a specific vertical or level of complexity, which means not all project stakeholders can take advantage of them. A unified, party-neutral platform that captures all the relevant data in one place offers the most flexibility for managing a disparate project portfolio. A recent survey of US contractors using Oracle Aconex Cloud Service revealed that the biggest pain point they wanted to resolve was the use of different project management tools on every project.

KEY TRENDS

The construction professionals surveyed are focused on the bottom line and keenly interested in cutting costs and gaining efficiencies through standardization and improved collaboration. But many are less aware of changes to the technological landscape that could dramatically affect their future success. They may be unprepared for an increasingly digitized, mobile, data-driven future. Here are three key trends that will radically transform the construction industry over the next decade.

Trend #1: An Always-Connected World

These days nearly everyone carries a smart phone with a 24/7 internet connection, but most contractors are using only a fraction of the device's capabilities on the job. While nearly 80 percent of survey respondents use mobile solutions to improve collaboration and efficiency between the construction site and the back office, only one in four rates this as a big concern. The 73 percent who see this as minor issue may be underestimating how much mobile technology is changing the industry.

A 2013 study of information mobility by Dodge Data & Analytics found that contractors benefited most from the move to mobile devices, citing improved communication and collaboration, as well as the ability to access key project documents stored in the cloud from the job site.

As a whole, the construction industry is slowly waking up to the importance of connectivity. According to JB Knowledge, the percentage of contractors who considered mobile technology important rose from just under 60 percent in 2012 to around 80 percent in 2016. The most popular smartphone application remains the camera, used for photo documentation on job sites. Less than half of those surveyed by JB Knowledge use their phones for data collection, time entry, daily reporting, or safety inspections.

Bottom Line

When software can't adapt to a contractor's business, performance suffers. And if the technology isn't relevant to their partners' day-to-day needs, the partners simply won't use it. Then, the contractor's technology investment isn't delivering the return it should.

Bottom Line

To maintain flexibility, reduce risk, and unlock the performance improvements born of project-to-project learnings, construction firms need to take a portfolio-wide view across all of their projects.

Trend #2: Building Information and 3D Modeling

Only 40 percent of survey respondents say the requirement to use 3D models and BIM systems presents a challenge to their organizations. Just 3 percent of respondents said they had a BIM solution in place; 80 percent said it was a matter of little concern.

However, research shows that deploying 3D models to design and modify project plans, fabricate parts, and use as a central repository of information can dramatically boost project success.

According to 2015 study of more than 300 BIM users by Dodge Data & Analytics, 70 percent reported fewer RFIs, 54 percent reduced the amount of waste material, 51 percent got projects done more quickly, 48 percent were able to cut costs, and 25 percent reported fewer on-site injuries.

Construction professionals who ignore BIM will be at a disadvantage compared to competitors in the European market, where the use of Level 2 BIM for public infrastructure projects is mandated by a half dozen governments, including the United Kingdom and most of Scandinavia. Spain and France are expected to join them within the next two years.

Mandatory BIM use is also growing in the US, albeit more slowly. Some federal agencies—such as the General Services Administration, Army Corps of Engineers, and Department of Veterans Affairs—now require BIM at some level. Globally, BIM use is expected to grow by a compound annual rate of 21 percent through 2022, reaching nearly US$12 billion in sales by 2022.

Trend #3: Big Data and Predictive Analytics

Many contractors are not yet aware how much it costs them to resist adoption of a single unified platform for their entire project portfolio; they don't realize the efficiencies to be gained. Once they standardize and combine data collection, they can use the patterns that emerge to evaluate project partners' performance, predict outcomes, and boost productivity.

Many companies are already making gains from crunching large data sets. The case study graph illustrates the results since one international contractor standardized their portfolio of projects on Oracle Aconex Cloud Service in 2005. It has consistently driven operational excellence, reducing both its process cycles and mail response times through visibility and insights into processes. With it, the company can optimize and standardize processes across its portfolio. The single platform enables the contractor to keep its projects moving while implementing lean process improvements companywide. Some additional benefits include workforce mobility, faster subcontractor and supply chain ramping, prompt performance analysis, and a significantly reduced risk profile compared to doing things differently on each project.

Researcher Joseph K. Shrestha, professor of Civil, Construction, and Environmental Engineering for Iowa State University, notes that big data and predictive analysis can be used for "predictive schedule analysis, performance evaluation of the subcontractors for large construction companies, [and] improving safety of the construction work zone."

Yet this remains largely off the radar for most construction professionals. A 2015 survey of more than 600 industry professionals by Sage Construction found 72 percent were unfamiliar with the term *big data*, and only 6 percent could explain what it meant.

Bottom Line

A technology solution that doesn't have mobile at its core is a partial solution at best. More importantly, it doesn't enable frontline risk management—equipping field workers with the right information so they can make decisions and act faster on the job site.

Bottom Line

BIM and 3D modeling offer clear cost and time advantages to early adopters and will rapidly become a requirement for major infrastructure projects.
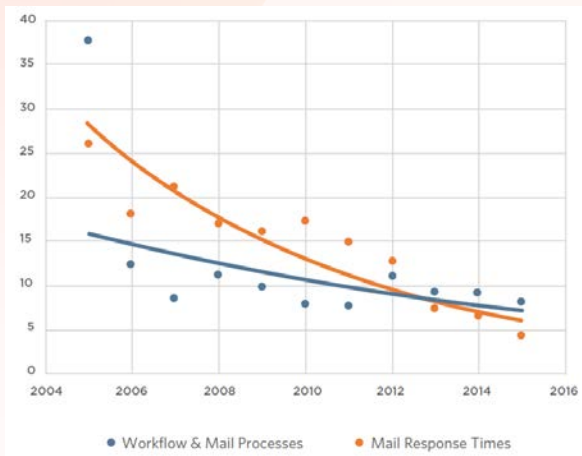
Figure 1. Data showing improvement in workflow processes and mail response times as a result of using the Oracle Aconox collaboration platform

CONTRACTOR MATURITY IS KEY

Data from the survey shows the potential for disruption across all segments of the construction landscape. The key differentiators between winners and losers over the next 15 years will be the willingness to adopt new technologies and adapt to changing circumstances. The crucial factor is the level of technological maturity each contractor has achieved.

1. Manual

At the most basic level, many contractors' technology use is virtually unchanged over the last 10 to 20 years. They use paper, email, and spreadsheets to manage project communication across RFIs, change orders, bids, submittals, drawings, payment applications, site instruction, and forecasting. They've invested in technology for corporate purposes such as finance and accounting, but typically don't use project management tools.

As a result, these organizations waste precious resources shuffling paper, searching for information, and chasing down individuals to get status updates. Errors are common, documents get lost, and disputes inevitably arise. With no way to accurately measure many key performance metrics, these organizations never improve.

2. Siloed

These organizations recognize the potential of technology and usually have implemented some form of project management software, but they still rely on multiple point solutions for activities such as planning, contract management, or site inspections. These applications often don't talk to each other, which means each organization's IT staff spends a lot of time and money struggling to integrate systems after the fact. It may take months to get the system up and running, and years to map it to the company's unique processes. And without a party-neutral single source of truth, companies continue to be plagued by disputes.

3. Transforming

Most contractors aspire to reach this level. Here, project collaborators are all connected on a single technology platform, sharing information freely among different partners and across different departments within the same company. They can identify high-performing subcontractors, standardize processes, and continuously improve—cutting time and waste out of each process. Adopting a

Bottom Line

Big data has the potential to reveal cost, productivity, and safety gains not yet imagined—but only if companies implement systems that can capture and analyze this data across their key processes.

"With Oracle Aconex Cloud Service, we save time because it's easier to find information and export reports. It also has a user-friendly setup."

Document controller
Large enterprise construction company

connected construction management platform offers organizations visibility across a portfolio of projects, enabling them to make better strategic decisions and get warned before little problems turn into big ones.

SELECTING THE RIGHT CONSTRUCTION MANAGEMENT SOFTWARE

Not all connected platforms offer the same benefits. Before you make a decision about which one to adopt, you need to answer these eight questions.

1. Is it easy to learn and use?

Connected platforms are most effective when everyone—from project managers to site supervisors—uses them. If the software isn't simple and intuitive, many in your organization will simply ignore it and continue to do things the way they always have. Cloud-based systems often indicate a modern interface, because updates and new functionality are rolled out more frequently. Less obviously, easy-to-use technology helps you attract talent. Tomorrow's construction workforce grew up using intuitive, mobile applications and will expect nothing less as they enter the field.

2. Does it offer a single, integrated platform inclusive of your key processes?

The real power of construction management software comes from its ability to create a single source of truth that all project participants can access. The platform should include most of your key processes, with the ability to integrate to other systems when needed. More data capture enables greater visibility into bottlenecks and project progress, so you can take action faster. A collection of point solutions that must be stitched together on the back end does not offer the same power and flexibility. Need a checklist?

KEY PROCESSES FOR AN INTEGRATED PLATFORM	
Contract management	Plan management
RFIs and change orders	Project cost management
Transmittals and submittals	Project scheduling
Design and shop drawing reviews	Handover to operations and maintenance
Inspections, quality, and safety	Project reporting
Bids and tenders	Estimating
BIM	Accounting
Daily site reports	

3. Is it neutral, with security by default?

Before project members begin using a new system, they must trust that their data is secure. Look for a technology partner whose security model ensures that uploaded data is private to that organization until shared with others.

Unfortunately, most vendors expect the system implementer to set up the correct permissions on each

"We incorporated Oracle Aconex Cloud Service into our enterprise software toolbox. As the company executive responsible for making this happen, I'm encouraging all facets within our organization to fully utilize the platform."

Executive Director
Fortune 500 construction company

"We provided a neutral platform to more than 1500 outside organizations with great success."

Lisa Dorrance
Program Manager
Regional Transportation District

84 percent of US contractors surveyed agreed with the following statement: Oracle Aconex Cloud Service is easily configurable as a project management solution.

new project. This increases the risk of the wrong information getting into the wrong hands. The other component of neutrality is that no super user can alter or delete the trail of communication or documents shared between organizations. Without neutrality, project members will keep duplicate records to protect themselves from potential litigation, which creates multiple versions of the truth. Other simple security questions are: Is the technology ISO 27001 certified? Is there a two-step verification process? Data security is job one, and the platform should provide an indelible audit trail that helps you build trust with your supply chain.

4. Is it flexible and scalable across your portfolio?

Some contractors want a platform that works straight out of the box, with minimal tweaking, so they can get an upcoming project up and running fast using minimal IT resources. Others want the ability to configure software to their unique business processes, especially for high-volume processes. The ideal platform allows you to do both, with a focus on fast and easy workflow configuration. It should also support different types of projects—including different delivery models, contract types, level of complexity, and project size—so you can report across your diverse portfolio, standardize processes, and extract project learnings or best practices for continuous improvement.

5. Is it designed with mobility in mind?

The ability to quickly share information between the back office and the job site is essential. The platform must include mobile access and apps for all its core processes to support your field team, enabling you to reach the right decisions faster. Empowering job site workers starts with ensuring they can access the right information when they need it, to take action faster and minimize delays.

6. Does it allow you to manage insights at every level—process, project, and portfolio?

A platform should give you insight into your day-to-day processes—so you can take action on bottlenecks and stalls—and also extend those insights across multiple projects. The platform should provide visibility at every level, so project controls managers can build and customize reports without assistance from a technology expert.

7. What types of service, training, and consulting are provided?

Construction management is an extremely complex endeavor with many moving parts. Even the best, easiest-to-use software can't anticipate every situation. Seek a platform vendor that offers multiple support options, both onsite and online, 24/7.

Beyond user support, pay close attention to how the vendor engages you during the buying process. Does the sales team take time to understand your processes and needs? Software mapped to your workflows helps ensure a successful implementation. The up-front investment will minimize future support requests, saving you time and frustration down the road.

8. For contractors bidding on government projects, does it meet security requirements?

Governments around the world face increasing threats to cybersecurity from a wide range of sources. In response, they have implemented higher compliance specifications for information and communications technology (ICT) services.

"Oracle Aconex Cloud Service increased our efficiency. We can access our filed documents in a timely and safe manner. Creating reports is easy, not stressful. It's also easy to collaborate with outside clients and stakeholders while we control what they can see or have."

Document controller
Large enterprise company

91 percent of surveyed customers rate the mobile access and mobile apps from the Oracle Aconex cloud platform as better than other solutions.

"Oracle Aconex Cloud Service provides good customer support, a simple user interface, and a product that does what it is promoted to do."

Project engineer
Large enterprise construction company

In the US, government agencies have been directed to FedRAMP, a standardized approach to security assessment, authorization and continuous monitoring for cloud-based products and services. When engaging potential technology partners, confirm they are FedRAMP certified or in the process of becoming certified.

97 percent of surveyed construction customers rate the security and performance of Oracle Aconex Cloud Service as better than other solutions.

INDUSTRY-LEADING PROJECT MANAGEMENT AND COLLABORATION TECHNOLOGY

Oracle Aconex Cloud Service manages information and processes for the world's largest construction and engineering projects. With more than 6 million users and more than US$1 trillion of project value delivered in 70 countries, it is the industry's most widely adopted and trusted platform.

The platform gives owners and contractors projectwide visibility and control between the many different organizations collaborating across their projects. The solution is rich in features that support industry processes and it meets or exceeds customers' internal security and data management standards. Oracle backs the platform with unmatched client service that ultimately drives user adoption, maximizes return, mitigates risk, and promotes project success.

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