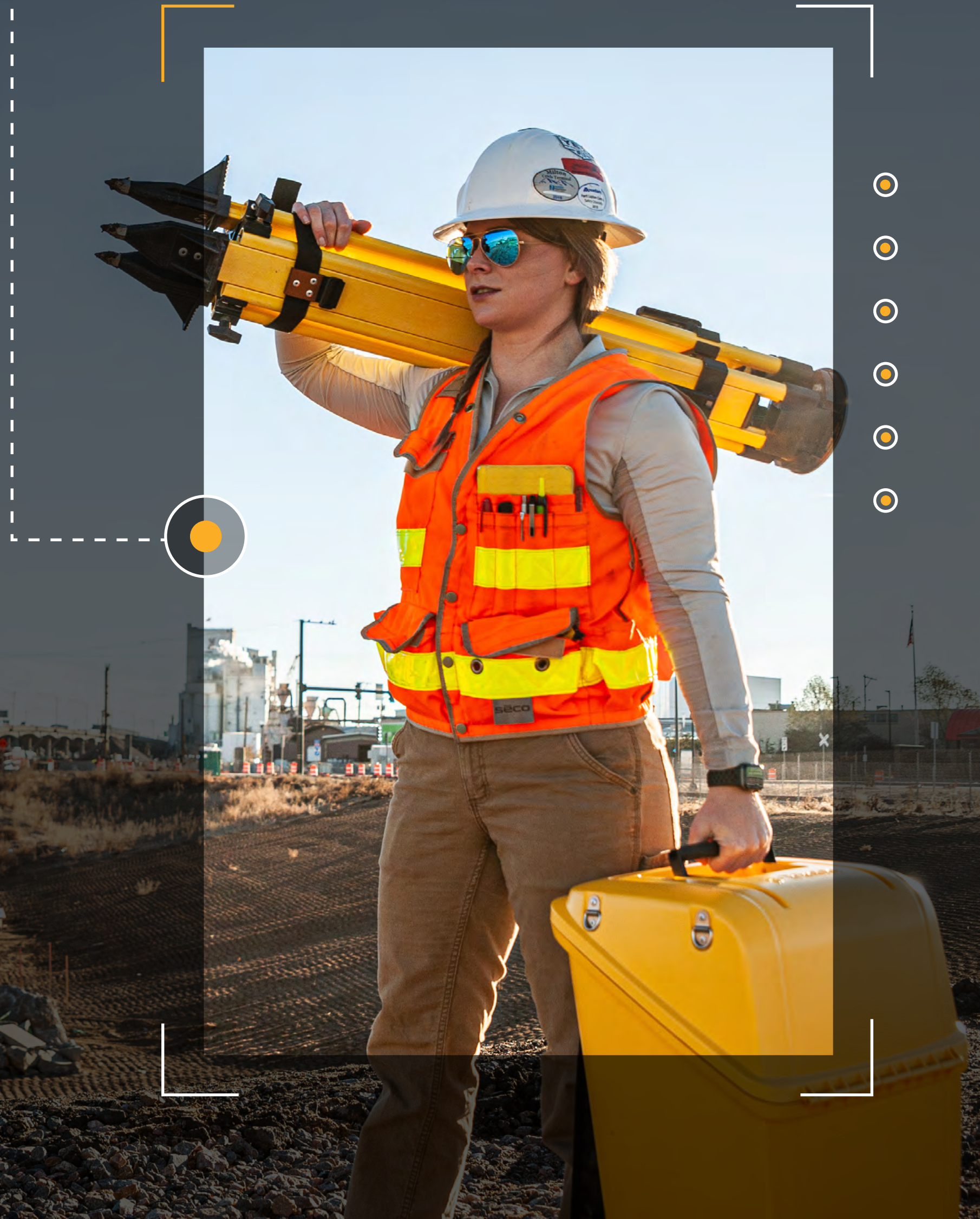




How to Get Started with
Connected Workflows

A GUIDE FOR CONSTRUCTION TECHNOLOGY LEADERS



Technology Delivers Building Blocks but Also Roadblocks

From reality capture and positioning systems to tablets and common data environments (CDE), digital technology touches nearly every corner of the modern construction project. Understanding how, when and where to use technology is crucial. Companies that get the equation right operate more efficiently and cost-effectively. In a best-case scenario, they're able to achieve transformative results.

Construction technology leaders recognize that digital technology plays an integral role in advancing their business.

According to a 2022 study conducted by Trimble and Dodge Data & Analytics:¹

69%-86%

of AECO organizations that currently have a low level of digital adoption plan to invest in digital workflows.

62%-83%

that have a high level of digital adoption plan to continue investing in technology.

This includes areas as diverse as design review, materials/inventory management, document management, bidding/procurement, structural analysis and calculations, and model-based take-offs and estimates.

Make no mistake, digital workflows that connect people, data and machines unlock significant value for construction firms.

^{1,2} Dodge Data & Analytics and Trimble Construction, [Connected Construction: The Owners' Perspective](#), [Connected Construction: The Architects' Perspective](#), [Connected Construction: The Engineers' Perspective](#), [Connected Construction: The General Contractors' Perspective](#), [Connected Construction: The Specialty Trade Contractors' Perspective](#), 2022.

The same Trimble-Dodge study found that:²

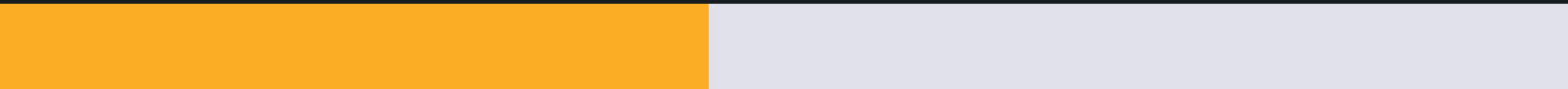
65% of organizations realize efficiency gains for internal processes.



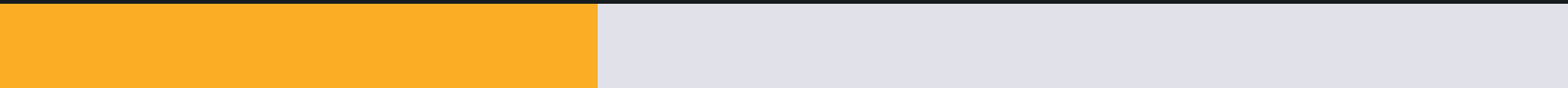
61% improve decision-making.



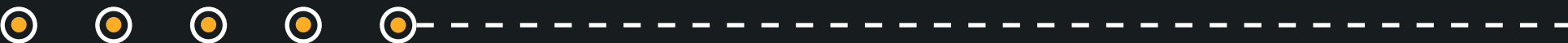
Among larger companies, 45% see increased efficiency for multi-company processes, and



38% report reduced changes during construction.



But that's where things get difficult. Simply adding technology to the mix doesn't necessarily unlock maximum value. It's all about how a business uses various tools, technologies and solutions together—and how they synergistically create advantages.



A common problem in the architecture, engineering, construction and operations (AECO) industry and beyond is that the quest for faster, cheaper and easier ways of working leads to a chaotic array of point solutions that rely on different data sources, formats, schemas and standards. The number of applications can easily reach into the hundreds or even thousands.

The result is a company that achieves only incremental gains when much larger gains are possible. Instead of witnessing breakthroughs in improved decision-making, total cost of ownership, sustainability or profitability, an organization winds up with silos of digital processes and data—along with duplication and errors.

As a supply chain or business ecosystem expands, the challenges escalate and technical debt accumulates. Worse, different design, construction and business users cannot access essential data in the right format and on the right device at the precise moment it's needed.

Standalone point solutions can transform a single workflow, but transforming how your teams collaborate, how you deliver projects and how you run your business requires bigger thinking.



Paving a Path to Progress

Organizations that tap into connected construction, which in its simplest form means integrating data across the project lifecycle, are able to make big process improvements in the areas that matter most:



Increased productivity



Higher levels of profitability



Reduced rework



Improved safety



Enhanced forecasting models



Stronger security



Improved budgeting



Improved regulatory compliance

These gains take place across business models, project types and business initiatives. They encompass conventional and progressive design-build, digital project delivery, public-private partnerships, integrated and high-performance value chains, new products and services, and horizontal and vertical integrations.

As an organization becomes more connected, it's equipped to fully leverage augmented or virtual reality, optioneering, digital twins, automation, AI and other advanced technologies. It evolves from reactive reporting to predictive and prescriptive analytics. All of this leads to a higher level of collaboration and transparency across stakeholders—and the ability to act and react faster to changing conditions. This digitally agile enterprise is equipped to address the opportunities and challenges that technology delivers.

This eBook will guide you through the steps required to start on your connected construction journey. It focuses on practical strategies and components revolving around:

GOALS

DATA

WORKFLOWS

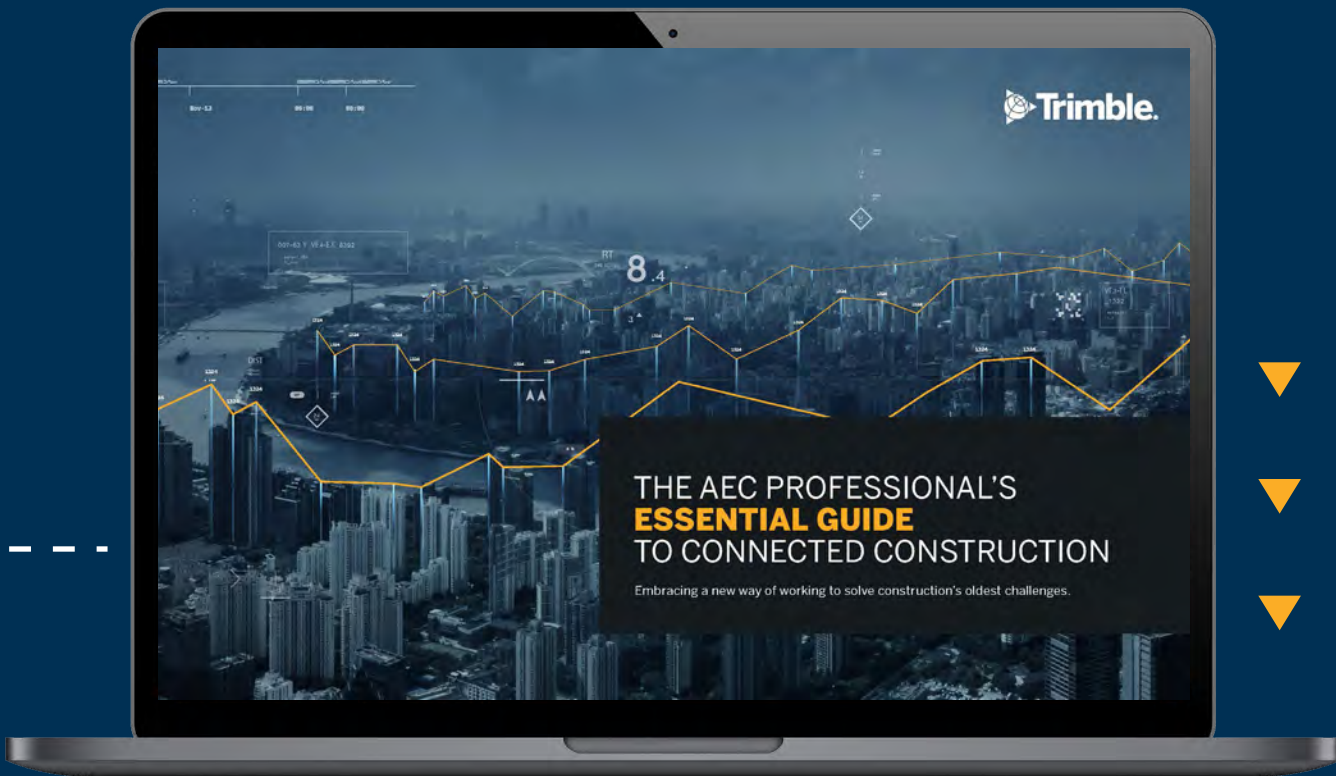
PEOPLE

SYSTEMS

This structure serves as a blueprint for digitizing and connecting workflows across an owner, architecture, engineering or contracting firm. In the following pages, you will learn about best practices and proven ways to construct a path to predictability and profitability.



New to connected construction?
Start here for basic definitions and use cases.



Common Pain Points

Here are some warning signs that you aren't taking advantage of digital connected workflows.

- + Time-consuming file and data management
- + Slow response time to RFIs
- + Scope misalignment with clients, vendors and other stakeholders
- + Frequent rework and changes in the field (20% of large projects wind up behind schedule³)
- + Difficult to determine the impact of a design change
- + Low cost predictability (only 31% of projects come within 10% of budget⁴)
- + Misalignment between labor, materials, equipment and schedules
- + Disappointing labor productivity
- + Inability to trace the root cause of errors or delays
- + Dark data that can't be used to improve project or business outcomes

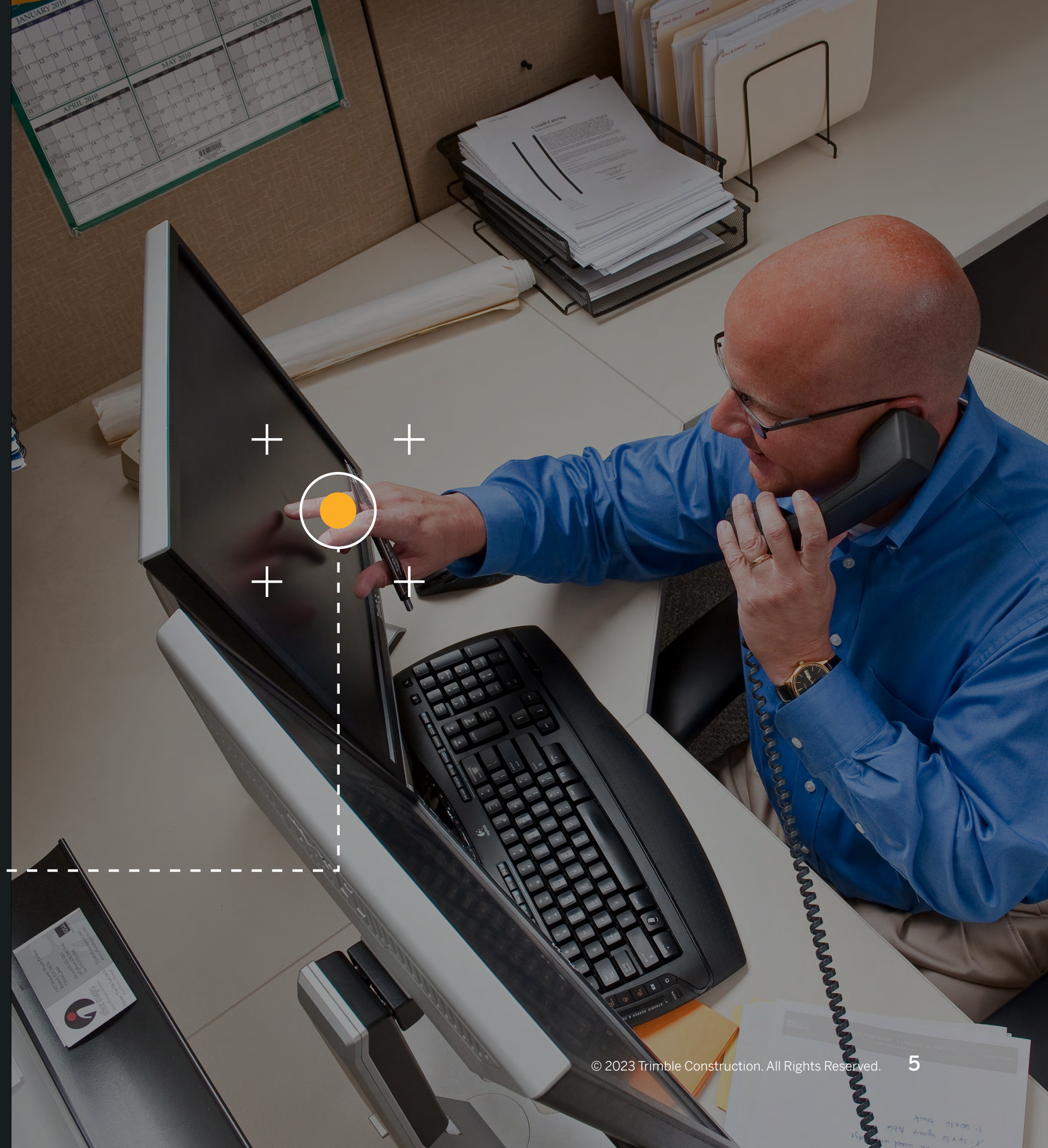
Benchmark Yourself Against Your Peers

Are you keeping up with digital workflow adoption?

Learn more about how connected technologies can support best practices.

³ McKinsey & Company, "Imagining construction's digital future," 2016.

⁴ KPMG International, *Climbing the curve: 2015 Global Construction Project Owner's Survey*, 2015.



GOALS

Identify Your Objectives

The first step in becoming a connected digital enterprise is to understand what connected construction offers. Digitization delivers gains on three primary levels:



Good:
A solution that automates an existing process. This trims time and dollars by introducing a more efficient way to tackle the task.
Example: Using accounts payable software that automatically generates payments based on approved invoices



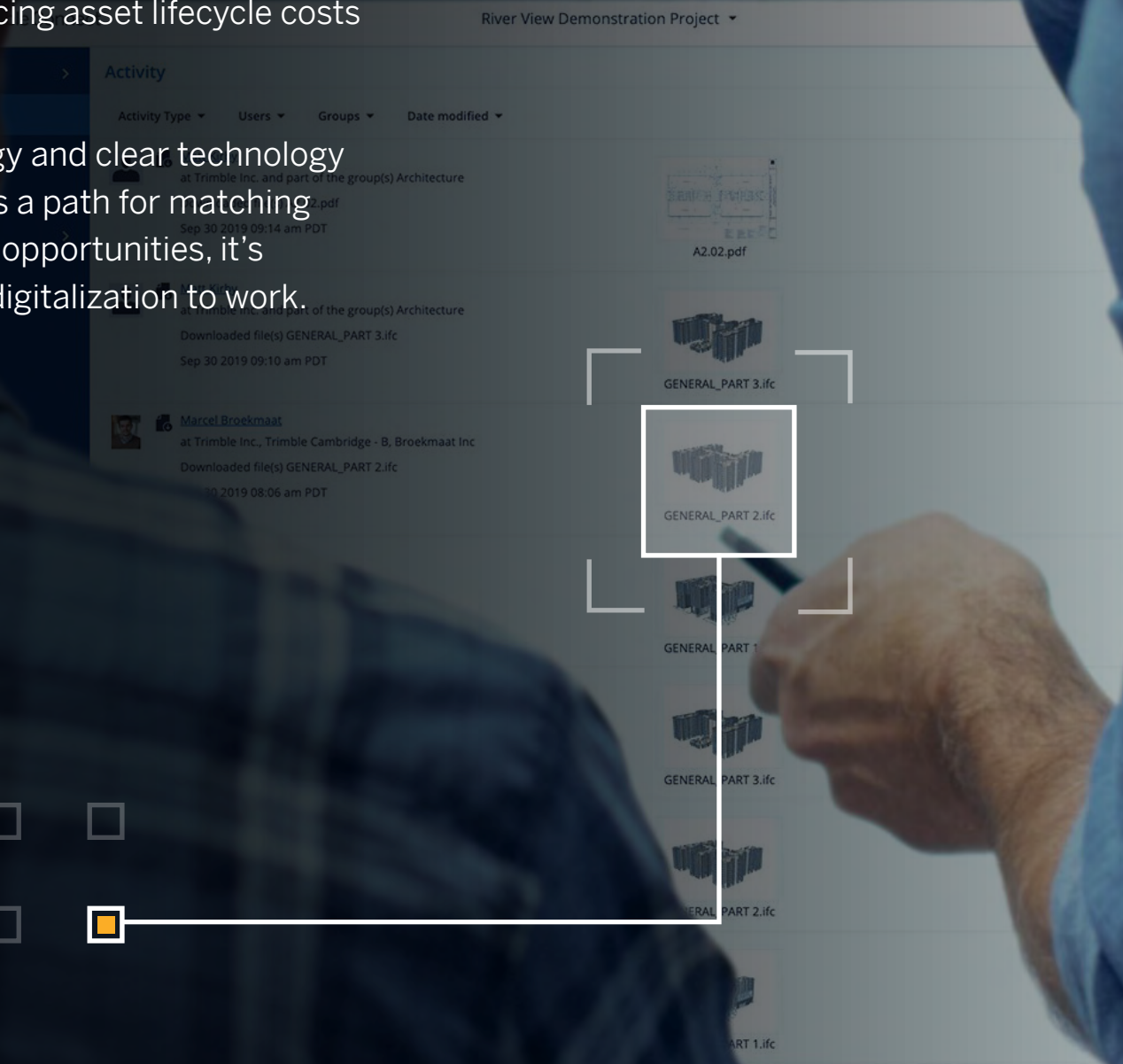
Better:
Software or hardware that significantly improves an existing process
Example: A 3D laser scanner that can capture the as-built conditions of your entire job site 10 times faster and with fewer people than using traditional methods



Best:
Technology that drives strategic business gains and innovation
Example: A cloud framework that allows teams to connect and collaborate in real-time—across offices, file types, vendors and geographic regions

A key to evolving as a company is to understand how to plug in technology in the right place and in the right way to achieve the desired objective and a competitive advantage. For example, a firm may want to eradicate data silos. Yet, how it approaches this task matters. Lowering costs by reducing manual touchpoints is beneficial, but the real value lies in gaining market share or reducing asset lifecycle costs through forecasting and analytics.

Success requires a business strategy and clear technology goals. Once your company identifies a path for matching technology with specific needs and opportunities, it's possible to understand how to put digitalization to work.



DATA

Establish a Solid Foundation for Managing Data

The second step toward becoming a highly digitized organization is to take stock of where you are and where you want to be. It's important to recognize that workflows are the way your organizational objectives play out. Data is the fuel that powers them. Consequently, it's vital to create a clear roadmap. **A best practice approach revolves around seven critical factors:**



Understand/identify your mission and goals.

It's essential to embed goals into benchmarks and KPIs. This might include: *Are profits in line with what we expect? Do processes require the number of labor hours we projected?* Learn more about how [Laing O'Rourke](#) and [Barton Malow](#) approached this process.



Prioritize technology projects based on the value they deliver to the entire ecosystem.

This step requires an analysis of individual projects and an understanding of what represents best-of-breed solutions. It's important to focus on technology at both the data flow and workflow levels. For example, [Ramboll Finland](#) has made day-to-day work easier for its designers on over 1,000 Quadri (a common data environment for infrastructure) projects.



Establish and deploy standards, rules and templates.

Next, it's important to document current systems, data formats, data format needs and standards. It's also crucial to identify so-called "dark data" that winds up inaccessible or overlooked despite the fact that it could improve decision-making and outcomes. Standardization and governance are critical. Many of Trimble's most innovative customers establish a governance office and team, along with a centralized data standards database capable of synchronizing data across systems and user personas.



Integrate IT systems and software.

With data standards, industry standards and workflow documentation in place, integrating systems becomes easier. At this point, it's a good idea to work with technology partners to fully understand their long-term strategy and roadmap—and ensure that the solution and the desired result are closely aligned. For example: *Can our firm deliver cumulative design data in an integrated way for use across construction processes? Does the data deliver insights into budget goals? Can our firm capture data that streamlines and optimizes future bids?*



Train teams to use the system.

Improving data standards and workflows establishes a framework for gains. Yet, it's vital to train teams to use new systems and workflows. The good news is that integration and automation simplify both processes and training. Award-winning [JLG Architects](#) trained its entire staff on building performance analysis software and created more than 200 energy models to meet their Architecture 2030 commitment.



Address custom development requirements.

As part of a broad industry trend, AECO firms are shifting away from custom development and adopting commercial off-the-shelf (COTS) solutions that deliver flexible data formats and adaptable workflow configurations. This allows Trimble and other technology partners to develop API-based scalable solutions that unlock value through custom integrations. For example, [Trimble and Microsoft](#) accelerate digital and physical world connectivity through a dedicated construction cloud.



Tap outside consulting expertise as needed.

As IT systems and cloud frameworks extend across companies, partnerships and alliances become essential. [Deloitte](#) found that 73% of engineering and construction firms with highly connected digital systems realize value. By contrast, only 27% that handle all development in-house report gains.⁵ [Trimble Consulting](#) works closely with other top consulting firms to build custom workflows. Trimble also taps several large channel networks that deliver field services, training and support.



⁵ Deloitte, [Ecosystem pathways for connected construction](#), 2021.

CASE STUDY

ASL Contractors Automates
As-Built Reporting Using
Trimble’s Construction Cloud

ASL Contractors, a Canada-based contractor known for earthworks, geothermal and landscapes, came to Trimble with an ambitious goal: To use as-built data to generate automatic reports and push notifications that keep site supervisors informed of the profitability of their site on any given day. By implementing the Trimble Earthworks Grade Control Platform and Trimble’s Construction Cloud, ASL has achieved its connectivity goals and is moving into gamification, exception-based reporting and more.

Watch the ASL case study



WORKFLOWS

Where Connected Workflows Matter

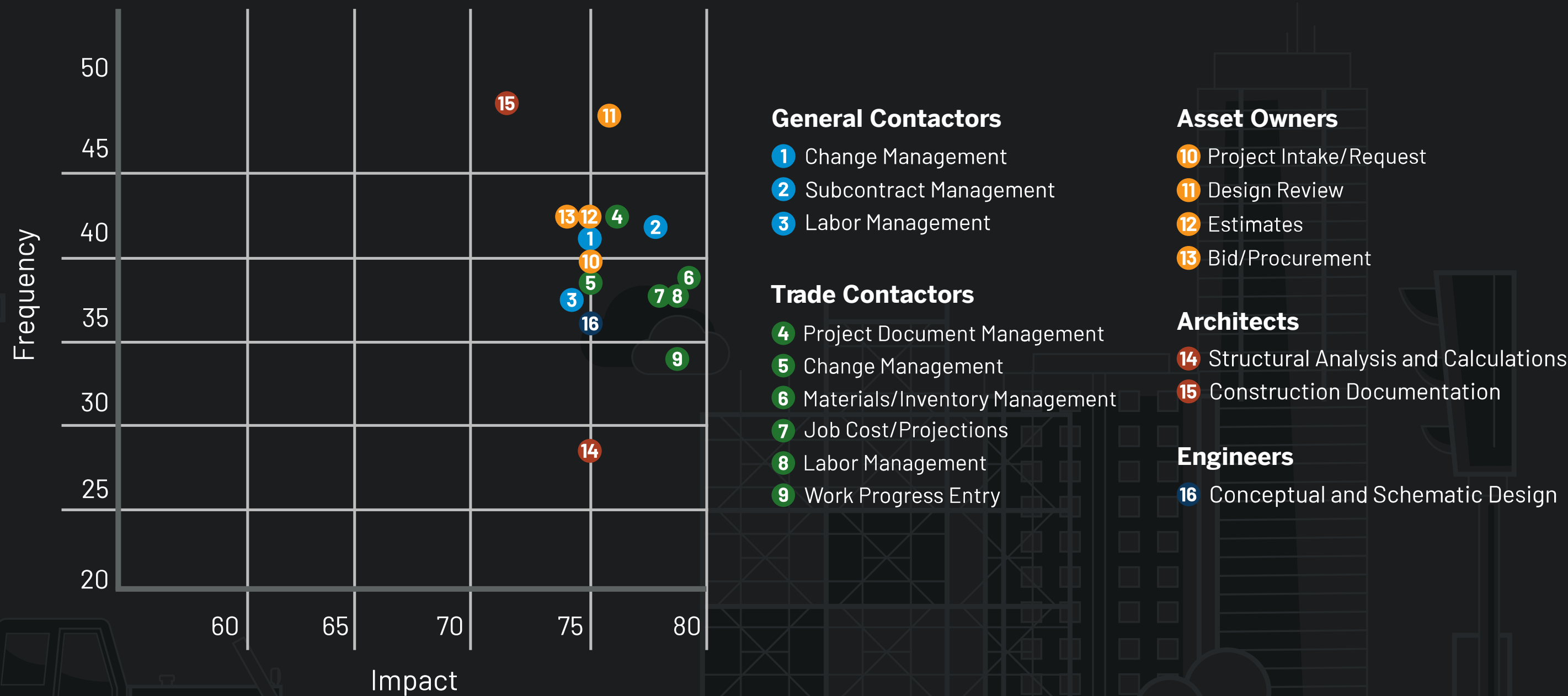
In the Dodge + Trimble study referenced previously, respondents using connected workflows were asked which processes are most often at the root cause of errors and delays.

When plotted out, their responses reveal that the most problems stem from the processes that happen frequently and have a large impact on projects and the business, including construction documentation and structural analysis and calculations.

These insights can serve as a roadmap for construction technology leaders who want to digitize and connect processes that will deliver deeper business value.

Frequency and Impact of Activities Identified as Root Causes for Errors/Delays

Dodge Data & Analytics, 2022

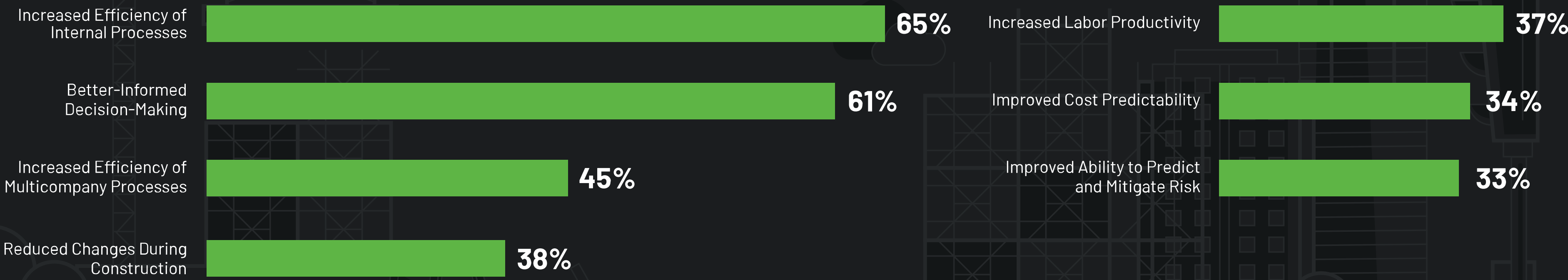


The Benefits of Connected Digital Workflows

Top Benefits of Digital Workflows

(according to all respondents using digital workflows)

Dodge Data & Analytics, 2022



PEOPLE

How to Cultivate a Culture That Supports Change

Building a robust and modern digital framework and developing the right processes and workflows are only part of connected construction. A cultural shift must take place so that people understand the value of a project, how workflows and processes change, and how to use the technology to maximum advantage.

Here are seven ways to ratchet up results:



Focus on use cases and value, not the specific technology. Tie performance gains, reduced costs or labor demands, improved carbon lifecycle impacts and other tangible outcomes to the technology—not the other way around.



Stay focused on your goals. It's incredibly easy to become overwhelmed by daily events and begin to stray from a strategic focus. For example, many firms simply create new divisions or groups for new technologies. But oftentimes, upskilling is far more efficient and less costly.



Be patient. Give teams and individuals time to internalize new concepts, ideas and technologies. This often means making groups aware of changes in stages so that they aren't surprised by them. Study up on [the psychology of change](#).



Communicate. Help them prepare mentally and gain an understanding of how the new framework will change their jobs, costs and daily routines. Focus on improvements but also possible pain points.



Motivate groups to change the way they work. Provide resources and support employees' need to navigate change. Introduce incentives for adoption, when and where they're appropriate.



Play the long game. Create a multi-year strategy that management can clearly articulate. Establish key milestones and reinforce wins through frequent communication or gamification.



Invest in training and development. The rapid pace of technological advancement makes ongoing training essential, whether it covers advancing skill sets or coping with cultural changes. Remember that 25% of AECO firms do not fully adopt digital workflows because there is insufficient training.⁶

⁶ Dodge Data & Analytics and Trimble Construction, [Connected Construction: The Owners' Perspective](#), [Connected Construction: The Architects' Perspective](#), [Connected Construction: The Engineers' Perspective](#), [Connected Construction: The General Contractors' Perspective](#), [Connected Construction: The Specialty Trade Contractors' Perspective](#), 2022.

CASE STUDY

SNCF Réseau Saves €6 Million in Rework Using AR to Tie Design and Construction Together

In recent decades, SNCF Réseau, France's national state-owned railway company, has had to meet the twin challenges of increasing traffic demand and deteriorating infrastructure conditions. As part of the railway's modernization efforts, it has used Trimble to implement an enterprise-wide common data environment and used augmented reality to review design changes in the field. This has resulted in significant savings for the organization.

Read the full case study

SYSTEMS

Connected Construction Features and Requirements Checklist

Whether you're starting from scratch or expanding your digital arsenal, the selection process is at the center of success. Here are seven key considerations for building a best practice framework:

CONSIDERATION #1

A Common Data Environment (CDE)

Key features:

- + Adherence to open industry standards
- + Interoperability with other systems (via APIs, Connectors, etc.)
- + Manages proprietary file formats while maintaining data fidelity
- + Manages document-based, object-based and asset-based workflows
- + Scalable to meet project data needs and data types (building information modeling [BIM] data, GIS data, Lidar data, Survey data, high volume raw data, etc.)
- + Tracks all activities with the data
- + Includes a “data management layer” such as an approval workflow

CONSIDERATION #2

A Digital-Ready Project Management System

Key features:

- + Scalable to handle multiple enterprise projects as well as one-off projects and programs
- + Customizable data entry forms
- + Business process automation that’s easily configured and maintained by your organization
- + A collaborative framework with granular permission controls and data views to support real-time workflows with partners and other stakeholders
- + Robust reporting capabilities, including a data warehouse that connects to third-party business intelligence tools like Power BI and Tableau
- + AI and machine learning capabilities that mine data for correlations, patterns and trends
- + Mobile access for field users
- + Streamlined workflows for quick in-field reviews and data capture
- + Interoperable with other systems (via APIs, Connectors, etc.) via an integration platform that links to commonly used financial systems such as Oracle, PeopleSoft, SAP and Workday
- + Integrates flawlessly with BIM, GIS and other field data tied to cost calculation and update workflows
- + Incorporates laser scanning, surveying solutions and robotic layout tools for keeping a model and reality aligned

SYSTEMS

CONSIDERATION #3

Highly Precise Design Authoring Software

Key features:

- + Adherence to open industry standards (i.e., capable of IFC export and import)
- + Interoperability with other detailing, analysis, barcoding, scanning, MIS and CNC machine systems (via APIs, Connectors, etc.)

CONSIDERATION #4

A Connected Accounting System

Key features:

- + An application built for construction firms by industry experts
- + Configurable for your current IT environment systems, workflows and data flows
- + Interoperable with other systems (via APIs, Connectors, etc.)
- + Integrates flawlessly with BIM, GIS and other field data tied to cost calculation and update workflows

CONSIDERATION #5

A Powerful Estimating Solution

Key features:

- + An application built for construction by industry experts
- + Accelerates or improves your existing estimating workflow
- + Configurable for your current IT environment systems, workflows and data flows
- + Interoperable with other systems (via APIs, Connectors, etc.)
- + Integrates flawlessly with BIM, GIS and other field data tied to asset changes and updates
- + Automates manual steps across workflows



SYSTEMS

CONSIDERATION #6

Automated Surveying Using Laser Scanning, RTS and Mobile Mapping

Key features:

- + Streamlined workflows for quick data capture and in-field tasks
- + Accuracy levels that meet or exceed project needs
- + A cost focus revolving around data storage, including what data should be actively stored for projects versus archiving it
- + A complete view of mobile mapping data capture and processing costs, including factors like data processing cost per hour and at what density and accuracy level

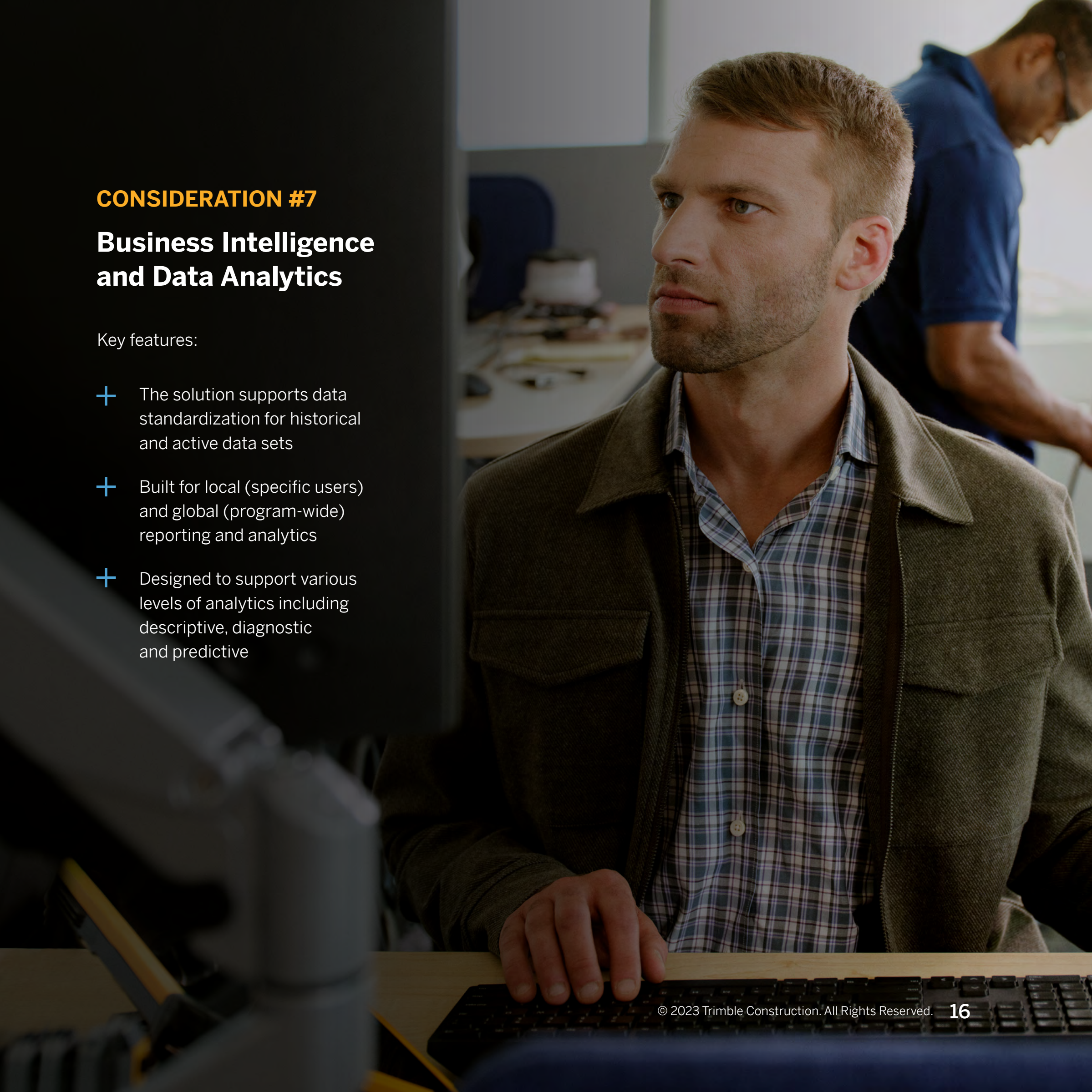


CONSIDERATION #7

Business Intelligence and Data Analytics

Key features:

- + The solution supports data standardization for historical and active data sets
- + Built for local (specific users) and global (program-wide) reporting and analytics
- + Designed to support various levels of analytics including descriptive, diagnostic and predictive

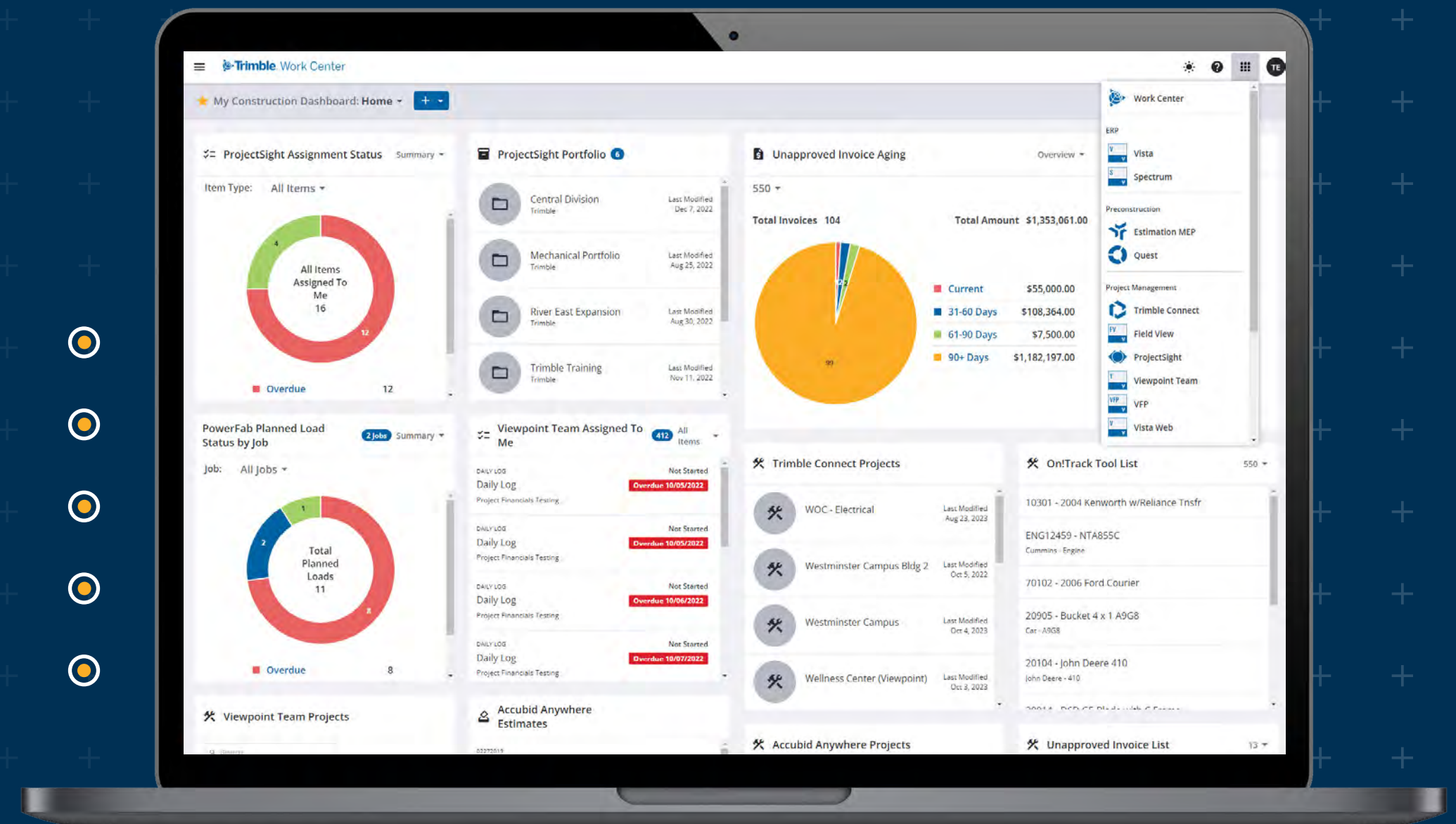


Connections Equal Opportunity

Getting the right information to the right people at the right time isn't always easy. But the payoffs of better decision-making, efficiency and risk reduction are worth it. And a business-as-usual approach to your goals, data, workflows, people and systems just isn't going to get you there.

Technology that connects workflows doesn't have to be complicated. Trimble Construction One is a custom suite of interconnected tools built specifically around your needs and workflows. Give your firm a way to successfully leverage digitization while simplifying your tech stack.

[Learn how](#)





Trimble solutions help AECO firms
in over 150 countries achieve:⁷

20%-50%

productivity increases

Up to 30%

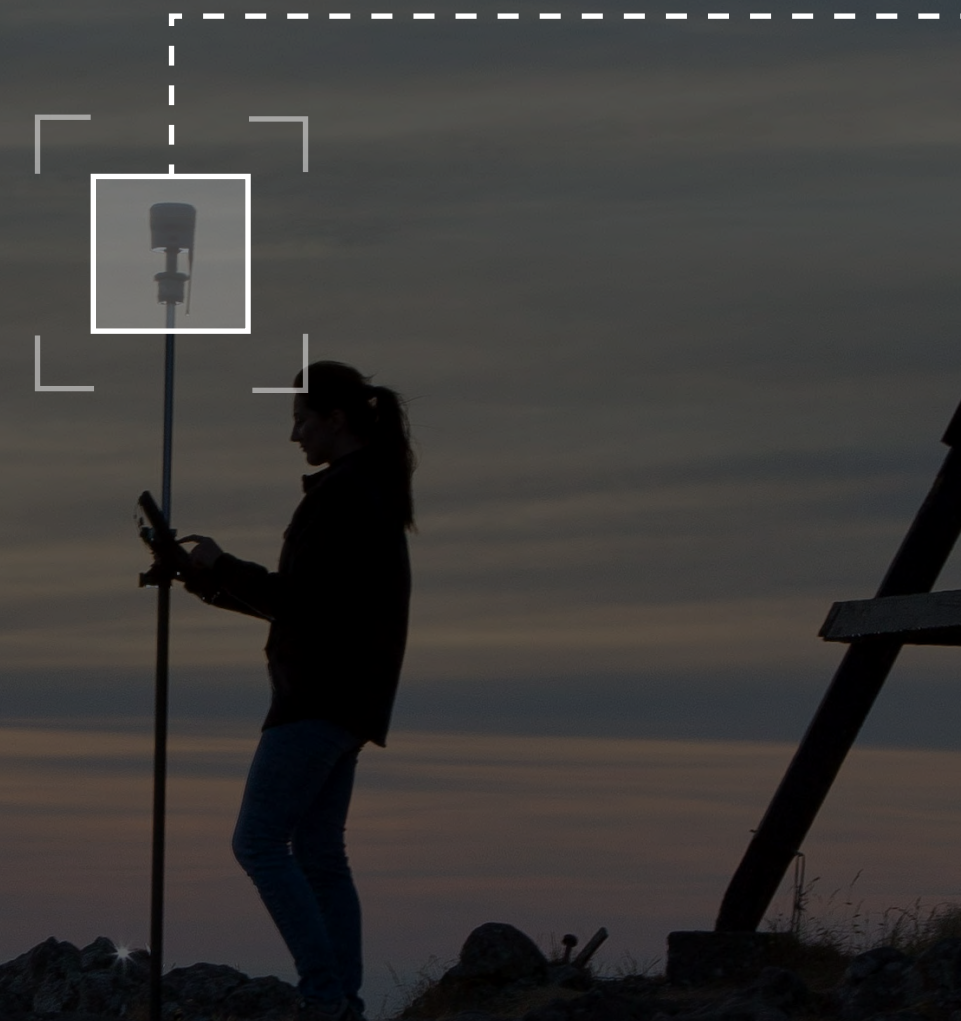
cost savings

Up to 50%

less rework

Up to a 30%

boost in machine productivity



⁷ Trimble, [2020 Sustainability Report](#), 2020.