Trimble

PREMIER PARTNER

SmartMarket Brief

Dodge Construction Network

Connected Construction: The Owners' Perspective

Introduction

ABOUT THIS SMARTMARKET BRIEF

This SmartMarket Brief is the first in a series of reports that take a deep dive from the perspective of one of the key stakeholders on a construction project—owners, architects, engineers, general contractors and specialty trade contractors—on the topic of connected construction and the use of digital workflows.

This inaugural report is from the perspective of the owner. In an industry as fragmented as design and construction, it is hard to drive meaningful change, but owners are in a unique position to influence the rest of the project team members. Whether they do so through mandates and requirements on their projects or they do so by building relationships in the industry with organizations that can participate in the goal of allowing data to flow better across all project team members, they can encourage wider use of digital tools in the industry.

The findings of this study clearly demonstrate that the owner organizations benefit greatly from the additional insights provided by using both internal and multicompany digital workflows. They can manage their projects better due to the improved flow of information.

Dodge wishes to thank Trimble Construction for sponsoring this research.

CONTENTS

A MESSAGE FROM TRIMBLE

Trimble and Dodge conducted this landmark study to help understand the impact of digital transformation in the construction industry by understanding the dynamics between project stakeholders including owners, designers, contractors and suppliers. The goal was to identify what problems exist in digital workflows within their own organizations as well as challenges between other organizations that need to come together as a team.

Among the owners surveyed, digital transformation is well underway. Most owners are advanced in the adoption of digital workflows internally, but also identify a need for growth in working with external stakeholder organizations including contractors, designers and other suppliers. As infrastructure investment flows into the construction industry and labor and material shortages persist, further digital transformation will provide much needed transparency and risk reduction for all.

As you review these findings, think about how your organization – being either an owner yourself or an organization that supports the owner's success – can help to solve the challenges that are explicitly laid out before us.

Greg Blackman
Vice President & General Manager
Trimble Project and Program Management Division

Key Findings

INTRODUCTION

Owners can play a pivotal role in the design and construction industry to encourage better digital connection between players. The findings in this study demonstrate that they are poised to lead the industry in the adoption and use of digital workflows due to the key advantages they experience on their projects.

OWNERS ARE HIGHLY ENGAGED WITH DIGITAL WORKFLOWS

Owners in the study have embraced the use of digital workflows and are more frequently engaged with technology for conducting them than other types of organizations. In fact, over half have already created integrations between various software products or even use a single, connected construction management solution.

Currently, they use internal digital workflows more frequently than multicompany ones:

- Nearly two thirds (60%) exchange half or more of their project data with internal workflows, but only 28% do the same with external companies.
- More owners (62%) believe that their organization is highly successful at creating internal digital workflows than external ones (41%).
- 62% of owners are satisfied with the connection they have fostered between internal departments at their organization, but fewer than half are with their external connections.

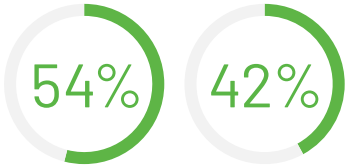
Their success with internal digital workflows may provide a strong foundation for expanded use of external ones.

OWNERS CAN HELP DRIVE THE USE OF DIGITAL WORKFLOWS IN THE INDUSTRY

The study demonstrates that owners are already helping to drive the use of digital workflows in the industry, since most have frequent contractual requirements that contractors use digital documentation and practices on their projects. However, their influence also extends beyond contractual requirements:

- Their use of digital workflows to exchange information with members of their project teams encourages those team members to become more proficient with them. Large owners (those with annual capital project values of $100 million or more) lead in their digital engagement with the project team, with two thirds or more using digital workflows with key project team members .
- However, 59% of owners using multicompany workflows currently have frequent connectivity breakdowns with team members. Since owners' top factor for increasing their satisfaction with their connectedness is improving their decision-making processes, delivering data effectively to owners will be a competitive advantage for companies, which will encourage wider use of digital workflows across the industry.

Highly Engaged With Technology for Conducting Digital Workflows:



Percent of owner organizations that have frequent contractual requirements that contractors use digital documentation and practices

Key Findings (CONTINUED)

BENEFITS LIKELY TO DRIVE WIDER USE OF DIGITAL WORKFLOWS AMONG OWNERS

Owners who use digital workflows currently report several benefits, but the top two are increased efficiency of internal processes and better-informed decision-making. They also frequently report improved project outcomes such as higher quality and faster delivery.

Wider knowledge of these benefits can help drive increased use of these workflows among owners who rarely/never use them currently.

- Large owners in this category cite the increased efficiency of internal processes as the top benefit that would encourage them to use them, and small/midsize owners cite better-informed decision-making as their top influence.
- In addition, the largest share of all of these owners select more timely project delivery as the top project outcome that would encourage them to more use digital workflows.

The alignment between what users report as top benefits and the top benefits most desired by nonusers should help drive wider use of these workflows in the future.

DIGITAL WORKFLOWS PROVIDE INSIGHT INTO THE IMPACT OF SPECIFIC PROCESSES ON PROJECTS

One of the challenges that all project team members, including owners, face on their projects is the ability to understand the root causes of issues that arise during the project. Being able to trace those causes back to issues related to specific processes allows for continuous improvement in the future.

Owners who do not use digital workflows for the six preconstruction processes and the eight construction/closeout ones studied have far less insight into how those processes contribute to errors and delays on projects than do owners who are using them. This gap includes processes associated with high-impact issues that occur frequently on projects, such as project intake/request, estimates, bid/procurement and RFIs.

Delivering this data effectively to owners will be a competitive advantage for other companies, encouraging wider use of digital workflows across the industry.

Top Benefits and Project Outcomes Owners Experience From Digital Workflows

Benefits	Project Outcomes
Increased Efficiency of Internal Processes	**Higher Quality**
Increased Efficiency of Internal Processes	**Faster Delivery**

Average Percentage of Owners Who Say They Cannot Trace Root Causes of Delays/Errors Back to Project Processes

	Preconstruction Processes	Construction/ Closeout Processes
Those Not Using Digital Workflows	36%	50%
Those Who Use Digital Workflows	7%	8%

Use of Digital Workflows

ENGAGEMENT WITH TECHNOLOGY FOR CONDUCTING DIGITAL WORKFLOWS

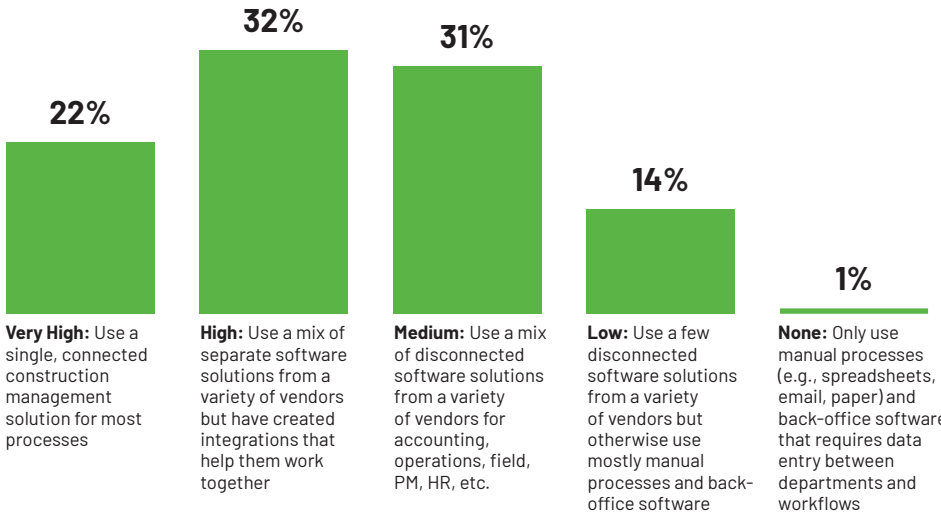
In order to better understand the degree to which owners are poised to benefit from technology to make their construction workflows more productive, the owners in the study were asked to place themselves along a spectrum of technology use, from not engaging in technology at all to the use of a single, connected construction management solution. The detailed findings are shown in the chart at upper right. The chart at lower right compares owners reporting a high/very high level of engagement with the responses from designers (architects and engineers) and contractors (prime and specialty trade contractors).

- Most owners (85%) believe they have at least a moderate level of engagement with technology, with nearly one quarter (22%) reporting that they use a single, connected construction management solution for most processes. This can significantly help owners maximize the productivity of their use of digital workflows.
- Far more owners (54%) than designers or contractors (42%) report that they are experiencing this high level of engagement. Since owners are more likely to require designers and contractors to be able to work with their digital systems than to adapt to those of the companies they hire, this finding is not surprising.

VARIATION BY TYPE OF OWNER

More owners engaged in vertical building projects (57%) than those engaged in horizontal projects (49%) report a high/very high degree of engagement with technologies that support digital workflows. This finding is consistent with other studies conducted by Dodge Data & Analytics that reveal that civil construction lags behind vertical building in the US in the pursuit of digital transformation.

Level of Engagement With Technology for Conducting Digital Workflows



High/Very High Engagement With Technology for Conducting Digital Workflows

By Company Type

Use of Digital Workflows (CONTINUED)

NUMBER OF SOFTWARE SOLUTIONS USED TO CONDUCT DIGITAL WORKFLOWS

The number of software solutions used for construction processes can directly impact the degree to which they can improve productivity for owners. Those who report using more than one software solution for digital workflows (those who select low, moderate or high on page 2) were asked how many software solutions they use for this activity. The chart at upper right shows the responses of all owners in the survey, as well as the contrast between large/very large owners and small/midsize ones.

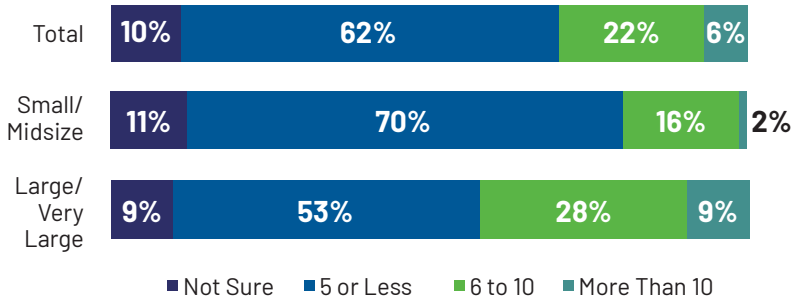
- Generally most owners using more than one type of software tend to use five or less.
- However, there is a sharp contrast in the responses between small/midsize owners and large/very large ones.
  - Small/midsize owners are more likely to use five or fewer solutions.
  - Many large/very large owners (37%), on the other hand, use six or more solutions. This may be due to less internal alignment between groups within larger organizations, the need to work with a wider variety of software used by other project team members or the desire to manage complex projects with numerous specialized tools. This finding does suggest that small owners may have an advantage over larger ones in being able to avoid multiple integrations between point solutions on their projects.

CHANGE IN NUMBER OF SOFTWARE PRODUCTS IN USE

Owners were also asked to what degree they have seen a change since 2019 in the number of software products they use. As the chart at lower right shows, far more owners have experienced an increase than a decrease in the number of solutions they deploy. This is especially true among small/midsize owners, which may suggest that they will soon confront the challenges faced by larger owners when trying to integrate between multiple solutions.

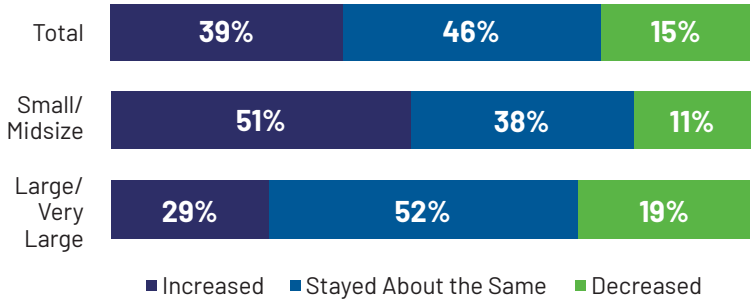
Number of Software Solutions Used to Conduct Digital Workflows

According to Owners Using More Than One Software Solution for Digital Workflows



Change Since 2019 in Number of Software Systems Used for Digital Workflows

According to Owners Using More Than One Software Solution for Digital Workflows



Small/Midsize: Annual Capital Project Value Under $100 Million
Large/Very Large: Annual Capital Project Value of $100 Million or More

Use of Digital Workflows (CONTINUED)

DIGITAL DOCUMENTATION REQUIREMENTS

FREQUENCY OF REQUIREMENTS

In addition to their own use of digital workflows, owners have a high degree of influence on the use of digital workflows in the design and construction industry. One way in which they influence the industry particularly is through the requirements they have on their projects. In this study, owners were asked about how frequently they require contractors to use digital documentation and practices. The findings are shown in the chart at upper right.

- Over two thirds (69%) report that they do so frequently/very frequently, which demonstrates the value they find in the use of digital documentation.
- 80% of large/very large owners have this requirement, compared with just 57% of small ones.

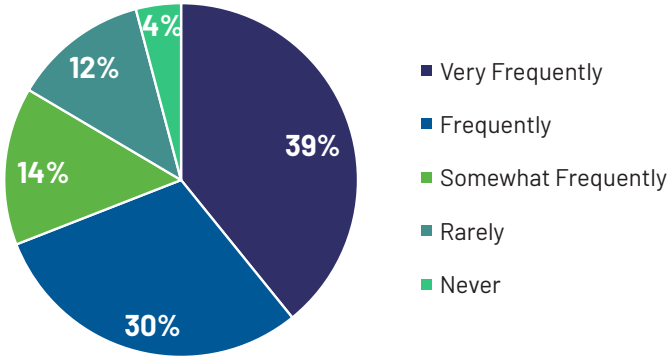
REASONS THAT OWNERS DON'T REQUIRE CONTRACTORS TO USE DIGITAL DOCUMENTATION AND PRACTICES

Owners who rarely or never have requirements about digital documentation and practices were asked why they don't. Their top responses are shown in the chart at lower left.

No single reason dominates, and one third or more identify each of the top five, suggesting that these owners face multiple challenges implementing requirements for digital doucumentation and practices, and therefore are unlikely to do so in the near future.

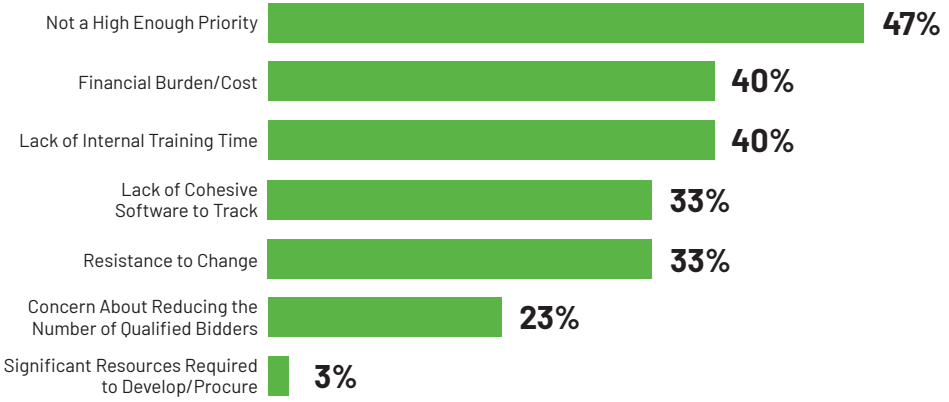
Frequency With Which Owners Contractually Specify That Contractors Use Digital Documentation and Practices

According to Owners Using Digital Workflows



Reasons Owners Do Not Contractually Specify That Contractors Use Digital Documentation and Practices More Frequently

According to Owners Who Rarely/Never Require Contractors to Use Digital Documentation or Practices



USE OF INTERNAL AND MULTICOMPANY DIGITAL WORKFLOWS

OVERALL USE OF INTERNAL AND MULTICOMPANY DIGITAL WORKFLOWS

Owners were asked how frequently they use digital workflows to share information with two groups:

- Internal workflows with other functions within their organizations.
- Multicompany workflows with outside companies that are part of the project team.

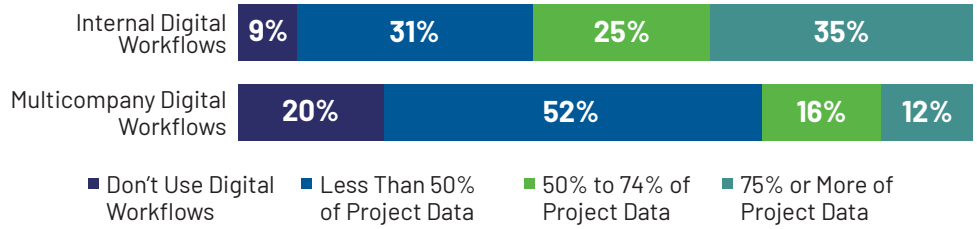
As the findings shown in the chart at upper right reveal, owners more commonly use internal digital workflows than multicompany ones, with 60% of owners using internal digital workflows for sharing half or more of their project data, but only 28% sharing project data at that rate externally through digital workflows.

USE OF INTERNAL DIGITAL WORKFLOWS

Those using internal digital workflows were asked which departments they conduct them with.

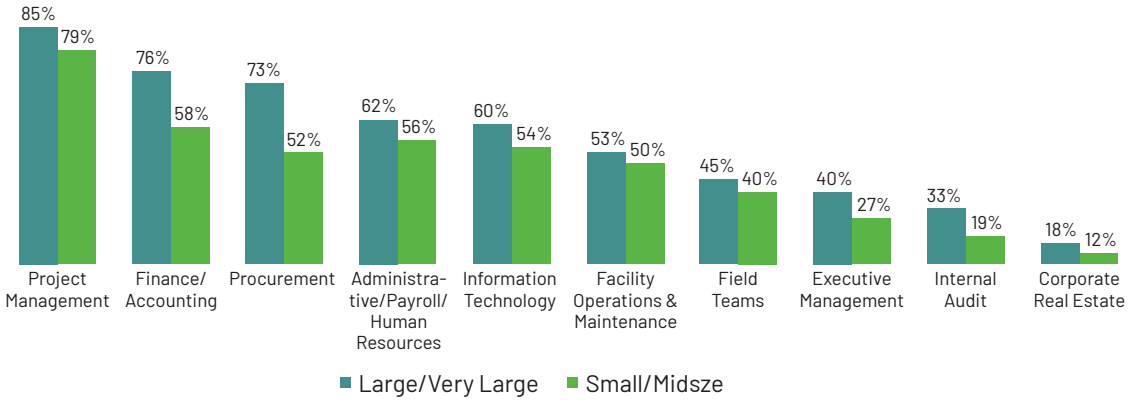
- Project management is most commonly connected among large and smaller owners alike.
- Large owners are significantly more likely to be connected through digital workflows to their finance/ accounting and procurement departments than are smaller organizations.

Use of Digital Workflows to Exchange Data Internally Versus Externally With the Project Team



Share Who Frequently Use Digital Workflows to Exchange Information With Other Functions at Their Organization

By Size of Organization



Small/Midsize: Annual Capital Project Value Under $100 Million
Large/Very Large: Annual Capital Project Value of $100 Million or More

Use of Digital Workflows (CONTINUED)

USE OF INTERNAL DIGITAL WORKFLOWS (CONTINUED)

The remaining findings show a generally consistent pattern of slightly higher usage by large, rather than by smaller organizations.

Analysis of the findings by project type shows that owners doing horizontal construction are more frequently connected to their IT departments (71%) than are those doing vertical construction (51%).

USE OF MULTICOMPANY DIGITAL WORKFLOWS

As the chart at upper right reveals, large owners far more frequently conduct multiparty digital worflows than do smaller organizations.

The biggest differences are reported in sharing data with the major project team members (GCs/CMs, consulting engineers, architects and specialty trade contractors). This finding reinforces that large owners are significantly more advanced in the use of multicompany digital workflows.

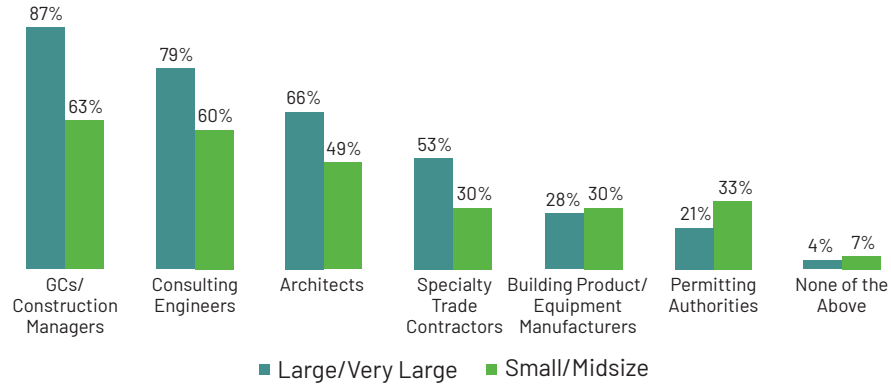
Not surprisingly, those doing vertical construction more frequently use digital workflows with architects than those doing horizontal work. It is notable, though, that this is the only significant difference in the use of multicompany workflows related to project type.

TRANSFORMING TRADITIONAL WORKFLOWS

As the chart at lower right shows, far more owners believe that they have successfully transformed their internal workflows to be digital than their external ones. This may in part be due to the ability to coordinate better internally than externally.

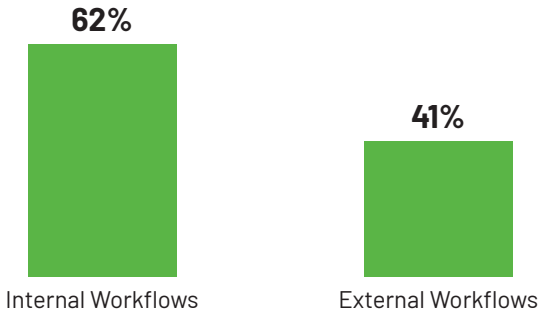
Share Who Frequently Use Digital Workflows to Exchange Information With External Companies on the Project Team

According to Those Using Multicompany Workflows



Small/Midsize: Annual Capital Project Value Under $100 Million
Large/Very Large: Annual Capital Project Value of $100 Million or More

Users of Digital Workflows Who Believe That Their Organization Is Highly Successful in Transforming Traditional Processes Into Digital Workflows



Connectedness With Stakeholders

SATISFACTION AT THE LEVEL OF CONNECTION BETWEEN STAKEHOLDERS

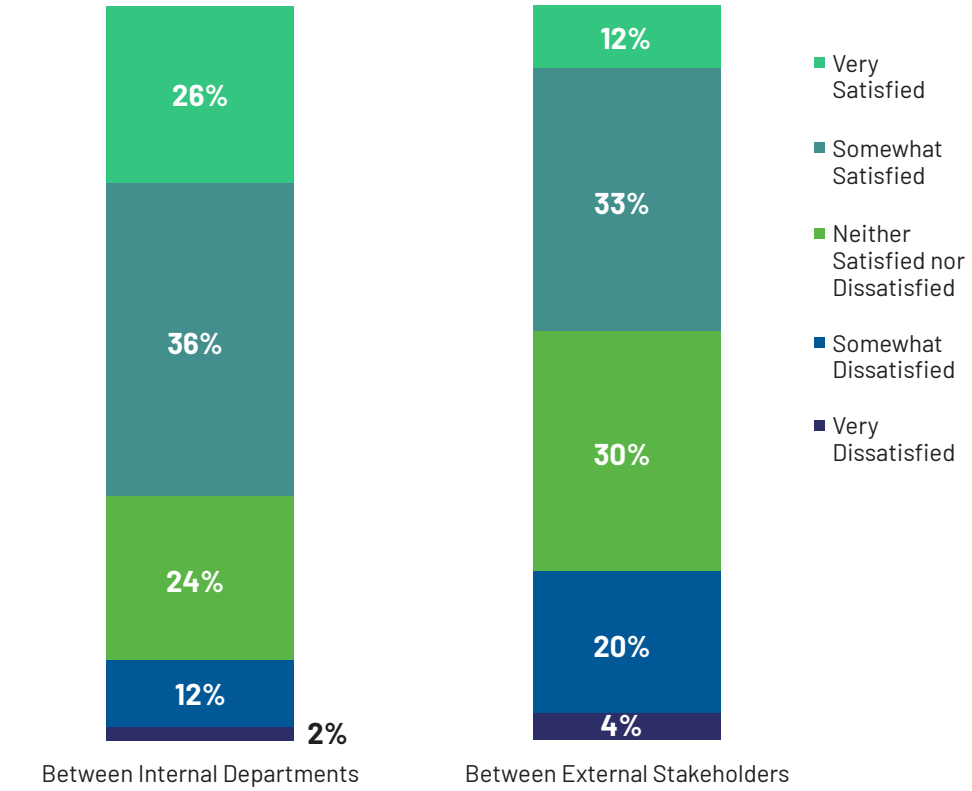
Owners who use digital workflows to share information internally and externally (see page 5) were asked about their satisfaction with the level of connectedness in each case. The findings are shown in the chart at right.

- Aligning with the findings on frequency, owners are generally more satisfied with their internal connectedness (62%) than external (45%).
- Encouragingly, less than one quarter report being dissatisfied with either type of digital connectedness.
- Analyzing by size, large/very large organizations more frequently report being very satisfied with the connection between internal departments (35%) than do smaller ones (17%).
- There is no difference, though, in the satisfaction levels of those doing vertical versus horizontal projects.

These findings, combined with the more frequent connections and more successful transition of traditional workflows internally than externally, suggest that internal connectedness is becoming well established and owner organizations now need to work with their project teams to improve multiparty connectedness.

Satisfaction With the Level of Connectedness With Stakeholders

According to Owners Using Internal and/or External Digital Workflows



Connectedness With Stakeholders (CONTINUED)

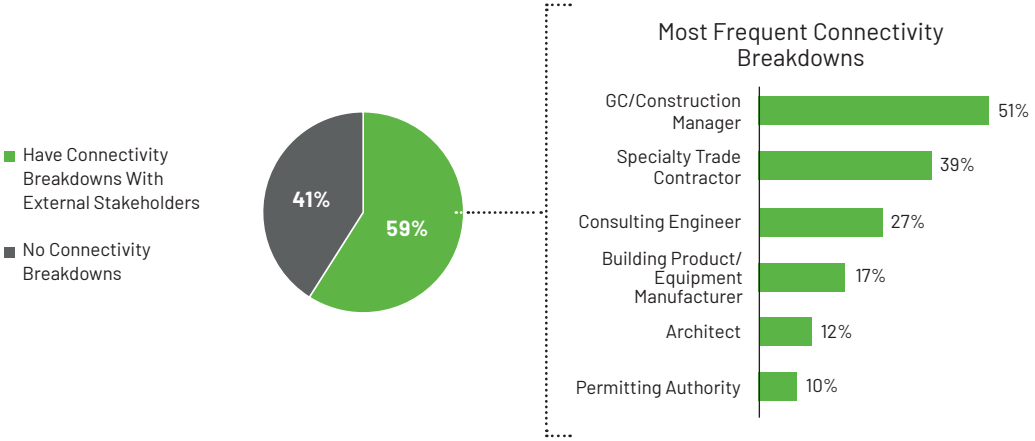
BREAKDOWNS IN CONNECTIVITY BETWEEN COMPANIES

Owners who have digital workflows connecting them to external companies were asked to select the type of company with which they most frequently experience breakdowns in communication. The findings are shown in the chart at upper right and described in the text below.

- As the pie chart reveals, over half of owners report that they experience connectivity breakdowns with external stakeholders, so this is a common challenge.
- The percentages shown in the bar chart at right are the types of organizations with whom the 59% most frequently experience breakdowns.
- Contractors are by far the most frequent with whom breakdowns in communication occur.
  - GCs/CMs are also the company type that the most owners select as having the most negative impact when breakdowns in communication do occur. This suggests that these breakdowns are the most important to address when evaluating where to focus improvement efforts.
  - Encouragingly, fewer regard breakdowns with trade contractors to be a major cause of issues during construction.
- Breakdowns are least commonly reported between owners and architects and permitting authorities. Only a negligible percentage also report that these types of breakdowns have a highly negative impact.

Experience Frequent Connectivity Breakdowns With External Stakeholders

According to Owners With Digital Workflows for Sharing Information With External Stakeholders



Connectedness With Stakeholders (CONTINUED)

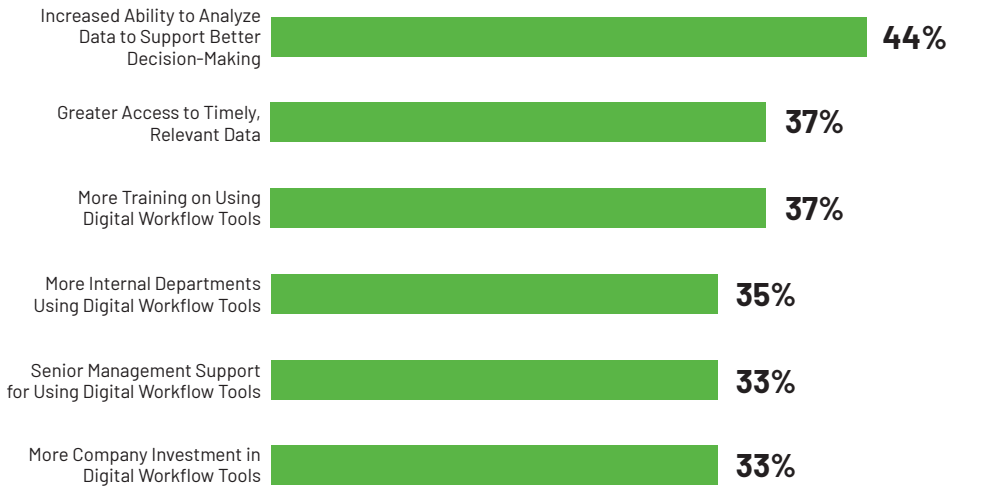
TOP WAYS TO IMPROVE CONNECTEDNESS WITH STAKEHOLDERS

Owners who reported that they were dissatisfied with their connections to internal or external stakeholders were asked to select the top three ways to improve that satisfaction level from the list of six options in the chart at right. Only 6% do not believe any of these would improve their satisfaction.

- No individual option was selected by over 50% of the owners, which suggests that all of these can help improve connectedness.
- Among these, the most frequently selected option is the need to increase their ability to analyze data to support better decision-making. This is closely aligned with more training on using digital workflow tools.
- A large share also find that they need better access to timely, relevant data, which may originate in their own organization or from the others with whom they are establishing digital workflows.
- There is also a general call for more internal departments to use workflow tools, and more senior management support and investment, two concepts that may also be linked together.
- Analyzing by project type, more than twice the share of those doing horizontal construction (58%) believe that more internal departments using digital workflow tools would improve their satisfaction than those doing vertical construction (24%).

Top Ways to Improve Satisfaction With Their Connectedness to Other Stakeholders

Selected in Top Three



Digital Workflows for Specific Activities

INTRODUCTION

This section looks at the use of digital workflows for six preconstruction activities and eight that occur during construction, all shown in the charts at right.

The findings in this section address the following about these 14 processes:

- **Root Causes of Problems:** The ability of owners to identify root causes of errors and/or delays associated with these processes.
- **Severity of Problems:** The degree of negative impact that these errors/delays tend to have on projects.
- **Use of Digital Workflows:** The frequency with which digital workflows are used for each process.

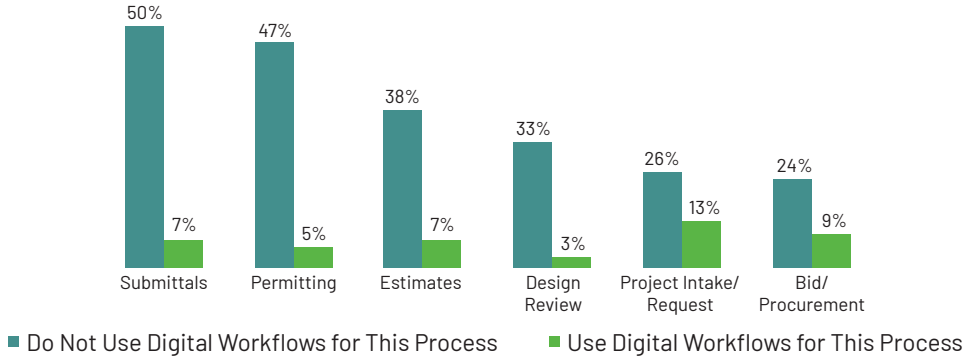
ABILITY TO LINK ROOT CAUSES OF ERRORS AND DELAYS TO SPECIFIC PROCESSES

Focusing just on the owners who say that they can never trace the root causes of project problems back to issues with conducting each of these processes, the two charts at right show what percentages of that group do and do not use digital workflows for those processes.

This analysis reveals one of the most striking findings in this section, making it clear that those who use digital workflows have a much better understanding of the causes of the challenges they face, thereby providing them with a much better foundation to avoid similar issues on future projects.

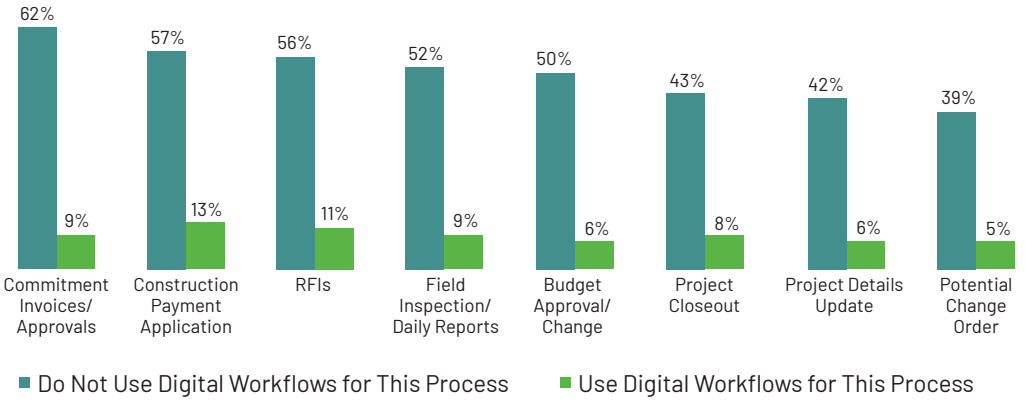
Preconstruction: Those Who Report That They Never Trace Root Causes Back to Issues With Conducting These Processes

According to Those Who Do and Do Not Use Digital Workflows for Each Process



Construction: Those Who Report That They Never Trace Root Causes Back to Issues With Conducting These Processes

According to Those Who Do and Do Not Use Digital Workflows for Each Process



Use of Digital Workflows for Specific Activities (CONTINUED)

ISSUES ASSOCIATED WITH SPECIFIC PRECONSTRUCTION PROCESSES

The table at right shows six preconstruction activities in their order of occurence on projects. Owners were asked two questions about each of them:

- The frequency with which issues that arise with them are the root causes for errors and/or delays on projects.
- The severity of the issues associated with each (asked only of those who can trace the root causes of those issues back to these processes).

The responses for each were then converted to a 100-point index for comparison.

- Design review is most frequently identified as the root cause for errors/delays. It is also most frequently associated with serious negative impacts when issues arise.
- The frequency with which the remaining activities underlie errors/delays on projects is in a five-point range (37–42).
- Similarly, all activities are in a narrow and notable high range for the severity of their negative impacts (65–75).

Frequency and Impact of Issues Associated With Specific Preconstruction Processes

	Frequency Index: Activities Identified as Root Causes for Errors/Delays	**Impact Index:** Degree of Negative Impact of Errors/Delays Caused by Processes
Project Intake/Request	38	75
Design Review	48	76
Estimates	42	75
Bid/Procurement	42	74
Permitting	37	69
Submittals	41	65

Use of Digital Workflows for Specific Activities (CONTINUED)

FREQUENCY OF USING DIGITAL WORKFLOWS FOR PRECONSTRUCTION ACTIVITIES

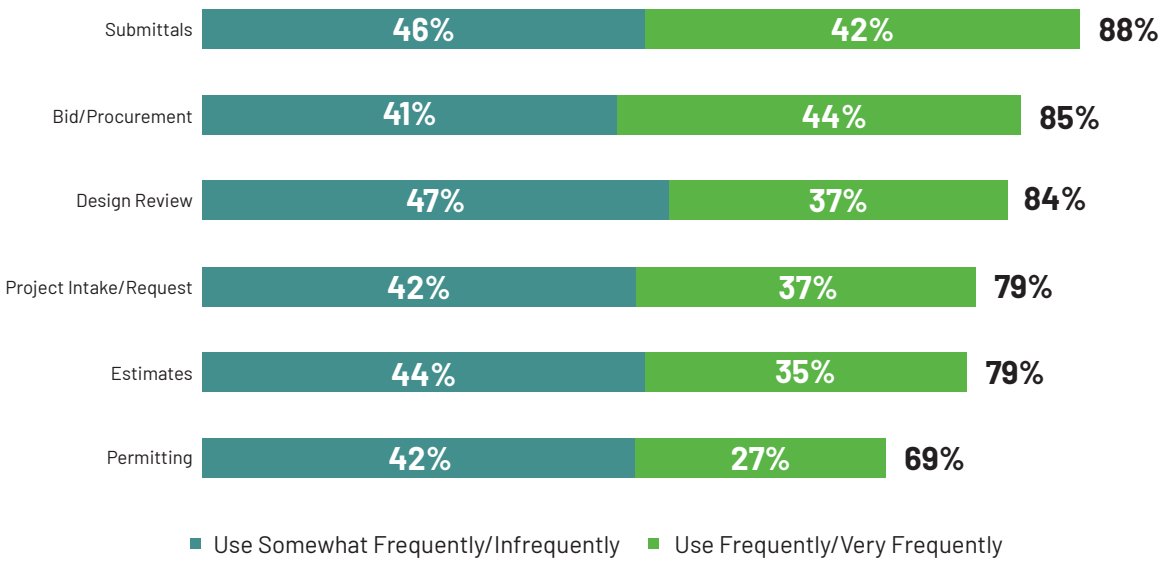
Owners were asked how frequently they use digital workflows for each preconstruction activity studied.

Encouragingly, most owners report using digital workflows at least some of the time for each process, with three quarters or more reporting they do so for submittals, bid/procurement, design review, project intake/request and estimates.

Submittals are the most widely used overall, with bid/procurement most often used frequently/very frequently. Owners least frequently use digital workflows for permitting.

The only significant difference by size of company is that large companies more frequently use digital workflows for project intake/request than do smaller ones.

Share of Owners Using Digital Workflows for These Activities



Use of Digital Workflows for Specific Activities (CONTINUED)

ISSUES ASSOCIATED WITH SPECIFIC CONSTRUCTION AND CLOSEOUT ACTIVITIES

Owners were asked the same two questions about the activities related to construction and closeout shown in the table at right as they were about the preconstruction activities:

- The frequency with which issues that arise with them are the root causes for errors and/or delays on projects.
- The severity of the issues associated with each (asked only of those who can trace the root causes of those issues back to these processes).

As on page 11, a 1-100 index was created reflecting their responses for each.

- The activity most frequently associated with root causes for errors or delays is budget approval/change, and it is also one of the ones with the biggest negative impact.
- Fortunately, although RFIs have a very high impact rating, they have a relatively low one for frequency.
- And conversely, potential change order and project closeout both are frequent, but have relatively low negative impact.

Frequency and Impact of Issues Associated With Specific Construction and Closeout Activities

	Frequency Index: Activities Identified as Root Causes for Errors/Delays	**Impact Index:** Degree of Negative Impact of Errors/Delays Caused by Processes
RFIs	39	71
Field Inspection/Daily Reports	36	50
Project Details Updates	41	62
Potential Change Order	43	68
Budget Approval/Change	44	71
Commitment Invoices/ Approvals	37	53
Construction Payment Application	36	61
Project Closeout	44	63

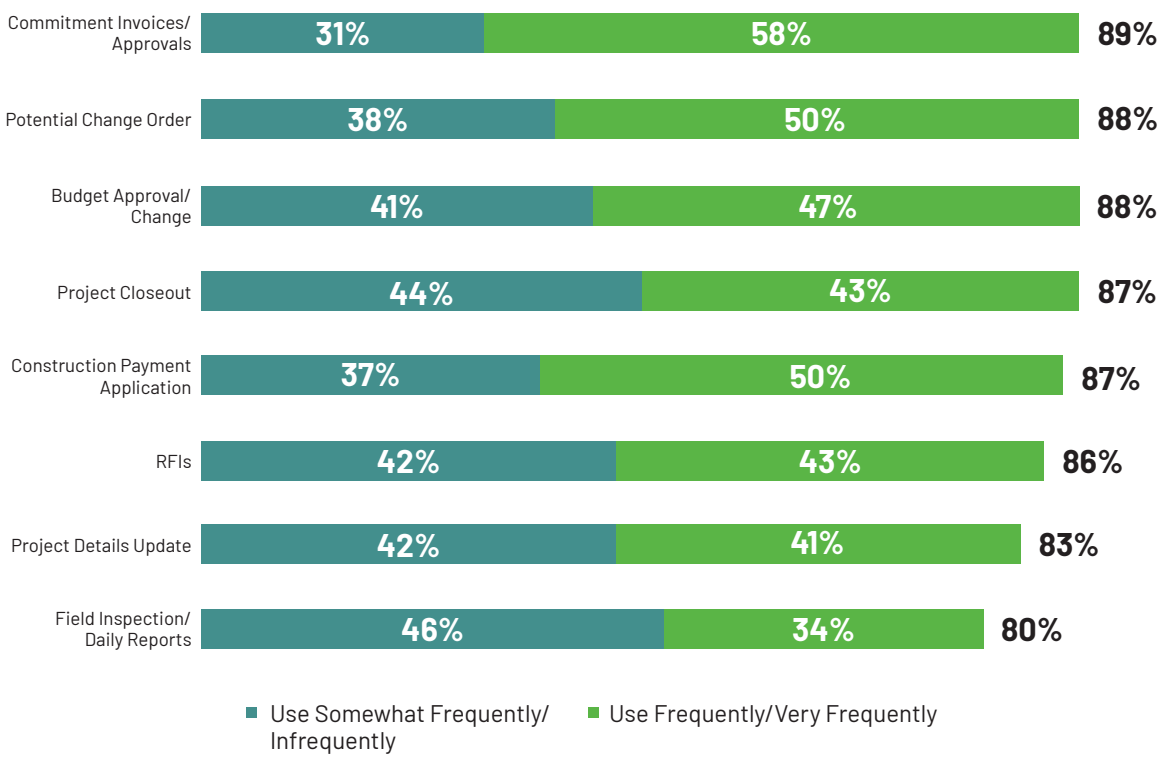
Use of Digital Workflows for Specific Activities (CONTINUED)

FREQUENCY OF USING DIGITAL WORKFLOWS FOR CONSTRUCTION AND CLOSEOUT ACTIVITIES

80% or more of owners report using digital workflows for each of the eight construction and closeout activities shown in the chart at right.

- The top activity for use of digital workflows is commitment invoices/approvals. These help owners to pay contractors in a more timely fashion. They are widely used by large owners, 71% of whom report they employ them frequently/very frequently.
- Other digital workflows that are used frequently/very frequently by significantly more large companies than small ones include digital workflows for potential change orders (60%) and project closeout (55%).
- Use of digital workflows for field inspection/daily reports appears to still be an emerging capability for owners since the share using them frequently/very frequently is much smaller than the share using them somewhat frequently or infrequently.

Share of Owners Using Digital Workflows for These Activities



Use of Digital Workflows for Specific Activities (CONTINUED)

FREQUENCY AND IMPACT OF ALL ACTIVITIES

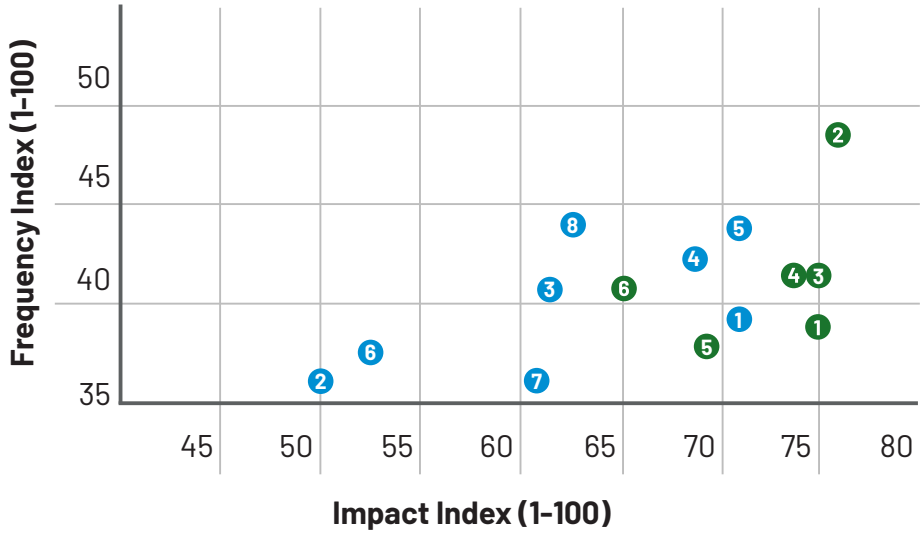
In order to better understand the top activities that owners believe create issues with errors and delays on their projects, all the activities included in the survey are shown in the chart in terms of their frequency and impact index ratings.

Understanding this ratio can help owners prioritize which activities to focus on to help reduce the impact of errors and delays that occur on their projects.

The chart reveals a few basic patterns:

- **Activities with the highest impact and frequency levels:** Most are preconstruction activities (design review, bid/procurement, estimates) plus budget approval/change during construction.
- **Activities with the lowest impact and frequency levels:** All are construction/closeout activities, including field inspection/daily reports, commitment invoices/approvals and construction payment application.
- **Activities that occur frequently but have a lower impact:** These include a mix of preconstruction and construction/closeout activities, including submittals, project details update and project closeout.
- **Activities that occur less frequently but have a very high impact:** These are also a mix of preconstruction and construction/closeout activities, including project intake/request, RFIs and permitting.

Frequency and Impact of Issues Arising From Preconstruction and Construction/Closeout Activities



Preconstruction

1. Project Intake/Request
2. Design Review
3. Estimates
4. Bid/Procurement
5. Permitting
6. Submittals

Construction/Closeout

1. RFIs
2. Field Inspection/Daily Reports
3. Project Details Update
4. Potential Change Order
5. Budget Approval/Change
6. Commitment Invoices/Approvals
7. Construction Payment Application
8. Project Closeout

Use of Digital Workflows for Specific Activities (CONTINUED)

PLANNED INVESTMENTS IN DIGITAL WORKFLOWS

Owners were asked two questions about investments in the preconstruction and construction/closeout workflows discussed on pages 11 and 13.

- The first presented them with a list of activities for which they rarely/never use digital workflows currently and asked them to select up to three that are top priorities for investment by their company in the next three years.
- The second presented them with a list of activities for which they frequently use digital workflows currently and asked them to select the top priorities for investment from that list.

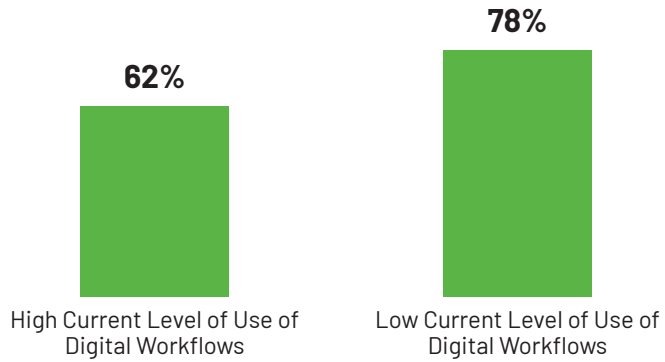
Both questions included the option of saying that their company does not intend to invest in any of the options listed.

OVERALL LEVEL OF INVESTMENT

The chart at upper right shows the share who indicated that their company was prioritizing at least one of the options provided for investment, and it reveals two key conclusions, both of which demonstrate that owners are committed to investing in digital workflows.

Plan to Invest in Digital Workflows

According to Owners With High and Low Levels of Use of These Workflows



Top Areas of Investment for Owners With a High Current Level of Use of Digital Workflows

Use of Digital Workflows for Specific Activities (CONTINUED)

OVERALL LEVEL OF INVESTMENT (CONTINUED)

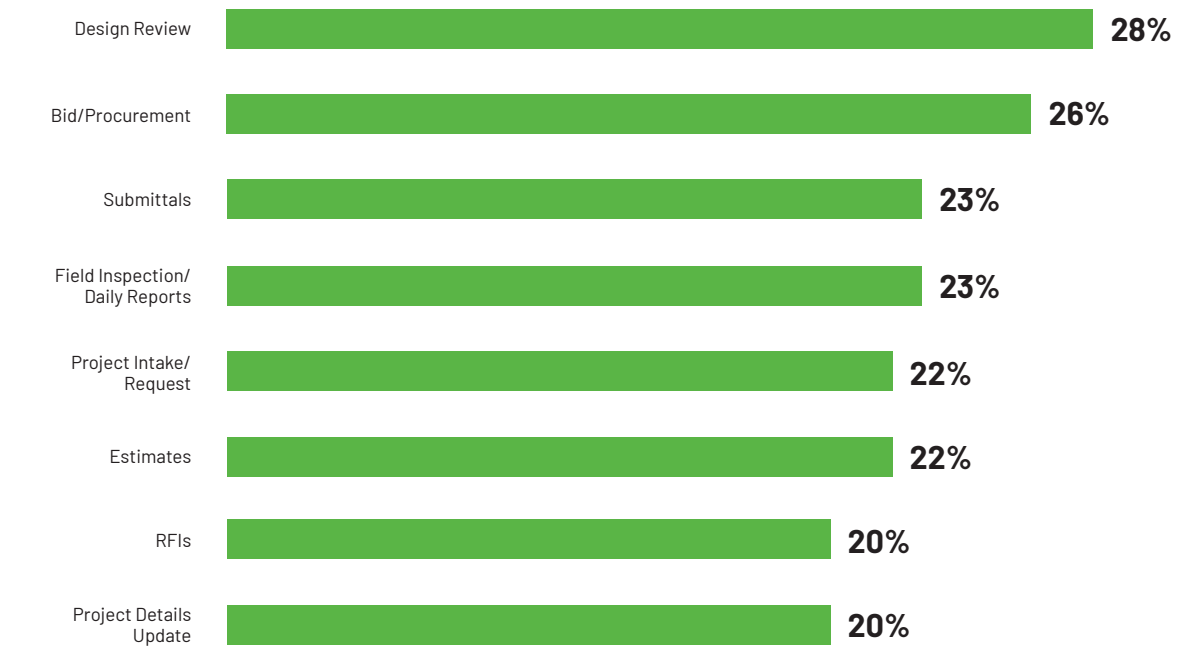
- Nearly two thirds of owners plan to continue to invest in developing and improving digital workflows that they already have in place.
- Most owners (78%) are planning on investing in creating digital workflows for new activities, or expanding their limited engagement with them thus far.

SPECIFIC ACTIVITIES IN WHICH OWNERS PLAN TO INVEST

The charts at the bottom of the previous page and to the right of this one show the specific activities most frequently selected as top priorities for investment in digital workflows.

- Design review, bid/procurement and estimates are top priorities for those with a high and low level of use.
- Those already using digital workflows extensively for project closeout still intend to invest more in that area.
- There is no dominant candidate for a top priority among those with low levels of use, with several activities prioritized by a similar share of owners.

Top Areas of Investment for Owners With a Low Current Level of Use of Digital Workflows



Benefits

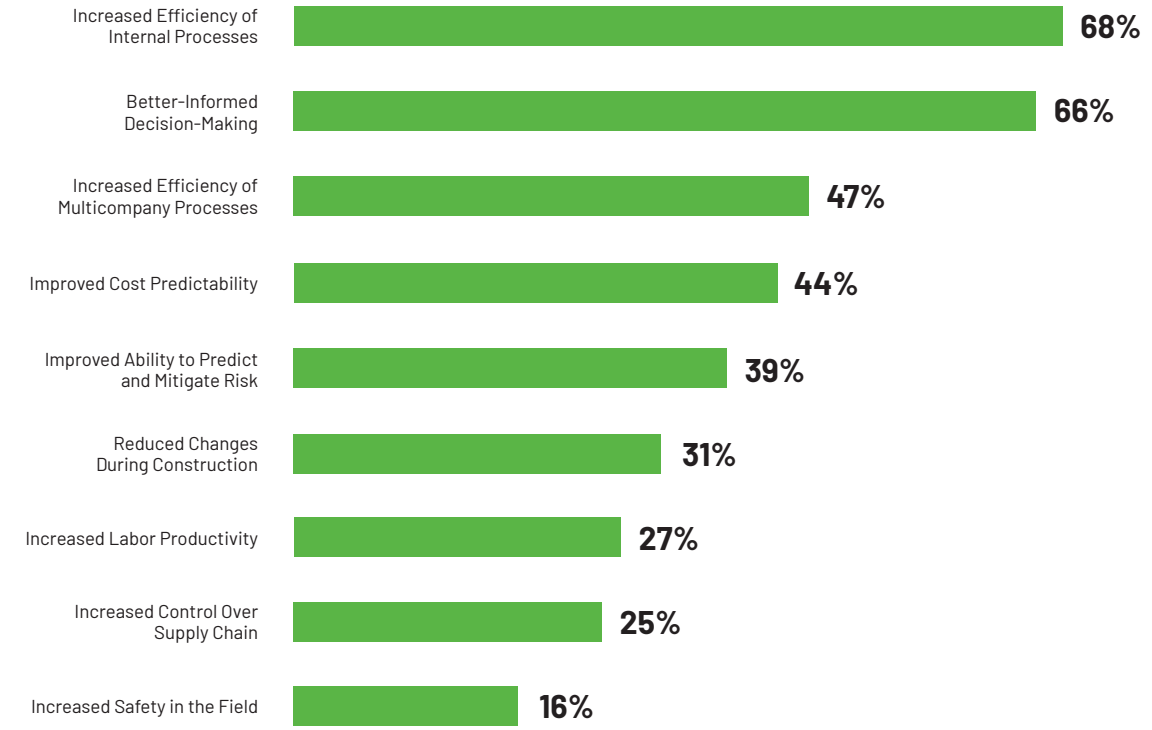
PROCESS AND BUSINESS BENEFITS OF USING DIGITAL WORKFLOWS

Almost all (95%) of the owners using digital workflows cite at least one of the benefits shown in the chart at right from their use.

- Over two thirds find that they frequently experience increased efficiency of internal processes, which is not surprising given their prevalence of use (page 5) and the owners' satisfaction with them (page 7). This bodes well for greater use of digital workflows internally.
- Increased efficiency of multicompany processes is somewhat lower, ranking third. This corresponds to the findings that suggest owners are using multicompany digital workflows less frequently.
  - Important to note is that 62% of large owners experience this benefit, compared with just 30% of smaller companies.
- Two thirds report that digital workflows generate better informed decision-making. This aligns with the finding that digital workflows provide owners with insight into the processes and root causes of issues on projects (see page 10).
- Other critical benefits experienced by a notable share of owners include improved cost predictability and risk management, both of which are especially vital to successful project and program management for owners.

Benefits Frequently Experienced From Using Digital Workflows

According to Owners Who Use Digital Workflows



IMPROVED PROJECT OUTCOMES FROM DIGITAL WORKFLOWS

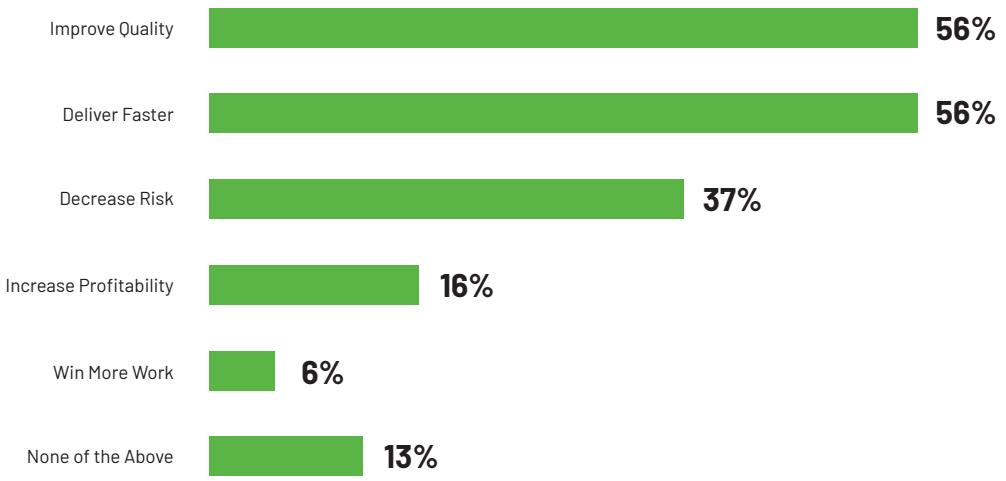
Owners were also asked how many of the five project outcome improvements shown in the chart at right they frequently realize from their use of digital workflows. Again, the vast majority (87%) report that they see positive project outcomes from their use.

- Over half see improved quality and accelerated completion, which are two of the three most common construction project metrics (cost, quality, schedule). This is a very encouraging finding for the core value proposition of digital workflows.
- Over one third also report decreased risk on their projects, roughly the same share who report an increased ability to predict and mitigate risk (shown in the chart on the previous page).
- Project profitability and winning more work apply primarily to commercial developers so it is not surprising that only a small share of the overall survey sample selected these.
- Encouragingly, only a small percentage indicate that they are not currently experiencing these outcome improvements. This proportion may further reduce as owners complete more projects that leverage digital workflows and are thereby better able to directly associate them with improved outcomes.

In addition to these five outcome benefits, owners noted that digital workflows are making information on projects more readily available to them. This is particularly important for owners, since it gives them greater visibility into the status of a project in real time.

Frequently Experienced Improved Project Outcomes From Use of Digital Workflows

According to Owners Using Digital Workflows



ROI OF INVESTING IN DIGITAL WORKFLOWS

HAVING A MEANS OF EVALUATING ROI

Only about one in five owners (19%) reports that they have a method for evaluating the ROI for their investments in technology for digital workflows.

- This finding generally aligns with the 17% average for all others (architects, engineers and contractors) in the full study.
- It is also consistent regardless of the size of organization or whether they have primarily vertical or horizontal building projects.

UNCERTAINTY ABOUT EVALUATING ROI

The high percentage (40%) who say they are not sure if their organization is evaluating ROI is also notable, since it may suggest a more general uncertainty about how to measure ROI on these investments, or who should be responsible for doing so. This could be a particular challenge since most of the top benefits, and at least one of the top outcomes (quality) are hard to quantify. It may also reflect that many organizations do not track their performance shortcomings adequately enough to measure improvements in a meaningful way.

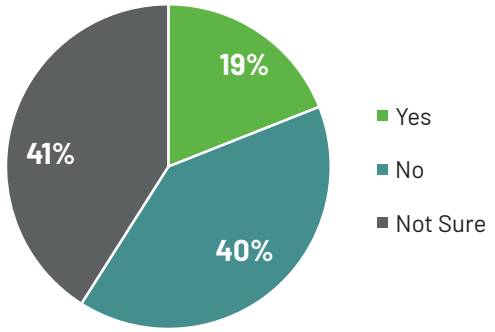
FREQUENCY OF MEASUREMENT

The 19% of owners who do measure their ROI are equally divided betweeen those who do so about 50% of the time that they could and those who are doing so less frequently.

More active measurement of current improvements in light of past shortcomings will accelerate the appreciation and further implementation of digital workflows.

Organizations Evaluating the ROI of Their Technology Investments in Digital Workflows

According to Owners Using Digital Workflows



Influences on Widening Use of Digital Workflows

POTENTIAL FUTURE IMPORTANCE OF DIGITAL WORKFLOWS

Owners who rarely or never use digital workflows were asked to rate the degree to which they believe they will be important for the construction industry in the future.

The chart at right shows the share who believe the future importance of internal and multicompany workflows will be high or very high. In addition the chart compares that finding with the shares of designers and contractors who are similarly infrequent users yet also rated them as potentially important.

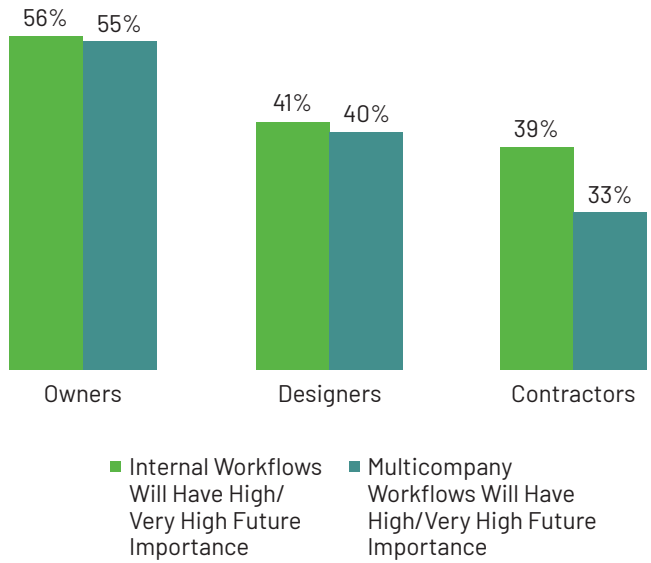
- Owners have notably higher expectations for the future importance of digital workflows than do other types of companies that participated in the survey.
- Encouragingly, despite the greater frequency of internal workflows reported by their more experienced peers, these owners expect both internal and multicompany workflows to be important.

IMPACT ON THE BROADER PROJECT TEAM

Since owners can have a major influence on the practices and investments of other members of their project teams, this finding may bode well for future growth of digital workflows in the construction industry. While direct owner requirements for digital delivery would be a major driver, mere awareness of the importance that both experienced and inexperienced owners place on digital workflows could encourage design and construction companies to adopt and implement them for a competitive advantage.

Percentage of Infrequently-Using Respondents Who Believe Digital Workflows Will Have a High/Very High Level of Importance for the Construction Industry in the Future

According to Respondents Who Infrequently or Never Use Digital Workflows



Influences on Widening Use of Digital Workflows (CONTINUED)

REASONS THAT OWNERS DO NOT USE DIGITAL WORKFLOWS

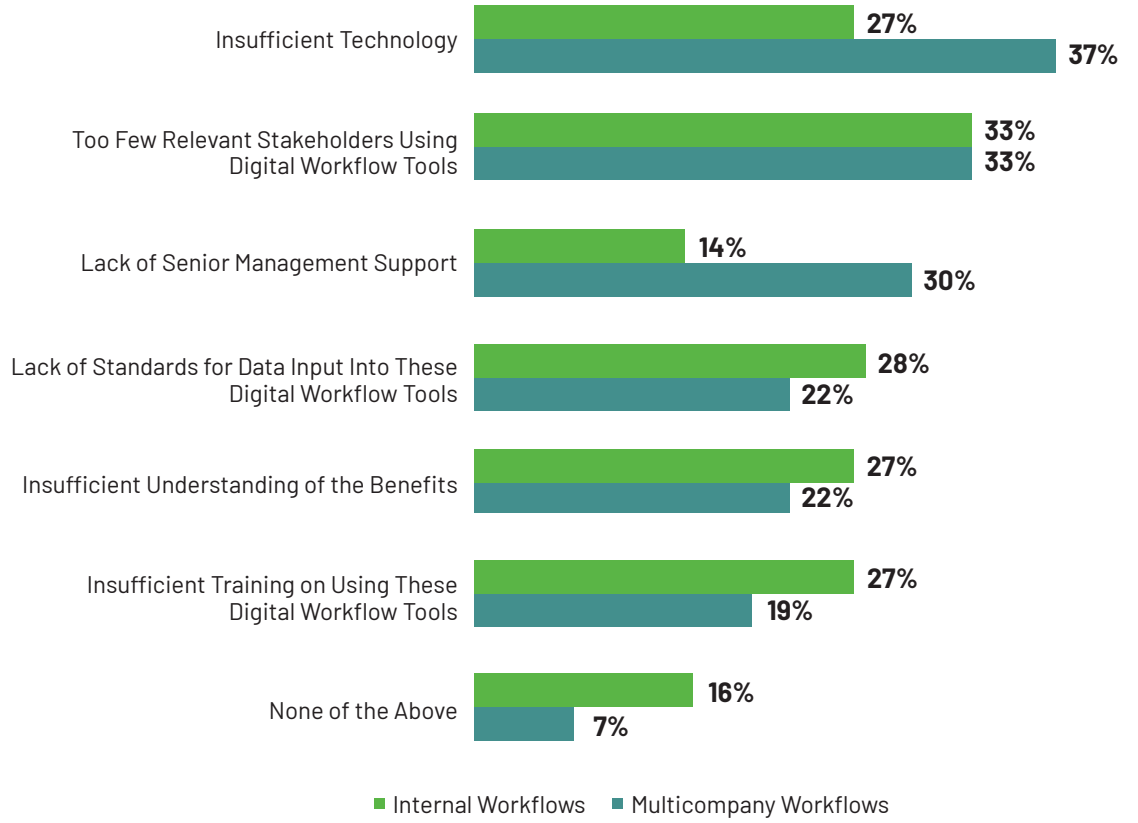
Owners who rarely or never use digital workflows were asked to select the top three reasons that they are not doing so from the list of options in the chart at right. The findings rank the obstacles overall, and reveal many differences between internal digital workflows and multicompany ones.

- **Internal Workflows**
  - Too few relevant stakeholders using digital workflow tools leads the list, suggesting that information silos may be frequent inside many owner organizations.
  - The next four reasons are closely clustered (27%–28%) suggesting they reinforce each other in preventing wider internal use.
  - Fortunately, lack of senior management support (14%) is a minor issue.
- **Multicompany Workflows**
  - Insufficient technology tops the multicompany list, which is compounded by too few relevant stakeholders using digital workflow tools and lack of senior management support.

The next three pages identify three types of benefits (project, process and business) that would most effectively encourage owners to overcome these obstacles and adopt digital workflows in order to achieve them.

Top Reasons for Not Using Digital Workflows

Selected in the Top Three by Owners Who Have Little/No Use of Internal and Multicompany Workflows



Influences on Widening Use of Digital Workflows (CONTINUED)

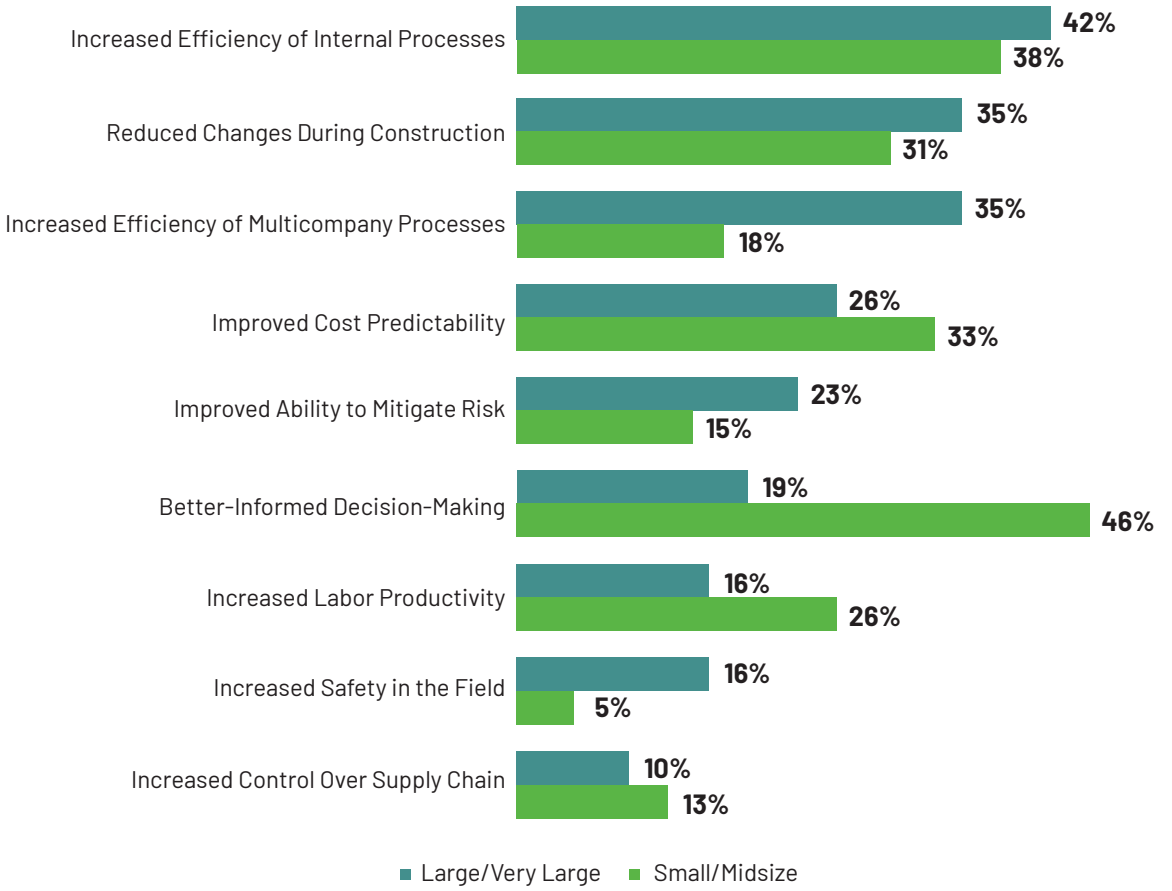
PROCESS BENEFITS THAT WOULD ENCOURAGE OWNERS TO USE DIGITAL WORKFLOWS

Owners who rarely/never use digital workflows were asked to select the top three process-related benefits which, if proven, would most spur them to start or increase their use of those workflows. With 89% of owners selecting at least one benefit, it is clear that this could be an effective driver.

- Increased efficiency of internal processes leads overall. Fortunately this is also the most widely reported benefit by digital workflow users (see page 18), boding well for wider use.
- Better informed decision-making is another widely reported user benefit, and it is also cited as highly influential here. Its appeal is not universal, however, in that it ranks much higher for small/midsize owners and is also more influential for owners doing vertical (46%) versus horizontal projects (17%).
- Large owners more often select increased efficiency of multicompany processes as important. This aligns with their higher level of engagement with them (see page 6) and is encouraging as they are generally involved in larger projects with bigger project teams, therefore potentially able to influence more adopters.

Most Compelling Process Benefits to Encourage Wider Use of Digital Workflows Among Owners

Selected in theTop Three by Owners Who Rarely/Never Use Digital Workflows



Influences on Widening Use of Digital Workflows (CONTINUED)

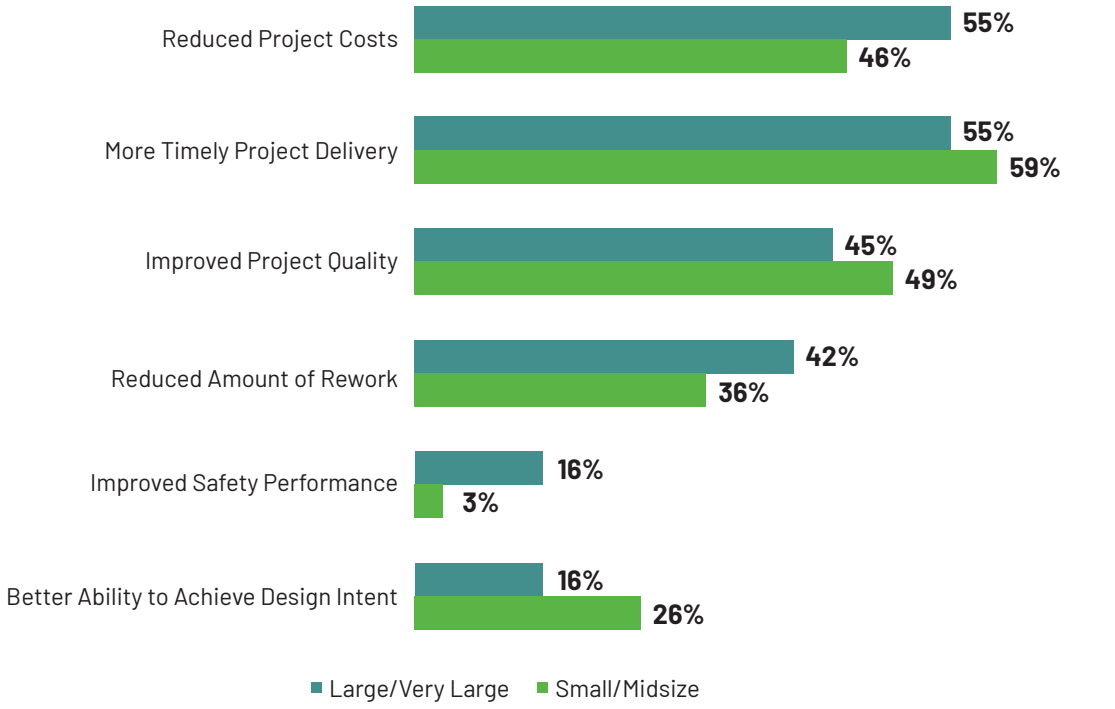
PROJECT OUTCOME BENEFITS THAT WOULD ENCOURAGE OWNERS TO USE DIGITAL WORKFLOWS

As with process benefits, owners who rarely/never use digital workflows were asked what project outcome benefits would encourage them to begin or expand their use of digital workflows. Nearly all (91%) of the owners say that at least one of these benefits would influence them.

- More timely project delivery would encourage over half of both large and smaller owners to use digital workflows. Most owners are negatively impacted when projects get delayed, so this benefit is compelling.
- While large owners place more emphasis on reducing project costs, it would still be a top driving benefit for small to midsize organizations as well.
- Small/midsize owners more frequently select improved project quality and better ability to achieve design intent, while large owners are more influenced by the prospect of reducing the amount of rework, which can be particularly toxic on big projects.
- Vertical owners place somewhat more weight on these project outcome benefits, with 98% selecting at least one, than do horizontal owners (83%).

Most Compelling Project Outcome Benefits to Encourage Wider Use of Digital Workflows Among Owners

Selected in the Top Three by Owners Who Rarely/Never Use Digital Workflows



Influences on Widening Use of Digital Workflows (CONTINUED)

BUSINESS BENEFITS THAT WOULD ENCOURAGE OWNERS TO USE DIGITAL WORKFLOWS

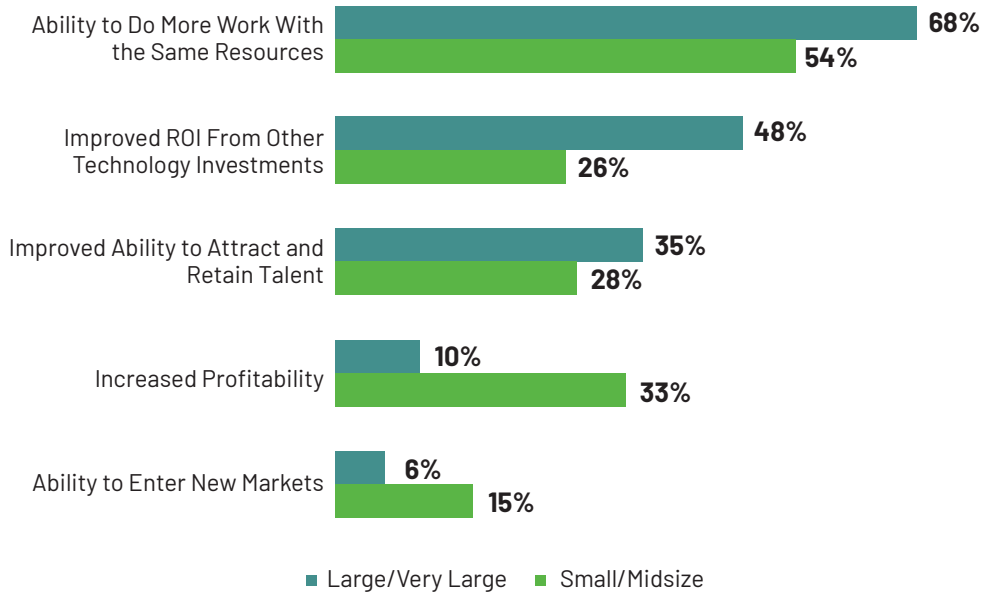
Following the questions about process and project benefits, the owners who rarely/never use digital workflows were asked to select the most influential business-related benefits of using digital workflows from a list of seven potential options. The majority (81%) selected at least one business benefit as influential to them and their top five choices are shown in the chart at right.

- All organizations most frequently select the ability to do more work with the same resources. Owners are experiencing workforce shortages, just like their supply chain, and with tighter budgets due to reduced revenue during the pandemic recession, the ability to optimize existing resources is more valuable than ever.
- Far more of the large organizations report that having improved ROI from other technology investments would encourage them to invest in digital workflows. Other Dodge research suggests that, in many cases, large organizations are more invested in technology than are smaller ones, and they have more rigorous criteria for analyzing its impact.
- Significantly more small/midsize organizations would be influenced by the prospect of increased profitability, which may in part reflect current COVID-related profitability struggles.

These findings suggest that adoption can be driven by dissemination of information about all three of these types of benefits created by digital workflows.

Most Compelling Business Benefits to Encourage Wider Use of Digital Workflows by Owners

Selected in the Top Three by Owners Who Rarely/Never Use Digital Workflows



Interview: Owner

Chad Foley

Enterprise Senior Application Developer
Information Technology Department, City of Raleigh

Chad is a technology supervisor in the IT department at the City of Raleigh, whose current role is that of a player/coach for a small team that supports various enterprise applications focused around asset management and construction management. He also leads the city's systems integrations team, which handles various back-end integrations to automate workflows across these enterprise sytems.

In the last three years, what are the biggest technical changes your organization has experienced in how data is exchanged internally at your organization?

FOLEY: There is a technical response and a business-related response to this question. From a technical perspective, we have implemented a middleware system, which is a service architecture that allows us to exchange data via various URLs. It acts as a "middle man" that allows our ERP system to talk to our work order system, or the structural management system in our CMIS to talk to GIS, so that our staff does not have to manually update GIS fields. The middleware platform will read the data from the CMIS system and update GIS automatically on a scheduled job. Not many municipalities are mature enough to have this kind of solution. They do a lot more point-to-point integrations, whereas [our platform] can query data from one system, transform the data and send it to another system.

Since this type of software isn't common in municipalities, what argument did you use to encourage your organization to invest in it?

FOLEY: To reduce technical debt, have more data exchange and avoid doing dual entry into various systems. There were so many nuanced, very specific integrations. One system would have some weird COBOL script that would do the data exchange. There would be another little widget in visual basic or some Python script. All these systems were hard to maintain: One person would know the database structure of one system and how to interact with it, but not many other people would. So if someone left, that knowledge would be gone. We were trying to standardize that ... We have been talking about this for 10 to 12 years at least ... The system is almost like a city API for all our internal enterprise system that is a façade on top of that system that makes it friendlier to unlock the data ... We had a few failed attempts with other software systems, but finally we got the middleware solution working.

And what are the biggest business-related changes you have seen related to internal data exchange?

FOLEY: The business side is constantly evolving. We're still working on exchanging data in a cross-departmental workflow. It started with our stormwater group's use of a construction management system. They saw a need for it, and they went out on their own and got it, just pulling IT in at the last minute. Once the stormwater group had it, the roadway design and construction groups, both started to use it and saw the benefits. So now we're trying to build some cross-department workflows where [data

Interview: Owner (CONTINUED)

can be handed off from planning to design to construction.] That handoff traditionally has been very manual, with a lot of emails back and forth, and a lot of Excel. Now we have a few examples of where they can all have visibility into where a project is and its workflow. They can hand off more seamlessly [between departments]. We have an ongoing strategy to roll it out to the other departments [on an enterprise level]. We are trying to get buy-in by saying, "Hey, we want to standardize how we communicate on a single construction project." We're constantly seeing more collaboration across departments in all kinds of areas, and this would add efficiency.

What are the biggest benefits you have seen from the digital workflows you've created for your internal organization?

FOLEY: The biggest advantage is standardization: To [have different departments] do things the same way and [stop relying on] Excel and emails, [as well as getting] construction plans, CAD drawings and BIM files off some shared drive or somebody's thumb drive and having them in one system that anyone can access. Executive-level reporting is another big benefit of having these internal digital workflows. They allow people at the management or executive level to use a dashboard to see where a project is in the workflow at any given time. They don't have to call the project manager. They can just log in and check the expenditure balance to see if projects are over budget or under budget, or if they are on schedule versus overdue. We are still in the process of building these things, but the goal is to standardize how we do our projects versus [the old way in which] one department does it one way, another department does another way, and it's all in Excel and it's all on shared drives and folders on people's personal computers.

What are the biggest challenges you experienced when setting up your internal digital workflows?

FOLEY: The biggest challenge was getting buy-in. When you deploy an enterprise system, the big bang approach doesn't work very well. We have learned a smaller strategic [approach of] targeting the right people [works better]. My team goes to different departments and says, "Hey, there's this thing we'd like to show to you, give a demo." Often, we'll get some initial pushback, either related to change in general or [specific departmental needs]. They don't want to be locked down to one system. We explain that we can build these workflows [to adapt to] however they want them, and we can even allow them to build the workflows themselves. We have two or three power users who are doing that now, and we're identifying a power user in each department or even one or two champions to quell some of these fears of change.

Funding has also been a huge challenge, especially with COVID budgets … The good news is we have a bottom-up approach and a top-down approach. Once city management got wind of what the stormwater department was doing with the project management information system for construction projects, the assistant city manager said that the city needs access to this across the board. The city management recognizes the need to standardize how we report up to the executive level, instead of it taking two weeks to dig out different spreadsheets and compile them together just to get a snapshot of the statuses of all the different CRP projects. We had that top-down assistant city manager mandate, and then we had the bottom-up approach [with different departments organically saying], "Hey, you guys are doing it this way. I can see the benefit of that. We want to try it too." And then you have our outreach program trying to sway people.

What best practices would you recommend to other owners seeking to create more internal digital workflows?

FOLEY: We have a user group that meets quarterly, and we invite departments that aren't in the system yet to participate. [That allows users and nonusers to] share ideas, "How do you do your projects? Maybe it would be more efficient if we used the same monthly status report

Interview: Owner (CONTINUED)

template." We include some demonstrations of functionality at these user groups, along with different business units sharing ideas about how they they use the system. We have also established "office hours" where any user can come to ask a question about anything. We schedule informal training sessions on different functionality we'd like to see more widely adopted. We keep them short and targeted to a specific functionality or module. Because one of the good things about our CMIS is that you don't have to learn all of it. You only care about your piece of the workflow, so you don't need to master the whole system.

What is the next step for you to improve your internal system?

FOLEY: We are trying to build a real-time integration to our GIS system. We are also planning an integration between our CMIS system and our asset management system. That could be a huge win for us if we get that integration in place.

Let's talk about the external flow of data now. What are the biggest changes in workflows you've established between your organization and external project team members in the last three years? And what benefits have you achieved?

FOLEY: Before we started using our CMIS system, we interacted with contractors and design companies through email, a lot of phone calls or in-person meetings. Now the big shift is that we can give them a login to our CMIS system. Now they're actually initiating some of these workflows... [Without providing them access to everything], they can have a view into the project and understand when and how much they're going to be paid at any given time ... The fact that they can log in to the same system we're using and see where things are, that's a bit of a game-changer. [When they work with two different departments], we don't want them to have two different experiences. For example, we used to handle taxes slightly differently from one department to the next, and that is not a good experience for the external partner.

That system is integrated with a digital document signature system, where contractors and external vendors can digitally sign things. We implemented that at the very beginning of COVID, and it was a big help.

What challenges have you experienced with your external workflows?

FOLEY: The challenges are always the people part. The technical stuff is usually the easy part. [Currently because we have a limited number of seats in our CMIS platform, they need to buy a license upfront, and that is a challenge], especially if they need more than one person to access the system. They have to buy multiple licenses, and we reimburse them. Some departments that [still aren't using the CMIS system] think we shouldn't reimburse them. They say that's the cost of doing business. But that is unfair to smaller companies that may have one or two employees or a mom-and-pop shop that we need for a certain job. An upfront license cost for them is a much bigger deal than for a very large company, and we don't want to exclude them.

We provide some training to the external vendors too but sometimes it is challenging to manage the logistics of training.

Do you have specific requirements for contractors to submit digital documents, and anything in the future that you'd like to have submitted?

FOLEY: Yes, we do have some requirements. For the future, one thing I'd like to get is to require any construction drawings, CAD files, PIM files, to be part of the project documentation in our CMIS system, rather than those being sent through email or downloaded from a cloud drive. We have tools that allow us to take CAD files and convert them to spatially aware GIS maps, indoor vertical asset maps. If we get the CAD files in our system, we can convert them through some tools with our GIS platform into these indoor maps that we can then pull into our asset management system. That's huge because you will know exactly where [equipment is] in the building. We can have a real view of these vertical assets.

Methodology

In 2021, Dodge conducted an online study to gauge the perceptions and experience of engaging in connected construction in the US. The overall study included 954 responses from architects, engineers, general contractors, specialty trade contractors and owners. This SmartMarket Brief examines the responses from the 113 owners who participated in the study.

Occasionally, data from the other types of organizations are included in the analysis to provide context for the owner findings. Those responses include: 240 architects, 133 engineers, 236 general contractors and 232 specialty trade contractors.

The overall survey was fielded from April 28 to Aug. 17, 2021. Sample was provided by Dodge Data & Analytics Architect and Contractor Panels, a Dodge database of engineers and lists of industry contracts from Trimble.

OWNER DEMOGRAPHICS

The sample for the owners who participated in the survey was solely from Trimble. The survey was fielded to owners from July 1 to August 17.

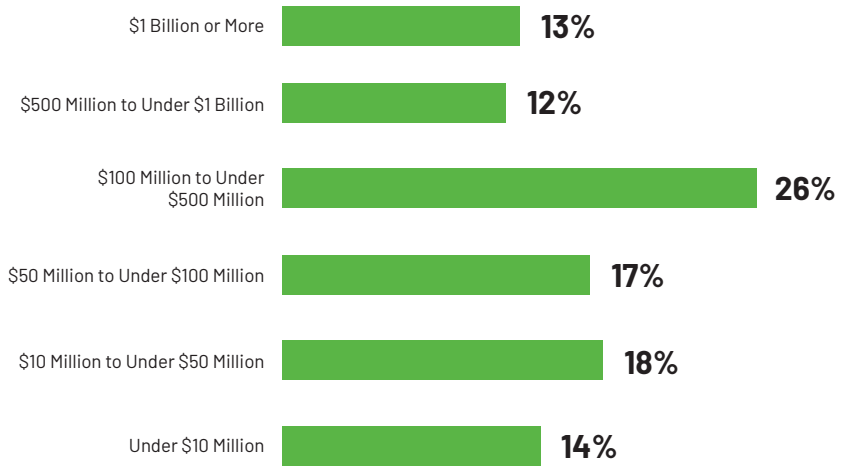
Two analytic variables are used throughout the analysis in this *SmartMarket Brief*.

VERTICAL BUILDING VERSUS CIVIL CONSTRUCTION

To participate in the study, owners had to have primarily institutional, commercial or civil projects in their portfolios. The share of owners with each type of project in their portfolio is shown below.

- Institutional: 66%
- Commercial: 34%
- Transportation: 34%
- Water/Wastewater: 25%
- Industrial: 20%
- Energy/Power: 14%
- Multifamily Residential: 12%

Annual Capital Project Value



The analysis in this report includes comparisons of owners doing primarily vertical building projects to those doing primarily horizontal (civil) projects. One third of the owners (37 respondents) indicated that over 50% of their projects were in the transportation, water/wastewater, industrial or energy/power sectors, and these were identified as those in the civil sector. The remaining two thirds were included in the vertical building construction category.

SIZE OF ORGANIZATION

The analysis also compares owners based on the size of their organization, determined by the annual capital project value of their completed projects.

- Small/Midsize Owners (Annual capital project value under $100 million): 49%
- Large/Very Large Owners (Annual capital project value of $100 million or more): 51%

Contacts & Resources

DODGE EDITORIAL TEAM

Stephen A. Jones leads Dodge Data & Analytics' Industry Insights Research division and is the primary author of this report. He is active in numerous industry organizations and frequently speaks at industry events around the world. Before Dodge, Jones was a vice president with Primavera Systems (now part of Oracle). Prior to that, he was principal and a Board of Directors member with Burt Hill, a major A/E firm (now Stantec). He holds a BA from Johns Hopkins and an MBA from Wharton.
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