



No turning back

An industry ready to transcend

2021 Global Construction Survey



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Turning point or business as usual?

In the 20 years that we've been surveying project owners and engineering and construction companies' performance, we've never lost sight of their core objectives: to deliver high-quality projects on schedule and on budget. Over decades, the industry has invested heavily in construction methods, controls, risk management and technology in pursuit of these goals.

However, increasing project complexity, plus the pressure to build bigger, faster and more cost-effectively, has outpaced the ability to control risks, costs and schedules, resulting in continued failures—sometimes, regrettably, on an epic scale.

Which is why it's so pleasing to report how the sector responded to the pandemic. Yes, most of the players weren't fully prepared. And yes, companies felt a lot of pain in terms of cost overruns and schedule delays. But, with the exception of only a few sectors, contractors had enough diversity in their portfolios to ride the shocks, as owners continued to fund public and private projects like healthcare facilities, wind farms, data centers, roads, rail and bridges.

Consequently, there's an abundance of positivity, with two-thirds of owners predicting an expansion in their capital programs, and half of all respondents are 'very' or 'somewhat' optimistic about the future direction of the construction market. A vast majority of contractors expect revenue growth over the next year, and nearly 30 percent believe this will be 10 percent or more.

The past 18 months have seen some welcome changes in approach to major projects. There's been an imperative step change in the use of remote and collaborative technology, in order to keep projects running despite fewer people on site. We've also witnessed a renewed spirit of collaboration, as owners acknowledged the truly unique nature of the pandemic and lockdowns and accepted their share of the associated risks and costs. Having come through this difficult period relatively unscathed, there's a sense that contractors may finally be turning their backs on projects with unmanageable risks that could jeopardize their entire business. We've seen too many instances where a few poor-performing mega-projects can destroy an esteemed legacy.

Are these accommodations a signal of more permanent shifts or merely temporary adjustments?

True and meaningful transformational innovation in construction techniques is long overdue. It also remains to be seen whether, once a form of 'normality' returns, engineering and construction companies continue to shun high-risk, turnkey projects. Let's hope that leaders work together to establish a more optimal way to allocate risk to those most capable of bearing it.

This 13th edition of KPMG's Global Construction Survey also shines a light on the significant challenge of diversity in the sector. Enriching the talent pool with a wider range of skills and perspectives can bring enormous benefits, creating more equal and inclusive working environments and helping to attract the best young people to the industry.

As industry professionals who have worked in engineering and construction for many years, we maintain a passion for the sector and an admiration for the 'can-do' attitude and fortitude shown by all those engaged in projects, large or small. We sincerely hope that we're on the cusp of a long overdue era of progress characterized by sophisticated risk management and dramatically improved project performance.

On behalf of our team, we would like to personally thank all those who took time out of their busy lives to contribute to the annual survey, which serves as a platform for continued dialogue and debate on advancing the industry.



Geno Armstrong
International Sector Leader—
Engineering & Construction
KPMG International



Clay Gilge
Lead, Major Projects Advisory
KPMG in the US



Kevin Max
Principal, Major Projects Advisory
KPMG in the US



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Transcendent action plan



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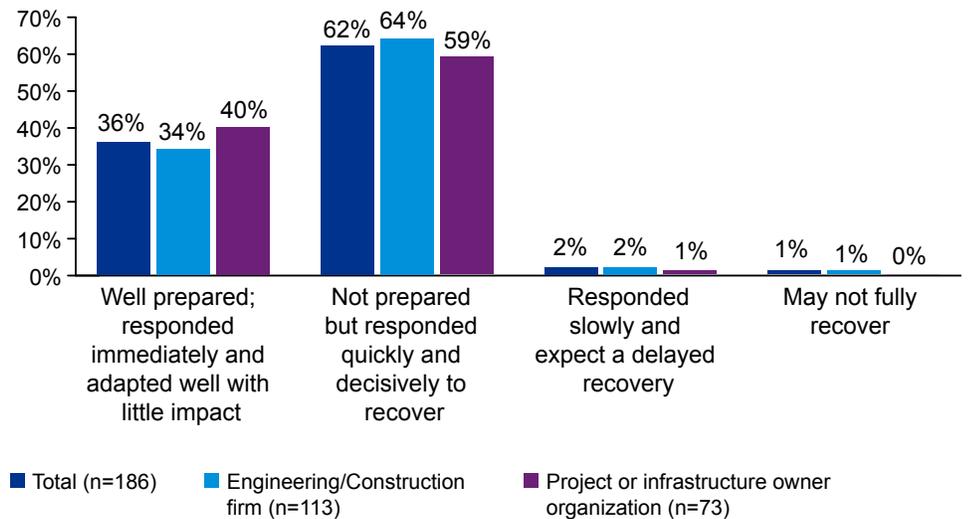
**Paradigm shift
opportunity**

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Survey participant feedback
 We deliver in an environment of continuous change, adapting to the conditions of the physical location of our projects, interacting with multiple third parties who influence the cost or duration of our projects, and coping with a very dynamic workforce.”

The engineering and construction industry is accustomed to coping with disruption. Whether it's macroeconomic and financial cycles, natural and man-made disasters, or increasingly varying and impactful weather conditions, the sector routinely overcomes design, schedule and budget changes, supply delays, equipment failure, labor disputes and accidents.

And so it was with COVID-19, where all over the world, projects continued in the face of remote working, lower workforce numbers allowed onsite, and illness. Although just 36 percent of respondents say they were 'well prepared' for the pandemic, the vast majority feel they were able to respond quickly and decisively recover (Figure 1).

Figure 1: How did your organization respond to the pandemic?



Source: 2021 Global Construction Survey

Rebalancing contract risk

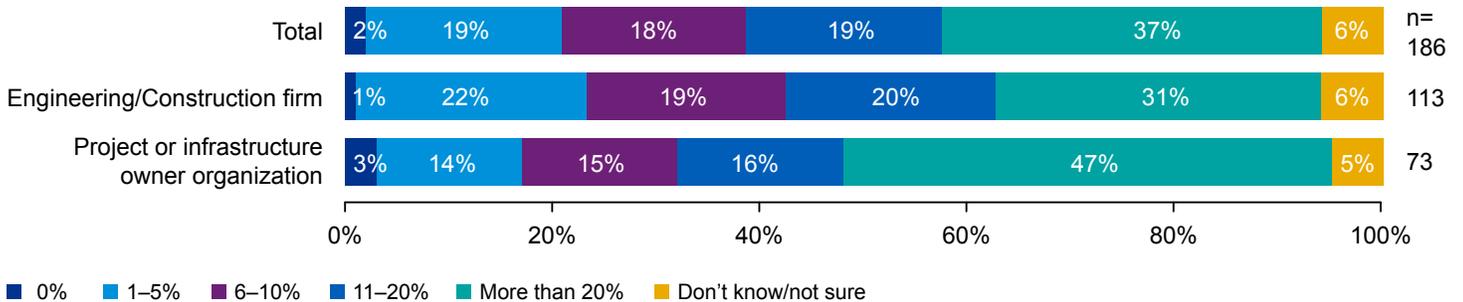
For many years now the sector has been looking at ways to break the cycle of at-risk, lump-sum contracts. These 'bet the farm' projects carry a significant risk imbalance weighted heavily in favor of owners, placing existential pressure on contractors. All it takes is for one contractor to accept such a burden, and others follow suit in a vicious cycle. Recently, however, for complex, multi-year, mega-projects, contractors have been shifting to hybrid or cost-plus arrangements with lower liability for cost and schedule overruns.

Consequently, project owners, faced with a shared responsibility for risks, are now taking greater interest

in controls over scoping, budgeting, and planning, and investing in risk management to support their capital investment decisions.

The pandemic accelerated the risk transfer away from contractors and also saw an unusually high level of cooperation, to cope with the increased impacts on cost and schedule. Owners were largely appreciative of the challenges—most notably the health and safety restrictions—and, as our survey suggests, appeared willing to absorb a higher proportion of cost overruns; consequently respondents from owner organizations were considerably more likely to suffer excess costs (Figure 2).

Figure 2: Percentage of projects experiencing a schedule delay or cost impact attributable to COVID-19?



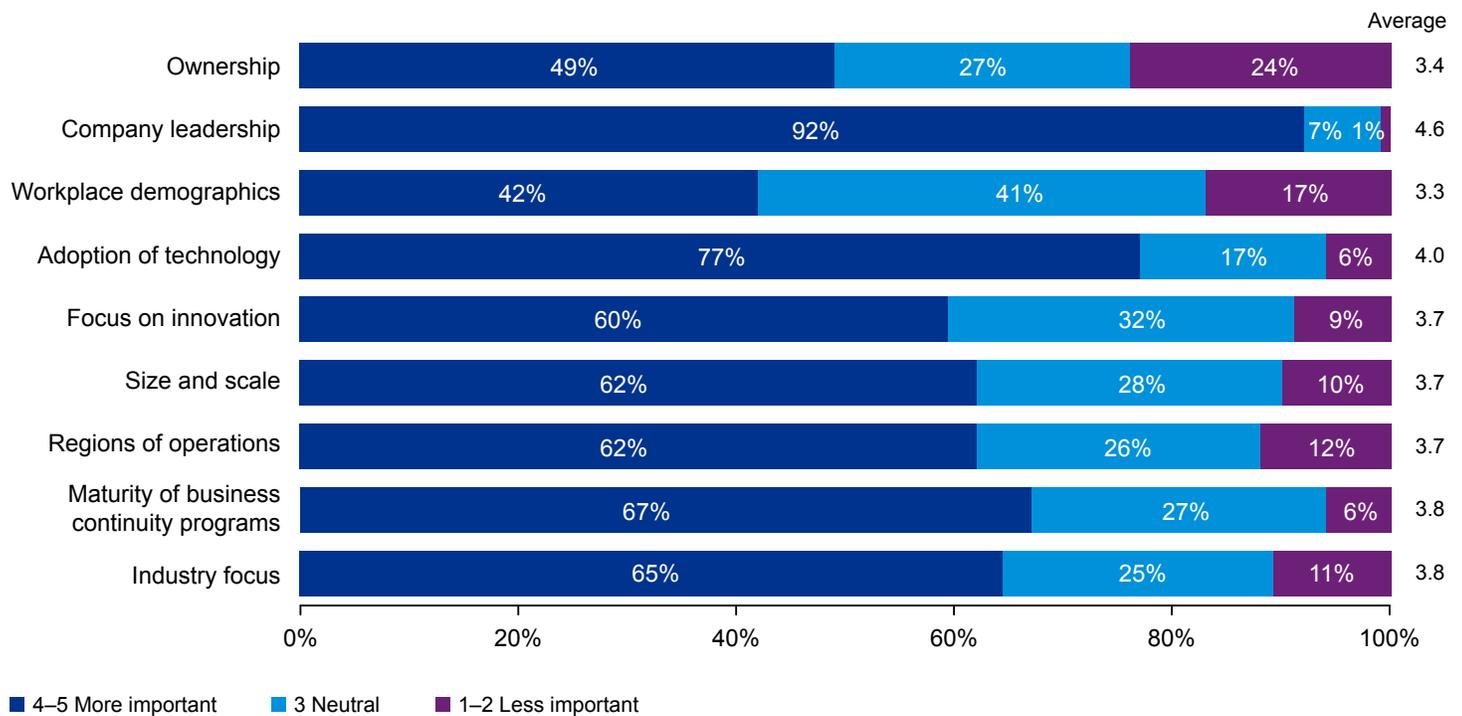
Source: 2021 Global Construction Survey

Acquiring tools for resilience

In KPMG's 2017 Global Construction Survey, [Make it or break it](#), fewer than half of respondents had a technology road map for improving project controls, and only a fifth used project management information systems (PMIS)

across all projects. Fast-forward 4 years and both contractors and owners report technology as the second most important capability to help deal with disruptive events (like COVID-19 and other shocks) (Figure 3).

Figure 3: Rate the attributes that influence your organization's success or failure in dealing with disruptive events.



Source: 2021 Global Construction Survey

The sudden COVID-19 lock downs, experienced in countries around the world, has forced companies' hands in improving communications and connectivity, to keep projects running while adhering to far stricter health and safety criteria. Having enjoyed the dramatic improvements from remote working and digital collaboration, 50 percent of engineering and construction firms (and 33 percent of project owners) plan to build on this with significant investment in technologies designed to enhance their delivery of capital programs (Figure 16, page 33).

Other factors driving resilience are strong company leadership, diversity of regional operations, business continuity planning, and innovation. When asked how they could improve their resilience, respondents cite financial management, risk management, and labor/resource management as the top three areas of focus, along with supply chain and governance.

Recognizing resilience as a core capability

The engineering and construction sector has started to recognize that it's not enough to simply respond effectively to shocks, and that resilience must be operationalized and treated as a key strength.

A large majority of respondents (87 percent) say it's very or quite important to plan for resilience in capital projects/ programs (Figure 4), while an even larger proportion are committing resources to achieve this goal (Figure 5).

Figure 4: How important is building resilience into the delivery of your organization's capital projects and programs?

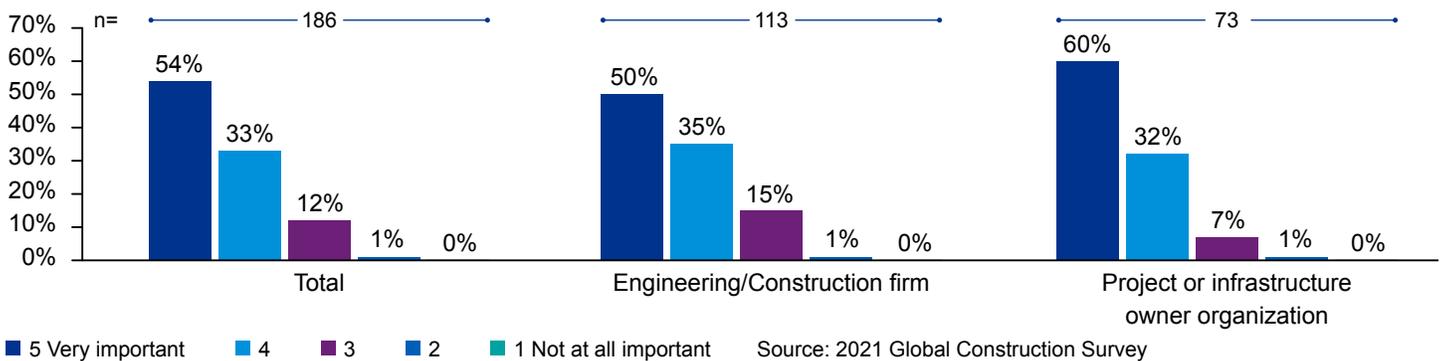
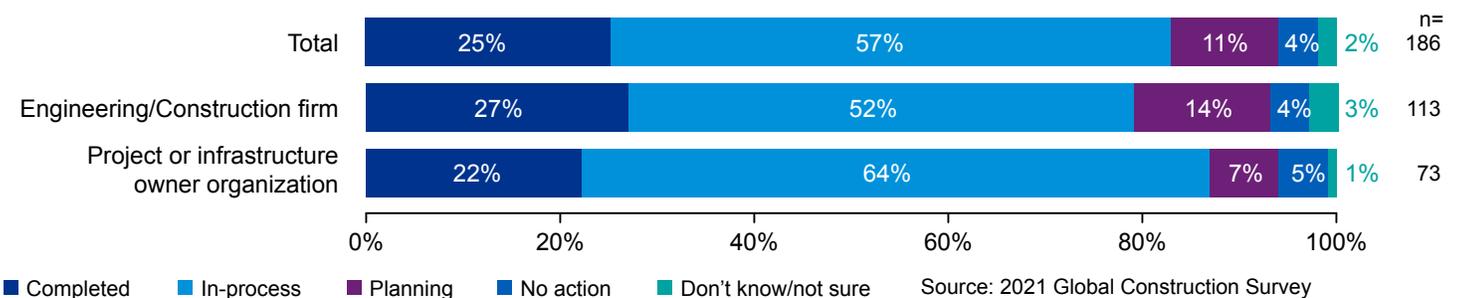


Figure 5: What level of commitment is your organization taking to improve resilience of your capital projects and programs to future disruptive events?



Survey participant feedback

We are continuously looking to improve resilience. As a general contractor, that often means looking at the diversity of the projects we pursue ... to protect ourselves in the event of economic changes, be that in the private or public sector.





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KPMG thinks:

Adapting to permanent disruption could increase efficiency

In many respects, the sector responded admirably to the challenges of COVID-19. Owners tended to acknowledge the unforeseen pressures on contractors and frequently compensated them for delays. The move away from imbalanced, fixed-price contracts feels like a re-balancing of risk after too many years of contractors suffering huge losses, which in some cases pushed companies into liquidation—with inevitable knock-on effects for owners who saw projects stalled. Hopefully this will signal a more collaborative approach to risk sharing that should benefit all players, with risks allocated to those most equipped to manage them. It would be unfortunate if over-competitive bidding once again saw contractors saddled with burdens that they couldn't live up to.

The pandemic also meant that contractors had to work in different and smarter ways, speeding up the adoption of innovative technologies like video communications, cloud-shared files and walk-throughs by drones. This has been a game changer for efficiency, enabling project managers to communicate remotely, change plans in real time and track people on site, enabling projects to proceed at pace. It

feels like we're embracing a new breed of agile specialists working anytime from anywhere.

As vaccines are rolled out, the pandemic appears to be slowing in many parts of the world, but that doesn't mean that other emerging risks won't surface. Both owners and contractors will have to plan for continued horizontal and vertical integration of the construction supply chain in the form of business consolidation and reorganization. These changes are driven by improved productivity (a result of technology integration) and shifts in regional demand for construction services. Industry leaders will continue to integrate diversity and inclusion into recruitment and training, changing patterns of government infrastructure investment, new social policies and regulatory changes, and rising investor demands for higher environmental, social and governance (ESG) standards.

Such challenges can only be met by a strong focus on assessing, prioritizing and responding to risks, and a full understanding of the impact of future disruption on the workforce, the operations, costs, revenue and reputation.



View from the industry

Integrated project delivery is a concept that's coming of age. As an owner, we have seconded our people to the vendor, with a 'one team' concept, to make them and us more successful. Now we can go into to a room and talk to project managers or construction managers, and I honestly don't know which company they work for. This approach could work for any of our vendors and it really speeds up the project. The lesson here is to integrate and work together, with more transparency.

Gary Rose,
*Deputy Vice President,
Ontario Power Generation*



View from the industry

The digital and technological environment around us is forcing change more rapidly. We can't continue as we are. Highways England is taking the opportunity to consider how best we contract with our supply chain partners and get serious about an integrated approach. This is about our operating model: how we better understand the supply chain at every level in order to extract value, and how we influence suppliers to invest in digital adaption and drive innovation.

We must ensure that our partners get plenty of opportunity and that we are working seamlessly with them through our commercial models. We can't just wish things to be true. We work and partner with private sector organizations and we must help them shape their investment and change towards the new digital world.

Peter Mumford,
*Executive Director, Major Projects & Capital
Portfolio Management,
Highways England*





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Integrated risk management

A joined-up view of risk



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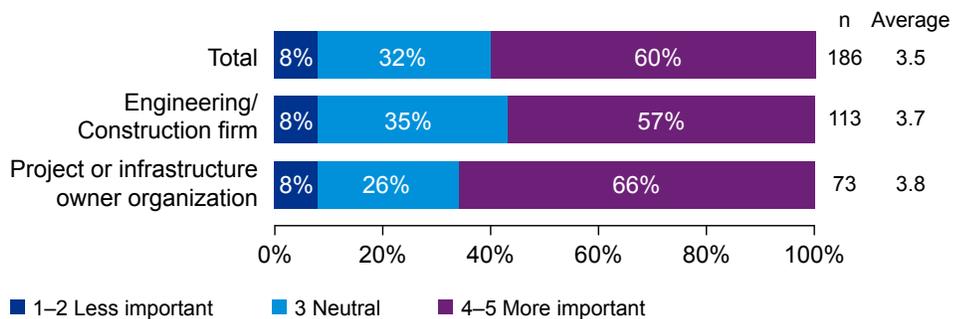
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In the very first KPMG Global Construction Survey in 2005, a majority of respondents cited ‘managing risk’ as one of their top three challenges. COVID-19 is just the latest in a series of ‘black swan’ events over the past decades, and once more the engineering and construction industry has struggled to manage the complexities at both enterprise and project level. More than one-third (37 percent) of respondents say their companies missed budget and/or scheduled performance targets (by a factor of 20 percent or more) as a result of COVID-19 (Figure 2, page 7).

Not surprisingly then, risk management is considered one of the most critical areas to address in order to improve organizational resilience. There’s a particular desire to achieve a more holistic view of risks, with 60 percent acknowledging the need to increase integration and visibility between enterprise risk management, portfolio risk management and project risk management functions (Figure 6).

Figure 6: How important to the success of your capital projects and overall capital program is the level of integration and visibility between enterprise risk management, portfolio risk management and project risk management functions?

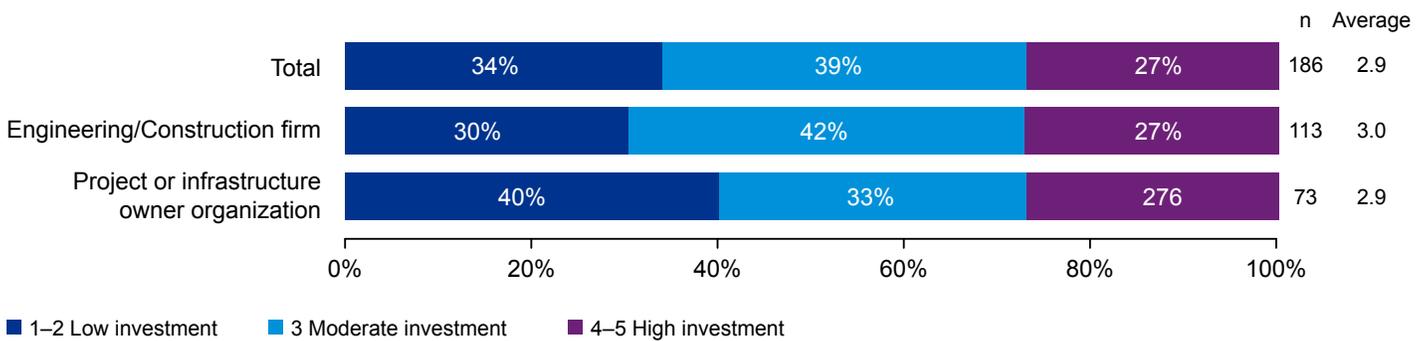


Source: 2021 Global Construction Survey



Both owners and contractors have pushed money and resources into risk management in recent years, a trend that's set to continue, with two-thirds planning a moderate or high level of investment in future (Figure 7).

Figure 7: What level of investment does your capital projects organization plan to spend on risk management?



Source: 2021 Global Construction Survey

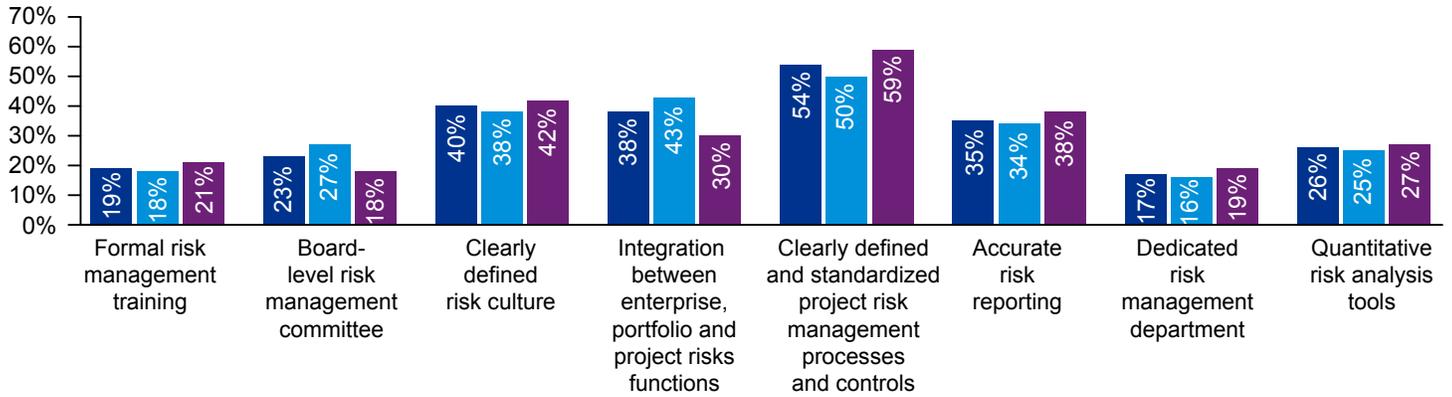
Risk management game-changers

The engineering and construction executives taking part in this year's survey are determined to improve their organizational risk management and recognize the need to get the 'basics' right. Clear and standardized risk processes and controls are the top priority, along with a risk culture and accurate risk reporting (Figure 8, page 15). Risk management across the sector can vary widely in quality and these elements are table stakes.

Relatively few respondents (27 percent) consider quantitative risk analysis tools as important, which could turn out to be an oversight, as boards increasingly expect to see more detailed analysis of the financial impact of events. These tools have tremendous potential, but the relatively low adoption may signal a wider lack of trust in the underlying data, which can undermine the ability to develop reliable, accurate risk analyses.



Figure 8: Elements most important to achieving successful risk management across a capital project portfolio



Up to three responses allowed ■ Total (n=186) ■ Engineering/Construction firm (n=113) ■ Project or infrastructure owner organization (n=73)

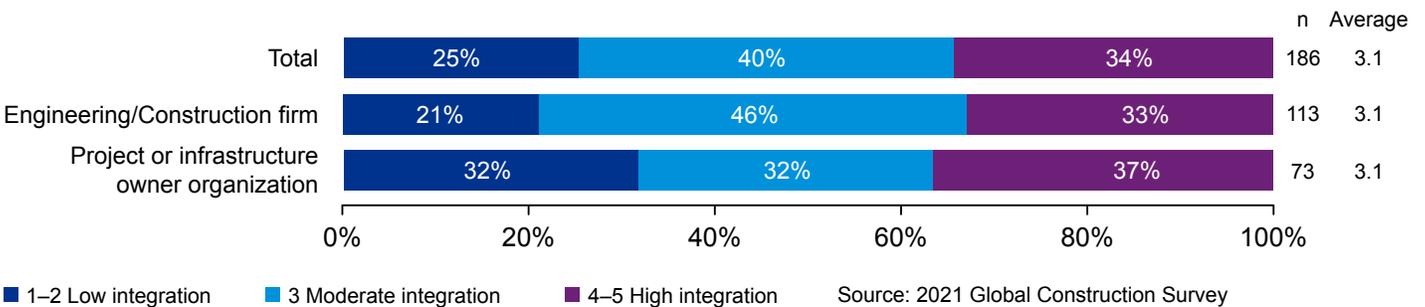
Source: 2021 Global Construction Survey

Risk processes and controls are only as good as the people that operate them. In the same way that the sector has made safety second nature, companies must embed risk management into their DNA. Forty percent of respondents say their organizations are committed to creating a clearly defined risk culture, where people feel comfortable voicing concerns and raising challenges. This can only work if the messages from the top are aligned and consistent, with leaders seen to be taking firm action to address any failings. Having the right tone at the top and consistent communication and reinforcement throughout the organization is critical.

However, it appears that risk management has some way to go before it's treated as seriously as other functions. Only a small proportion feel their organization needs a board-level risk management committee and/or a separate risk department, while formal risk management training is also lacking—for both owners and contractors.

Which is why integrated risk management is such a big deal. Yet at present, a mere 34 percent (Figure 9) say their organization has a joined-up ethos that encompasses enterprise, portfolio and project risk management. Without integration, it's hard, if not impossible, to work out the impact of different events and phenomena.

Figure 9: To what extent is your organization's level of risk management integrated, from enterprise risk management to portfolio risk management, and project risk management?



■ 1-2 Low integration ■ 3 Moderate integration ■ 4-5 High integration Source: 2021 Global Construction Survey



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KPMG thinks:

Understanding the interconnectedness of risks

As a sector, engineering and construction has some way to go in developing sophisticated and holistic risk management practices. Standards vary widely between different companies and between different project owners' industries.

An independent risk function would be an excellent step forward. Currently it's hard to take a high-level, cross-enterprise view of risks in projects, procurement, supply chain, markets, contracts and finance. For instance, a project team tends to focus on construction risk, but also has line of sight into other risks including supply chain, IT and operations—and may be aware of other risks. Yet, there may be no process to capture or disseminate this critical information. Similarly, a risk in one region could affect the wider organization, but may go unnoticed if risk management is not managed centrally and integrated across the organization.

With a complete, transparent and real-time view across all regions, business units and projects, it may transpire that the organization is facing a larger—and possibly unsustainable—level of portfolio risk than it had imagined, which would influence decisions to take on new projects. It's especially challenging for project owners, who may not be able to see what's happening with operators and contractors and may not receive data for days or even months.



View from the industry

There's a need to take enterprise risks more seriously, to get good linkage between project level activities, business units and regions. Find ways to capture and categorize risk items to roll up to enterprise level, to make sure that what you do operationally aligns with strategy, from an enterprise risk appetite and management perspective. This means having bigger conversations at the board table than used to happen.

Jon Nield,
Chief Executive Officer,
Engineering & Construction Risk Institute



View from the industry

You must collect a whole lot of data on project risk, categorize it, prioritize it, quantify it, and be very process driven, to aggregate risk and assess what it means for the entire enterprise. Much of this is regularly done at the project-level. For example: projects already address hazardous materials, so why not compile all project information as it relates to hazardous materials—along with proven mitigation strategies. Another example is local resources. Some countries require local labor, which brings a substantial risk to productivity if you can't access this resource. Out of necessity, projects mitigate this risk by developing local resources resulting in a social benefit to the workforce and community. We should capture and process this available project information to recognize how the enterprise may deliver on ESG objectives through its regular course of business.

Gregory Amparano,
Senior Vice President and Corporate Risk Officer, Engineering & Construction Risk Institute





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Portfolio project management

The impossible job?



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Managing a significant portfolio of programs and projects involves juggling a complex set of criteria to gain maximum value—a task made harder by the size and complexity of individual mega-projects that can soak up resources and carry huge risks. Political factors also intervene: in some cases, shiny new initiatives take precedence over less exciting but important maintenance projects. A well-run portfolio aligns project decisions with organizational strategy and aims to optimize return on investment.

The responses from this year's survey indicate that owners have more mature portfolio management than contractors (Figure 10, page 20), with the larger organizations the most advanced—which is to be expected given their superior resources. In our experience, engineering and construction companies are, however, making progress and, indeed, are ahead in terms of screening potential projects and employing financial and risk analysis tools—a sign that they're no longer willing to undertake any project without regard to margin or risk. This may also mean that engineering companies and contractors are becoming increasingly cautious about bidding on very large, highly regulated, complex, extended duration projects in competitive markets, fearful of repeating past failures.

Interestingly, respondents from real estate and hospitality companies suggest that these sectors lag behind others in their portfolio controls. Real estate in particular is often not the core business of investors, who are more typically corporations looking to expand into new space, with decisions often driven by the most powerful business units.

Government, on the other hand, appears to lead the way in its portfolio management, which suggests a big leap after years of under-investment. Certainly the approval process in the public sector is typically long and onerous, although there remains a question mark over how funds are allocated and how resources are used on actual projects.

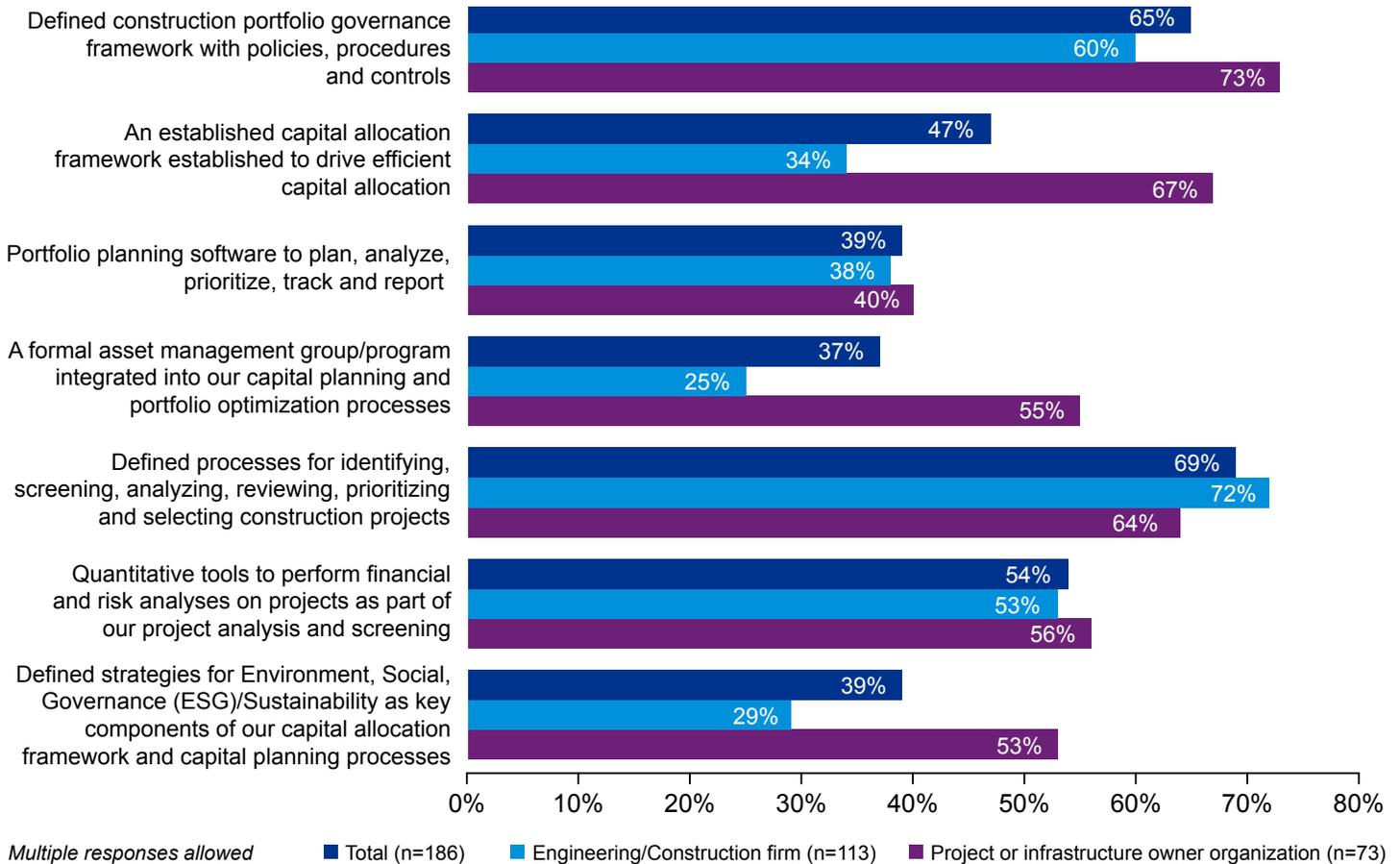


Project owners making strides—but key gaps prevail

More than two-thirds of project owners have defined portfolio governance processes and an established capital allocation framework, which lets executives stay abreast of the overall portfolio direction and performance and ensures

that resources are applied in an optimal fashion (Figure 10). Healthcare, government, and power and utilities are the sectors that appear to practice the most effective allocation of capital.

Figure 10: Which attributes apply to your organization’s construction portfolio?



Source: 2021 Global Construction Survey

One concern is that only four in ten owners say they use portfolio planning software (Figure 10). With a crisis like COVID-19, there’s often an urgent need to reallocate resources, but to do so requires real-time data to do

scenario analyses and figure out how best to shift people, equipment and money. In an asset-intensive organization, running multiple projects worth billions of dollars, this represents a big opportunity to improve performance.



Similarly, 45 percent of owners do not have an embedded asset management team to oversee capital allocation between projects (Figure 10). The tension between competing interests puts pressure on leaders to funnel resources into certain projects that may be higher profile or satisfy immediate issues. For instance, in the public infrastructure sector, we often see expensive new programs such as new lanes on highways to reduce congestion, with critical maintenance taking second place. The result? The immediate needs of commuters are satisfied, while crumbling bridges and roads get worse and eventually have to be replaced at enormous cost.

Another gap in owners' portfolio management is quantitative tools for financial and risk analysis, which help

in screening big projects. Respondents from oil and gas and chemicals score more highly in this category, reflecting the longer life spans of their assets, and the need to plan ahead accordingly.

And it's interesting to note that more than half of owners say they now factor ESG factors into their capital allocation and planning (Figure 10). Technology, government, and power and utilities are ahead of the curve in this respect, to some extent due to the heavy regulations and various purchase agreements to limit CO2 emissions from power plants and data centers. With growing demand for greener and more equitable business practices, expect to see these figures rise.

Engineering and construction companies playing catch-up

Contractors appear to be a long way behind owners in integrating ESG frameworks into their key capital decisions, although respondents serving the technology, media and telecoms industries look to have closed the gap somewhat. Capital allocation is a further challenge for contractors—just one-third of respondents say they have an allocation framework (Figure 10).

Given the huge potential risks inherent in large projects, contractors may want to consider why 47 percent do not employ quantitative tools to perform financial and risk analysis as part of the project selection process. One big project failure can undermine the rest of the portfolio, so rigorous due diligence is essential to reduce the risk (Figure 10).

The bright spots for engineering and construction companies are screening and prioritizing projects, where they actually exceed owners in having robust processes. Part of being a contractor is to produce a pipeline of projects, so it's understandable that there's a greater focus on this element of portfolio management.

Overall, it's the contractors with annual revenue between US\$1 billion—US\$5 billion who report the highest scores for portfolio governance, processes and controls. Some of the larger companies have grown rapidly through acquisition and may still be coping with fragmented IT systems, with management yet to fully integrate into the organization.



KPMG thinks:

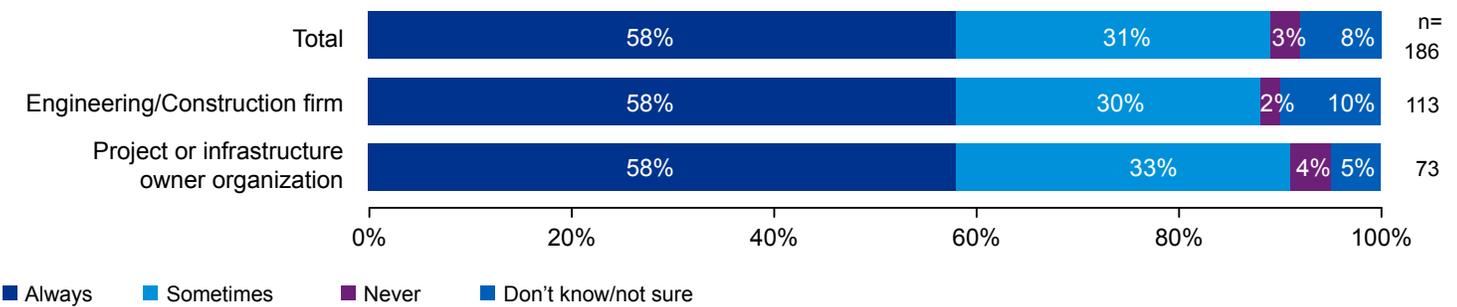
Intelligence over intuition can lead to more rational planning

Today’s construction projects involve a range of stakeholders including owners, contractors and suppliers, each with multiple projects of their own. One failure—like a cost overrun—can have a devastating impact upon the rest of the portfolio. In managing finite financial and human resources, owners must take tough decisions on capital allocation that fit the strategic goals of the organization, rather than satisfying individual empire builders or responding to short-term challenges. Infrastructure illustrates this dilemma perfectly: a failure to maintain existing assets can lead to an inability to cope with environmental shocks like fires, flooding and unseasonably hot and cold weather.

When a portfolio management process is based around reliable data insights, decisions like screening and selection and capital allocation become more rational; there is less reliance upon power plays by different groups and individuals, or knee-jerk responses to public opinion (especially in the case of government infrastructure programs).

Ongoing tracking of benefits is a key area for improvement. Currently a minority of owners and contractors deploy sophisticated software which gives assurance that their investment strategies are generating value. Which may explain why only 58 percent of the survey respondents say they consistently monitor, track and report on benefits realized from capital projects and programs (Figure 11).

Figure 11: Does your organization consistently monitor, track and report on actual benefits realized from your capital projects and programs?



Source: 2021 Global Construction Survey



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View from the industry

Especially with the rising importance of ESG, organizations must get better at managing issues from board strategy level right the way into the organization. This may cause companies to change strategies and make some tough and good decisions about what they will choose to do and no longer do. It could take them into other areas around types of contract, types of business, types of market they operate in. Some may exit and others may enter, so it is likely to be a very dynamic environment.

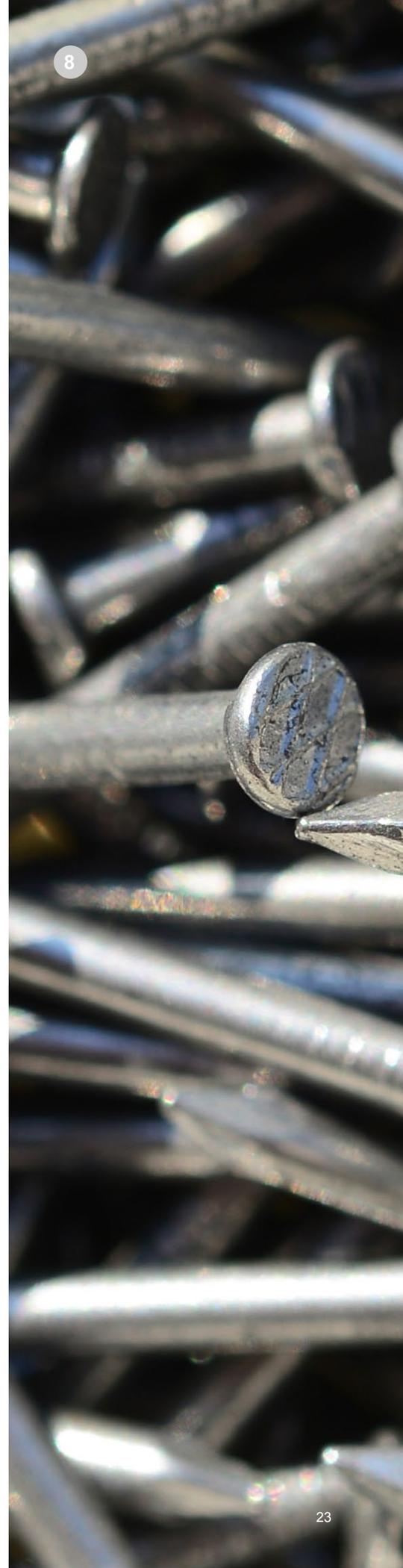
Jon Nield,
Chief Executive Officer,
Engineering & Construction Risk Institute

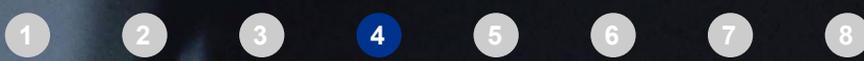


View from the industry

When we conceive and implement capital projects, we ensure that any ideas generated are aligned with our long-term goals, carefully prioritized, and subject to a rigorous capital allocation process that looks at project risks and potential revenues. This approach has helped us to focus our energy, efforts and investment towards the right kind of projects with long-term growth potential and profitability.

Satish Pai,
Managing Director,
Hindalco Industries Limited





Diversity, equity and inclusion

**Enriching capabilities
through diversity—
from a low base**



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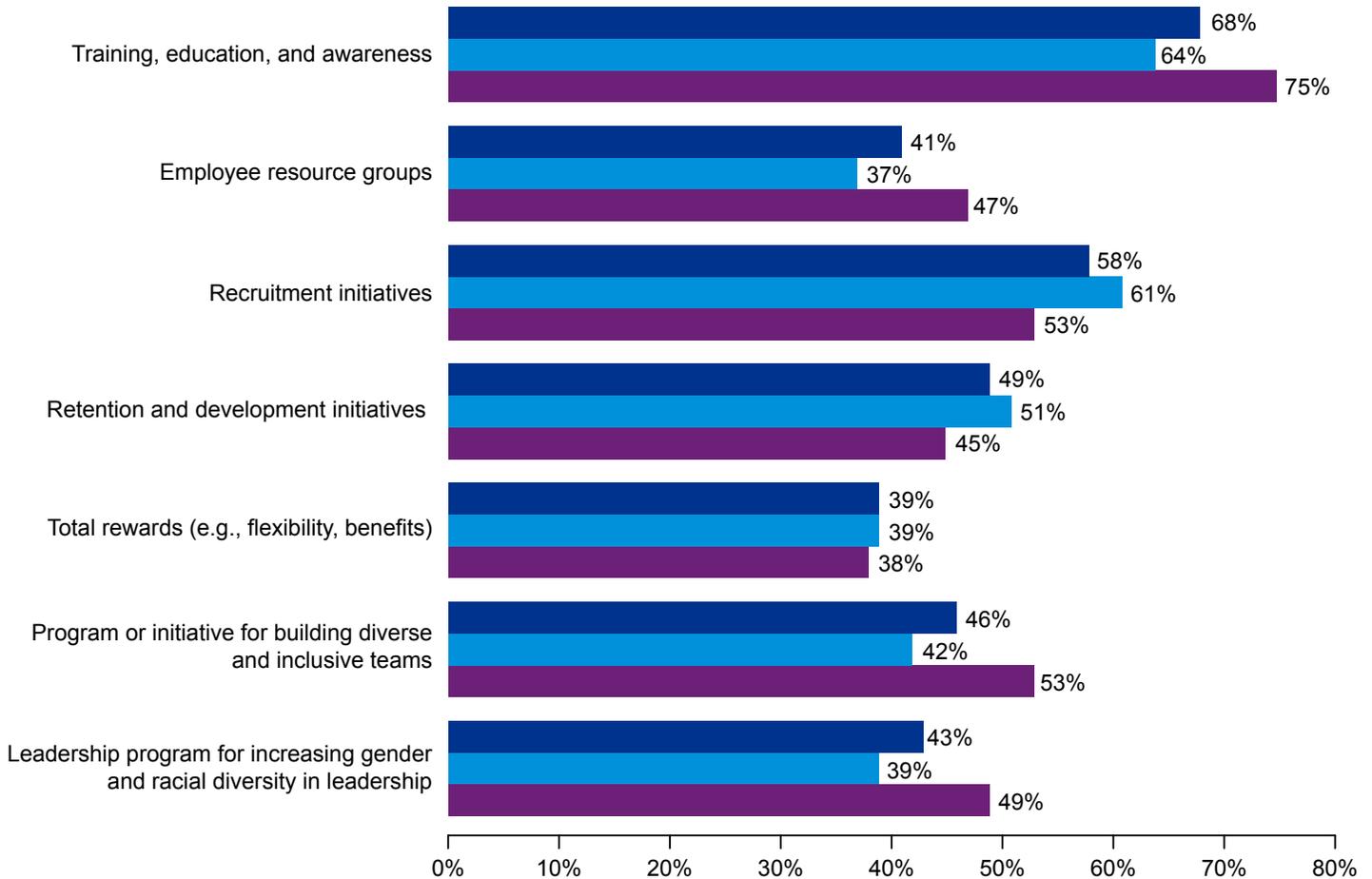
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Across all sectors, companies are striving to create more diverse and inclusive working environments. According to KPMG's [Global 2021 CEO Outlook](#), 96 percent of leaders say they're increasingly scrutinizing their organization's diversity performance. But a majority (58 percent) also admit that the business world as a whole has been far too slow to embrace diversity and inclusion.

The global engineering and construction sector has not been historically renowned for its diversity, equity and inclusion (DEI), something reflected in this year's survey, where most organizations' efforts are shown to be at a nascent stage—although owners seem to have made greater progress than contractors. Only 46 percent of respondents' organizations currently have a formal program for building diverse and inclusive teams (Figure 12, page 26), with the Americas ahead at 66 percent and Europe, Middle East and Africa trailing with 29 percent.



Figure 12: Which of the following workplace culture plans or initiatives does your company have related to diversity, equity, and inclusion?



Multiple responses allowed ■ Total (n=186) ■ Engineering/Construction firm (n=113) ■ Project or infrastructure owner organization (n=73)

Source: 2021 Global Construction Survey

Given the growing pressures on DEI in public projects, it's notable that relatively few of the companies who participated in the survey say they have a strong focus on diversity and inclusion in the supply chain. When asked whether their company tracks and measures supply chain diversity, 37 percent of executives from engineering and construction companies responded that they don't know (Figure 13, page 27).

In the US, federal, state and local authorities have for decades demanded supply chain checks and diligence, which may explain why respondents from the Americas region (53 percent) are the most likely to have assigned specific jobs and functions dedicated to diversity and inclusion in their suppliers.



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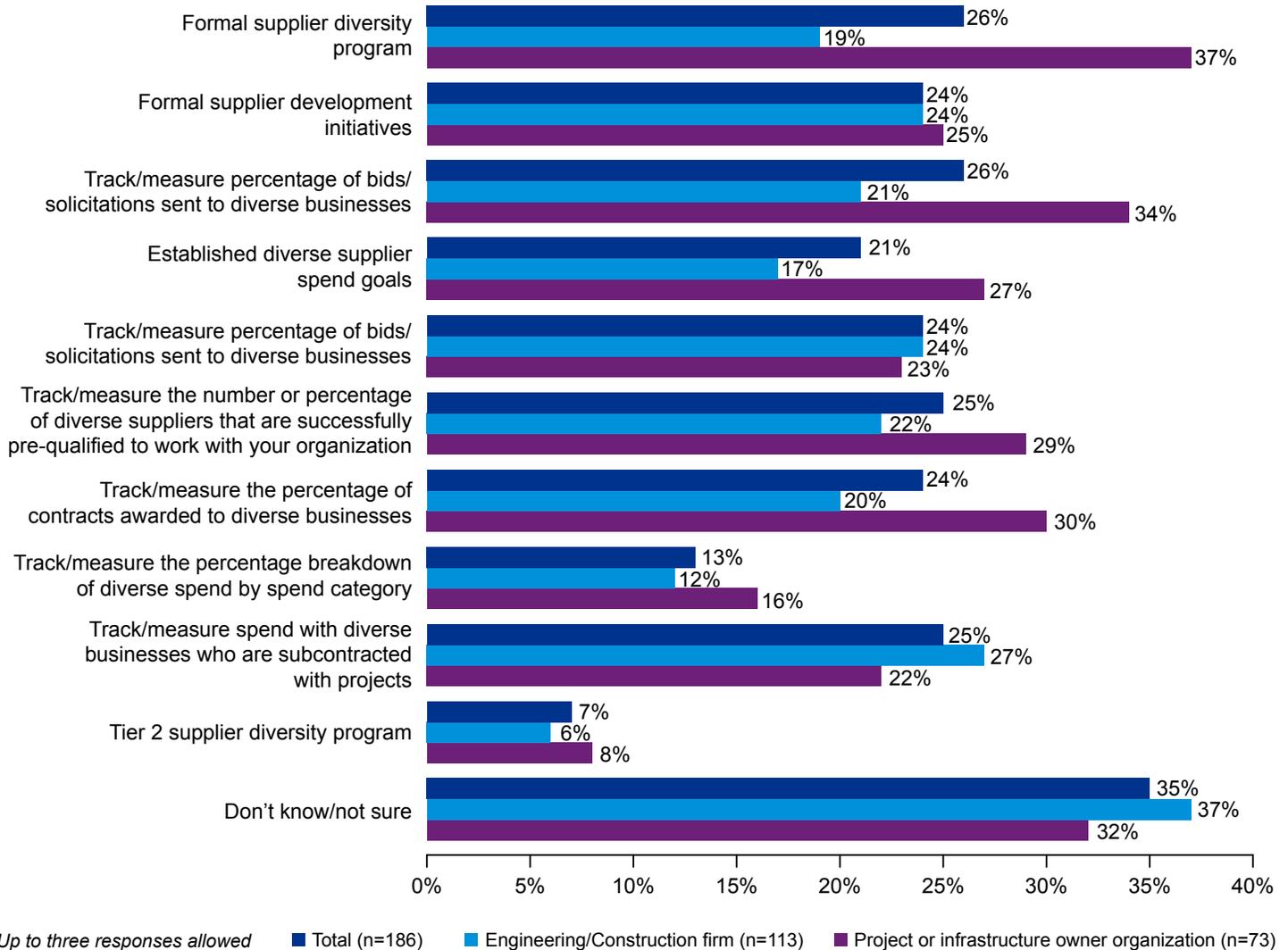
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Figure 13: How does your organization encourage, track, and measure diversity and inclusion in your own construction supply chain?



Source: 2021 Global Construction Survey

There are a few bright spots, with 68 percent stating that their company carries out training, education and awareness in diversity, and 58 percent striving to embed

greater diversity into their recruitment processes. Once again, the Americas leads the way, with organizations from Asia Pacific a close second.



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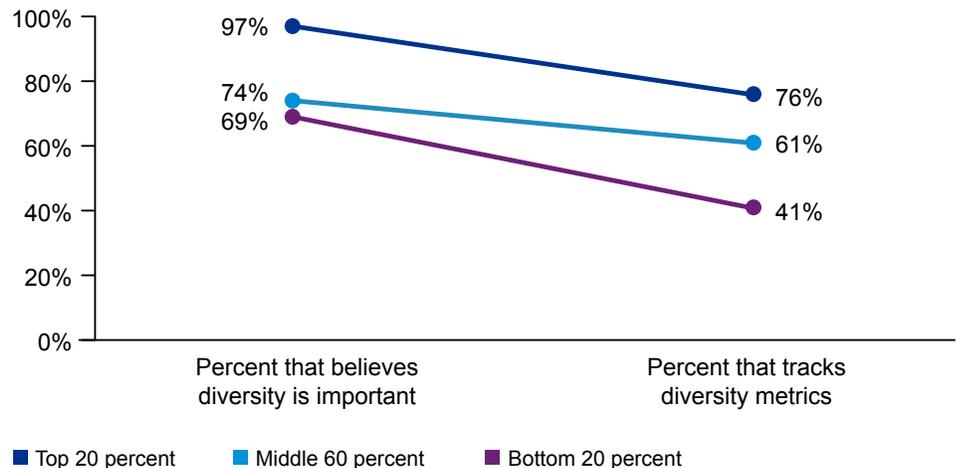
KPMG thinks:

Good for society; good for the construction sector; good for business

In KPMG's 2019 Global Construction Survey - [Future-Ready Index](#), the organizations defined as 'innovative leaders' in the sector demonstrated significantly greater commitment to diversity as part of their drive to re-define their cultures (Figure 14). They were more proactive in recruiting a diverse set of workers and tracking their progress towards DEI. Innovative leaders were characterized by cutting edge contractors with strong innovation cultures, and owner-innovators who focus on technology—with an emphasis upon forward-looking recruitment strategies.

A number of studies have shown that, across multiple industries, companies with higher diversity outperform their peers in terms of revenue, profitability, innovation and staff turnover (Figure 15, page 29). Additionally, a vast majority of job candidates say that an organization's approach to diversity and inclusion will impact whether they accept a position.

Figure 14: Which attributes apply to your organization's construction portfolio?



Source: 2019 Global Construction Survey



Figure 15: Observed benefits of a more diverse company culture



Sources: 1) "Diversity wins," McKinsey, May 2020; 2) "How diverse leadership teams boost innovation," Boston Consulting Group, 23 January 2018; 3) "Fostering innovation through a diverse workforce," Forbes Insights, page 5; 4) Yello white paper: Job seeker survey reveals what matters; 2019; 5) "Why inclusive leaders are good for organizations, and how to become one," Harvard Business Review, 29 March 2019.

A diverse and inclusive culture enriches organizational capabilities and creates a talent pipeline, where the most in-demand jobseekers are attracted by the potential to have a fulfilling career in a safe and nurturing environment. For women, people of color, LGBTQ+ and people with disabilities, the knowledge that they are less likely to face implicit bias, career roadblocks and ceilings is an enormous plus and opens up a larger and more skilled resource pool.

But the level of commitment required to achieve such a culture cannot be underestimated. The organization must hold itself, its leaders and entire workforce accountable for practicing DEI, should track and incentivize its performance and highlight its successes and challenges in a fully transparent manner.

Engineering and construction companies have the additional pressure of ever-stricter contractual obligations from project owners to meet DEI targets in their own company and along the supply chain. National and local government in many countries have already established such criteria, with private sector owners moving in the same direction as they seek to embed ESG principles. It's common now to see tender proposals stipulating use of minority or women-owned vendors, diverse recruitment policies and inclusive workforce and leadership quotas. Failure to adapt to such demands can severely undermine contractors' ability to win new contracts.



View from the industry

Delivering major projects is a team sport, dependent on a vast number of people coming together. We cannot deliver them alone and we cannot continue doing things the way we have in the past.

Capital investment in infrastructure is money well spent and helps create a better world. We must embrace the opportunity to be part of the green recovery and economy. Highways England will be part of the solution, integrating our network with other transport modes and using investment in strategic roads as an enabler. We've reorganized, creating strong alliances that are accelerating the trend to offsite production with digitally rehearsed and designed modular components. We have digital design teams and project management hubs who are making production management and efficient delivery happen at pace.

Our industry needs to move on beyond the image of building everything on a muddy construction site. We are listening, adapting and setting the tone for the future. The skills of people running major projects will change, creating an opportunity to recruit from a wider field of skilled people. We will need more than just experienced civil engineers as over the coming years, 50 percent of roles in our industry will be brand new. We will need people who have a relationship with digital capability, as this is where the real opportunities lie.

In the future we want our supply chain and our industry to employ a more diverse workforce, with wider skills. One that creates more challenge and stimulates creativity, that welcomes what makes us each unique and builds on what we have in common, to improve our industry.

Peter Mumford,
*Executive Director, Major Projects & Capital
Portfolio Management,
Highways England*





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Technology and innovation

Time to be bold and brave





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Technology has become ubiquitous to all sectors and is no longer something left to the innovators. Which is why the response to the pandemic has been so interesting, in that the more forward-thinking companies really enjoyed the benefits of their previous investments. With large numbers working from home, and site workers on staggered shifts, remote collaboration came into its own, enabling managers to plan and design, keep abreast of project progress, make virtual inspections, and communicate instructions and changes in real time.

These successes cannot, however, mask the mixed efforts to adopt technology, with many contractors and, especially, owners, lacking the tools that could create a step-change in project performance and increase resilience to further shocks.

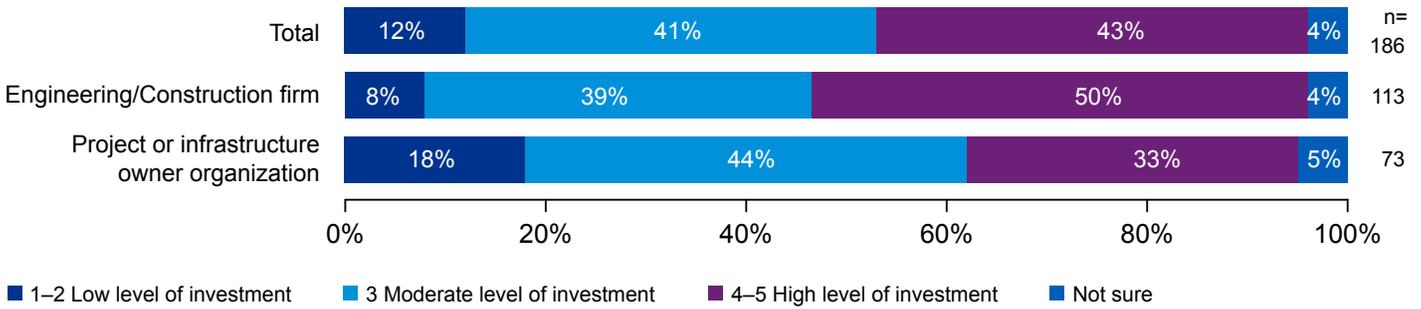
What's driving investment choices?

The desire to adopt technology appears strong, with most of the respondents reporting that their companies plan a moderate or high level of investment. But there's a noticeable gap between owners and contractors, with the latter considerably more likely to invest heavily (50 percent versus just 33 percent for owners) (Figure 16, page 33).

This presents an opportunity for owners to step up their program management—especially as 'adoption of technology' was rated as the second most important factor that enabled engineering and construction companies to cope with disruptive events.



Figure 16: Planned technology investment for your capital program



Source: 2021 Global Construction Survey

With projects getting larger and more complex, it's surprising that less than four in ten are using portfolio level planning software (Figure 17). Such tools are essential for planning and tracking projects across the portfolio—especially relevant to owners with a number of ongoing initiatives across different geographies.

When asked which technologies have the greatest potential, the top three responses are integrated PMIS, Building Information Modeling (BIM) and advanced data and analytics (Figure 10, page 20). Both owners and engineering and construction companies believe these innovations can give a healthy return on investment by increasing efficiency and improving decision-making.

“ **Survey participant feedback**
 During the pandemic-forced lockdowns, we switched to virtual meetings on collaborative platforms to keep our projects operational. We also used internet enabled devices such as smart glasses to support remote inspections and overcome travel constraints. **”**





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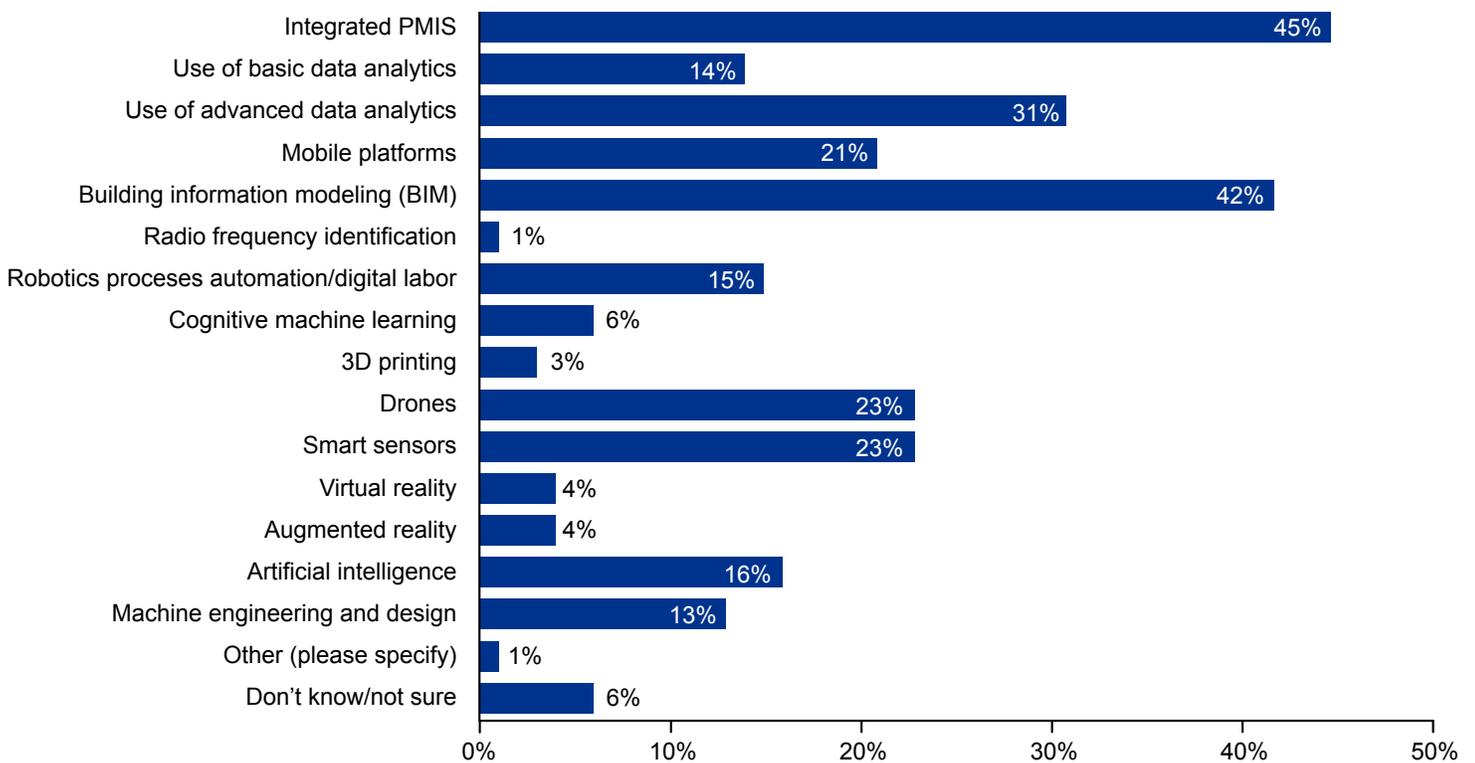
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In stark contrast, there is negligible interest at present in many up-and-coming technologies like artificial intelligence (AI), radio frequency identification (RFID), 3D Printing, cognitive machine learning (ML), robotics,

process automation (RPA), digital labor and augmented reality. It seems as if the industry is waiting for some positive use cases before buying into such advances.

Figure 17: Technologies with the potential to deliver the greatest overall return on investment to your organization



Source: 2021 Global Construction Survey

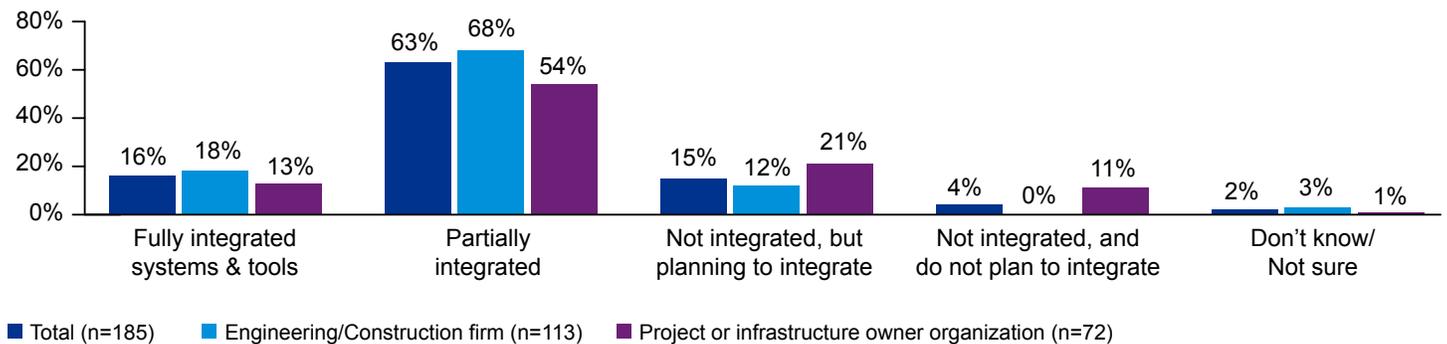


Integrating technology for a richer picture

Integration offers a great opportunity to automate and streamline projects. Project managers can survey a rich history of past projects to develop early cost estimates and schedules, as well as making more reliable cost forecasts. Procurement and logistics should also become more accurate, as decision-makers can see what's happening across multiple sites and work out a logical flow of supplies to meet the pace of projects. Data security and privacy is another beneficiary of integration, reducing the number of attacks and introducing common access protocol to decrease the chance of breaches by malicious and/or criminal hackers.

Faced with a wide range of geographies, fragmented supply chains, and a constant stream of new software, companies can struggle to effectively integrate risk management and project management. Only 16 percent of the executives surveyed say their organizations have fully integrated systems and tools (Figure 18). It's a similar story when it comes to automation—with just 6 percent claiming to have automated all or most of their business processes (Figure 19, page 36). Automation has the capability to replace and speed up manual tasks and provide more current and accurate intelligence. The three areas where capital projects could most benefit are listed as project reporting, estimating and budgeting, and performance monitoring.

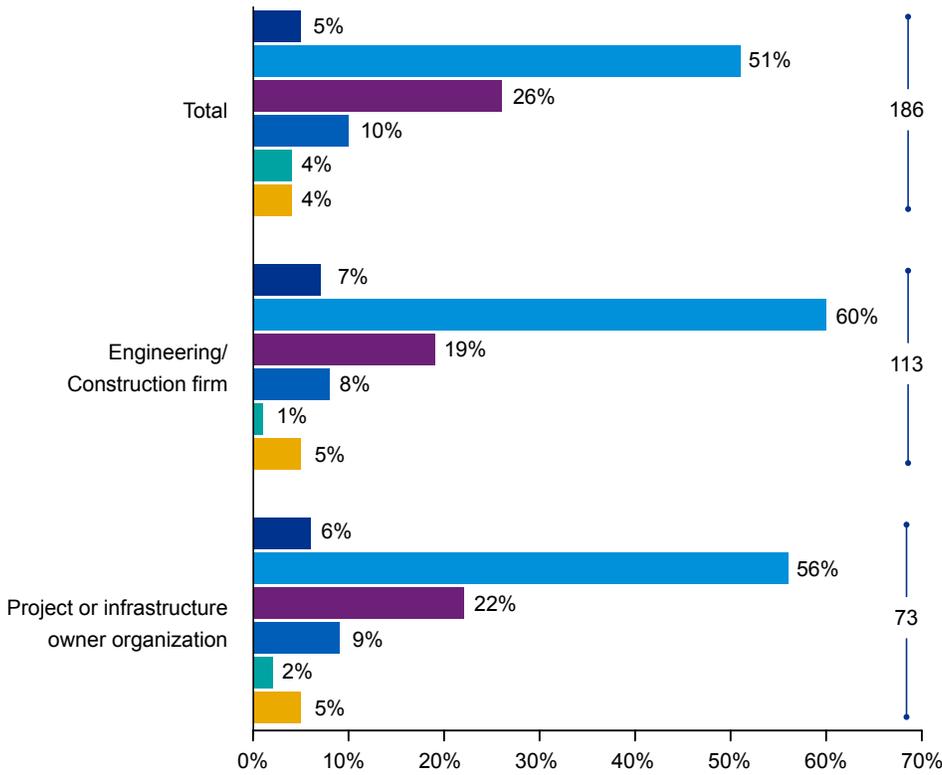
Figure 18: Integration of construction technology within your organization?



Source: 2021 Global Construction Survey



Figure 19: To what extent has business process automation been incorporated into your organization’s future capital program plans?



- Most (if not all) of the processes have already been automated
- Some processes have been automated
- Started to explore the processes that would benefit from automation
- Understanding the importance, but no substantive actions taken yet to explore which processes
- No plans to automate processes currently
- Don't know/not sure

Source: 2021 Global Construction Survey

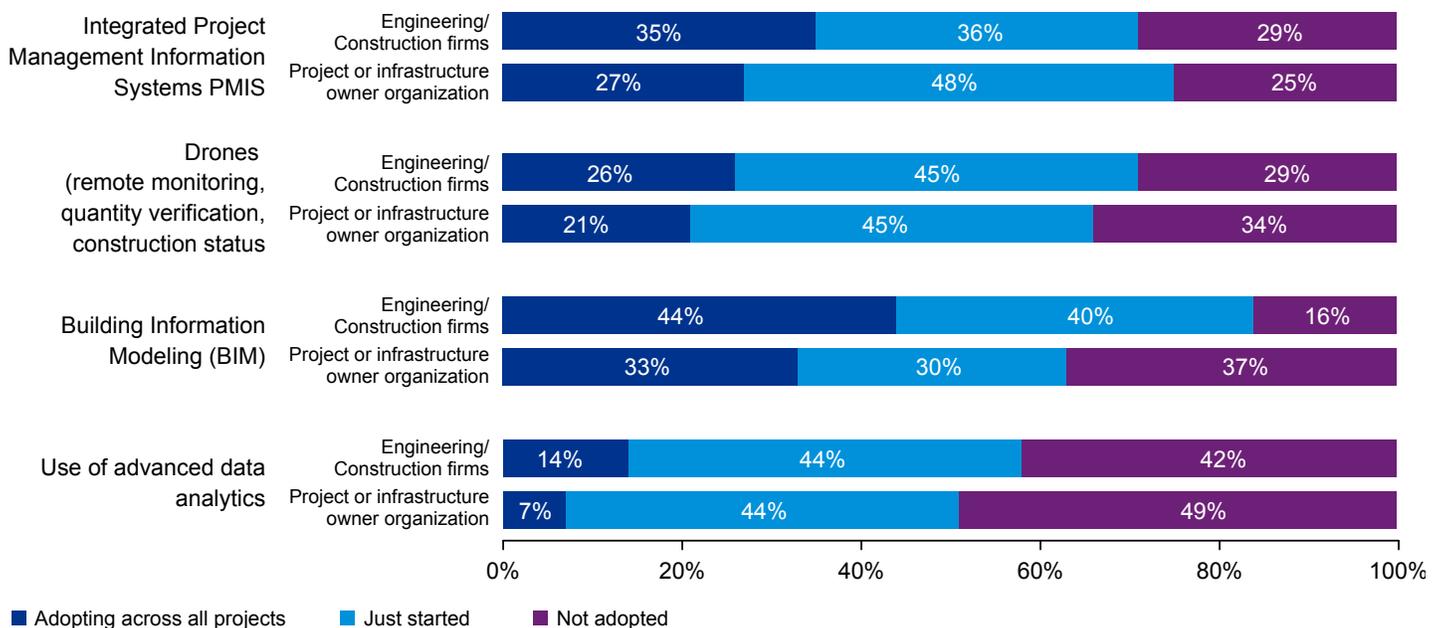


Lack of alignment in technology ambitions

The responses to this year’s survey suggest that owners and contractors don’t always pursue the same technology investment patterns, with the latter tending to be the early adopters across many categories, notably integrated PMIS, drones, BIM and advanced data and analytics (Figure 20). Project owners’ focus has often been on

investment oversight, tracking, performance reporting, and governance, whilst engineering and construction firms’ minds are firmly on the task in hand, calling for better management of project data and on-ground project delivery.

Figure 20: Level of technology adoption



Source: 2021 Global Construction Survey

Interestingly, owners are keen on the potential of automation to improve performance monitoring, contract management and payment management, reflecting their role as buyers of services. Engineering and construction

companies, on the other hand, value the power of automation in areas like construction, design and schedule management.



KPMG thinks:

Collaboration can lead to common gains

One of the questions that senior industry executives should ask themselves is: how can we develop a more uniform and coherent adoption of technologies to enhance project performance metrics? If all parties can access the same platforms and software, then it will be easier and faster to move through the various stages of conceptualization, design, implementation and even operationalization.

The industry collectively stands at a crossroads: either continue the current path of conservative, disjointed and experimental investment by individual stakeholders—or collaborate for common gains. In certain sectors, such as government infrastructure and construction programs, the use of technology is already stipulated in the contract for tools like BIM, to approve designs. Yes, owners can force digitization via contracts, but this eats into already-thin margins for contractors. Surely it's preferable for project owners to go one step further and invest in these groundbreaking innovations in a way that benefits every contractor they work with?

Such a move may start to break down the lines of responsibility between owner and contractor, in the interests of efficiency, safety and quality. When owners have a large pipeline of known projects, a common data environment enables each contractor to 'plug in' to access cloud-based software and hardware. Take the increasing demand to demonstrate ESG: a common platform and reporting enables the owners to track carbon footprint, people management and community contributions. All of which should make projects more robust and less susceptible to delays, cost-overruns and accidents.

Finally, both owners and engineering and construction companies should invest in relatively untapped technologies like AI, machine learning, robotic process automation and digital labor.



View from the industry

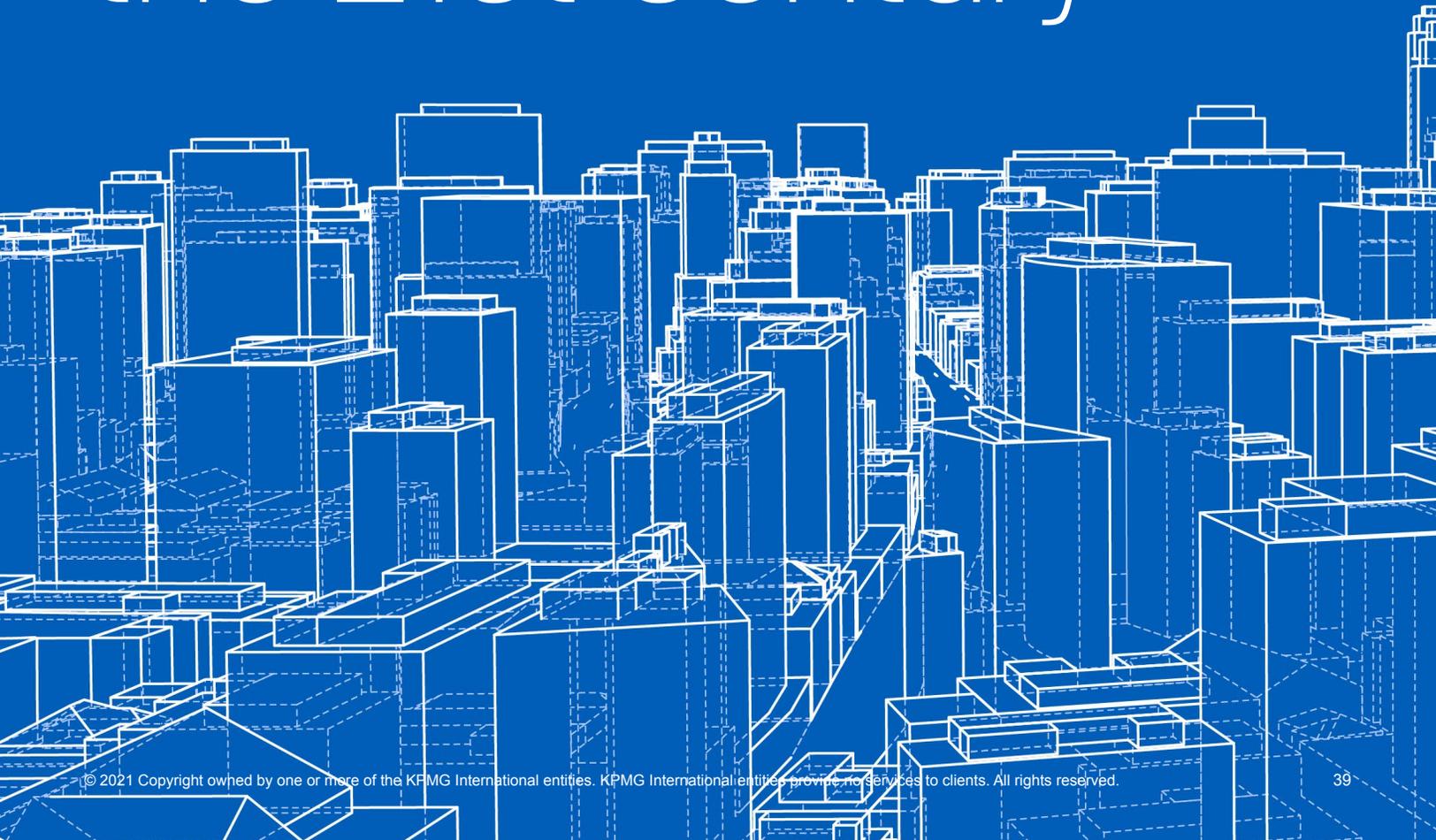
We have adopted digital tools like drone-based analytics for progress monitoring, real-time CCTV monitoring of project site and dashboard-based reporting. Additionally, we've initiated use of smart glasses: a head-mounted, hands-free, voice-controlled device for bi-directional audio-visual communication between a project person and remote expert. This has facilitated installation and commissioning activities and minimized site visits.

Satish Pai,
Managing Director,
Hindalco Industries Limited





Moving construction into the 21st Century





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Bent Flyvbjerg,

*BT Professor and Chair of Major Programme Management,
Saïd Business School, University of Oxford*

We still build houses the way we did 4,000 years ago—the main difference is electricity and glass. With a lack of competition on a global scale, the sector has struggled to innovate, leaving a productivity gap compared to other industries. One obvious solution is to go modular, to have everything manufactured off site and assembled on site like Lego. Using standardized station designs and other new approaches, between 1995—1999, Madrid managed to build 56 km of railway lines at a cost of US\$26.7 million per km,¹ whereas shorter but comparable rail projects performed relatively poorly, taking significantly longer to complete at a much higher cost per kilometer.

Owners are looking at the wrong place by focusing on companies delivering; they need to create demand for innovation by insisting contractors use BIM and prefab, and in a competent manner. For instance, wind turbines used to be built like houses by pouring concrete on site, but that's not the case anymore—they've gone modular and prefab. This happened because governments, through subsidies, created a market for wind, in the process moving towards a global, competitive market. The industry won't change by itself. It needs to be pushed and pulled from outside.

¹ Comparison of Capital Costs per Route-Kilometre in Urban Rail, Bent Flyvbjerg*, Nils Bruzelius** and Bert van Wee*** * Department of Development and Planning, Aalborg University, Denmark



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Transcendent action plan



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Owners should explore collaborative and integrated project teaming models, rebalance risk allocation in projects, avoiding excessive risk to engineering and construction companies, who in turn should exercise greater caution in taking on high-risk, fixed price projects.

2

Establish an independent risk management function for portfolios and projects, reporting into a board-level risk management committee. This provides an extra layer of awareness and comfort over the total level of risk across the project portfolio. At the same time, it's important to continue to focus on the fundamentals of risk management at all levels of the organization, with a commitment to a culture of continuous improvement.

3

Invest in portfolio planning software and a formal, embedded asset management team. This should help ensure that capital allocation decisions reflect the organization's wider interests, and that investments in projects generate the optimum ROI.

4

Commit at leadership level to embrace diversity, internally and across the supply chain, forming a dedicated diversity team, setting targets, awarding incentives, and tracking and publishing diversity and inclusion numbers.

5

Bridge the technology gap between owners and engineering and construction companies, with owners investing in shared platforms to enable contractors to access technologies like integrated PMIS, BIM and advanced analytics.

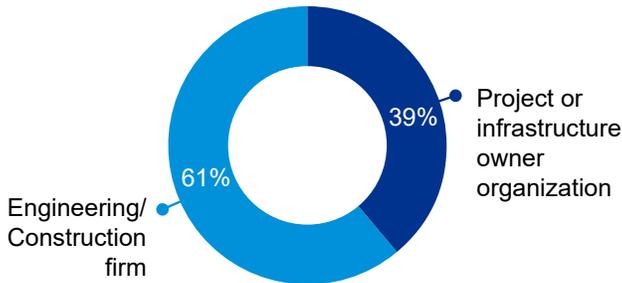


About the survey

In this survey, you will find the perspectives of 186 people from engineering and construction companies and project owners from a variety of industries.

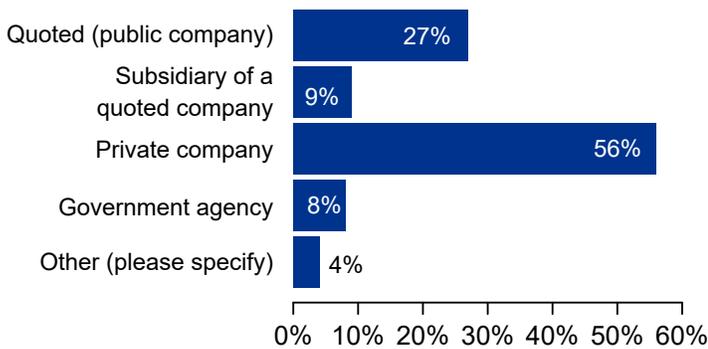
Many of the responses were gathered through face-to-face interviews in 2021 with senior leaders—many of them chief executive officers. The vast majority of respondents are from organizations carrying out significant capital investment projects.

Organization category



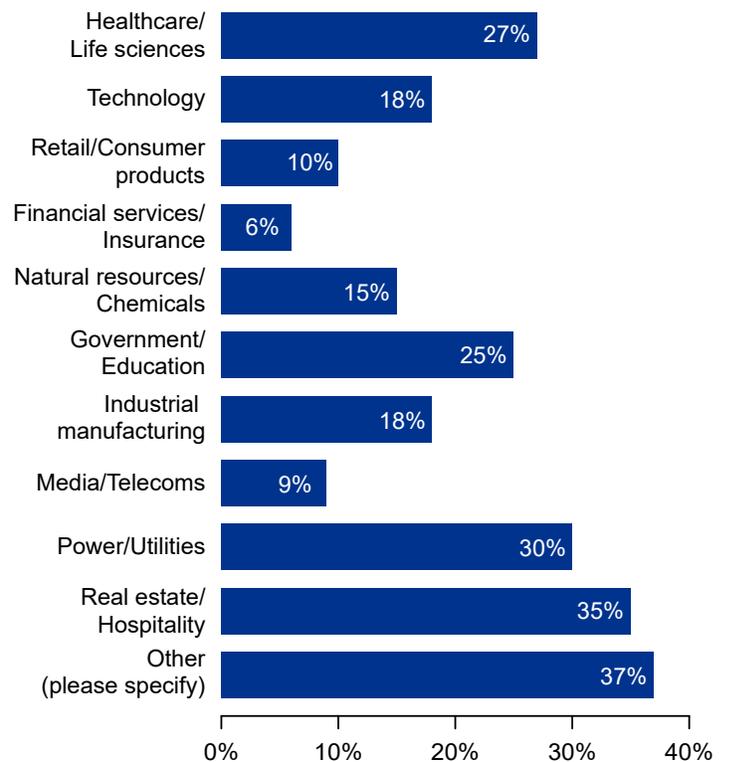
Total count (answering): 186

Entity type (multiple selections allowed)



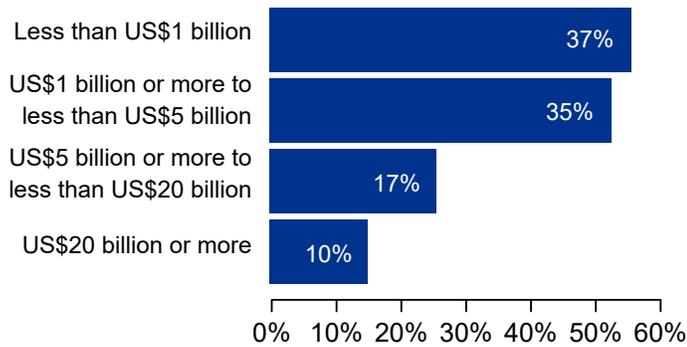
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Industry sector (multiple selections allowed)

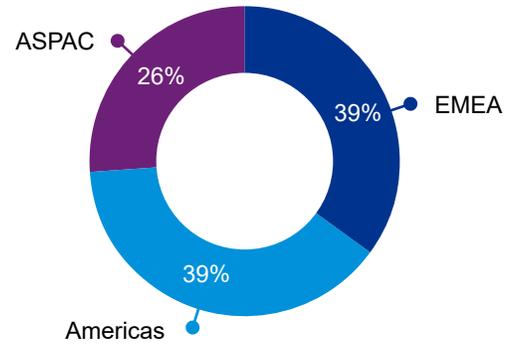




Approximate entity revenue from operations in the last 12 months Headquarter region

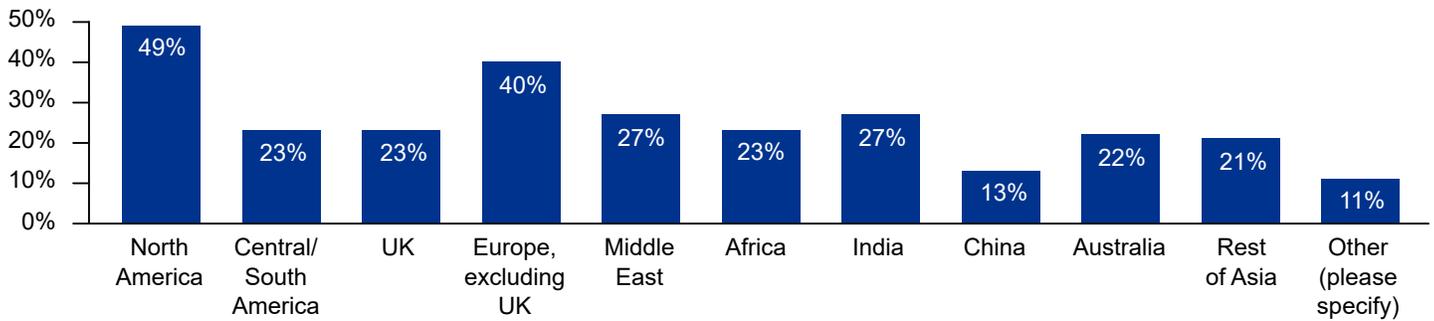


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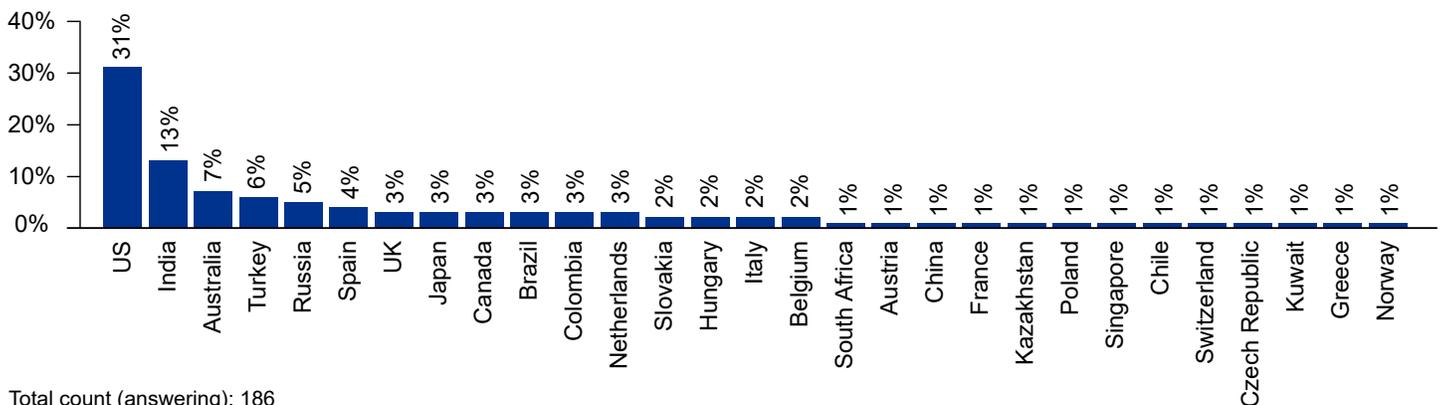
Total count (answering): 186

Regions of operation (multiple selections allowed)



Total count (answering): 186

Headquarter country



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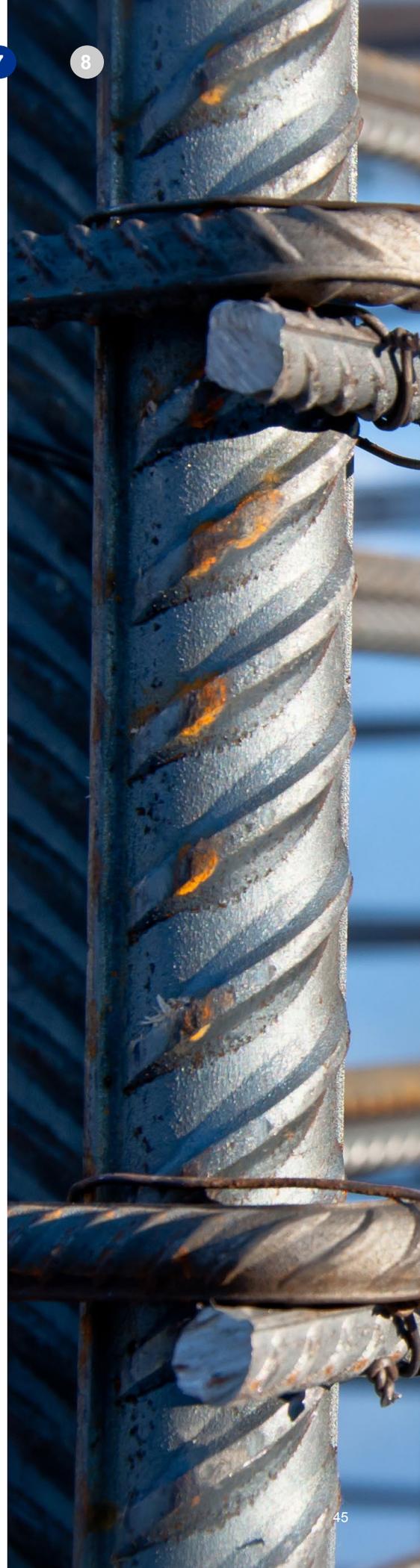
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Contacts

Geno Armstrong
International Sector Leader
Engineering & Construction
KPMG International
E: garmstrong@kpmg.com

Clay Gilge
Lead, Major Projects Advisory
KPMG in the US
E: cgilge@kpmg.com

Kevin Max
Principal, Major Projects Advisory
KPMG in the US
E: kmax@kpmg.com



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