KPMG

Future-Ready Index

Leaders and followers in the engineering & construction industry

Global Construction Survey 2019

KPMG International

kpmg.com/gcs

Is your organization future-ready?

The *Global Construction Survey 2019* is all about the future. In the following pages, you will find examples of how leading organizations are investing effectively in technology, people and project culture to become more future-ready.

And this year we have also introduced a new concept: the Future-Ready Index — a way for the industry and individual players to measure and benchmark their preparedness for what lies ahead. We also discuss the results and the subsequent implications and include a simple self-assessment tool (see page 30) to allow comparisons with your peers and provide a reference point for developing or enhancing your capital programs. Our Value map (page 32) considers the potential value from investing in different technologies, while a Strategic roadmap (page 33) plots a course to future-readiness.

Since our first *Global Construction Survey* in 2005, we have sought to create a collaborative and ongoing dialogue about the pressing issues facing the engineering & construction industry. Foremost among these is the challenge of improving our collective track record of delivering projects on time and on budget.

More recently, in response to how technology and innovation is impacting the industry, we took a closer and critical look at how it is embracing disruption. Our *Global Construction Survey 2016 Building a technology advantage*[1] outlined a technology adoption spectrum showing a few 'cutting-edge' industry leaders and many laggards struggling to catch up with a new, digitally driven world.

As the pace of disruption accelerates, we continue to press owners and contractors on their response to the many threats and opportunities. Our *Global Construction Survey 2017 Make it, or break it*[2] urged a three-pronged approach to rationalizing governance and controls, optimizing human performance and innovating with technology. Reflecting on the past years, the industry has made many positive steps to address rapidly changing technology, increasingly complex and highly pressurized projects, and a widespread scarcity of talent.

Make it, or break it[3] highlighted a perceived lack of urgency over the necessary changes and investment required to transform the fortunes of the industry. When you factor in some spectacular and very public project and company failures in 2018, then the overall picture is one of continued uncertainty. In this year's report, you will see how different players are addressing this uncertainty by answering three vital questions.

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[1] *Building a technology advantage,* Global Construction Survey, KPMG International, 2016.
https://assets.kpmg/content/dam/kpmg/xx/pdf/2016/09/global-construction-survey-2016.pdf

[2] *Make it, or break it,* Global Construction Survey, KPMG International, 2017.
https://assets.kpmg/content/dam/kpmg/xx/pdf/2017/10/global-construction-survey-make-it-or-break-it.pdf

[3] Ibid.

Is governance rationalization becoming a reality?

Project governance and controls remain the lifeblood of the industry — underpinning how engineering & construction companies and project owners plan and deliver capital projects. Since our 2017 survey we've seen progress, with 'old-school' static project manuals or 'binders' being replaced by digitized, automated controls monitored via dashboards on a real-time (or almost real-time) basis. Many leading organizations have already transformed — or are well on the way to transforming — governance and controls, by rationalizing and digitizing their existing environment to reflect current project needs.

Is the technology breakthrough here?

We concluded our *Global Construction Survey 2017* with some degree of hesitancy. The majority of participants acknowledged the importance and impact of technology and innovation, but few were adopting it significantly, with even fewer reaping the benefits. In 2019 we see a wide range of views: at one end of the spectrum, some contractors are loathe to invest unless clients demand and pay for specific technologies; at the other end, Suffolk's Chairman and CEO John Fish says: *"We want to be a technology company that builds construction projects."*

Is the human touch gaining hold?

Despite the acknowledged influence of robotics and automation, humans remain the heart and soul of projects. Forty-six percent of respondents say people are the most important factor in delivering successful projects — against 28 percent for technology and 26 percent for process and governance. Leaders may have continued concerns over the ability of the next generation to fully grasp the fundamentals of project delivery; but they don't feel this challenge can be solved purely by technology. Instead, there is a growing belief that the best way forward is to re-define project culture, train the next-generation workforce on both technical and non-technical 'soft' controls, and increase investment in technological capabilities of newer recruits with guidance from more experienced workers.

The results of our *Global Construction Survey 2019* indicate that we are moving in the right direction. The top 20 percent of 'future-ready' organizations appear to be embracing disruption from strategy to execution. Like pioneering companies in other sectors, they are learning how to pilot projects and 'fail fast', investing in innovation without fear or uncertainty.

Yet, despite this progress, we remain continually and sharply reminded of how risky our industry is, where one misstep can mean disastrous consequences for both project owners and contractors. As we prepare to transition leadership to the next generation, investments in technology and innovation should closely reflect your organization's future-readiness.

The remainder of the sector should, therefore, be asking themselves how they can elevate their game. Indeed, for those in the bottom 20 percent, the situation is considerably more urgent, if not existential. These companies face a race to go digital, to enhance their profitability and fend off competitive threats — including the possibility of takeovers.

As the future shows, the most forward-thinking organizations are not only equipped to excel in governance and controls, human capital, and innovation and technology — they have also begun to integrate each of these capabilities.

We would like to thank our many clients and industry experts who contributed their valuable time and candid insights to our latest annual *Global Construction Survey* for the benefit of the industry as a whole.

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About the survey

In this survey, you will find the perspectives of 223 people from engineering & construction companies and project owners from a variety of industries.

Many of the responses were gathered through face-to-face interviews in 2018/2019 with senior leaders — a large number of them chief executive officers. The vast majority of respondents are from organizations carrying out significant capital investment projects.
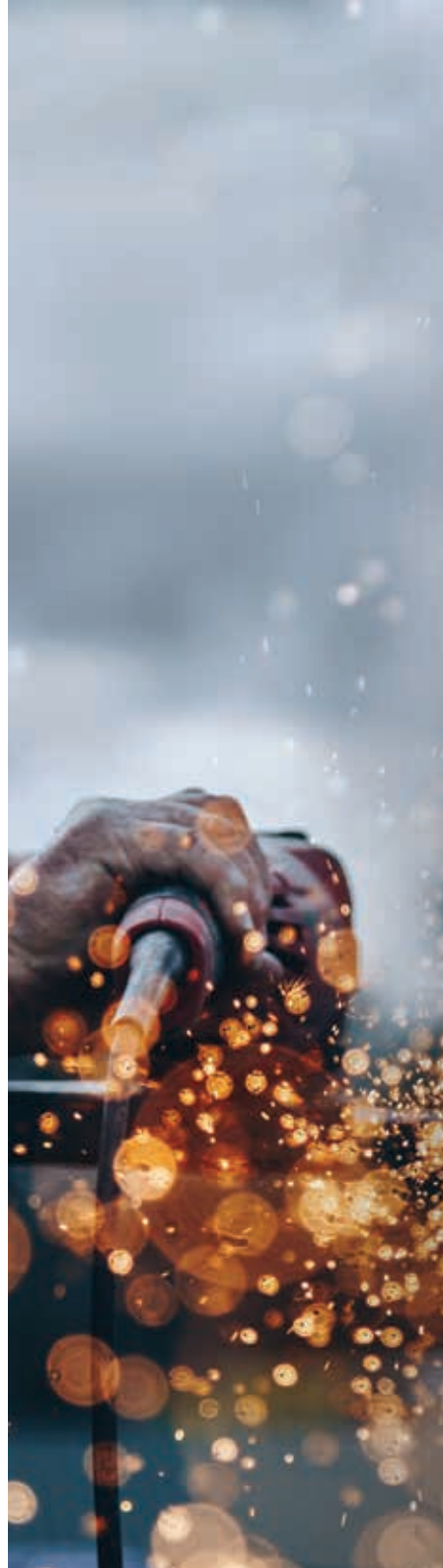
Survey at a glance

The Future-Ready Index:

Leaders and followers in the engineering & construction industry

Are capital project organizations making the right investments and following the right strategies to stay ahead of existing and new competitors and thrive?

As disruption and innovation continue to make the headlines, both contractors and owners face tough decisions on where to invest precious resources to achieve the greatest impact. The speed of change brings a huge promise of greater efficiency, precision and predictability. Project delivery alone has seen numerous new technology solutions promising to make delays and cost overruns a thing of the past.

But, as we envision a world of robots building infrastructure and 3-D printers producing flawless site-ready components, we must pause for thought. In many ways, the industry has stubbornly remained largely unchanged for decades.

Some are leaving their old ways behind and others are more constrained or tentative. KPMG's Future-Ready Index enables organizations to measure their preparedness for a disrupted future.

Building
the Index

To compile the Future-Ready Index, we looked at survey participants' responses to 12 key questions relating to governance and controls, technology and innovation, and people (shown below). Based upon responses to these questions, the Index yields a single score (between 1–100) to represent how effectively an organization embodies the core capabilities necessary to become efficient, diverse and high-performing.

Governance and controls

The sophistication, maturity and fitness of the governance environment:

Fit-for-purpose management practices, processes and controls, applied consistently and monitored for effectiveness in terms of project outcomes

Agility to respond and change course in the face of evolving conditions and risks, based upon accurate, real-time reporting

A flexible approach to megaprojects, acknowledging their unique capital requirements, eclectic mix of third parties and demands on internal resources

Technology and innovation

Ability to use technology to drive performance:

A robust and comprehensive technology strategy

A structured approach to innovation reflecting a culture that embraces fresh ideas and new ways of working

Willingness to experiment with new technologies, knowing that all investments carry a risk of failure

People

The 'fitness' of an organization's human capital:

Attracting, developing and retaining future leaders and top talent

Communicating both strategic vision and project progress

Performance-based rewards and promotion aligned with strategic objectives

Using
the Index

The Future-Ready Index provides a consolidated worldview of the industry, and at the same time, enables comparison across regions and sectors, so contractors and owners can benchmark themselves against the industry as a whole or against select peer groups. Figure 1, below, shows an overview of the segments our respondents landed in.

Figure 1: Overview of all respondents and low-/mid-/high-Index groups
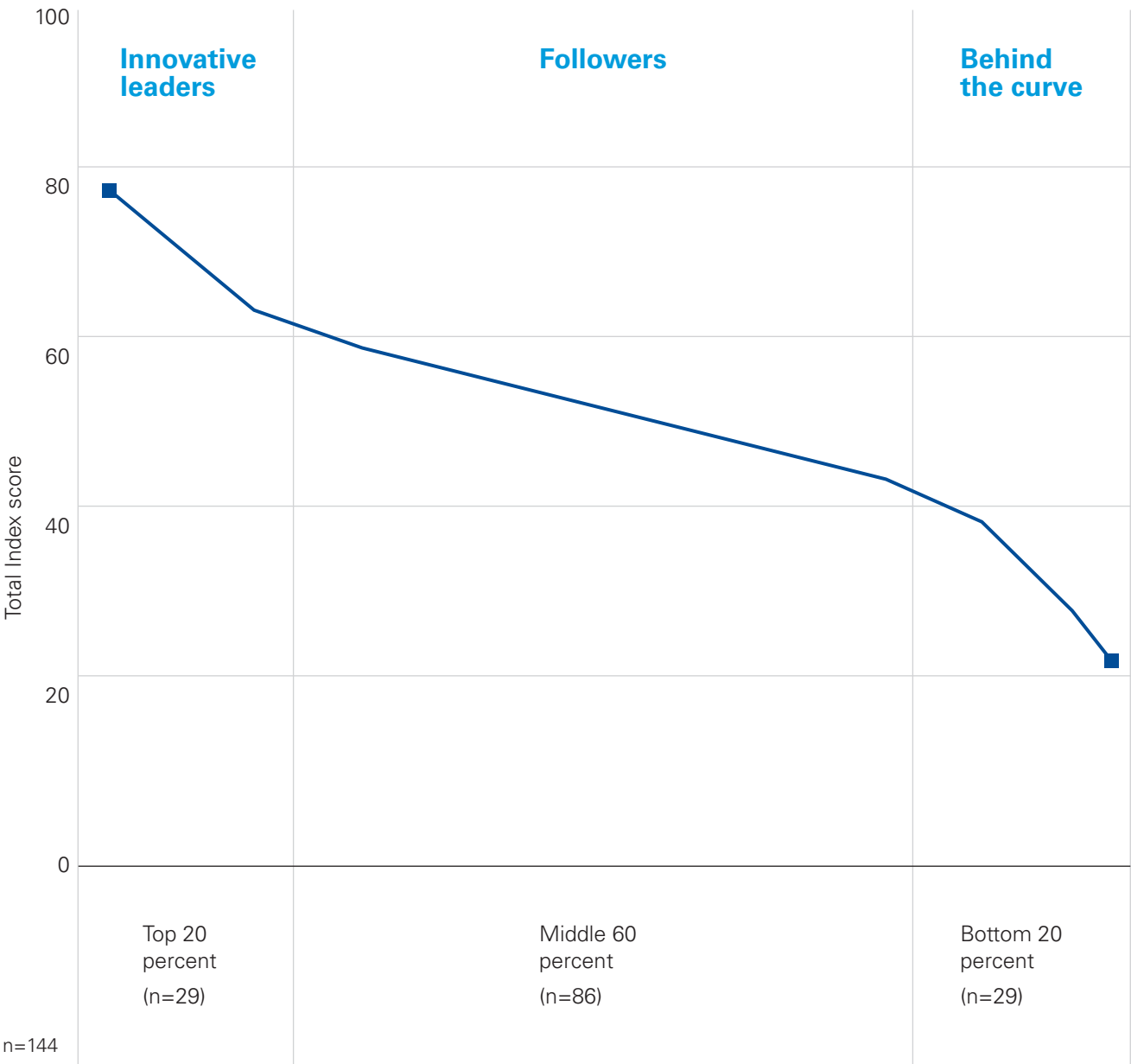
Source: Future-Ready Index: Leaders and followers in the engineering & construction industry

A snapshot of who's who in the Index

Characteristics of the three segments that make up the engineering & construction industry.

"
As we prepare for the next cycle, the weakness will be the supply chain. And when your suppliers haven't invested, you won't know how your chain will stand up until you put it under pressure. "

David Seaton
Chairman and CEO
Fluor

Top **20** percent:
Innovative leaders

Innovative leaders constantly seek opportunities to improve performance, and anticipate change and risks, with an ultimate passion to create a better industry for all stakeholders. Within this group there are two broad types of organizations:

Cutting-edge contractor

- Fosters a strong innovation culture embodied in a clear technology vision and strategy

- Dedicated innovation teams headed by senior leaders, with ongoing recruitment and internal development of technology and innovation specialists

- Technology is a driving force, with rapid investment in pilots (via test labs), a willingness to 'fail fast', and wholehearted adoption of those technologies that can deliver value

- Significant investment in BIM, drones, VR/AR and smart sensors

- Recognizes the importance of a continued talent pipeline, utilizing the latest recruitment methods and channels, supported by innovative performance management and flexible career options tailored to millennials and Generation Z

- A strong focus on geographic, industry and service expansion with an eye on the future and a bold vision of their organization.

Owner innovator

- Typically Fortune 100 and Fortune 500 technology companies and industrial manufacturers

- Participates in highly competitive industries where construction is a key enabler

- Innovation is embedded across the entire company culture

- A high priority on talent acquisition and a recognition that new employees are attracted by working in a technology-rich environment — hence the extensive use of technology in recruitment campaigns

- Creates and shares a clear technology vision that embeds innovation into the organization

- Operates organization-wide labs to test new technologies.

Middle **60** percent:
Followers

This segment encompasses a broad mix of companies striving to gain a balance between investing in the future and addressing current challenges.

Global/regional contractor

- Wide range of companies including owners, architects/engineers, subconsultants, contractors, subcontractors, and material and equipment suppliers

- Offers traineeships/internships to attract and retain talent

- Most of the workforce are millennials; not surprisingly, diversity is becoming more important but diversity tracking needs improvement

- Utilizes annual/periodic individual performance bonuses

- Still skeptical about the ability to fully integrate a digital construction supply chain

- Implementing BIM, basic data analytics and PMIS; and just starting to explore mobile platforms, VR, smart sensors, machine engineering and design and robotics

- Beginning to develop a technology road map, assign innovation to a dedicated team and experiment with new technology on pilot projects

- Investments in technology heavily driven by demonstrated ability to recover costs.

Asset-driven owner

- Seeks to improve long-term career growth opportunities to attract and retain talent, in a workforce that is balanced between millennials, Gen X and Baby Boomers

- Top perceived challenges are cost and time overruns

- Project financing and regulatory challenges still driving many projects

- Utilizes annual/periodic individual performance bonuses

- Implementing BIM, basic data analytics and PMIS; just starting to explore mobile platforms, smart sensors, machine engineering and design and drones

- Beginning to develop a technology road map, and experiment with new technology on pilot projects.

Bottom 20 percent:
Behind the curve

These organizations are struggling to get to grips with immediate issues, with little longer-term strategic vision for technology, governance and people. The two key types of players are:

Non-diversified contractor

- Limited to zero organic or inorganic investment in technology

- Limited investment in, and adoption of, key project management, finance and reporting technologies driving the industry such as BIM, PMIS, mobile platforms and drones. Virtually no adoption of cutting-edge technologies such as VR/AR, 3-D printing, AI, robotics and machine learning

- Investment primarily focused on field labor and subcontractor oversight

- Narrow geographic, industry and scope of service focus

- Light focus on diversity, which is rarely tracked.

Cost-driven owner/developer

- Low priority for innovation, with no dedicated senior leaders or teams assigned to innovation, and little or no investment in, or focus on, technology and innovation

- Limited experimentation with new technology pilots

- Virtually no adoption of cutting-edge technologies such as VR/AR, 3-D printing, AI, robotics and machine learning

- Limited to zero organic or inorganic investment in technology or people related to innovation

- Attention on people, culture and diversity is limited

- Primary focus on short-term revenue growth and cash flow.

"

It's a good idea for companies to bring in people from outside of their industry to help them adopt technology and create a culture of change. Many senior executives and project personnel are so busy that they don't really have the time for innovation — especially if they're from a conservative sector like mining. "

Augusto R. Patmore
Partner, Global Infrastructure Advisory
KPMG in Canada

Contrasting strategies, practices and performance of the main players

R esponses highlight the different ways industry players approach governance and controls, human performance, and technology and innovation.

> "We have re-tuned and redesigned our tools and have also created an analytical tool using AI, which is an 'off the charts' predictive tool and now catalogues 140 projects. With the help of big data, we can ask "where are you now?" for any project and determine which critical decisions have to be made."

David Seaton
Chairman and CEO
Fluor

Evolving by rationalizing
governance and controls

It's hard to overstate the value of governance. Knowing that you have the right processes, functioning as designed, is critical to success. Innovative leaders have adopted methodologies for evaluating the effectiveness of their key processes and controls. They are also able to link their governance to project outcomes. Well-run projects, with good management practices and appropriate controls, are more likely to achieve broad measures of success.

Those trying to mitigate risk are dependent upon an ability to view and interpret real-time project data. Trends, forecasts and changing circumstances may alter the risk profile and impact expected outcomes. Transparent access to accurate, appropriate, meaningful project data could mean the difference between a minor course adjustment and a colossal project failure. Often undervalued until it is too late, effective project reporting separates leading organizations from the pack.

Not all projects are created equal. Varying capital requirements, strategic significance, and a combination of third parties and internal resources create a unique environment. This is especially the case for megaprojects, which involve dozens of organizations and stakeholders and require a very customized, tailored approach to management.

KPMG's _Emerging Trends in Infrastructure 2019_ paper highlights megaprojects such as the new bridge linking Hong Kong to Macau and Zhuhai, Thailand's Eastern Economic Corridor, Australia's Inland Rail project and the Dubai Solar Park (the world's largest single-site solar installation with a committed private investment of more than US$4.3 billion).[4]

Innovative leaders (the top 20 percent) are significantly ahead when it comes to governance and controls: 69 percent have integrated project management reporting systems, with multiple tools, for projects and portfolios. Just 33 percent of Followers and a mere 7 percent of Behind the curve players can say the same (Figure 2).

And when asked to rate their governance and processes, 55 percent of Innovative leaders rate themselves as 'good' or 'excellent' versus 33 percent of Followers — and just 10 percent of those considered Behind the curve (Figure 2).

Not surprisingly, the excellence in governance and controls is reflected in project performance. Innovative leaders say that two-thirds (66 percent) of their projects come within 90 percent of their planned schedule. Only 14 percent of Followers could claim a similar success rate, and 0 percent of Behind the curve organizations (Figure 2).

[4] _Emerging trends in infrastructure 2019,_ KPMG International, 2019.
https://home.kpmg/xx/en/home/insights/2019/01/trend-3-the-challenges-of-megaprojects-are-magnified.html

Figure 2: Innovative leaders are ahead in governance and controls

Innovative leaders (top 20%)
- Integrated project management systems: 69%
- 'Good' or 'excellent' governance and processes: 55%
- Projects achieving 90 percent of planned schedule: 66%

Followers (middle 60%)
- Integrated project management systems: 33%
- 'Good' or 'excellent' governance and processes: 33%
- Projects achieving 90 percent of planned schedule: 14%

Behind the curve (bottom 20%)
- Integrated project management systems: 7%
- 'Good' or 'excellent' governance and processes: 10%
- Projects achieving 90 percent of planned schedule: 0%

n=145
Source: Future-Ready Index: Leaders and followers in the engineering & construction industry

"

Mining projects are complex organisms that require intensive collaborative effort from all disciplines within an organization, in order to be successful. A complete understanding of the cause and effect of all inputs into a project is extremely difficult without the use of modern project management systems and software platforms. As the software becomes more sophisticated and able to provide project managers with real-time information on the project performance metrics, the early identification of deviations from plan will enable project managers to implement corrective actions earlier enough to prevent a negative outcome. "

Barry Murphy
Former Senior Vice President Technical Services
Yamana Gold

Case study

Sterlite Power: Covering every angle

Sterlite Power is a leading integrated power transmission developer and solutions provider, operating in India and Brazil.

As Group CEO Pratik Agarwal explains, the market Sterlite operates in places huge pressures on project performance. "When you consider the increasing need for access to reliable power and the rapid development of renewable generation capacity, it becomes clear that transmission projects must be commissioned in a fraction of the usual project schedules."

When it comes to planning and reporting, Sterlite leaves no stone unturned to ensure a robust approach. "We go beyond the classic internal measures of time-cost-quality and factor in external dimensions such as impact on the community and environment," continues Mr. Agarwal. "Our project plan takes into account the 4 Cs of community, culture, customs and conservation so that there are no surprises during execution stage. This kind of attention to detail at the planning stage and use of innovative technologies helps ensure fast commissioning of our projects, setting us apart from other players."

Data analytics is a key factor throughout the project life cycle — all the way from bidding for projects to planning and execution. And the company has invested heavily in every angle of digitization with its fully automated and integrated Sterlite Planning and Execution Excellence solution, known as *SPEX*. All key processes are digitized, involving every stakeholder including engineering, procurement and construction (EPC) partners, planning, design engineering, quality, operations and right-of-way (ROW) teams.

According to Pratik Agarwal: "This revolutionary platform brings complete transparency to the system, saving time, improving productivity and efficiency and driving excellence. We've automated systems like document management and vendor payments and have 24/7 visibility including live-streaming straight from the project site. We can easily track costs, progress and quality, health and safety, with superb analytics and dashboards for project teams, EPC contractors and their teams."

Sterlite's SPEX solution has had a major impact on planning and execution, helping the company take data-informed decisions in real time and avoid cost and schedule slippage. And, by maintaining a library of historical data from past projects — along with regular insights from partners — project leaders can understand trends, predict changing scenarios, mitigate risk, establish sound control interventions and bid more intelligently for future work.

Power transmission projects by nature tend to be large, and Mr. Agarwal feels that the company's approach to megaprojects is particularly thorough.

"We carry out extensive surveys aided by technology such as LiDAR (to make topographical surveys) before the bidding process starts, to get a feel for the skills and knowledge required. And we build a mini organization, teaming up with people who've had experience of working in similar projects as well as local people who understand the community and cultural sensitivities. And we combine the strengths of man and machine with the use of helicranes and drones for faster execution. We carry out partner onboarding and governance using digital platforms to ensure transparency and efficiency. Through these methods, we have been able to maintain an industry-leading track record not only in execution speed, but also in safety."

Pratik Agarwal
Group Chief Executive Officer
Sterlite Power

Innovating through
investment in technology

The engineering & construction industry is starting to realize some tangible benefits from its investment in advanced technologies, like better, energy-efficient design, tighter scheduling, improved quality control, higher productivity and safer workplaces, to name but a few.

Figure 3: Top 20 percent embed innovation

Percentage of companies that implemented each organizational change to embed innovation in the organization
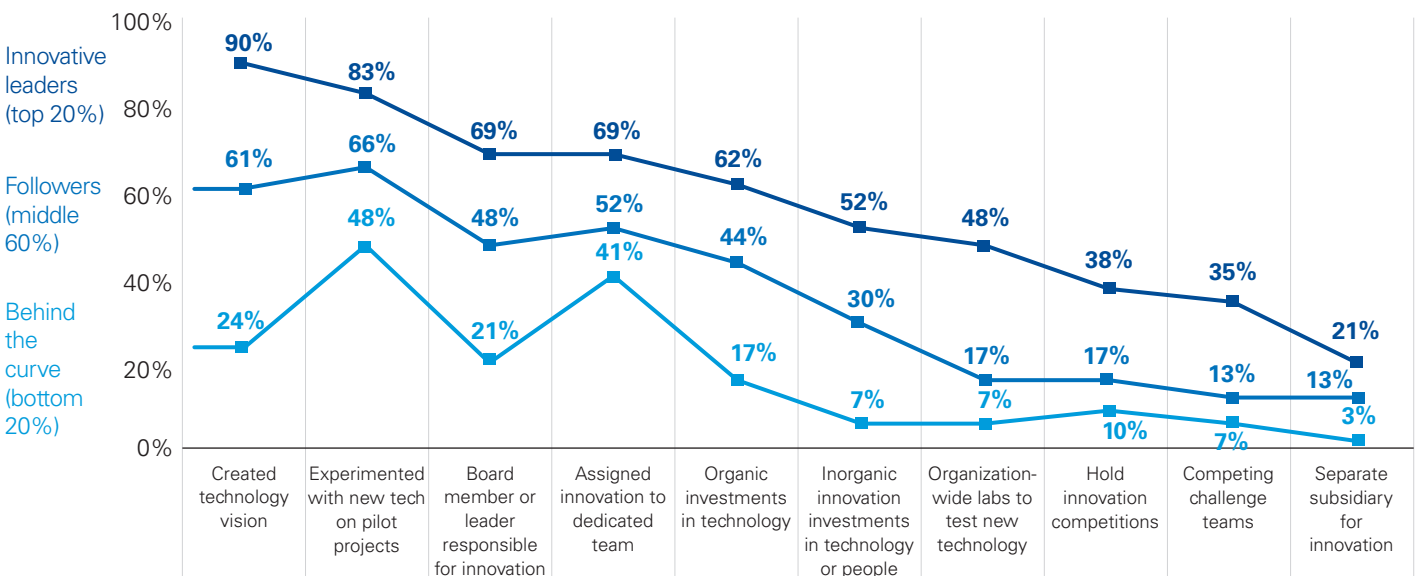
n=149
Source: Future-Ready Index: Leaders and followers in the engineering & construction industry

Establishing acceptable ROI

" The dominant trends in mining are automation and digitization as part of industry 4.0, and the challenge is how to build these into projects to give shareholders a decent return. To get the most out of technology, you have to redesign the way we carry out construction projects. Investing is a tough business; you pay capital up-front and the return doesn't come until you've paid it all back — in a volatile pricing world where margins are tiny. You'll get more success if you can start off smaller and build. "

Conor Spollen
Former COO and CTO
Vale Canada

But innovation does not just happen spontaneously. The future-ready companies we surveyed have embedded innovation and creativity as a core part of their cultures, with Innovative leaders fully committed to investment in technologies that can enhance performance. A vast majority of these organizations have a technology vision that is well-communicated across the organization and is supported by action and investment. In contrast to Followers or those Behind the curve, the Innovative leaders are far more likely to deploy pilot programs on new technologies, to have organization-wide labs to test new innovations, and to actively recruit new talent with specific technology skills (Figure 3).

And more than three-quarters of the Innovative leaders acknowledge that they are in front of the pack as either 'cutting-edge' or industry-leading. Only 42 percent of Followers and 21 percent of Behind the curve respondents feel the same way.

The top players are also ahead — often way ahead — in adopting new operational technologies like BIM, drone, VR/AR and smart sensors (Figure 4). Having already embraced the new, they continue to envision a tech-enabled future and are more likely to believe that intelligent equipment, machine learning and artificial intelligence (AI) will become commonplace in the next 5–10 years (Figure 5).

Figure 4: Innovative leaders are ahead in implementing technology

Percentage of companies that implemented each technology
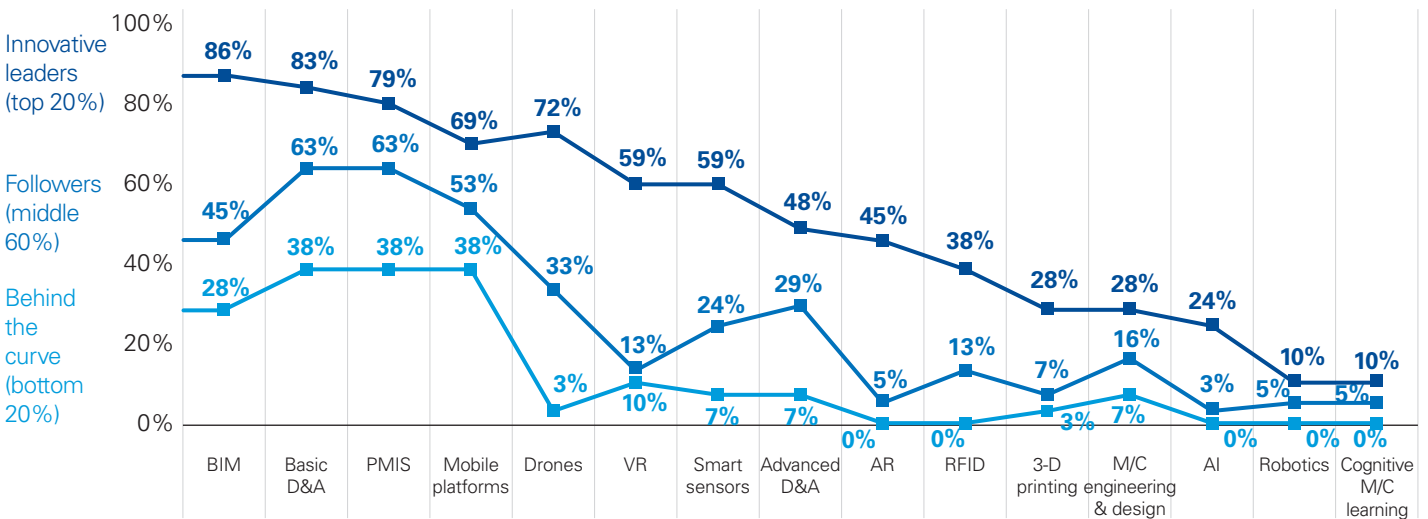
n=155
Source: Future-Ready Index: Leaders and followers in the engineering & construction industry

Figure 5: The top 20 percent are embracing technology

Within 5 years, machine learning, cognitive machine learning and AI will be commonplace

Percent that agree with to the statement

Top 20 percent — 52%
All others — 32%
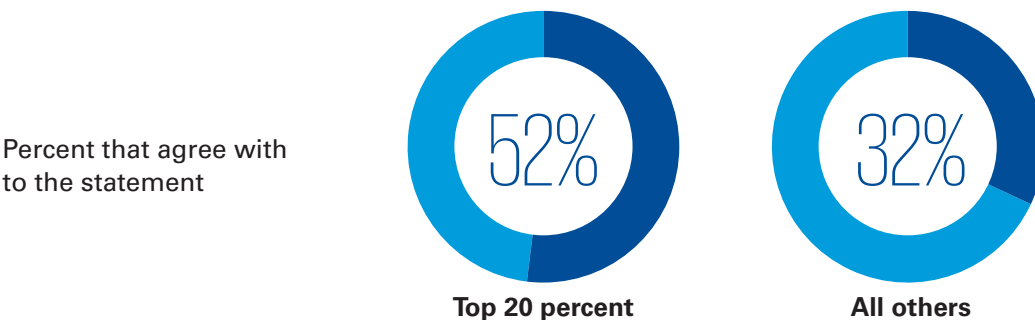
n=157
Source: Future-Ready Index: Leaders and followers in the engineering & construction industry

Case study

Suffolk Construction:
Creating an adaptive culture

Suffolk is recognized as one of the most innovative construction companies on the scene, with a string of exciting projects and a self-professed desire to "transform the construction experience."

But, as Chairman and CEO John Fish explains, it takes time to embed a new way of thinking and building. "We underestimated the challenge of becoming an adaptive culture. At first, we tried to force the issue, but we soon realized that moving the needle would take a lot longer than we ever thought — not least because we have several generations within our workforce, and everyone learns differently."

Suffolk's real breakthrough came when it was able to use data to measure the effectiveness of its new approaches. "I believe we're the first construction company in the US to have a clean data lake — something that's taken us almost 4 years and substantial investment in data scientists. Once we started measuring the effectiveness of our strategy, and demonstrating empirically how they created value, we got over what I call our 'technology hump'."

Data is the fuel behind all of Suffolk's technology advances. The company is creating a digitization platform enhanced with artificial intelligence. One key investment is in safety programs with visualization on job sites, to identify and outline risky behaviors.

According to John, not every company is likely to ride the wave of innovation. "You need strong, fully committed leadership. You need a strong enough balance sheet to make capex investments. And you must overcome any fear of failure, as some initiatives won't deliver. You're bringing together small groups of people willing to get out of their comfort zones in a small, 'incubator' environment. And then you have to socialize the success or failures of that experiment."

Suffolk appears poised for future success, having successfully created an adaptive, learning culture where everyone has a sense of curiosity.

> "Our mission is to become one of the most respected technology companies in our industry, and ultimately, one of the most respected companies in America."

John Fish
Chairman and CEO
Suffolk

Staying ahead by optimizing
human performance

Like many other sectors, engineering & construction is struggling to attract the right kind of people. As the so-called 'war for talent' becomes the norm, both contractors and owners should be constantly shaping their future workforces (for more on this concept, see KPMG's thought leadership *Workforce shaping in the age of automation*[5]).

Perhaps even more critically, organizations are now competing for skilled workers not just with each other, but with a wide range of employers from technology and other industries, as they seek to acquire and develop solid engineering and project management skills, along with the tech know-how to apply these capabilities in an increasingly digital environment.

Our survey findings suggest strongly that Innovative leaders are doing more to attract and retain the next generation of workers. They actively use technology and innovation as a way to entice millennials and Gen Z prospects. Having grown up with smartphones and apps, the last thing this generation wants is to walk into a workplace to discover outmoded ways of collaborating and communicating. A significantly higher proportion of the leaders offer 'virtual' work options — acknowledging the shift towards anytime, anywhere working.
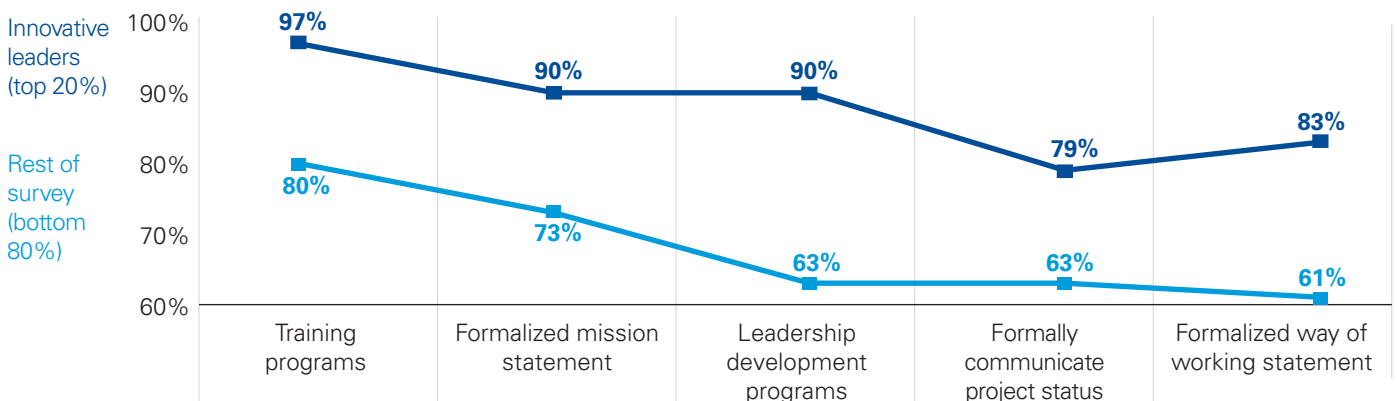
Indeed, these top organization on our Future-Ready Index rate attracting talent as the second most important challenge for the entire industry; this is in stark contrast to all other respondents, who only rank talent in fifth place.

In the *Global Construction Survey 2017 Make it, or break it*[6], we highlighted the importance of 'soft' controls, designed to foster a motivated workforce aligned with common goals and values, and to achieve high standards of excellence in construction. Innovative leaders have seized this issue and are considerably more likely to have implemented all the top 5 'soft' controls: training programs, formalized and communicated mission statements, project status updates, leadership development, conflict and bias programs (Figure 6).

As in all industries, diversity plays an ever more important part in organizational life and influences both performance and perception. The data clearly indicates that Innovative leaders take a more proactive approach to recruiting a diverse set of workers and tracking progress towards building a truly diverse workforce (Figure 7).

Diversity plays an ever more important part in organizational life and influences both performance and perception, and the engineering & construction sector is no exception. The data clearly indicates that forward-thinking players take a more active approach to diversity, tracking gender, race and indigenous participation.

Figure 6: Innovative leaders implement top 5 soft controls

Innovative leaders (top 20%)
Rest of survey (bottom 80%)

	Training programs	Formalized mission statement	Leadership development programs	Formally communicate project status	Formalized way of working statement
Innovative leaders	97%	90%	90%	79%	83%
Rest of survey	80%	73%	63%	63%	61%

n=162
Source: Future-Ready Index: Leaders and followers in the engineering & construction industry

[5] *Workforce shaping in the age of automation,* KPMG International, 2018.
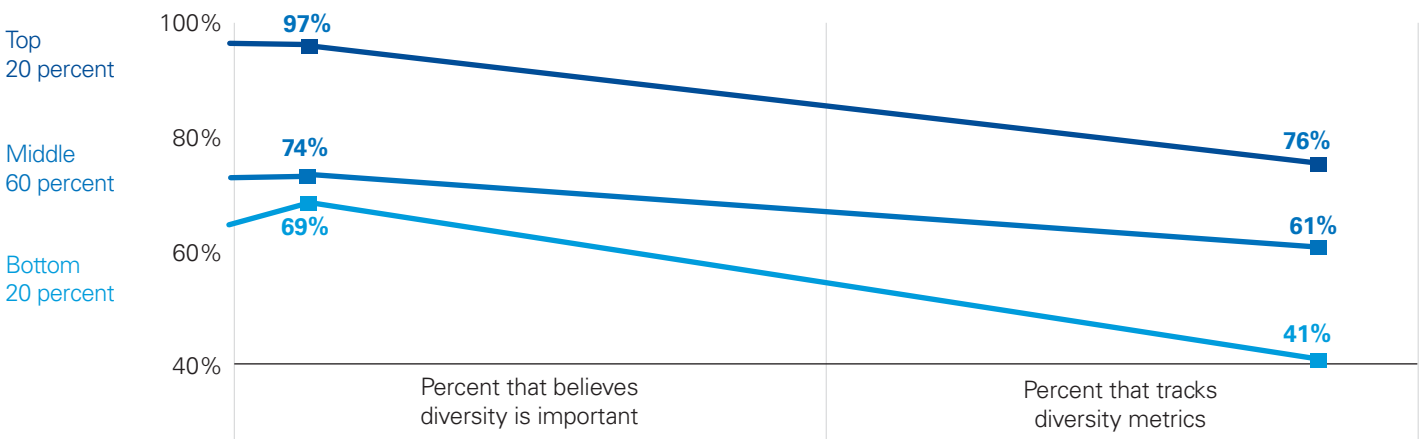 https://home.kpmg/xx/en/home/insights/2018/08/workforce-shaping.html
[6] *Make it, or break it,* Global Construction Survey, KPMG International, 2017.
  https://assets.kpmg/content/dam/kpmg/xx/pdf/2017/10/global-construction-survey-make-it-or-break-it.pdf

As the notion of a lifetime with a single employer fades to memory, leading organizations still optimize loyalty through management development programs and standardized promotion. It is little surprise then that 93 percent of the Innovative leaders have 'very' or 'somewhat' standardized objectives and requirements for promotion.

Addressing the gender gap

According to a recent publication by the Major Projects Association, the proportion of women in major projects has not changed significantly in the past decade. The report suggests that a "clearly defined, focused diversity strategy can help an organization improve its bottom line, attract top talent and retain high-potential employees". It also argues that: "By measuring as many metrics as possible, using an integrated HR system to track demographics and using vendors strategically, organizations can successfully make the case for culture change".[7]

Figure 7: Innovative leaders are more committed to diversity

Top 20 percent — 97% ... 76%
Middle 60 percent — 74% ... 61%
Bottom 20 percent — 69% ... 41%

Percent that believes diversity is important

Percent that tracks diversity metrics

n=160
Source: Future-Ready Index: Leaders and followers in the engineering & construction industry

" You can bring technology and innovation into project controls, but what about people? You have experienced professionals with experience in schedule and costs, and a young generation that is tech savvy but may not understand the basics. The challenge is how to give the new guard more skills and how to get the old guard to better understand technology. "

Geno Armstrong
Partner, KPMG in the US
Global Sector Leader, Engineering &
Construction, KPMG International

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[7] *Gender balance interventions in major projects,* Major Projects Association, 2017.
https://majorprojects.org/pdf/misc/genderbalance.pdf

How future-ready is your organization?

How should you invest in controls, technology and people? And what is the expected return?

The value or return on investment (ROI) in governance and controls, technology and people, is influenced by an organization's future-ready maturity, its commitment to change and its ability to adapt and manage change. Innovative leaders tend to be more adept at implementing cutting-edge processes, technologies and organizational and/or people initiatives.

Take the self-test on page 30 to see where your organization could place on the Future-Ready Index, and then use the charts on the following pages — featuring a value map and a strategic roadmap — to understand the potential value of investing in change.

Testing and implementing

"The effective implementation of an innovation strategy requires executive leadership and support. Absent this, the organization will default to the low risk strategy of maintaining the status quo. It is therefore important that the company's leadership foster an environment where innovation is both encouraged and rewarded, but also where the investigation and adoption of new technologies is done within a framework that manages the downside risk in the event of failure."

Barry Murphy
Former Senior Vice President Technical Services
Yamana Gold

Self-test: How future-ready
is your organization?

To find out how your organization could rank on the Future-Ready Index, simply complete the brief questionnaire below. This is a shortened version of the survey and provides approximate results. If you're interested in going through the full benchmarking process, KPMG can help you compare your scores to peers across industry, geography, size and category (owner versus contractor). All you need to do is contact Global Infrastructure.

ID	Question	Answer section	Points	
			Answer	**Pts**
1.	**What is the percentage of annual voluntary employee turnover/attrition within your organization? For owners, consider only project-related turnover/attrition.**	**Voluntary turnover**	**Answer**	**Pts**
		0–5		4
		6–10		3
		11–15		2
		16–20		1
		>20		0
2.	**How would you rate your ability to recruit qualified personnel?**	**Recruit**	**Answer**	**Pts**
		Extremely easy		4
		Very easy		3
		Neutral		2
		Very difficult		1
		Extremely difficult		0
3.	**Do you offer performance-based project bonuses, variable compensation or incentive mechanisms?**	**Performance bonuses**	**Answer**	**Pts**
		Group or project team performance bonuses upon attainment of project milestone or completion		1
		Individual incentives/spot bonuses for specific achievements		1
		Specific bonuses for innovation		1
4.	**Identify all of the 'soft controls' in use at your company or project organization.**	**Soft controls (check all that apply)**	**Answer**	**Pts**
		Leadership development programs		1
		Formalized and communicated 'our way of working' (or similar) cultural statement		1
		Bias training or conflict training		1
5.	**Identify which of the following technologies you have already implemented or begun to implement within your organization.**	**Technology**	**Answer**	**Pts**
		Integrated project management information systems (PMIS)		1
		Use of advanced data analytics		1
		Mobile platforms		1
		Building information modeling (BIM)		1
		Radio frequency identification		1
		Robotics process automation/digital labor		1
		AI or cognitive machine learning		1
		3-D printing		1
		Drones (remote monitoring, quantity verification)		1
		Smart sensors (tracking people, productivity, security, etc.)		1
		Virtual or augmented reality		1

ID	Question	Answer section	Points	
		Innovation initiatives	**Answer**	**Pts**
6.	**Which of the following initiatives has your organization implemented to advance innovation and technology?**	Developed a data/technology strategy or road map		2
		Appointed a senior leader responsible for innovation		1
		Inorganic innovation investment in technology or people		1
		Organic investments in new technology during the past 12 months		1
		Experimented with new technology on pilot projects		1
		Initiated technology/innovation competitions		1
		Budget performance	**Answer**	**Pts**
7.	**Over the last year, what percentage of your projects achieved their originally planned budgets?**	90%–100%		4
		75%–89%		2
		50%–74%		1
		Less than 50%		0
		Project reporting	**Answer**	**Pts**
8.	**Please select which statement best describes your organization's project reporting?**	Push one button: real-time, full PMIS, capable of project and portfolio dashboard reporting		4
		Integrated systems: multiple integrated tools, systems capable of project and portfolio reporting		3
		Separate systems: separate systems requiring manual reconciliation and updates		2
		Spreadsheets: spreadsheets and other manual documents or programs		1

Add up your points to see where you land

Use this placement key to add up your points and see where your company could land on the scale. Are you a Leader, Follower or Behind the curve?

Score	Category
>28	Innovative leaders
18–27	Followers
<18	Behind the curve

Value map

Using your results from the self-test on page 30, use this guide to determine the potential value for investing in change.

Bottom 20%
Behind the curve

High value
- Track diversity metrics
- Implement BIM across all projects

Medium value
- Develop standard training programs
- Utilize basic data analytics

Low value
- Standardize promotion process for project personnel

Middle 60%
Followers

High value
- Implement PMIS
- Experiment with new technology on pilot projects
- Utilize advanced data analytics
- Create a technology vision, road map or strategic plan

Medium value
- Improve long-term career growth opportunities and implement leadership development programs
- Invest in mobile platforms, drones and smart sensors
- Assign innovation to a dedicated team and appoint a senior leader responsible for innovation/technology
- Inorganic investments in technology or people and organic investments in new technology
- Organization-wide 'labs' to test new technology
- Specific formal approach for mega/giga/extremely complex projects

Low value
- Initiate technology/innovation competitions

Top 20%
Innovative leaders

High value
- Continue experimenting with new technology
- Integrate technology and leverage data across common platform
- Develop and operationalize predictive models to drive continuous performance improvement

Medium value
- Robotics process automation/ digital labor
- 3-D printing and machine engineering and design
- AI and machine learning

Low value
- Project team performance bonuses
- Invest in radio frequency identification and VR/AR
- Implement competing challenge teams to tackle new opportunities
- Establish separate subsidiary to develop new/innovative technologies

Strategic road map

Figure 8: Strategic road map for bottom 20 percent Behind the curve organizations

	2019		2020			
	Q3	Q4	Q1	Q2	Q3	Q4

People
- Track diversity metrics
- Implement leadership development program
- Improve long-term career growth opportunities

Process
- Specific formal approach for mega/giga/extremely complex projects

Technology
- Create a technology vision, road map or strategic plan
- Implement drones
- Establish an advanced D&A team
- Assign innovation to a dedicated team
- Appoint a senior leader responsible for innovation/technology
- Experiment with new technology on pilot projects
- Inorganic innovation investments in technology

Source: Future-Ready Index: Leaders and followers in the engineering & construction industry

A technology-enabled, strategic road map (Figure 8) should be a vital and ultimately a cost-effective route to dramatically improve capital project and program performance. As the survey results indicate, most engineering & construction companies and owners regard themselves as either Followers or Behind the curve, which could leave them more vulnerable to the threats from disruption and fast-paced innovation.

To build a deeper understanding of their competitive position, the first step is to clarify a vision and then identify key areas for investment based on the value map.

The challenge is often less about what the organization wants to accomplish, and more about being realistic on timing and effort required, as well as assessing and integrating new initiatives with current investments.

We believe a bold attitude could reap benefits — including a willingness to discontinue investing in areas that either fail to align with the strategic vision, or do not provide sufficient value. A road map is not a static 'document' to leave on the shelf; it is an ongoing, dynamic endeavor calling for perseverance and constant questioning over the direction taken.

The engineering & construction company of the future

Change may be coming, but is the industry prepared?

There is little doubt that a combination of labor shortages, flat productivity levels, rising material costs, fragmented supply chains and numerous high-profile megaproject failures makes the engineering & construction industry ripe for disruption.

Among the emerging trends shaking up the industry are sustainability (in both the construction process and the finished structures), digitization and technology, and a move towards modularization.

How is the industry prepared for such a shift, and where do respondents believe the industry will be in 5 years? (Figure 9)

Those respondents and readers who have invested in technology and innovation — and are reaping the rewards — may view these results with optimism. However, many others should see the findings as a wake-up call to action. As we have discussed, and as John Fish of Suffolk has commented on page 24, changing an organization's culture to embrace innovation and technology does not happen overnight — it takes years of focus and effort as well as strong leadership.

We urge organizations not to approach the future passively, nor to assume that disruption will somehow bypass their market or industry. Whether you are an Innovative leader, a Follower or Behind the curve, you can consider these three key points, to either help kick-start your journey, or assess your progress to date:

- **Take stock** — Self-test: Take the self-test included in this survey on page 30, and determine your organization's Future-Ready Index score and maturity category.

- **Prioritize options** — Value map: Evaluate the results and identify key areas for investment based on the value map. We recommend that this is not done in isolation, but as a team or part of a workshop, in order to develop momentum, gauge acceptance/resistance and determine the level of effort and resources required.

- **Develop a strategic plan** — Road map: Develop (or if already developed, refine) a technology and innovation road map based on existing technology and innovation investments as well as planned, new investments. Similar to the value map, a road map should not be developed hastily and should consider not only the level of investment but also the availability of key resources and the timing.
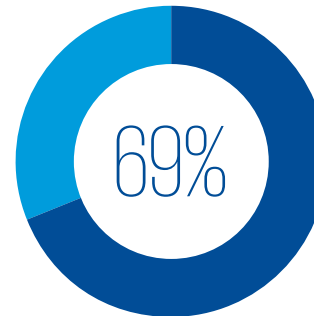
## Figure 9: Industry executives' perception of the future landscape (within 5 years)
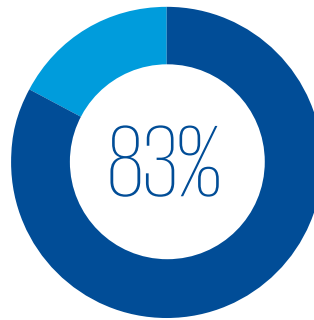
83% Feel organizations will be data-driven, including routine use of data analytics and predictive modeling for project planning and monitoring
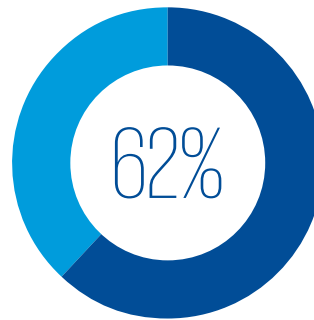
62% Believe most organizations will be performing real-time adaptive risk and return modeling and reporting on their projects

69% Expect to see new entrants challenging traditional players
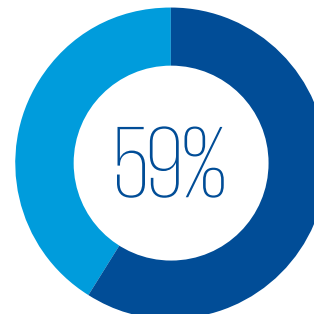
59% Foresee augmented and virtual reality as common on most projects

n=146

Source: Future-Ready Index: Leaders and followers in the engineering & construction industry

What will a top 20 percent Innovative leader look like in 5 or 10 years' time?

We believe that these organizations will be highly agile and thrive in an environment of continual disruption. Current leaders who have invested in technology and innovation are already developing the skills and operating model to succeed. The graphic below highlights four key characteristics that will drive Innovative leaders, along with examples of how these organizations are disrupting the industry.

Customer and stakeholder engagement
Delivers differentiated customer and stakeholder experience by providing an integrated view of data.

Example: Organizations should no longer receive disconnected snapshots of project or portfolio performance; instead, there should be real-time views of project value and performance, based on the most up-to-date project, market and operational data.
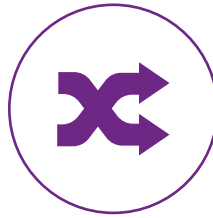
Changing view and nature of assets
Unlock assets' value and potential throughout their life cycles, in highly fluid and sometimes volatile environments, by embracing data, networks, alliances and organizational agility.

Example: By integrating vertical supply chains, organizations can achieve fully integrated planning, design, construction, commissioning and operation of assets.

Scalable and adaptive services
A nimble and adaptive approach to scale faster and more efficiently, by accessing resources and providing services on an as-needed basis.

Example: Utilization of modular designs and construction and on-site 3-D printing. This has the potential to shorten the duration of design and construction, while also increasing labor productivity, and minimizing the size and scale of on-site labor at specific, congested and inefficient dense urban construction sites.

Workforce of the future
Lean, automated and accesses skills on demand.

Example: The use of robots in the field, unmanned aerial vehicles (UAV) and intelligent tools and equipment should continue to automate many of the less complex and higher — risk tasks at the job site, leading to a leaner, more specialized and digitally enabled workforce.

About the survey

Survey responses were gathered a combination of face-to-face and online interviews in 2018/2019. A total of 223 senior leaders participated in the survey. As not each respondent answered all questions, the sample size for each question varies and is indicated below each chart in the report. Thirty-seven percent of respondents are from organizations carrying out significant capital construction projects (owners); 63 percent are from engineering & construction companies (contractors) (Figure 11).

The questions were compiled by a steering team of senior representatives specializing in the engineering & construction industry from KPMG member firms and reflect current and ongoing concerns expressed by clients of KPMG member firms. These same professionals also carried out the interviews.

Respondent organizations' turnover/ income ranged from less than US$1 billion to more than US$20 billion (Figure 13), with a mix of operations from global through to regional to purely domestic (Figure 10). The annual capital expenditure budget varied from around US$10 million to over US$5 billion.

We observed 20 percent of project owners from public bodies (Figure 14) — typically government agencies — and some of the main industries represented include energy and natural resources, technology and health care (Figure 12).

Figure 10: Regions of operation
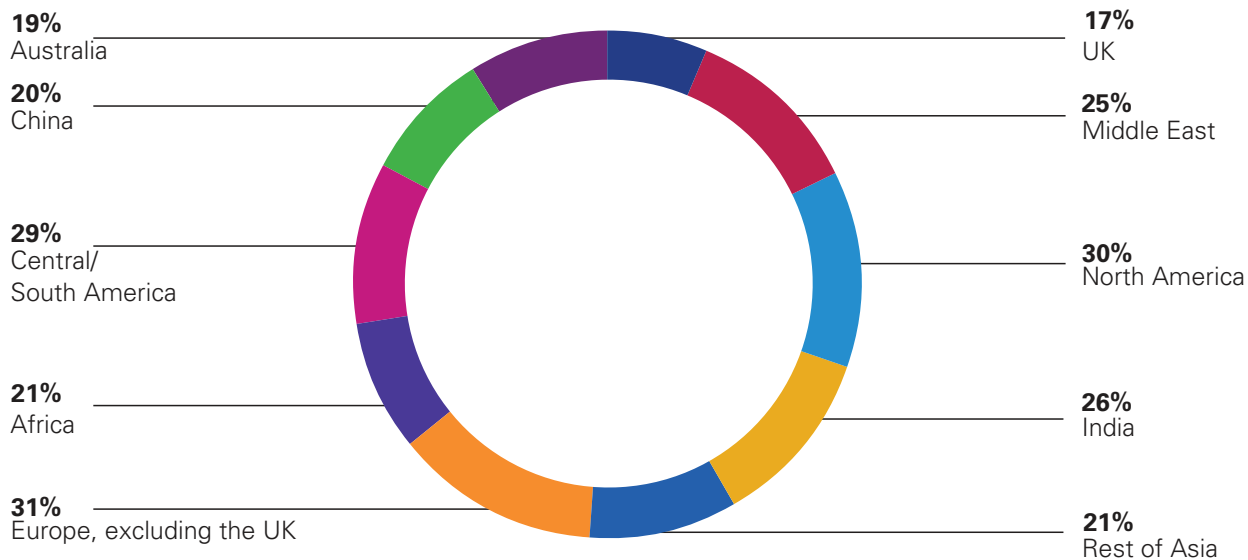
19%
Australia

20%
China

29%
Central/
South America

21%
Africa

31%
Europe, excluding the UK

17%
UK

25%
Middle East

30%
North America
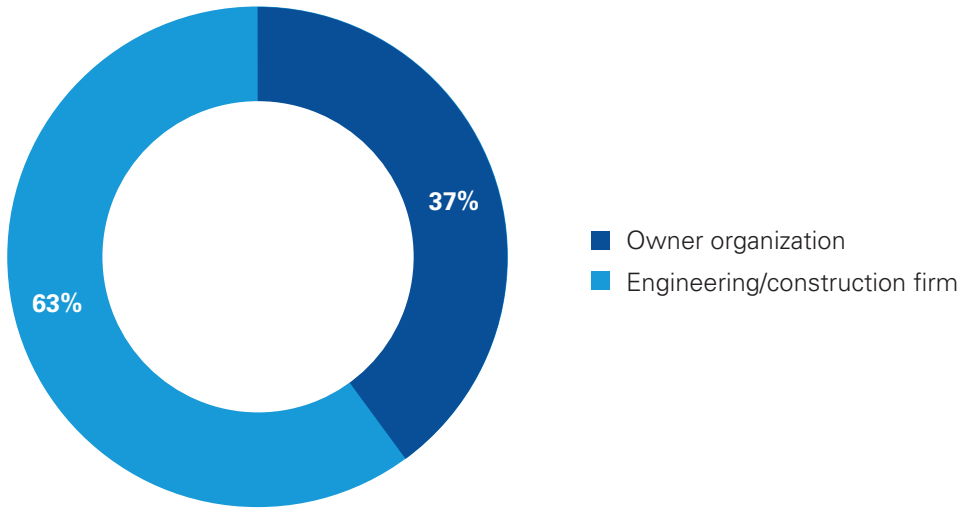
26%
India

21%
Rest of Asia

n=205

Multiple responses permitted

Source: Future-Ready Index: Leaders and followers in the engineering & construction industry

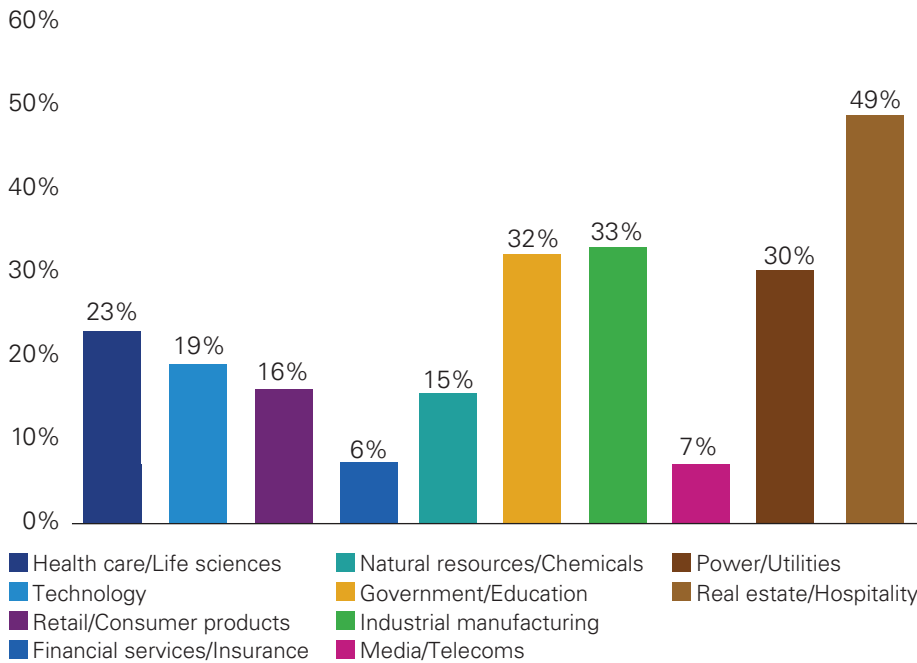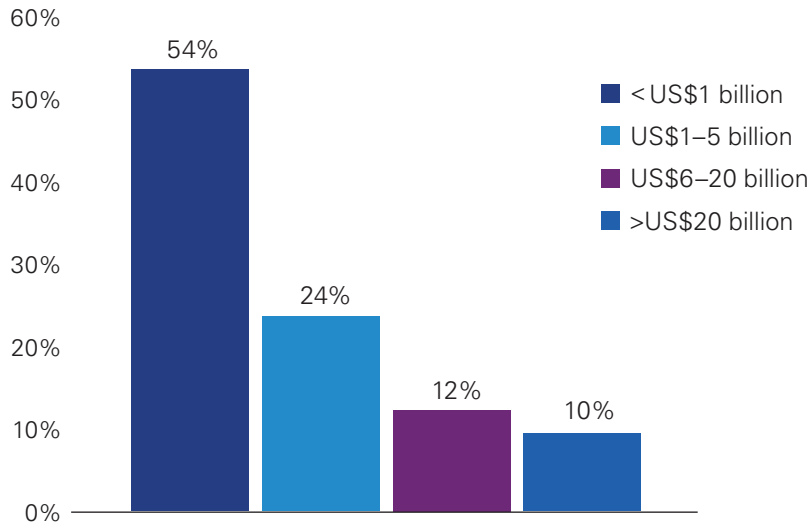## Figure 11: Organization category

- **37%** Owner organization
- **63%** Engineering/construction firm

n=199
Source: Future-Ready Index: Leaders and followers in the engineering & construction industry
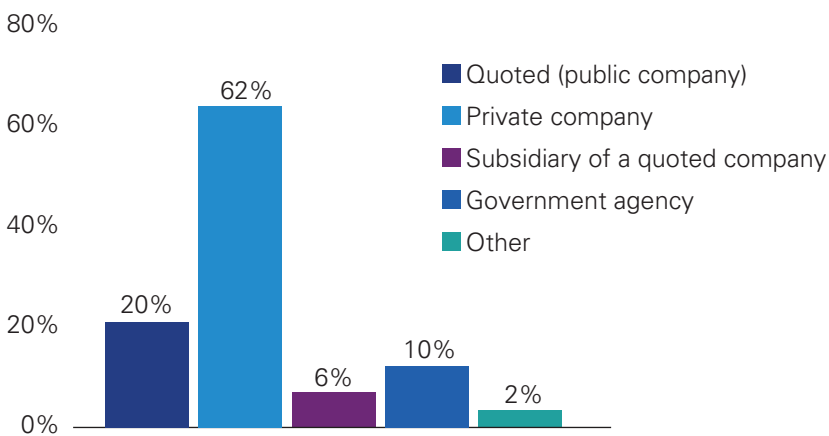
Figure 12: Industry sector

- 23% Health care/Life sciences
- 19% Technology
- 16% Retail/Consumer products
- 6% Financial services/Insurance
- 15% Natural resources/Chemicals
- 32% Government/Education
- 33% Industrial manufacturing
- 7% Media/Telecoms
- 30% Power/Utilities
- 49% Real estate/Hospitality

Legend:
- Health care/Life sciences
- Technology
- Retail/Consumer products
- Financial services/Insurance
- Natural resources/Chemicals
- Government/Education
- Industrial manufacturing
- Media/Telecoms
- Power/Utilities
- Real estate/Hospitality

n=205
Multiple responses permitted
Source: Future-Ready Index: Leaders and followers in the engineering & construction industry

Figure 13: Approximate entity revenue from operations in last 12 months

Legend:
- ■ < US$1 billion
- ■ US$1–5 billion
- ■ US$6–20 billion
- ■ >US$20 billion

Bar values: 54%, 24%, 12%, 10%

n=200
Percentages might not add up to 100% due to rounding
Source: Future-Ready Index: Leaders and followers in the engineering & construction industry

Figure 14: Entity type

Legend:
- ■ Quoted (public company)
- ■ Private company
- ■ Subsidiary of a quoted company
- ■ Government agency
- ■ Other

Bar values: 20%, 62%, 6%, 10%, 2%

n=205
Multiple responses permitted
Source: Future-Ready Index: Leaders and followers in the engineering & construction industry

KPMG's Global Engineering & Construction practice

When engineering & construction leaders turn to KPMG member firms for advice, they do so because KPMG professionals understand the industry on a local, national and global level. For decades, we have provided services tailored specifically to meet the needs of the industry. To do this, we have created a diverse practice that includes certified public accountants, professional engineers, architects, project managers, owner representatives, contract and procurement specialists, finance and tax professionals, business valuation specialists, cost estimators and specialists, certified fraud examiners and forensic technology specialists.

KPMG's Engineering & Construction professionals provide strategic insights and relevant guidance wherever our clients operate. Services are delivered through the global network of KPMG member firms by over 2,000 professionals in more than 40 countries worldwide.

KPMG professionals help clients identify and mitigate project risks throughout the project life cycle. Our methodology encompasses both 'doing the right project' and 'doing the project right.' Engineering & Construction practice services include construction program evaluations, project risk and controls assessments, contract compliance analyses and cost investigations, as well as project support on complex and troubled projects.

We provide industry knowledge, multidisciplinary teams, and substantive experience in managing both the financial and technical aspects of major capital projects and programs. Our Major Projects Advisory practice consists of professionals from diverse formal backgrounds. By combining valuable global insight with hands-on local experience, we can help you address challenges at any stage of the life cycle of infrastructure assets or programs — from planning, strategy and construction through to operations and hand-back.

For more information, or to view a selection of other relevant KPMG reports and insights, please visit: **kpmg.com/infrastructure**

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