2024 STATE OF DESIGN & MAKE
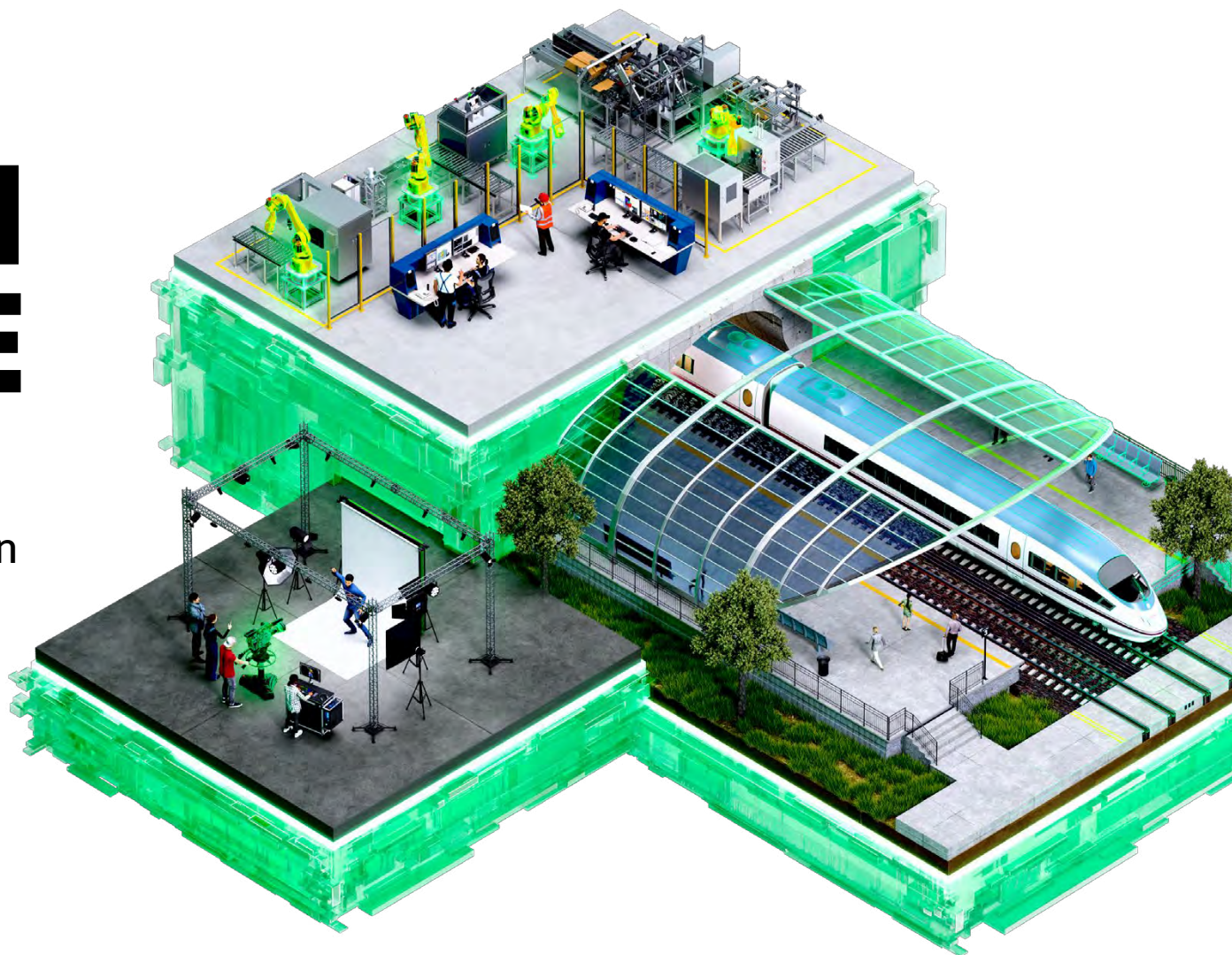
Architecture, Engineering, Construction, and Operations Edition

Insights from industry leaders on how digital transformation is driving business resilience, sustainability, and talent management

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About the study

The *State of Design & Make* report is a global, annual study for leaders who design and make places, objects, and experiences. It identifies the most pressing issues shaping today's businesses and helps leaders make informed, strategic decisions about how to prioritize and invest in the future.

Unless otherwise noted, the data in this document is from the AECO industry sample of 2,002 business leaders and experts—a subset of Autodesk's *2024 State of Design & Make* report—who are in the architecture, engineering, construction, and operations industries.

The overall sample includes 5,368 industry leaders, futurists, and experts from the following industries: architecture, engineering, construction, and operations (AECO); design and manufacturing (D&M);

and media and entertainment (M&E). Survey data in the main report has been broken down by global region: Asia-Pacific (APAC), which includes responses from Australia, China, India, Japan, and South Korea; Europe, Middle East, and Africa (EMEA), with responses from France, Germany, Italy, the Middle East, the Netherlands, the Nordics, Spain, Turkey and the United Kingdom; and the Americas (AMER), with responses from Brazil, Canada, Mexico and the United States.

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Introduction

Key themes and top insights

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The architecture, engineering, construction, and operations (AECO) industry has undergone a seismic shift in sentiment over the past year, driven by groundbreaking technological advancements, increasing cost concerns, and a new focus—from both the public and private sectors—on sustainability. AECO leaders and experts are optimistic about the global landscape, as well as their companies' resilience, preparedness, performance, investments, and level of digital transformation, a noticeable change from Autodesk's *2023 State of Design & Make* report. This sentiment was reflected in our qualitative interviews, where leaders said the economy's seemingly soft landing after years of recession fears inspired much of their confidence. But with this confidence, a new concern emerges—cost control, which now trumps talent as a top business challenge.

Also new this year was the understanding that artificial intelligence (AI) is a current tool rather than a futuristic pipe dream, and with that understanding, a surprising degree of trust. Leaders are embracing AI and emerging technology and the possibility of productivity gains through automation, augmentation, and analysis. One benefit of this impetus is improved sustainability. AI has risen to the top spot in terms of technologies leaders are using to make their businesses better able to meet sustainability goals.

This acceptance of AI has shown that new technologies have the power to transform organizations. Leaders that want to stay competitive in an industry as rapidly innovating as AECO need to focus on harnessing the power of their internal data, attracting, training, and retaining tech-savvy talent, and leaning into sustainability efforts that provide long-term revenue opportunities.

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Key themes

Business resilience

Talent

Sustainability

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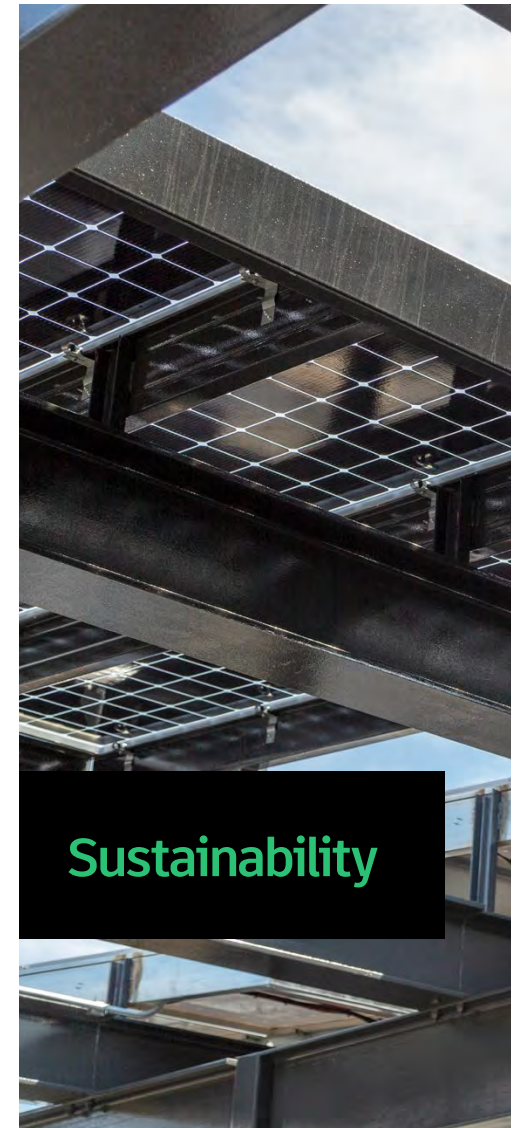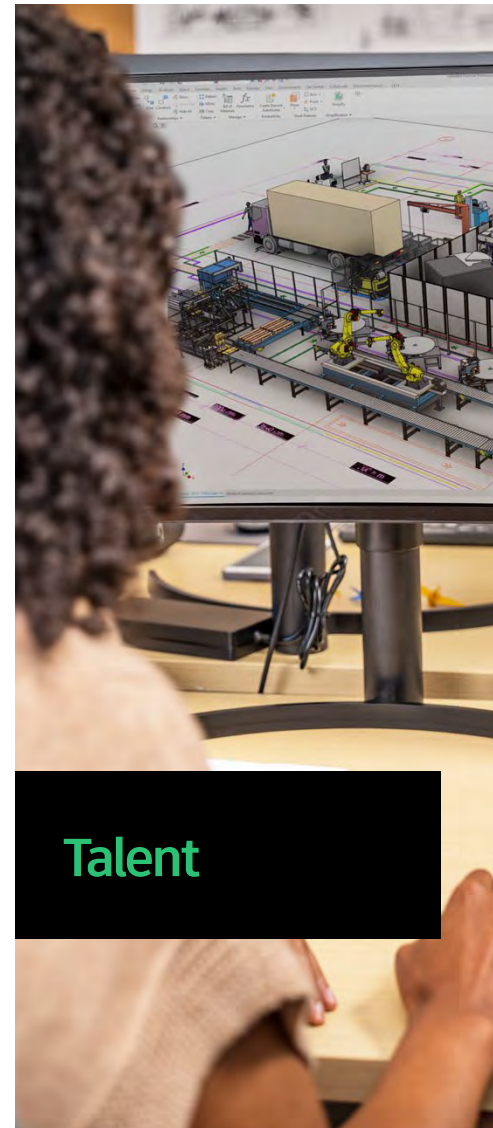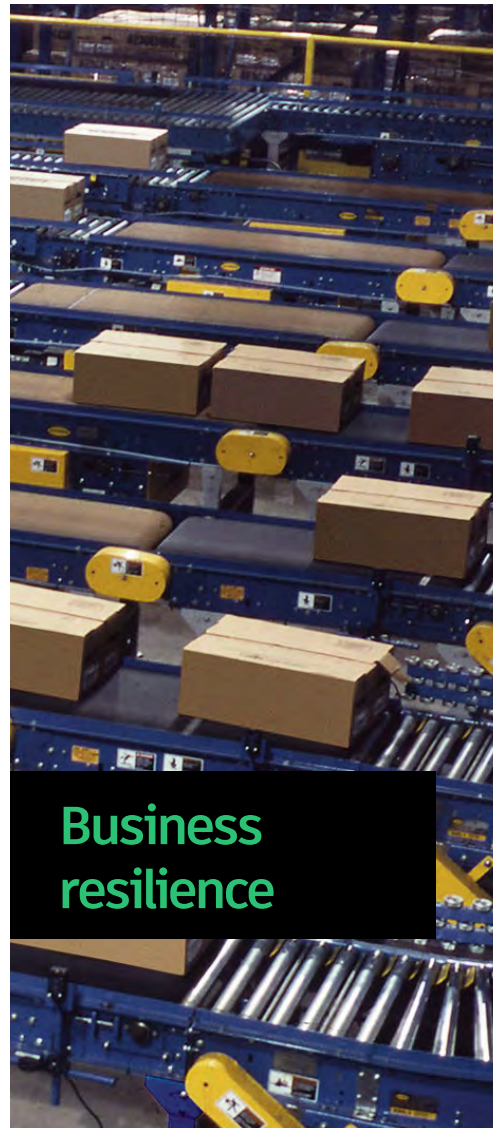
Top insights

Business resilience

1. **Optimism is returning:** Leaders feel their companies are far more resilient than last year

2. **Cost control** has risen above talent as the top challenge for businesses

3. **Digitally mature companies** are reporting even greater success

4. Companies are already making meaningful progress on their **AI adoption journeys**

Talent

5. **Upskilling** is essential but out of reach for many

6. Companies are taking a multi-pronged approach to solving the **talent problem**

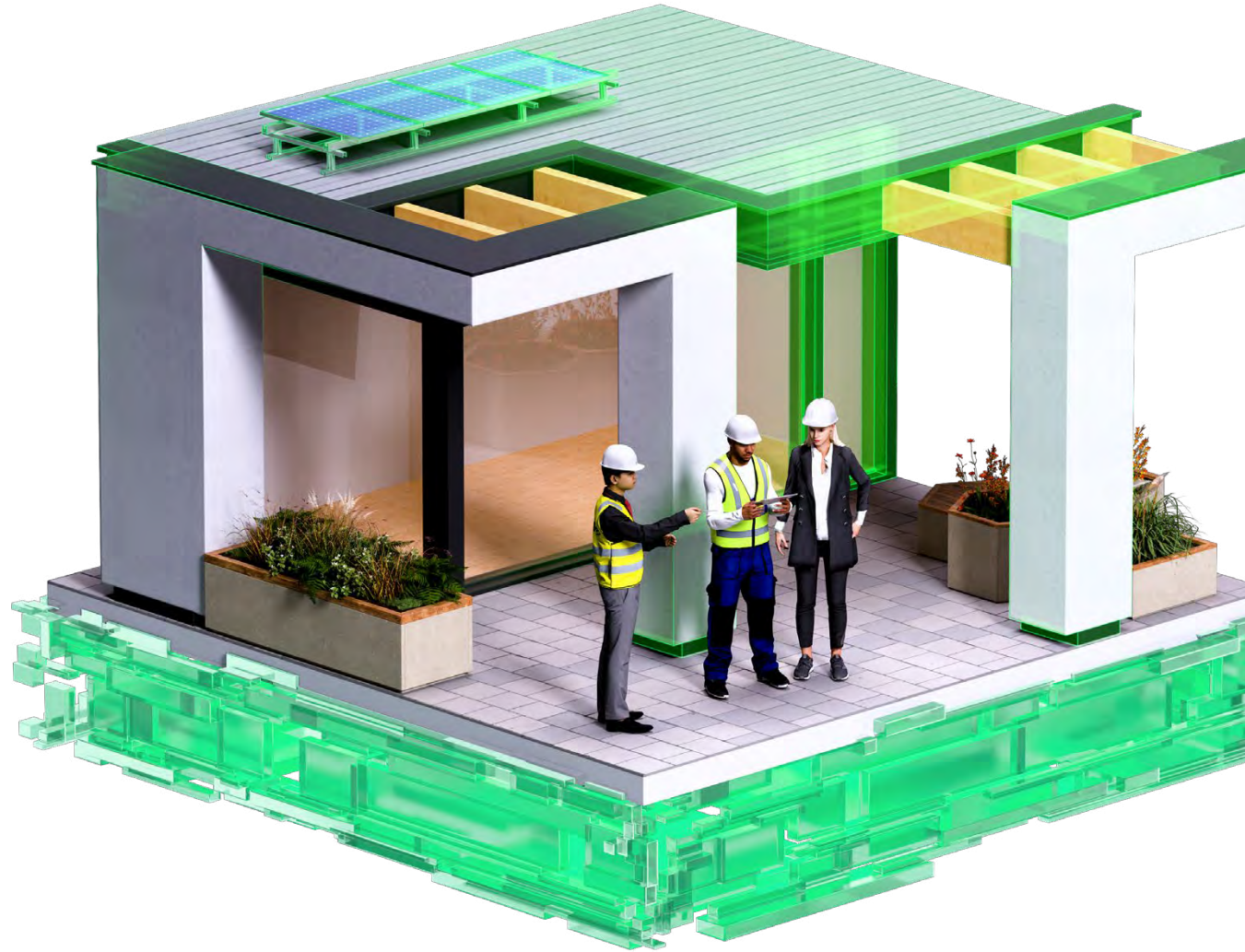## Sustainability

7. Companies are taking **sustainability seriously**

8. Sustainability is improving both **short- and long-term business health**

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Business resilience

Digitization boosts business resilience amid continued challenges

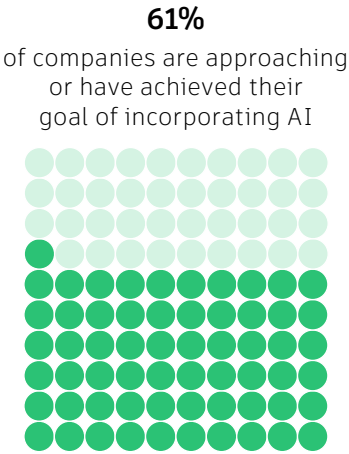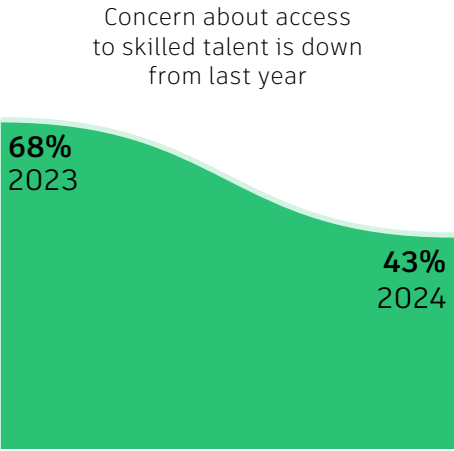**A positive outlook, new challenges and the value of digital tools**

In a word, AECO leaders and experts this year are optimistic.

While they continue to face significant challenges, the past few years have proven how resilient their organizations are. As a result, they feel far more confident than they did last year in their companies' ability to tackle challenges effectively.

Talent took the top spot last year among business challenges, with organizations struggling with both talent acquisition and retention. This year, cost control outweighs labor concerns, followed by product and service innovation and environmental sustainability.

Keeping up with the rapid pace of technological change—including artificial intelligence—is another important challenge, but one that presents significant opportunity for companies able to make strategic investments. Professionals report an array of benefits from digital investments, but they also say that costs, a lack of time, and skills gaps all present barriers to their digital transformation efforts.

75%
of companies are prepared to handle unforeseen change

Concern about access to skilled talent is down from last year

68%
2023

43%
2024

31%
say digital transformation has improved productivity

61%
of companies are approaching or have achieved their goal of incorporating AI

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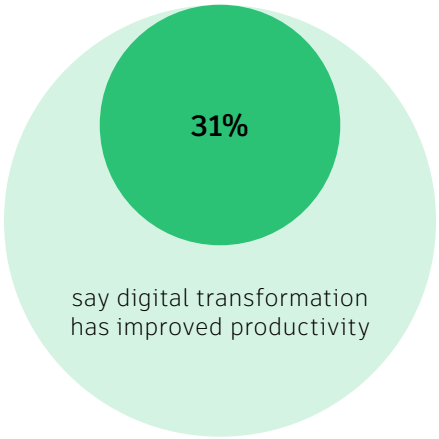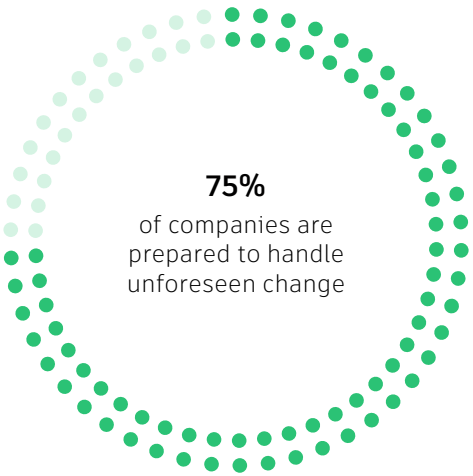
Optimism is returning

Companies are more prepared than before to face an uncertain future.

Last year, survey respondents emphasized the sense of uncertainty brought about by the global pandemic, geopolitical turmoil, and economic instability in many markets, with many businesses struggling to attract and retain the talent they needed to grow.

This year, business leaders and experts in AECO are much more confident. Seventy-five percent say their companies are prepared to handle unforeseen economic or geopolitical changes, compared to 62% in 2023.

This confidence is due in part to the fact that businesses have successfully navigated a series of unprecedented challenges over the past several years. "Coming out of COVID, people are a lot more optimistic," says Richard Matchett, digital lead at Zutari, an infrastructure engineering and advisory practice. "We've had a year now to figure out which way is up."

Companies are also proactively improving their positions, taking steps such as planning new offerings, entering new markets, increasing agility, and diversifying supply chains. The more of these steps a company takes, the more confident leaders feel about the future.

Businesses are also performing better and keeping pace with their competition. Seventy-four percent of leaders and experts say their companies outperformed expectations last year. In 2024, 7% say that their company is not keeping up with the rate of change in their industry this year, compared to 10% in 2023.

51%
of leaders and experts say the global landscape feels more uncertain now than three years ago, compared to 79% in 2023

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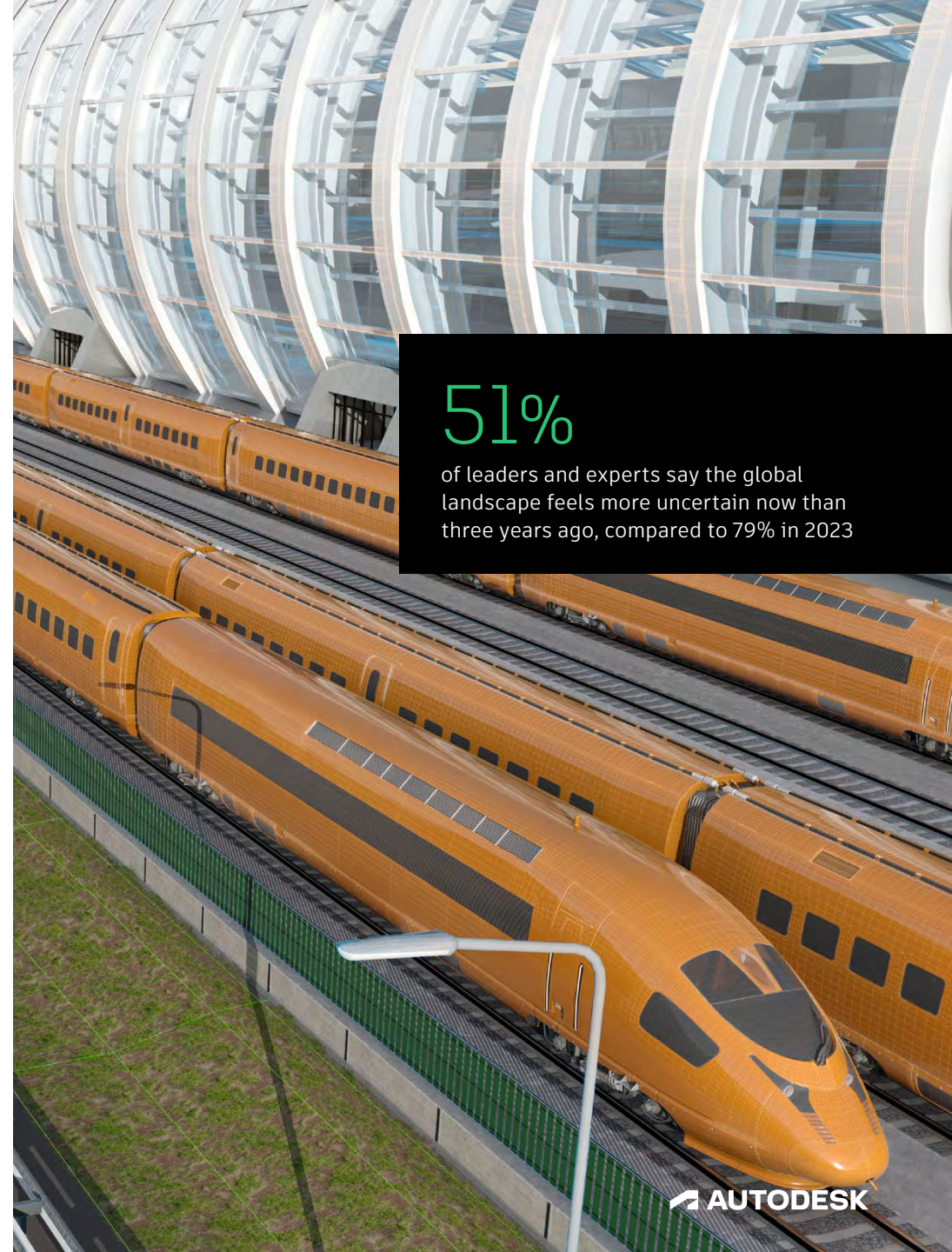
Resiliency measures are tied to confidence

At companies that take more steps to boost resilience, leaders and experts are more confident about the future.

This year's survey asked about company efforts to plan new offerings, enter new markets, increase agility, and diversify supply chains. At companies where leaders agree that they are taking these measures, respondents feel much more equipped to face down future uncertainty.

AECO company performance is improving

Percentage of businesses that outperformed corporate expectations
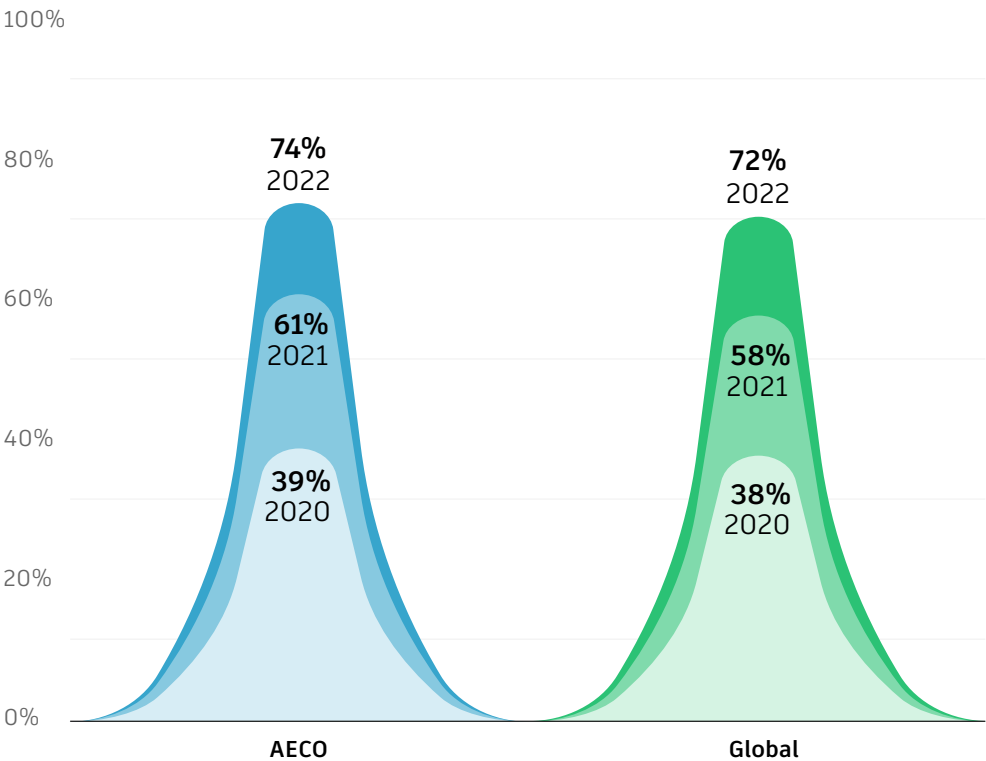
Survey question: How has your company or organization performed compared to corporate expectations in each of the last 3 years? In 2020, in 2021, in 2022. 5-point scale. Top two = above average performance.

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"Having experienced the global challenges in the last few years, we've now **established ways to hedge risks more effectively**, such as pricing quotations based on an understanding of price fluctuations and avoiding risky areas in the supply chain."

–Eiichiro Okano, Managing Executive Officer, Digital Transformation Division, Obayashi Corporation, a construction and general contracting firm

"I wouldn't say optimism returned, because I don't know that it ever left us. We've been very optimistic the last two years, and our team is definitely resilient. **The pandemic created different ways for people to think.**"

–Vince DiPofi, PE CEO, SSOE Group, an architecture and engineering firm

Architecture services firms are especially confident about the future

● My company is prepared to handle unforeseen future changes
● The future global landscape feels more uncertain now than 3 years ago
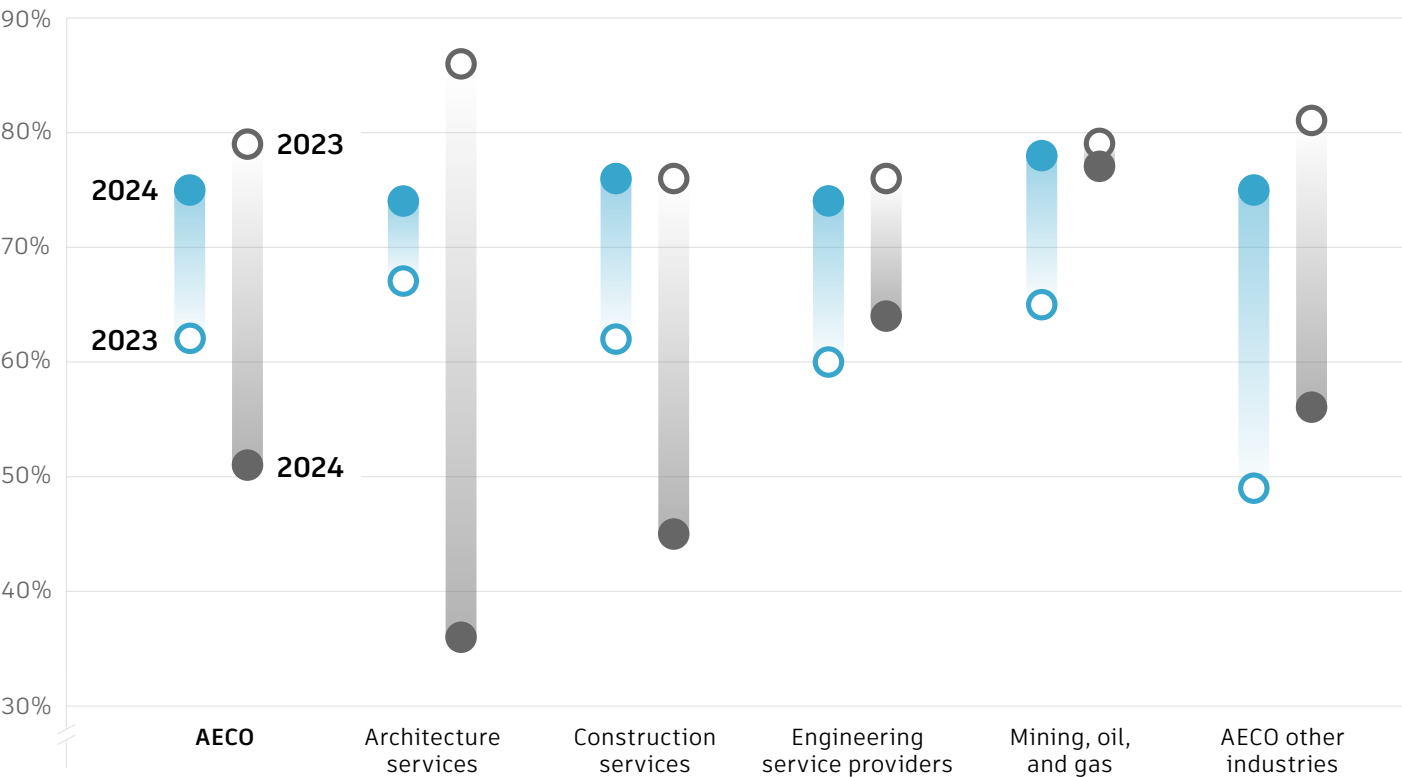
Percentage of AECO respondents who agree with statements: 1. My company is well prepared to handle unforeseen future macroeconomic and geopolitical changes. 2. The future global landscape feels more uncertain now than 3 years ago. 5-point scale. Top two = agree.

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Cost control has risen above talent as the top challenge for businesses

Talent remains critical to company success, but it is no longer the top challenge many businesses are facing.

This year, cost control and management is a top concern for many, with 34% of respondents in AECO citing it as their biggest challenge. Leaders at struggling companies are, understandably, even more concerned than others with costs.

Although talent fell this year, it still ranks highly on respondents' lists of top challenges. Attracting, training, and retaining talent is a top-three challenge for 28% of AECO business leaders and experts, down significantly from 48% a year ago. Forty-three percent say that access to skilled talent is a barrier to their company's growth, but that number is down from 68% last year.

"Talent is still a challenge, but not as big as before," says Maria Fernanda Olmos, global principal, digital integration at Unispace, a workplace strategy, design, and construction firm. "Cost control is emerging as a more significant concern.

Given the unpredictable nature of the economic landscape, our current emphasis is on prioritizing cost control. This strategic shift enables us to enhance our adaptability and resilience to better navigate uncertainties."

Additional top challenges include product and service innovation, with 25% of respondents citing it as their biggest challenge. Environmental sustainability was cited by 28%, data automation by 25%, and global economy and events by 26%.

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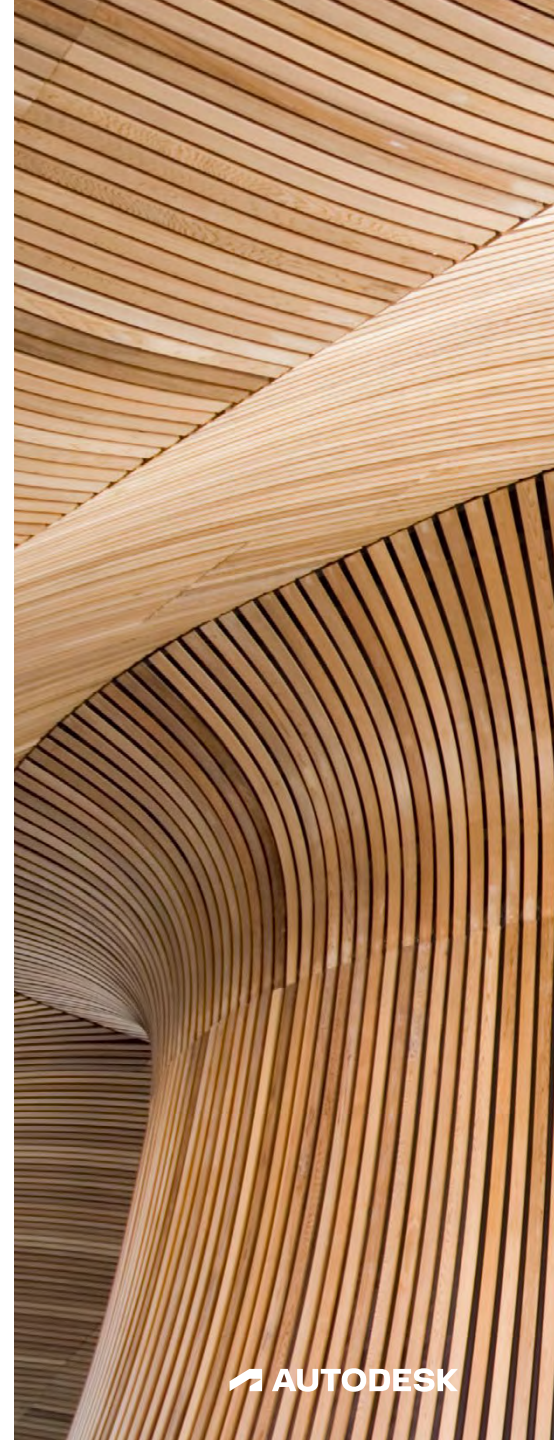
Cost control emerges as the top business challenge in AECO

Top 5 challenges showing year-over-year change

2023

2024

	2023	2024	
1	Attracting, training, and retaining talent	Cost control and cost management	1
2	Cost control and cost management	Attracting, training, and retaining talent	2
3	Global economy and events	Environmental sustainability	3
4	Data automation/technological advancement/digitization	Global economy and events	4
5	Product or service innovation	Data automation/technological advancement/digitization	5
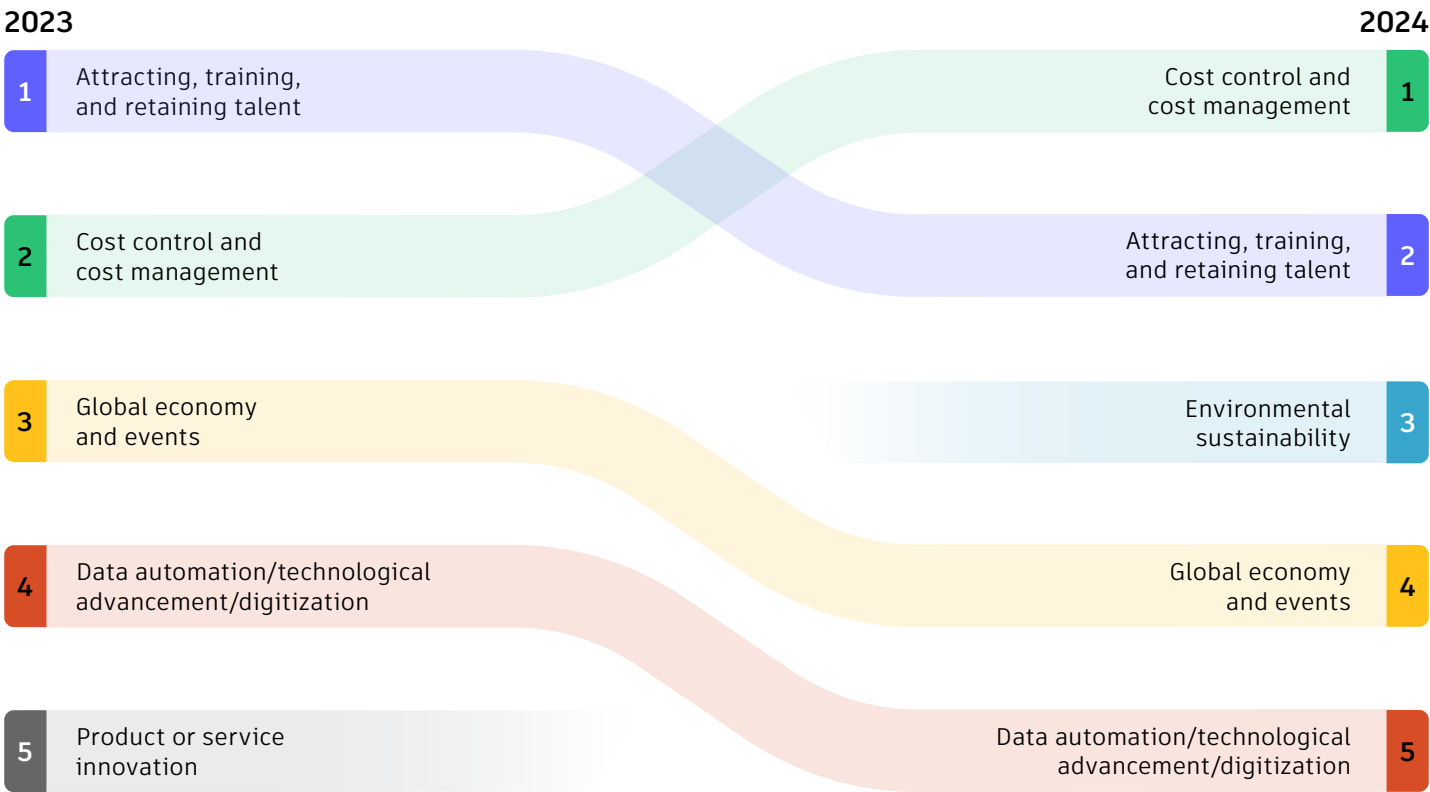
Survey question: What are the top 3 challenges your company or organization faces today? Select up to three.

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The global economy and events, which ranked as a top-three challenge a year ago, has fallen out of the top five this year. However, it is important to note that survey data was collected before the October 2023 outbreak of conflict in the Middle East. "The supply chain is the biggest worry related to global events," says Callahan Tufts, design lead at Nexii, a green construction technology company. "Anytime you see a global conflict—first off, it's horrible for the people involved. But it can also affect the rest of the world's economy."

The challenges facing organizations are not siloed, but rather intersect with one another, forcing decision-makers to weigh competing priorities—for instance, opting for only those sustainability measures that offer a return on investment in the form of energy savings. "If we were to tackle all the tasks required for digital transformation, we would run out of budget and time," says Eiichiro Okano, managing executive officer, digital transformation division at Obayashi Corporation, a construction and general contracting firm. "So we have shifted our thinking to: What kind of digital strategy should we implement to achieve overall optimization?"

27%

of organizations have strongly increased investment in technology to deliver improved project outcomes over the past 3 years

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**Talent and global events
pose less of a challenge**

Severin Tenim, head of strategic projects
& development at ALEC Engineering &
Contracting, a leading tier 1 construction
and contracting firm, offers his view
on why attracting and retaining talent
remains challenging at many organizations.
"Attracting young talent is a challenge.

Many of them like having exposure to the
major projects that we work on. But even
though we generally pay above market
rate, with all the demand that's picking up,
other firms are also starting to overpay
to attract the right talent into their
organizations. Whilst remuneration helps
us attract and retain talent initially, culture
is what retains our people long-term."

AECO regional change in talent and global struggles

Attracting, training,
and retaining talent

Global economy
and events

2023

2024

60%

40%

20%

0%

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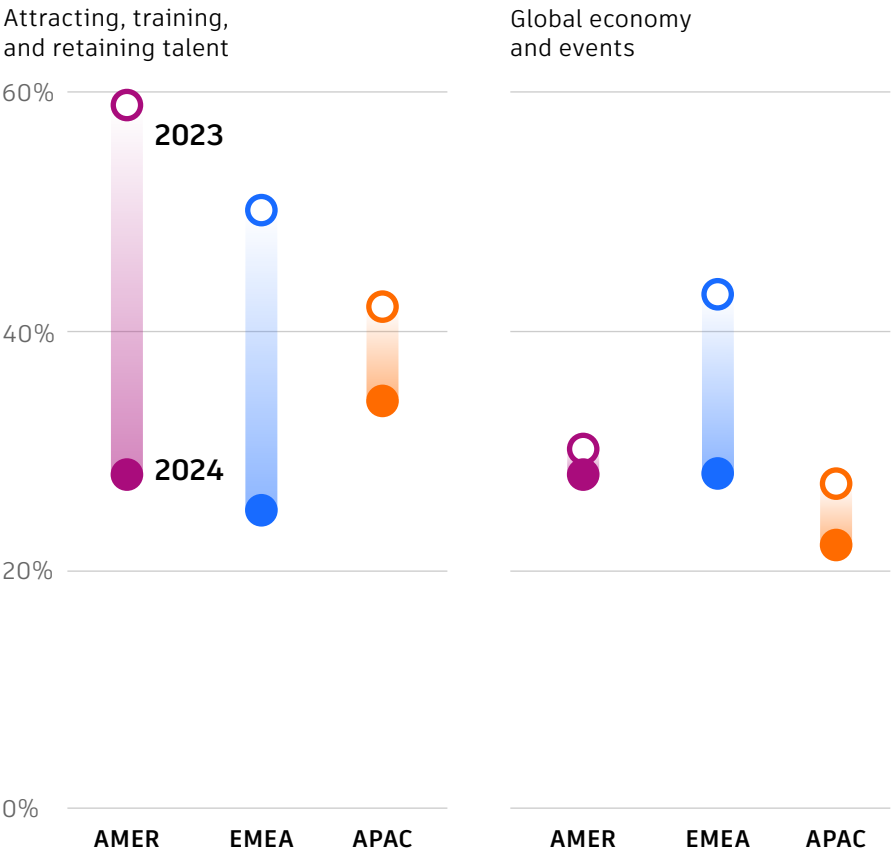
Percentage of AECO respondents who selected "attracting, training, and retaining talent" and "global economy and events (e.g., wars, pandemics, inflation, strikes)" as their top challenge. Survey question: What are the top 3 challenges your company or organization faces today? 12 response options.

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Top priorities for future investments differ among AECO segments

AECO

Overall investment

1. Technology
2. Improved operations
3. Environmental sustainability

Architecture services

1. Technology
2. Data management and analytics
3. Environmental sustainability

Building owners

1. Data management and analytics
1. Environmental sustainability
3. New products/services

Civil infrastructure owners

1. Environmental sustainability
2. Data management and analytics
3. Improved collaboration

Construction services

1. Environmental sustainability
2. Technology
3. New products/services

Engineering service providers

1. New products/services
2. Technology
3. Improved operations

Mining, oil, and gas

1. Remote work
1. Technology
3. Acquisitions

Utilities and telecom

1. Improved operations
2. Technology
3. AI/emerging technologies

60%   70%   80%   90%   100%

Axis: Percentage of AECO respondents who say investments will increase in each area.
Survey question: How do you think your company or organization's investment in these areas will shift in the next 3 years? 5-point scale. Top two = increase.

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Digitally mature companies see greater business success

Companies that invest in digital transformation are seeing dramatic results. They are more competitive in their industries, their employees are more productive, and they see overall better performance than companies with lower levels of digital investment.

These differences are apparent when comparing companies that invest more or less than 45% of their revenue in technology—and the results create a compelling case that effective digital transformation investments are now essential to business success.

At organizations with higher levels of investment in technology, respondents are more likely to rate their performance highly. And at companies with higher levels of investment, respondents feel their organizations are keeping up with changes in their industry.

Respondents have selected a variety of digital transformation benefits. The productivity gains tied to digital transformation are nothing short of eye-popping. In AECO, 31% of respondents say digital transformation improves productivity. Globally, respondents say their productivity has improved by 63%.

"Basically, all our departments are part of the digital transformation journey and define their transformation initiatives and projects to be considered on the corporate roadmap," says Robert Grys, projects management advisor at Public Works Authority of Qatar (Ashghal). "This is a very interesting phase because for many years we discuss and promote digitalization in construction throughout the lifecycle, but especially in the last 12 months we've seen a significant increase in interest and activity."

"We are very focused on digital documentation and information gathering. Whether we're collaborating with contractors or designing a project, **it's all fully digital.** Our suppliers do not send us lists in Excel or emails with attachments. Of course, as much as possible, everything is done through our software, and **there is one source of truth.**"

—Michał Latała, Deputy Director for BIM & GIS, Centralny Port Komunikacyjny, an air, road, and rail transfer hub

**Benefits to effective
digital transformation**

In this report, "digitally mature" companies are defined as those that are approaching the goal or have achieved the goal of their digital transformation journey.

Respondents from digitally mature companies are more likely than their peers to report that they ...

... have experienced "above average" or "exceptional" **performance** **+37%**

... have "increased" or "strongly increased" **investment** in the past 3 years **+38%**

... have kept up "very well" with **change in the industry** **+18%**

... "agree" they are **prepared** for the future **+23%**

... are "very effective" at **leveraging data** **+20%**

Top advantages to—and barriers of—digital transformation in AECO

Advantages:

Rank: 1 — Improved **productivity**

Rank: 2 — Improved **profitability**

Rank: 3 — Reduced **costs**

Barriers:

Rank: 1 — Cost

Rank: 2 — **Time** needed to invest in new tools and ways of working
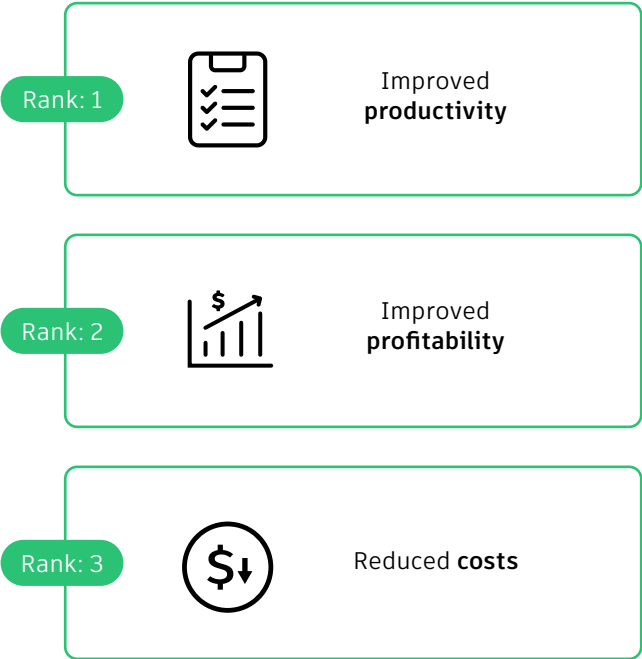
Rank: 3 — **Lack of knowledge** or **technical skills** to implement digital solutions
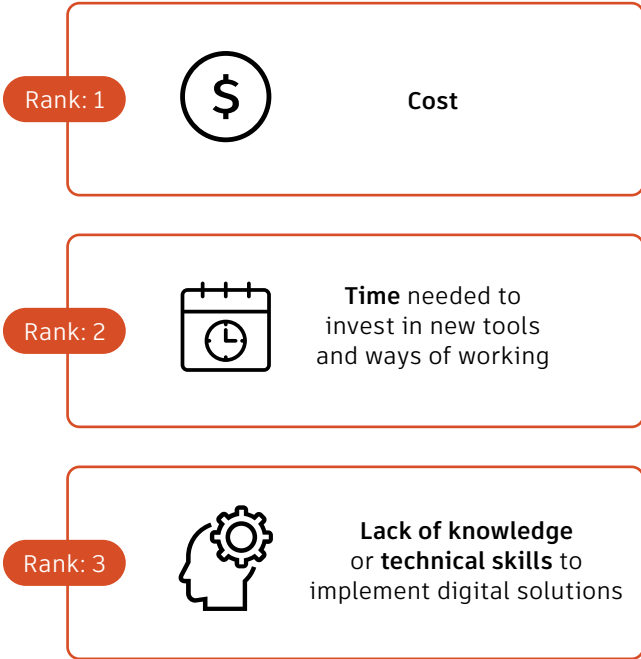
Top ranked response to survey question: Has your company or organization experienced any of the following benefits of digital transformation?
Top ranked response to survey question: What are the barriers to digital transformation in your company or organization?

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Barriers to effective digital transformation

The benefits of digital transformation are significant, but a number of barriers prevent companies from investing at the levels they would like. Thirty-five percent of respondents said that cost was a barrier and 35% felt the time needed to invest in new tools and ways of working was holding them back.

Leaders and experts note that implementing new tools is not enough to drive effective digital transformation. Rather, these solutions must be accompanied by process improvements and a shift in mindset, both from employees and leadership. "Digital transformation often involves significant changes to processes, technology, and even culture," says Damir Jaksic, CIO at KEO International Consultants, a design and engineering firm. "This is, almost in every case, met with resistance from employees. We're all comfortable with the status quo. Effectively navigating through this change is critical for overcoming this resistance."

Vince DiPofi, PE CEO at SSOE Group, an architecture and engineering firm, notes that data management is another significant hurdle: "The biggest challenge we have in terms of digital transformation is getting the data into a usable, standardized form so that it looks the same everywhere. We've heard feedback from new employees, that every time they switch to a different project team, it's organized differently. Those legacy walls need to be broken down."

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Digital maturity is now the norm

Perceptions of digital maturity have flipped in just one year.

In AECO, 65% of respondents say their companies are digitally mature, compared to last year, when 64% rated their organizations as "less digitally mature". This suggests that digital transformation has reached something of a tipping point—with businesses seeing the positive impact of digitalization efforts, and then continuing to invest to keep up with peers.

Indeed, effective digital transformation initiatives have now become a necessity for many organizations to stay competitive. "The main obstacles to digital transformation lie in the transformation of people's thoughts and the optimization of mechanisms and systems," says Quansheng Xu, president of the Beijing Institute of Architectural Design, an architectural design and consulting institute. "No matter how good the tools and processes are, they will be subject to whether people take that initiative."

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Most AECO segments are approaching their digital transformation goals

● Early stage ● In the middle ● Approaching the goal ● Achieved the goal

Segment	Early stage	In the middle	Approaching the goal	Achieved the goal
Architecture services	6%	32%	56%	6%
Building owners	10%	35%	45%	10%
Civil infrastructure owners	4%	13%	71%	11%
Construction services	10%	23%	57%	10%
Engineering service providers	8%	32%	51%	8%
Mining, oil, and gas	3%	22%	60%	14%
Utilities and telecom	9%	35%	46%	10%

AECO

56%
27%
8%
9%
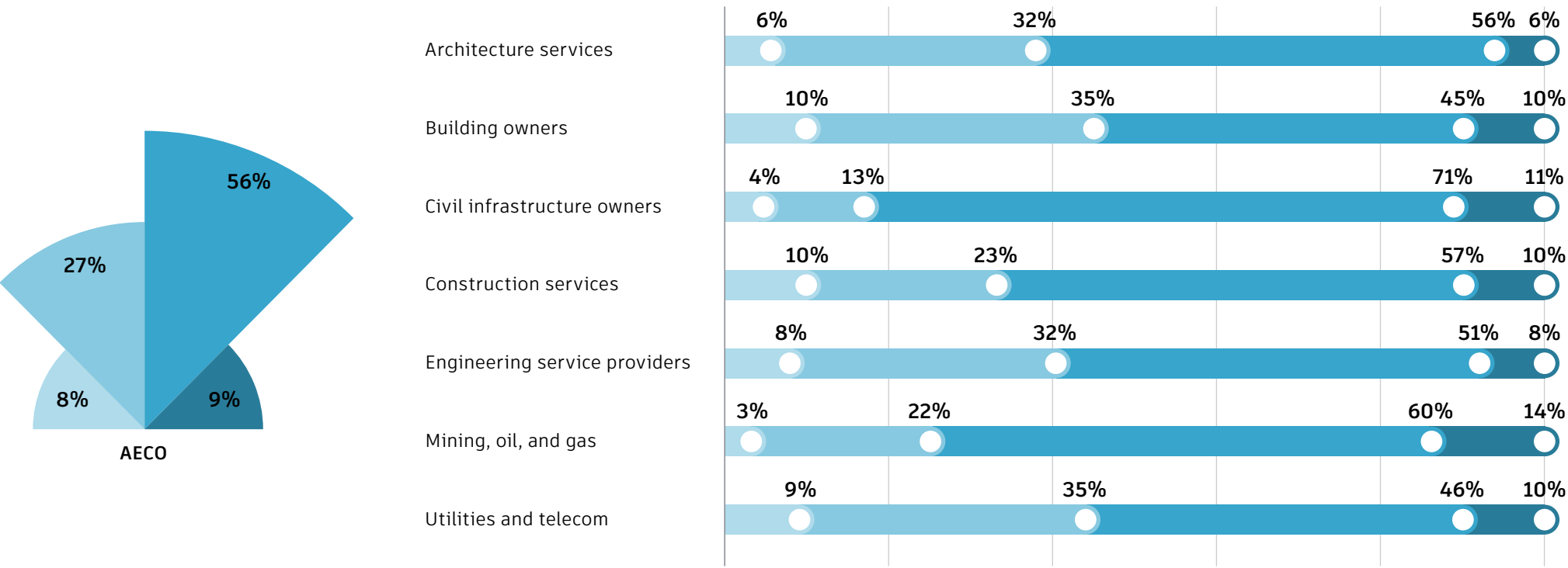
Survey question: Where is your company or organization in their digital transformation journey? 4-point scale. Values do not add up to 100 due to rounding.

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What does digital maturity mean for AECO companies?

Digitally mature AECO companies are further along than their peers on some of the industry's most important initiatives.
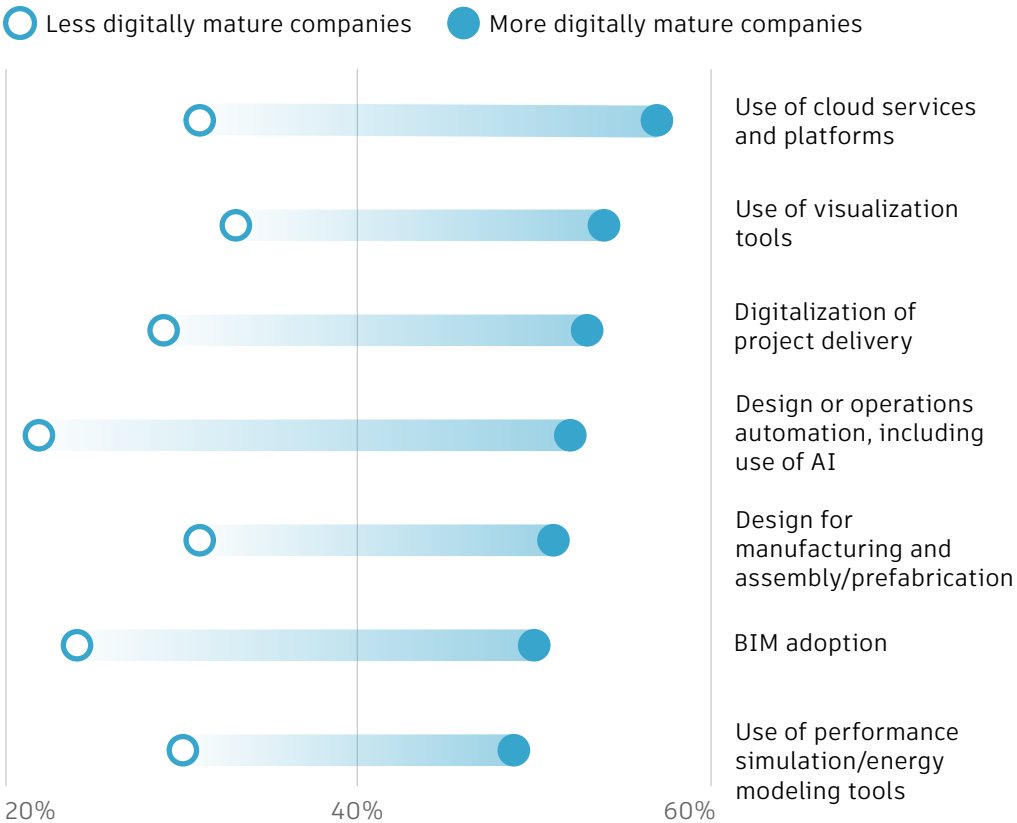
Across the sector, 65% of respondents say their company is digitally mature. These organizations are far ahead of others in the use of cloud services and platforms, digitalization of project delivery, BIM, and other processes that drive success within the sector. Companies that embrace building information modeling (BIM) can improve project visualization and mitigate the risk of errors, cloud platforms can enable centralized storage and management of project data, and digitized project delivery can improve accuracy and quality control, to name just a few benefits of these workflows. Taken together, these benefits of digital transformation can also lead to better tracking and management of costs, helping companies to address pressing challenges.

"Digital tools are key to staying competitive, producing quality work, and improving collaboration between teams," says Maria Fernanda Olmos, global principal for digital integration at Unispace, a workplace strategy, design, and construction firm. "These days, when most companies have embraced remote working, cloud and AI solutions help ensure that communication goes smoothly, enabling businesses like ours to deliver projects to clients faster and more efficiently than before."

Mining, oil, and gas leads other AECO segments in the use of digital visualization tools, with 66% of respondents identifying their companies as "very mature" in this area, while civil infrastructure leads in the use of cloud platforms, with 62%.

Utilities and telecommunications companies are relatively weak in BIM, with only 29% of respondents saying their companies are "very mature" in this area.

More digitally mature AECO companies are also more process mature

○ Less digitally mature companies ● More digitally mature companies

Use of cloud services and platforms

Use of visualization tools

Digitalization of project delivery

Design or operations automation, including use of AI

Design for manufacturing and assembly/prefabrication

BIM adoption

Use of performance simulation/energy modeling tools

20% 40% 60%

—
Percent of AECO respondents who selected "very mature" in each process.
Survey question: In your company or organization, how mature are the following? 5-point scale.
See glossary on p.57 for the definition of digital maturity.

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Companies are making meaningful progress in their AI adoption journeys

Businesses are bullish on artificial intelligence.

Already, companies are uncovering valuable, industry-specific AI applications—with uses ranging from automated transcription of meeting minutes, to robotics, to assistance laying out factory floors. In the future, leaders and experts predict generative AI will increasingly help human workers to make crucial design decisions about physical products, buildings, and digital assets.

Sixty-one percent say they are approaching or have already achieved their goal of incorporating AI into their companies—a perhaps surprising number, given that AI

is still an emerging technology. An even larger portion say that AI will enhance their industry and be "essential across the board" within two to three years.

"AI is going to be a massive driver for us," says Severin Tenim of ALEC Engineering & Construction. "I think every organization in the world is going to be impacted—it's just a question of the extent. We're identifying use cases where we can eliminate very manual or antiquated workloads. We use a number of AI point solutions at the moment for transcribing meeting minutes, logging action items, and extracting the sentiment of meetings, amongst others."

While much of the conversation about AI

in the design and make industries centers on generative design, AECO companies are also exploring use cases that streamline or enhance back-office processes. "We see AI use cases in our industry for quality control, stability of equipment operations, cost control, and carbon reduction initiatives," says Lei Yuan, chief engineer at China Baowu Design Institute/Baosteel Engineering & Technology Group Co., Ltd. "Once we identify the relevant data, we will try to take measures to apply AI to address those issues, just like we did in the past with digital twins."

Overall, the top use cases for AI today are increasing productivity and automating mundane, repetitive tasks.

80%
are confident that their company will make the **right decisions** regarding AI

80%
agree AI will **enhance** their industry

80%
agree AI will make the industry more **creative**

64%
agree in 2–3 years, AI will be **essential** across the board

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AI as trusted tool vs. AI as threat

Trust in AI is extraordinarily high, with 77% of respondents saying they trust the technology for their industry. However, this statistic is undercut by a vein of cautious skepticism running through interviews with business leaders and experts. Some express doubts that firms are going to be able to trust the technology enough to sign off on critical deliverables, noting that existing AI tools often present errors as facts. Others think that current levels of optimism will dim if bad actors misuse the technology. Thirty-nine percent of respondents say AI will destabilize their industry.

"I want to trust AI, but I think we have to challenge it," says Michał Latała, deputy director for BIM & GIS at Centralny Port Komunikacyjny, an air, road, and rail transfer hub. "I'm not surprised by a high general level of trust in AI because I think everybody is very happy with ChatGPT and the chat experience. But without understanding how AI works, we won't know what the risks and weaknesses are."

77%
trust AI technologies
for their industry

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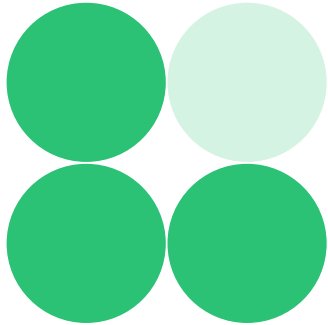
Opinions are split on the destabilizing effect of AI

Percentage of AECO respondents who agree that AI is a threat

29%
somewhat
disagree

18%
neither agree
nor disagree

24%
somewhat
agree

13%
strongly
disagree

15%
strongly
agree
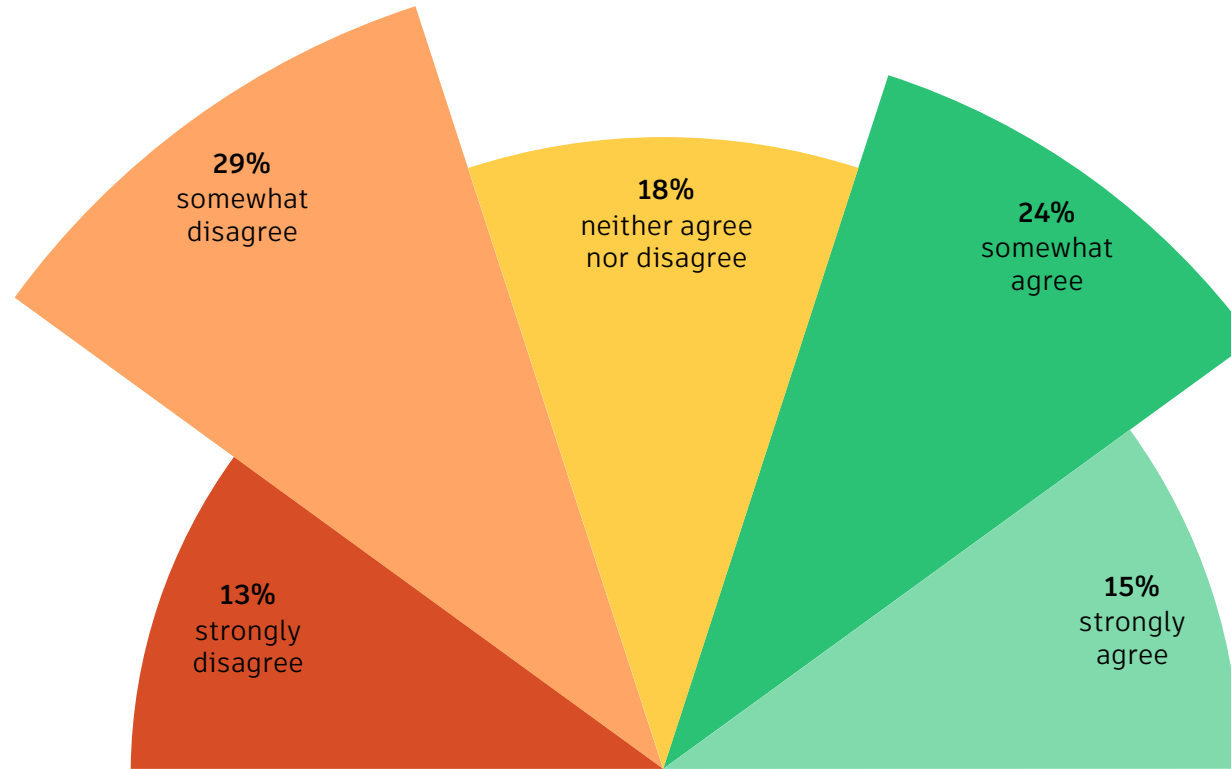
Survey question: When you think about artificial intelligence (AI) in your industry and company, to what extent do you agree or disagree?
AI will destabilize my industry. 5-point scale.

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AI adoption by region and sub-industry

Companies are already exploring different ways to use AI. But regulations around the world have a direct impact on the speed of adoption. "You do need guardrails," says David de Graaf, global director of digital at Royal HaskoningDHV, a consultancy engineering firm providing solutions for the natural and built environment. "The European Union is establishing a new act to regulate AI, including the use of ChatGPT and facial recognition. The US, UK, and China are also rushing to create guidelines. That makes it more difficult for international companies to adopt AI."

A number of core challenges must also be solved before leaders and experts feel comfortable using AI to its fullest potential. De Graaf goes on to note: "You can do a lot with AI and machine learning technology, but you need good data governance and organization, certain skills and capabilities to utilize all the benefits, and that's often ignored."

Nonetheless, in Autodesk's cross-industry generative design and AI-enabled products, user engagement increased by 24% from January 2023 to November 2023 (though this does not take overall subscriber growth into account). APAC led the way with a 55% increase in user engagement.

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AI adoption varies greatly among AECO companies
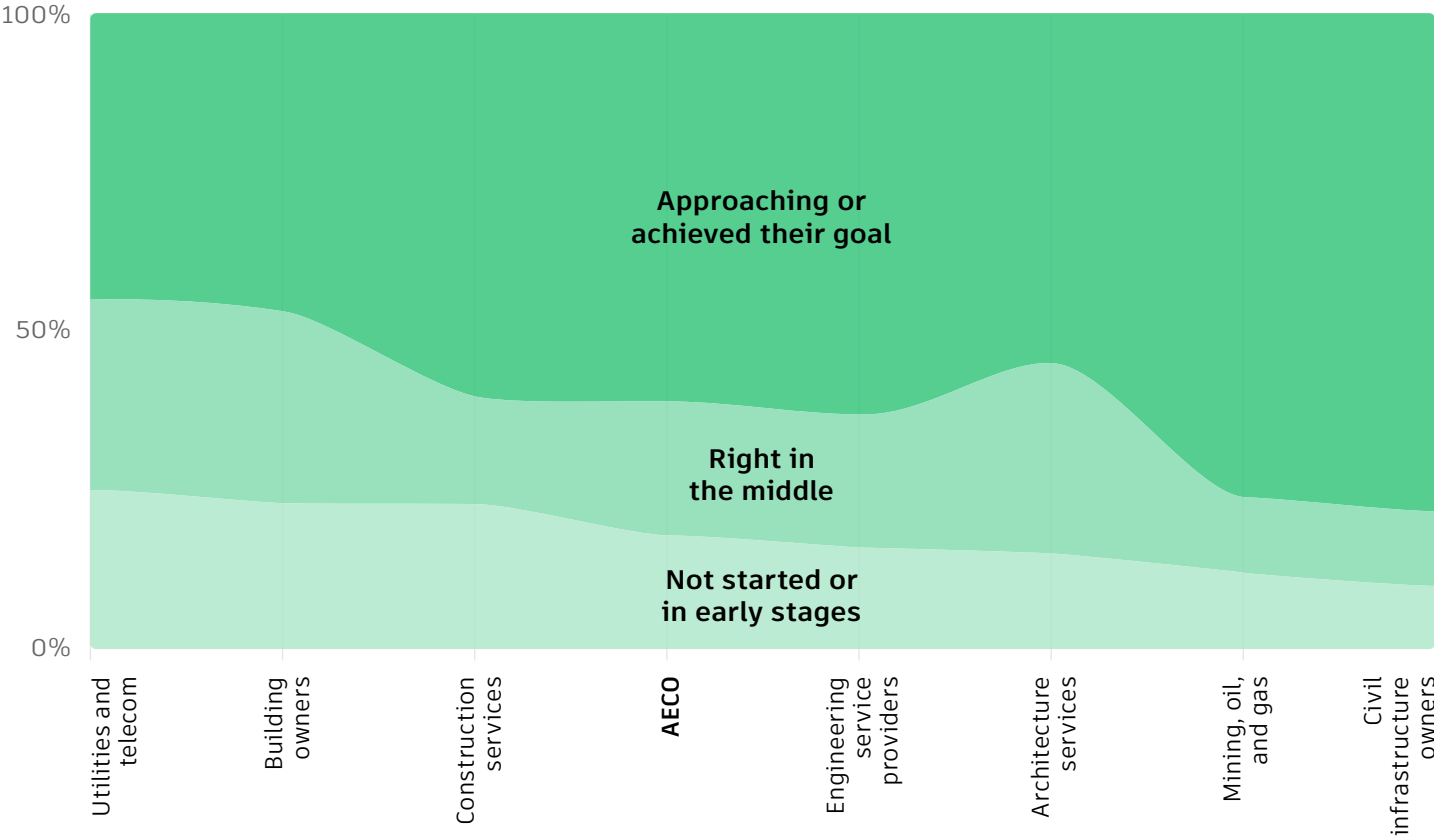
Survey question: Where is your company or organization in incorporating artificial intelligence (AI) technology? 5-point scale.
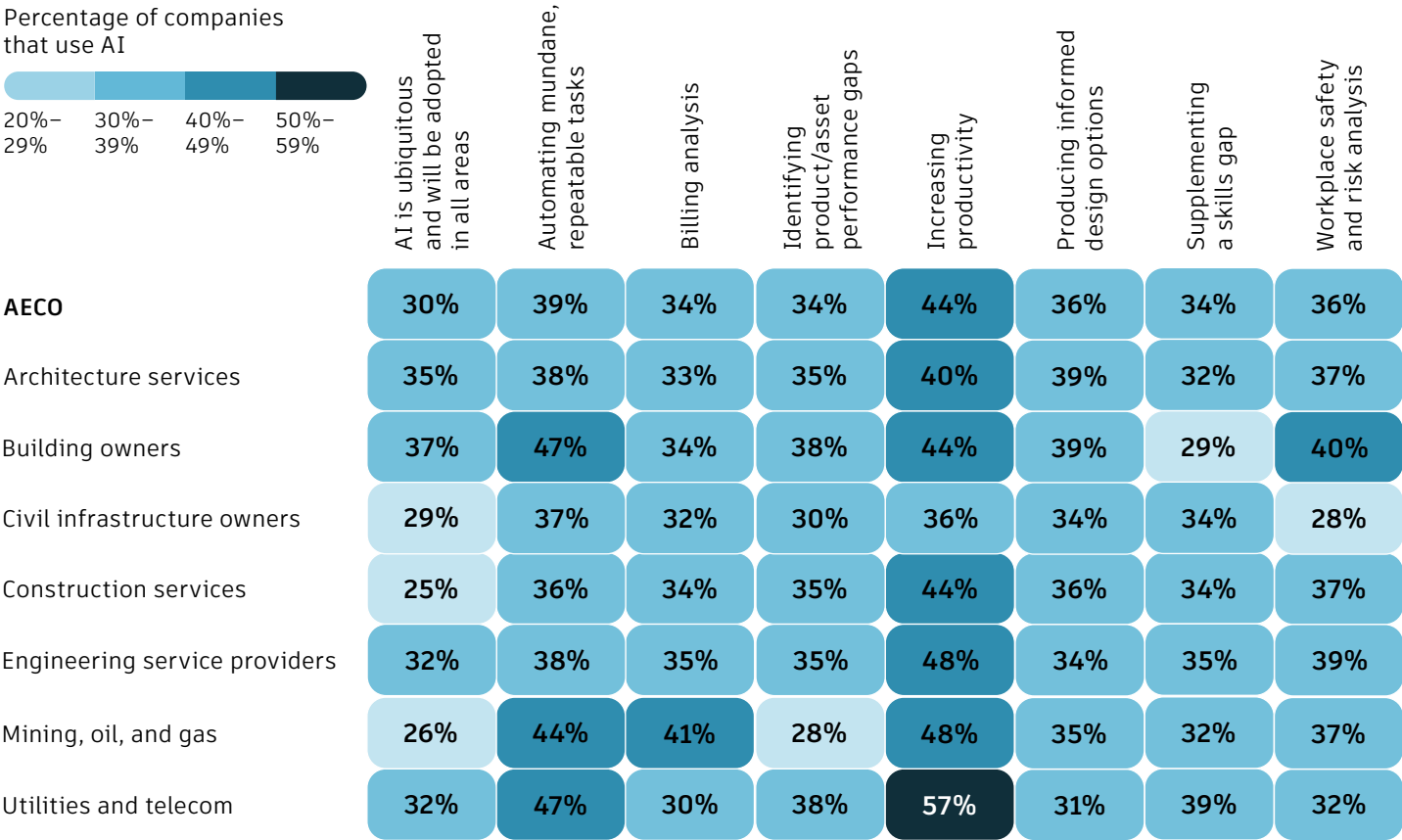
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"**Generative design is where we see the greatest potential for AI.** But even though AI could do the constraints and input for you, the question is, 'Are we going to be able to trust it in a production environment, and how thoroughly will it have to be checked?'"

—Todd Rogers, BIM Manager, Walter P Moore, a consulting engineering firm

"AI can **automate many tasks** and **free up creative people** to focus on what they do best. Right now, we use AI to codesign interior spaces; our landscape architects have used AI to assist with conceptual drawings; and we can thank AI for winning work, as a matter of fact."

—Damir Jaksic, CIO, KEO International Consultants, a design and engineering firm

Beyond productivity, AI use cases vary for AECO segments

Percentage of companies that use AI

20%– 29% | 30%– 39% | 40%– 49% | 50%– 59%

	AI is ubiquitous and will be adopted in all areas	Automating mundane, repeatable tasks	Billing analysis	Identifying product/asset performance gaps	Increasing productivity	Producing informed design options	Supplementing a skills gap	Workplace safety and risk analysis
AECO	30%	39%	34%	34%	44%	36%	34%	36%
Architecture services	35%	38%	33%	35%	40%	39%	32%	37%
Building owners	37%	47%	34%	38%	44%	39%	29%	40%
Civil infrastructure owners	29%	37%	32%	30%	36%	34%	34%	28%
Construction services	25%	36%	34%	35%	44%	36%	34%	37%
Engineering service providers	32%	38%	35%	35%	48%	34%	35%	39%
Mining, oil, and gas	26%	44%	41%	28%	48%	35%	32%	37%
Utilities and telecom	32%	47%	30%	38%	57%	31%	39%	32%

Survey question: What are the use cases for artificial intelligence (AI) in your company or organization? Select all that apply.

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Talent
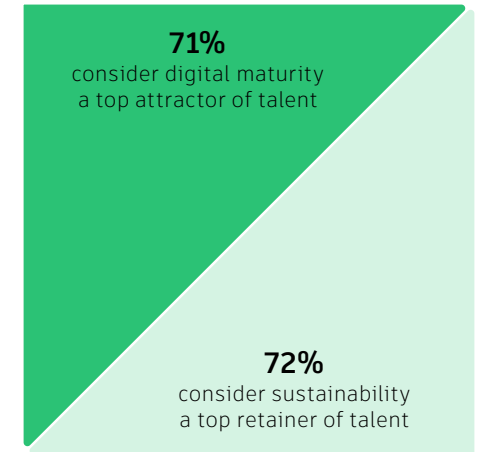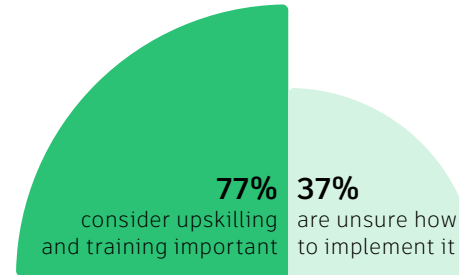
Bridging the talent gap

AUTODESK
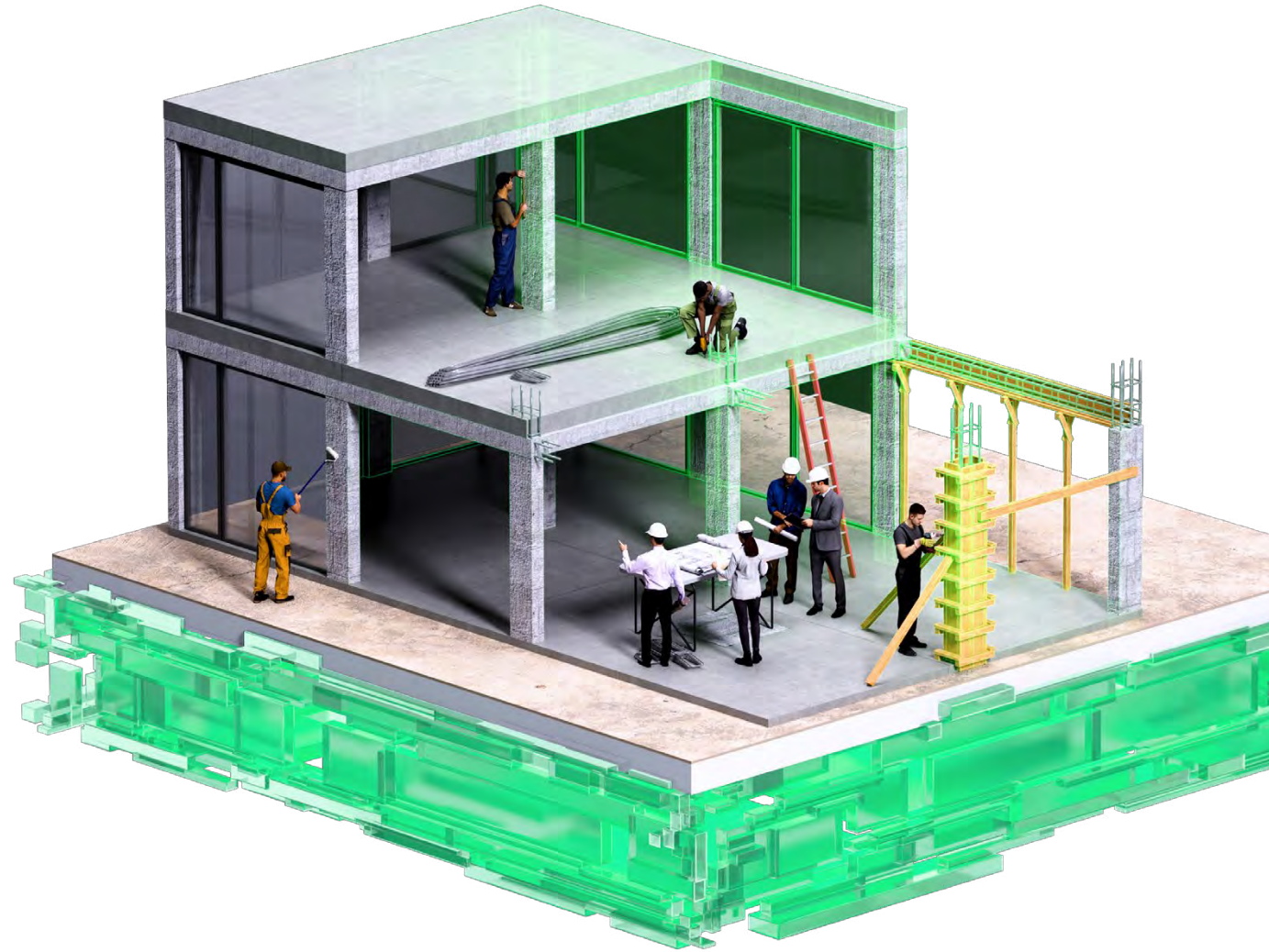
Companies tackle talent challenges with upskilling, digitization, and sustainability initiatives

Competition for top talent is less intense this year—but it's not over.

Although talent is no longer considered the top business challenge, attracting and retaining skilled employees is still top-of-mind for most leaders.

The global labor market has shifted in favor of employers, according to the business leaders and experts we surveyed. Still, respondents say their companies are shoring up remaining talent gaps through a mix of training, digitization, and other means.

Companies recognize the importance of developing talent but lack the resources

77%
consider upskilling and training important

37%
are unsure how to implement it

71%
consider digital maturity a top attractor of talent

72%
consider sustainability a top retainer of talent

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Upskilling is essential but out of reach for many

Leaders see the value in training and upskilling their workforces, but not everyone knows how, and many organizations lack the expertise needed to design effective internal training programs.
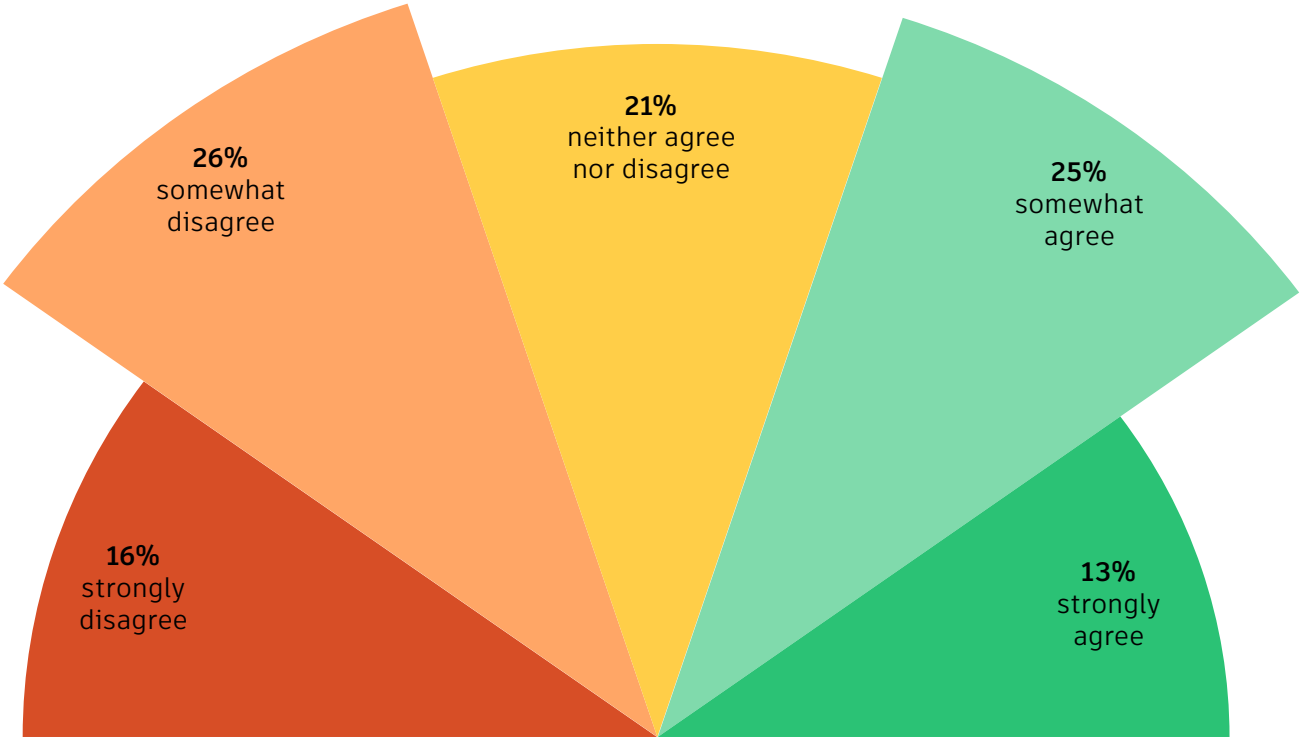
Seventy-seven percent of survey respondents agree that upskilling is important, but only 42% say their organizations have the necessary skills and resources to design internal training programs. However, these limitations are not stopping companies from offering any training at all. For instance, 71% are implementing continuous learning.

"We're investing heavily in our own workforce," says Damir Jaksic, CIO at KEO International Consultants. "We have training and upskilling programs focused on not only technical training and how to use the latest technologies, but also leadership and soft skills like communication and problem-solving."

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AECO companies lack resources or skills for internal training programs

Percentage of respondents who agree they don't have what they need

26%
somewhat
disagree

21%
neither agree
nor disagree

25%
somewhat
agree

16%
strongly
disagree

13%
strongly
agree

Survey question: My company doesn't have the skills or the resources to design internal training programs. 5-point scale. Values do not add up to 100% due to rounding.

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INSIGHT 5

Other self-directed learning methods include in-product training for learning digital tools, which already show a level of success—and often at a lower cost than formal training programs. For example, Autodesk's anonymized AutoCAD data shows users are 35% more likely to learn a new command after seeing a personalized insight recommendation.

Richard Matchett, digital lead at Zutari, an infrastructure engineering and advisory practice, points out that training challenges are not always related to a lack of budget or resources.

"Time is the big barrier to training. You're dealing with someone's desire and decisions on how to spend their time. You can have a stick approach or a carrot approach, but if you want to help people prioritize time, you need to help them understand the value of the training."

Severin Tenim at ALEC Engineering & Consulting stresses the importance of not only training employees but also offering opportunities for career development. "We have a wide variety of graduate and leadership development programs, which have helped retain and develop talent. You always have to challenge people."

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Digital skills in demand

The ability to work with AI has emerged as the top digital skill that organizations are looking for—followed by digital design and software development/programming.
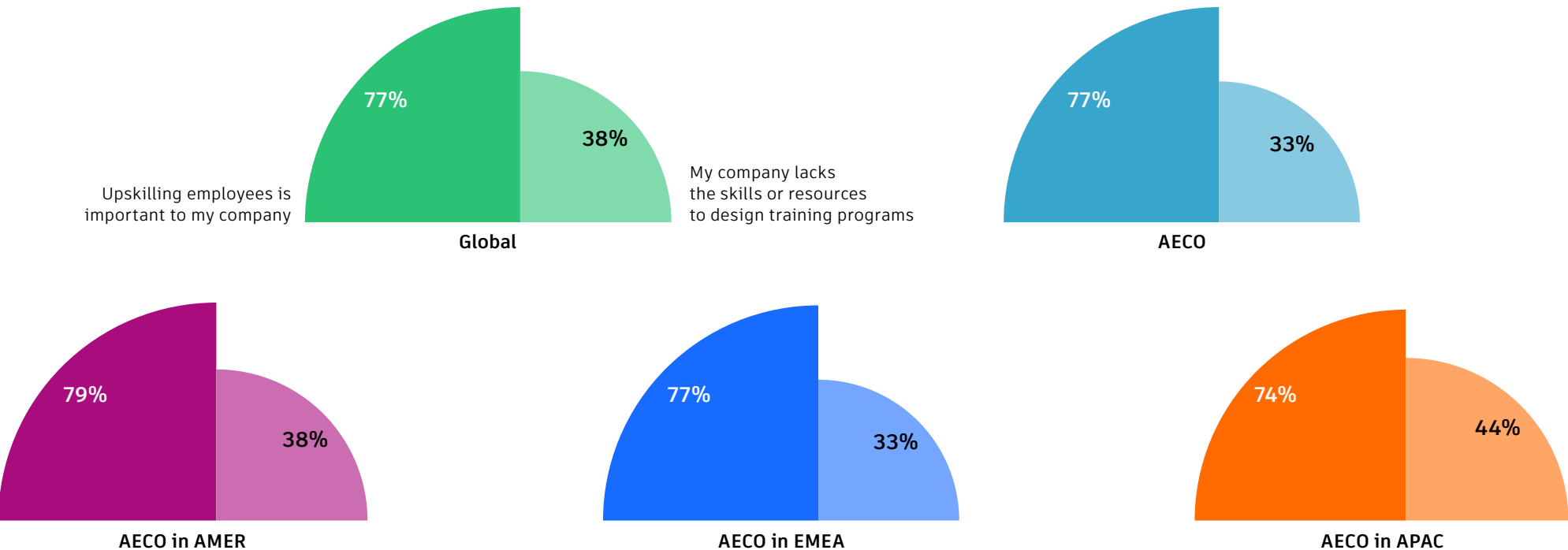
Industry professionals say that these skills are essential to unlocking digital transformation benefits. For instance, Robert da Silva Bressan, engineer, cultural and transformational change management at Petrobras, an oil and gas company, notes that organizations should start thinking about dedicated AI and data resources to stay ahead of the curve. "One key role for the future is some kind of data librarian. With so much data in every company now, one should be able to quickly find that one piece of data you need and guarantee it is correct."

The global training gap in AECO

Companies value training but lack resources

77% **38%**

Upskilling employees is
important to my company

My company lacks
the skills or resources
to design training programs

Global

77% **33%**

AECO

79% **38%**

AECO in AMER

77% **33%**

AECO in EMEA

74% **44%**

AECO in APAC

Percentage of AECO respondents who agree to statements: 1. Upskilling employees is important to my company. 2. My company doesn't have the skills or the resources to design internal training programs.
5-point scale. Top two= agree.

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AECO skills of the future

With the rapid evolution of technology in the AECO space, organizations are prioritizing digital skills for future hires. Cybersecurity, digital design, and AI will all be in high demand as companies try to gain a competitive edge through emerging technology—and the talent that wields it.
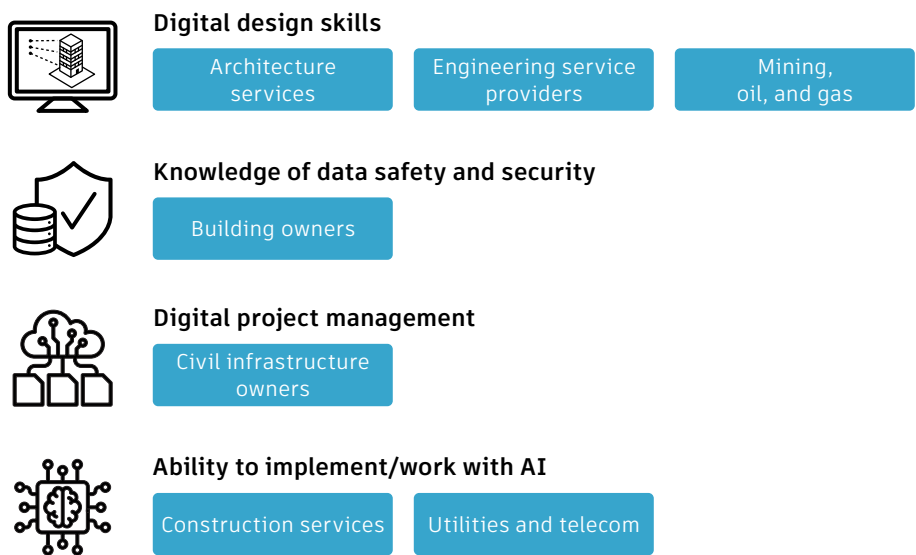
Trends in professional certifications reflect respondents' opinions, as well. For Autodesk's AECO certifications portfolio, there was a 71% increase in certifications from 2021 to the end of 2023.

In interviews, AECO business leaders and experts cite specific job roles that will become more important in the future. These include AI strategists who can help companies maximize the potential of the technology and data librarians who can help organizations to better leverage the vast quantities of information they store. "It's not easy to find professionals who have knowledge about digital systems and can link them with engineering development and construction management," says Kleber Moreira of metals and mining company Vale S.A. "That's the new reality of the market, and that's why we need to develop people."

Top 3 skills of the future

Rank: 1	Rank: 2	Rank: 3
Ability to implement/ work with AI	Digital design skills	Digital project management

Top industry skills

Digital design skills

Architecture services	Engineering service providers	Mining, oil, and gas

Knowledge of data safety and security

Building owners

Digital project management

Civil infrastructure owners

Ability to implement/work with AI

Construction services	Utilities and telecom

Survey question: What technical or digital skills do you believe your company or organization will be prioritizing when hiring over the next 3 years? Select all that apply.
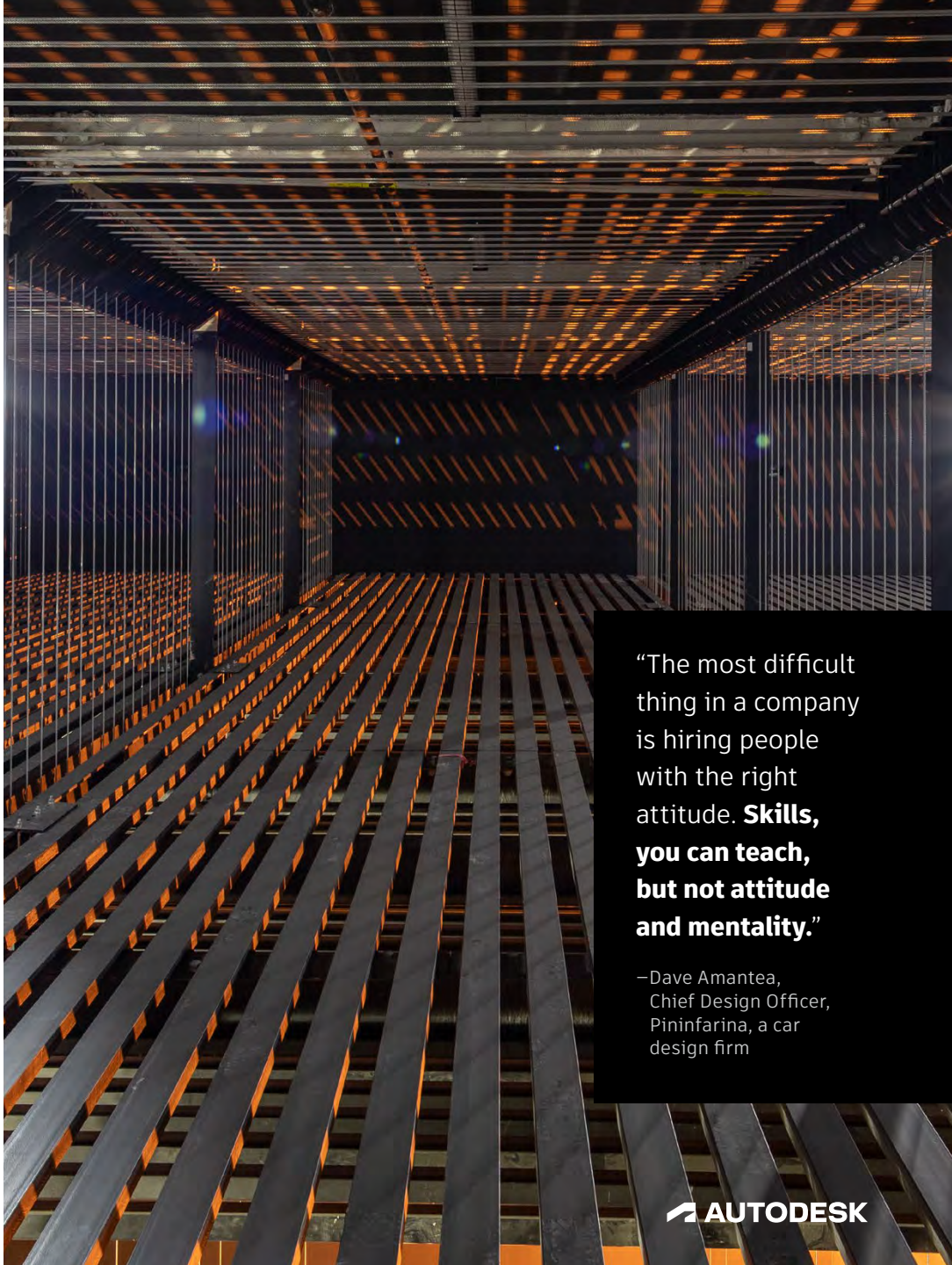
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Companies are taking a multi-pronged approach to solving the talent problem

Across the board, companies today are facing far fewer challenges when it comes to talent. In fact, the number of respondents citing access to skilled talent as a barrier to growth dropped to 28% this year, down from 48% in 2023.

Part of this shift may be due to changes in macroeconomic conditions, with some major companies initiating large rounds of layoffs in the past year, and the number of job openings in the United States shrinking to a post-pandemic low. However, businesses are also taking steps to

strengthen their company culture to attract potential recruits, help existing employees become more productive, and convince workers to stay for longer.

Employees are attracted to organizations that give them the tools to be productive and successful in their jobs, as well as those whose actions align with their own values. Seventy-one percent say digital maturity helps attract talent, 72% say sustainability efforts attract and help retain talent, and 62% say sustainability efforts impact job satisfaction.

"The most difficult thing in a company is hiring people with the right attitude. **Skills, you can teach, but not attitude and mentality.**"

–Dave Amantea,
Chief Design Officer,
Pininfarina, a car
design firm

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The most common ways companies are bridging the talent gap is by amping up their talent recruitment efforts and by diversifying their training and upskilling efforts.

These include training programs, online courses, and diverse forms of self-directed learning such as in-product cues, whose success makes them a viable alternative to traditional software courses. For example, anonymized Autodesk data shows that Revit and AutoCAD users are more likely to adopt learning recommendations viewed in-product than through other channels—Revit users had a 123% increase in adoption compared to a 55% when viewing learning recommendations through the account portal. AutoCAD users also saw a 44% increase for adoption with in-product recommendations compared to the 35% increase with the account portal.

Competitive salaries and benefits, a more transparent and efficient hiring process, remote work, and fostering diversity and inclusion are also top tools for attracting a broader range of skilled individuals.

Vince DiPofi, PE CEO of SSOE Group, stresses that organizations need to adopt incentives like flexible work opportunities as a draw for talent in his field. "Twenty years ago you could have a one-size-fits-all benefits program that covered 90% of your employees. Now, companies have to be more diverse in the types of benefits and flexibility offered. Working from home is big for providing that flexibility."

DiPofi also notes the importance of DEI initiatives in expanding the talent pool. "Through our diversity initiatives, we've seen a significant increase not only in the diversity of people we've been hiring, but also the diversity of people who apply to work here. We have a full-time corporate director of DEI, which is really impactful, and our executive team has metrics related to DEI. It's becoming part of the fabric of our company, but we still have steps to take on this journey."

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Taking action on talent

Companies are taking diverse steps to tackle their talent challenges.

Organizations that struggle to attract skilled workers and those with an aging workforce are largely focusing on expanded recruitment and training. For those with high rates of attrition, the focus tends to be more on providing career advancement and development opportunities, as well as on compensation and benefits.

Notably, a significant share of respondents who say their companies struggle with talent also say that their companies are not doing anything to solve the problem.
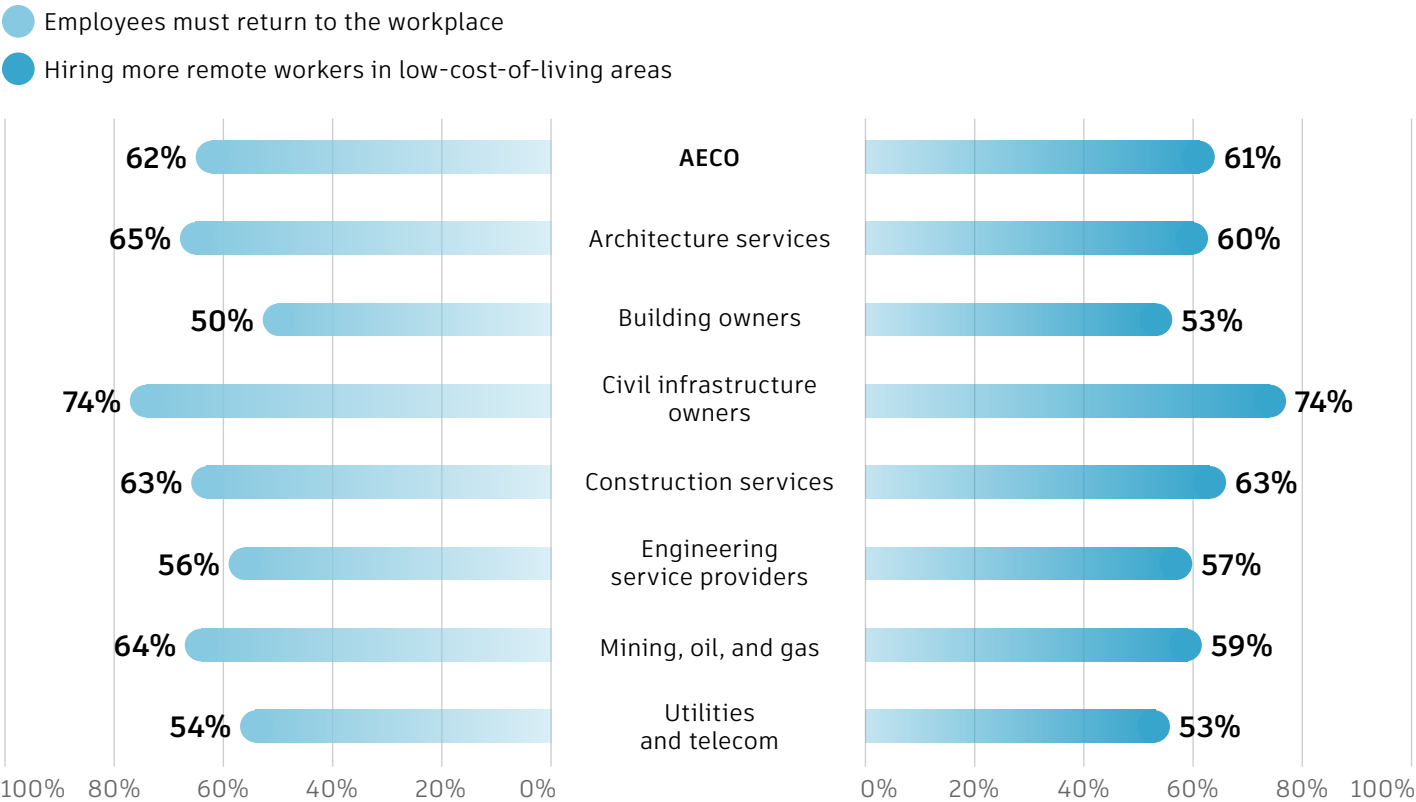
The push and pull of the new normal

AECO companies are both hiring remote workers and mandating employees return to the workplace

Workers return to the office, but remote hiring continues

Survey data shows a mixed picture regarding remote work. In AECO, 62% of respondents say their companies are mandating a return to the workplace, signaling that employers are not yielding to workers' preferences in the race for talent. However, 61% say their companies are seeking remote talent from low cost-of-living areas, a seeming contradiction. Most likely, this suggests that companies are hiring remotely to save on costs while also mandating return for employees who live close to a workplace.

"We put out a guideline that said we'd like to see everyone in the office two to three days a week, but it was up to local managers to determine what works best for their teams," says Vince DiPofi of SSOE Group. "As long as teams are getting the work done and our customers are happy (and they are), then I figure they must be finding the right balance. We believe local, not centralized control of hybrid work is a best practice."

● Employees must return to the workplace

● Hiring more remote workers in low-cost-of-living areas

	Employees must return to the workplace		Hiring more remote workers in low-cost-of-living areas
AECO	62%		61%
Architecture services	65%		60%
Building owners	50%		53%
Civil infrastructure owners	74%		74%
Construction services	63%		63%
Engineering service providers	56%		57%
Mining, oil, and gas	64%		59%
Utilities and telecom	54%		53%

Percentage of AECO respondents who agree with statements: 1. My company is mandating that employees return to the workplace. 2. My company is looking to hire more remote workers in low-cost-of-living areas. 5-point scale. Top two= agree.

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ALEC Contracting & Engineering

Severin Tenim, head of strategic projects and development at ALEC, says that hiring and retaining engineering talent continues to be a challenge—particularly when it comes to linking digital tools with engineering and construction processes. To solve these challenges, ALEC relies on training programs that help employees develop their skills and advance within the company.

"The challenge is trying to prioritize which training is the most important and when," Tenim says. "We often ask people what they want to learn, rather than try to dictate what they should learn. We adjust the curriculum based on their feedback. Alternatively, we focus it toward specific problems where we have to address particular issues that are occurring on multiple projects."

ALEC's leadership development programs also help with retention, as they provide employees with the skills they need to advance in the company. "It's not good having a person in the same role for a very long time," Tenim says. "You always have to challenge people. I myself went through these programs over the past 10 years, and that's helped keep me with the organization."
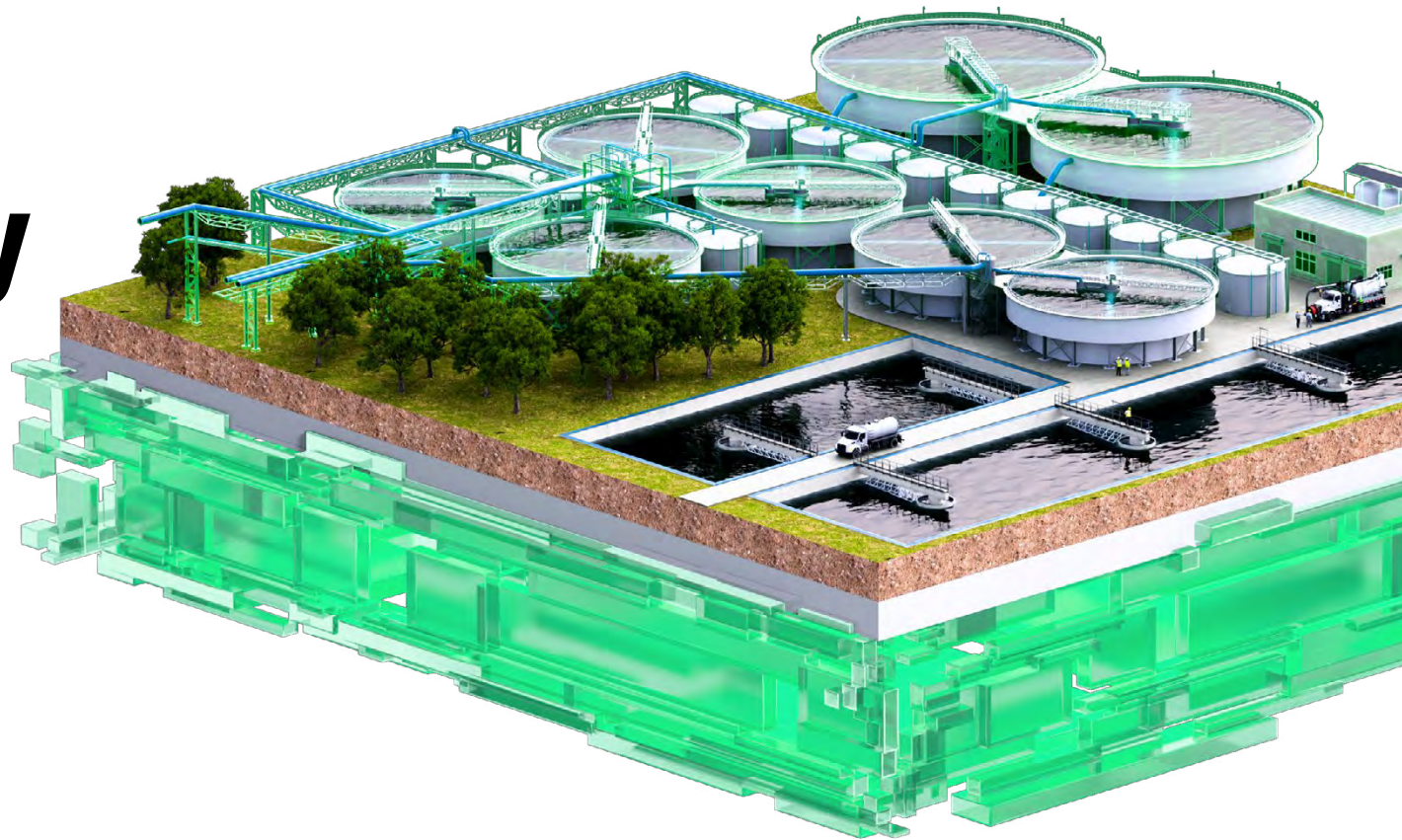
"We often ask people what they want to learn, rather than try to dictate what they should learn."

—Severin Tenim, Head of Strategic Projects & Developments, ALEC Contracting & Engineering

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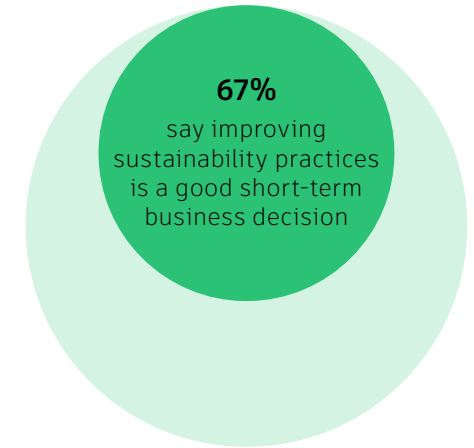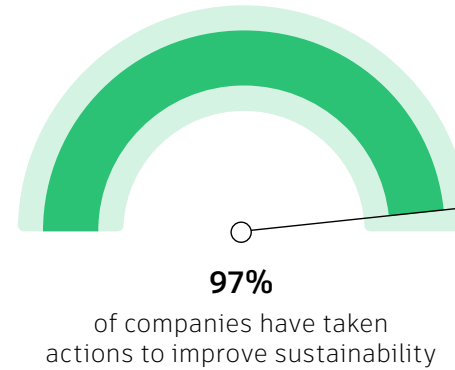# Sustainability

Business value drives
sustainability actions

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Attitude and action

Sustainability is now a key concern for employees, customers, and investors—as well as an important driver of business success.

Shifting attitudes about sustainability are driving action, with companies making investments in energy efficiency, materials reductions, and more sustainable processes that are better for both the environment and the bottom line.

"Sustainability is a challenge for our industry," says Damir Jaksic of KEO International Consultants. "We are under pressure to design and construct sustainable buildings and infrastructure, and this requires a shift in mindset and willingness to adopt new technologies and new approaches for which we may not be ready."

97%
of companies have taken
actions to improve sustainability

67%
say improving
sustainability practices
is a good short-term
business decision

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Companies are taking sustainability seriously

Ninety-seven percent of organizations are taking steps to improve sustainability—up from 92% last year.

Thirty-two percent of companies are using AI to become more sustainable. This makes sense, as the bulk of a project's or product's sustainability impact is determined during the conceptual phase—a part of the process when organizations can use AI tools to optimize their decision-making for specific outcomes, including sustainability.

Top changes include Decreased waste from production and construction, Used more recycled materials and Used AI to be more sustainable. Notably, use of methods is varied across the board. This suggests that organizations are only taking actions that will be effective in their specific settings,

rather than simply adopting broadly popular tactics.

China Baowu Design Institute / Baosteel Engineering & Technology Group Co., Ltd is taking a multi-pronged approach to sustainability. "In terms of sustainability actions, we've reduced our use of fossil fuel and encouraged the use of green power, and established a compact production process to reduce energy consumption and recycle materials such as waste, steel scrap, and water," says Lei Yuan, chief engineer. "We also plan to use digital twins to set up zero-emission factories, improve our carbon accounting, and better calculate changes in carbon emission, to name a few."

Lisette Heuer, director of business transformation at Royal HaskoningDHV
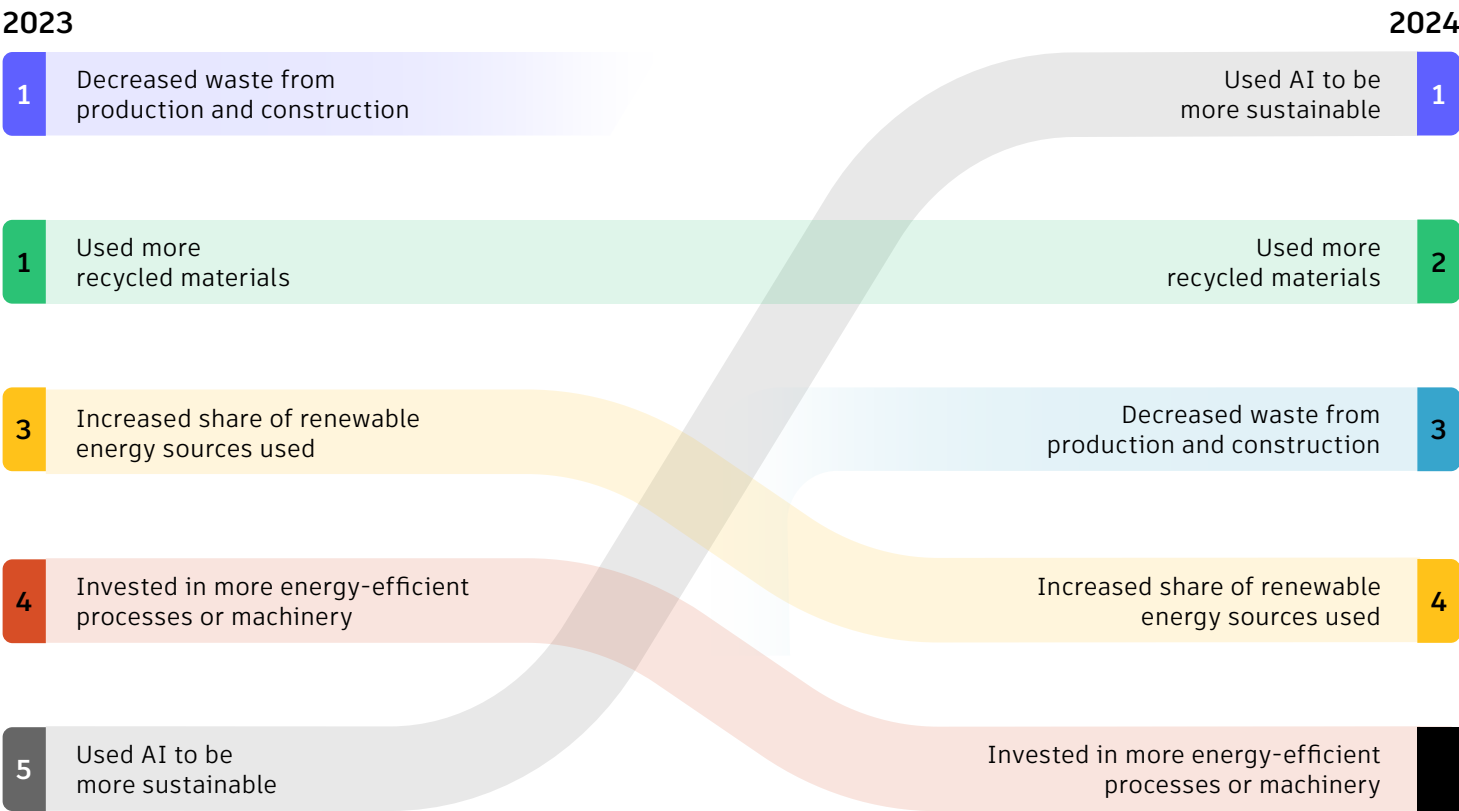
notes that sustainability efforts should involve clients for maximum impact. "For our big projects, we work with the client to look into the climate and biodiversity impact of the project, what it means for resource usage and circularity, and also the social impact. We have done that for 1,000 projects so far. For those 1,000 projects, we know what the scores are and we also monitor how they improve throughout the project up until delivery. It's not just a conversation with the client at the start of a project."

These actions are consistent with Autodesk data showing that user engagement with Autodesk products that enable sustainable outcomes increased by 14% across industries from January 2023 to November 2023.

AI jumps to the top sustainability action for AECO

Top 5 actions showing year-over-year change

2023 **2024**

1	Decreased waste from production and construction	Used AI to be more sustainable	**1**
1	Used more recycled materials	Used more recycled materials	**2**
3	Increased share of renewable energy sources used	Decreased waste from production and construction	**3**
4	Invested in more energy-efficient processes or machinery	Increased share of renewable energy sources used	**4**
5	Used AI to be more sustainable	Invested in more energy-efficient processes or machinery	

Survey question: What changes has your company or organization already made to be more sustainable? Select all that apply

Changing sentiment

As AECO organizations take more sustainability-centered actions, leaders and experts report significant changes in how they feel about their companies' efforts.

This year, 78% are proud of their company's sustainability efforts, up from 58% in 2023. This is a seismic shift in sentiment, and it is reflected in interviews with business leaders and experts, who largely say that their companies' leadership, employees, and customers are united in their desire to improve sustainable outcomes.

"We're trying to help our clients make better sustainability choices, especially with their net zero strategies," says Richard Matchett, digital lead at Zutari. "We're doing quite a bit on resilience, understanding energy security, which happens to also be a much more sustainable way of producing energy. South Africa has lots of sunshine, so rooftop regional and solar plants are a big part of our business. South Africa is not yet looking at embodied carbon as much as the rest of the world. We have only recently started considering embodied energy on selected projects."

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Top motivators

Gone are the days when sustainability was seen primarily as a concern for government regulators. Customers, employees, and investors are all becoming more influential motivators as companies pursue their sustainability goals.

Globally, just over four out of five respondents say they face pressure from each of these groups to be more sustainable. Government regulation trails slightly behind, with three-quarters of respondents saying their companies face government pressure to be more sustainable.

Some organizations are taking action by establishing their own sustainability institutes or research centers. "We have set up a Low Carbon Research Centre and a Zero Carbon Institute to work with Zero Carbon UK to research the integrated application of digital and low carbon technologies," says Quansheng Xu, president of the Beijing Institute of Architectural Design.

"In the project, more and more owners are putting forward low-carbon requirements and we will form a list of low-carbon technologies according to the specific requirements of the project."

35%

of experts and leaders in AECO say that employees are "very influential" in motivating them to create and meet sustainability goals

Respondents felt these groups were influential to their sustainability actions:

83%
customers

81%
investors

81%
employees

77%
government

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Becoming sustainability leaders

At 73%, the majority of AECO leaders and experts now see their companies as leaders in sustainability.

This new viewpoint is reflected in interviews where leaders and experts tend to speak of their organizations' sustainability efforts not as a burden, but rather as a source of pride for employees and a necessary step to stay competitive in the future. "We are putting a consolidated ESG report & strategy in place as an organization," says Severin Tenim of ALEC Consulting & Engineering. "We're near the beginning of that roadmap—we need to first quantify where we are to have a robust baseline, then identify where the top levers are in terms of quick wins and the highest value for the lowest effort. From there we can really drive impact."

AECO companies increasingly see themselves as sustainability leaders
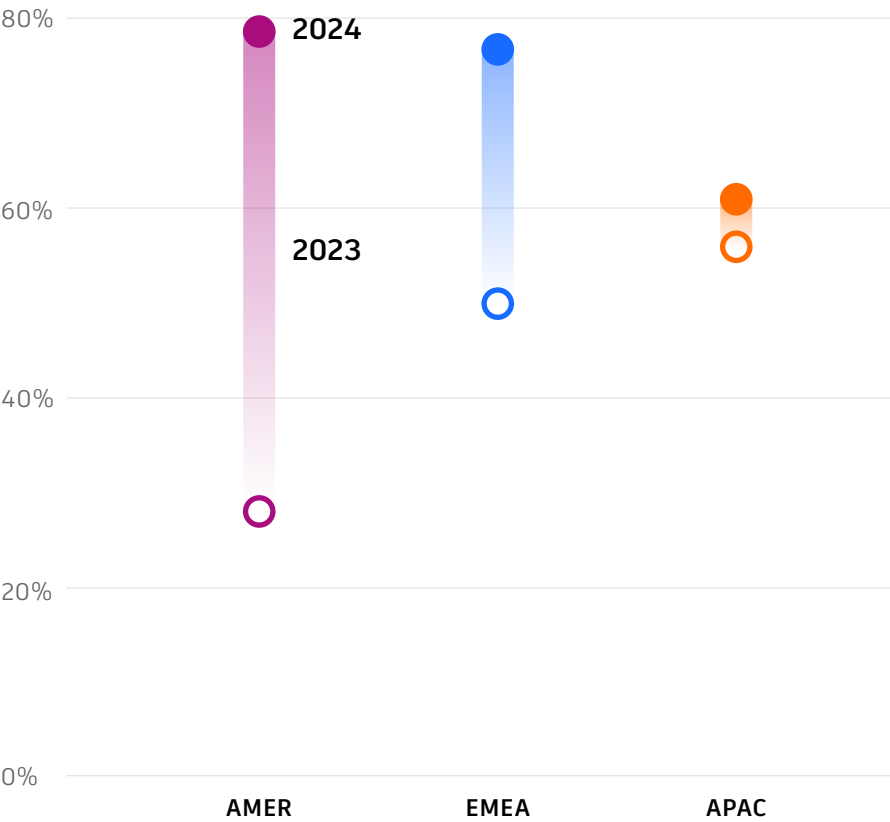
Percentage of AECO respondents who agree to the statement: My company is leading the way in this industry when it comes to sustainability initiatives. Top two = agree. 5 point scale.
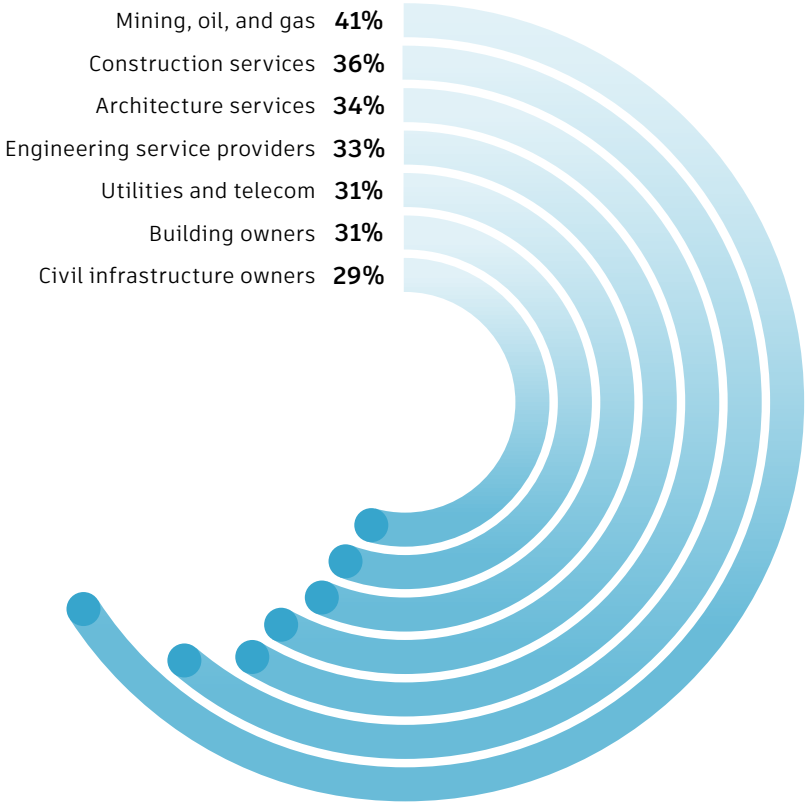
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The younger generation's influence on sustainability

Around one-third of AECO respondents say the next generation is "very influential" in motivating their companies to take steps to be more sustainable. Mining, oil, and gas saw the highest number of any AECO sector, with 41% saying the next generation is strongly influencing their sustainability efforts.

"I've gotten a lot of feedback from younger employees about how they want to work on sustainable projects," says Vince DiPofi, PE CEO for SSOE Group, an architecture and engineering firm. "Employees are saying, 'This is important to me; I want to work at a company that's focused on sustainability.' They want to have an impact and know they're doing the right things for the community and the world. I think that's great."

The next generation's influence on sustainability

Percentage of AECO respondents who say they are driving sustainability initiatives

Mining, oil, and gas	**41%**
Construction services	**36%**
Architecture services	**34%**
Engineering service providers	**33%**
Utilities and telecom	**31%**
Building owners	**31%**
Civil infrastructure owners	**29%**

Survey question: How influential is the next generation in pressuring your company or organization to create and meet sustainability goals? 5-point scale. Top option = very influential.

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Sustainability is proving its value to both short-term and long-term business health

What was true last year is even more true this year: Sustainability is seen as beneficial to the bottom line.

Sixty-seven percent of leaders and experts say sustainability is good for short-term business. Over the long term, 88% believe sustainability is beneficial for business.
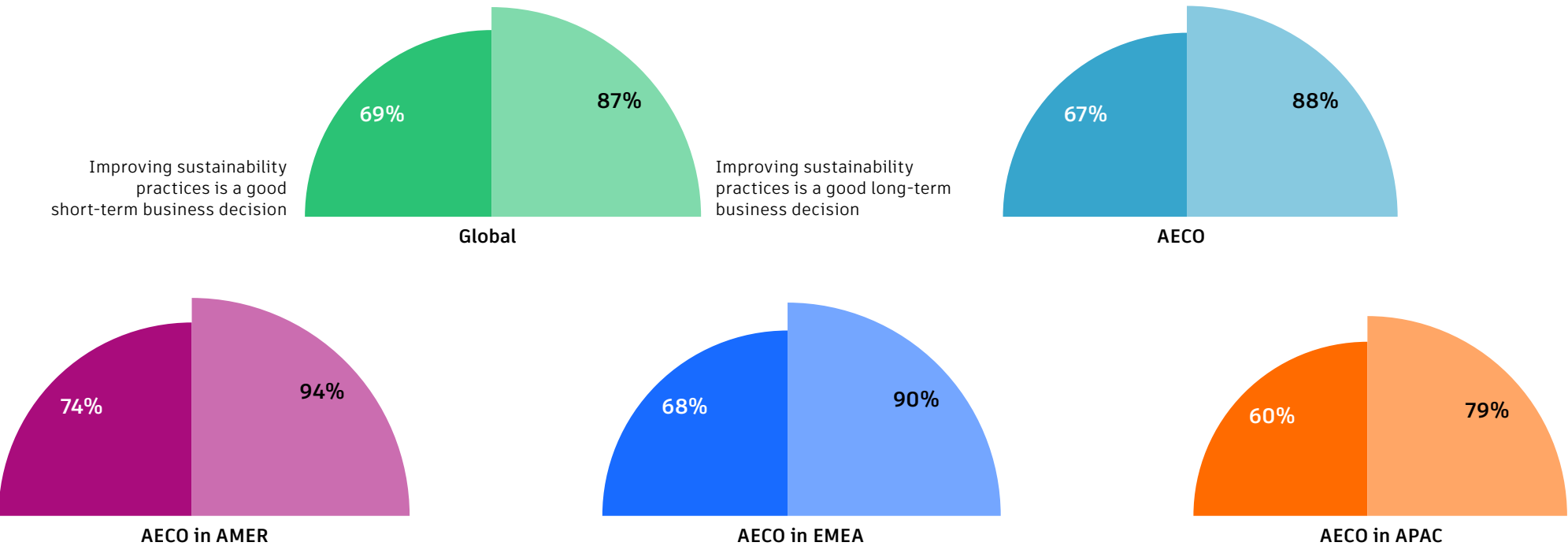
While some of this business value is likely due to an improved reputation with customers and employees, sustainability initiatives also present an opportunity to decrease operating costs through reductions in energy use and materials.

Sustainability initiatives drive long-term revenue for AECO companies

	2023	2024
>10%	20%	23%
5%–10%	28%	58%
1%–5%	24%	
<1%	16%	13%
Don't know	12%	2% / 5%
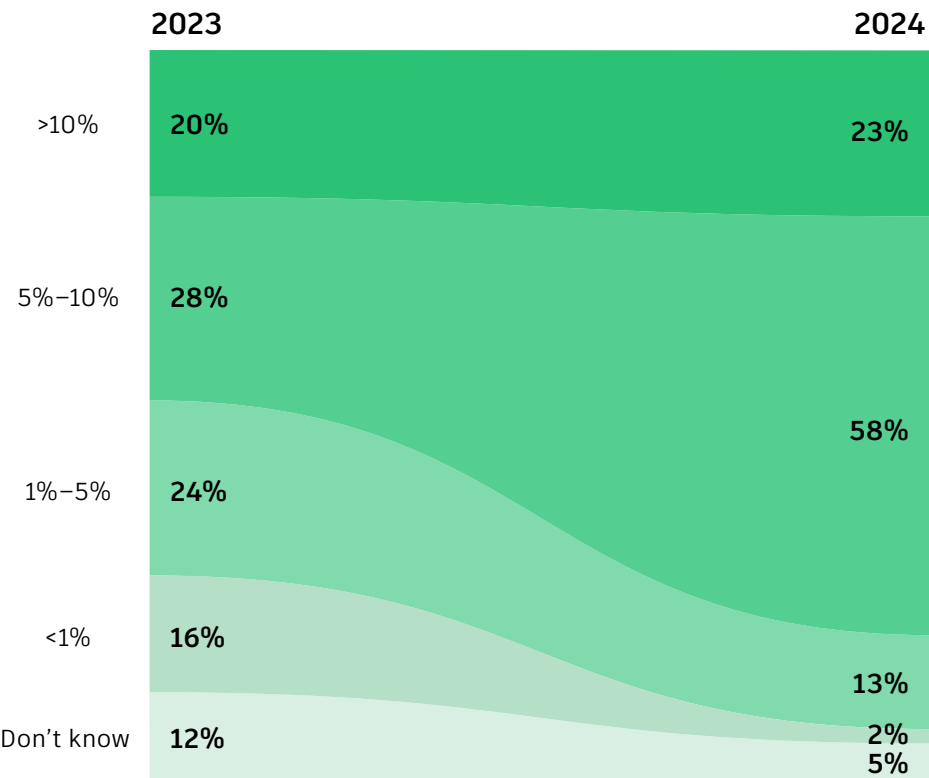
Survey question: To the best of your knowledge, how much business value (as a % of annual revenue) can sustainability measures generate in the long term for your company? 5-point scale.

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Long-term vs. short-term business value of sustainability:
A global view of AECO companies

Improving sustainability practices is a good short-term business decision

69%   87%

Improving sustainability practices is a good long-term business decision

Global

67%   88%

AECO

74%   94%

AECO in AMER

68%   90%

AECO in EMEA

60%   79%

AECO in APAC

Percentage of AECO respondents who agree to statements: 1. Improving sustainability practices is a good long-term business decision. 2. Improving sustainability practices is a good short-term business decision. 5-point scale. Top two = agree.

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Nexii

Canadian firm Nexii was the first construction and manufacturing company to achieve the TRUE Zero Waste Gold certification in North America, for its manufacturing plant in Squamish, Vancouver. Callahan Tufts, design lead, explains why the company is committed to sustainability, the challenge of creating environmental product declarations (EPDs), and how this effort helps the firm to win work.

1. The commitment: "When the company was started, sustainability was in our constitution," Tufts says. "It's been at the forefront of the company since the get-go, which means that we have a team whose sole role is sustainability. They're working with all our departments, all the time, on how we can keep sustainability front-of-mind when we're making decisions."

2. The challenge: "A big win for us was creating our environmental product disclosures, which were published recently," Tufts says. "For a composite-type panel system like ours, it's a difficult task, because you've got multiple materials from multiple sources. It's a very manual process, and the data is fragmented. That's a big barrier for a lot of people. If it was easy and the information people needed was accessible, more people would be creating EPDs."

3. The business benefits: "When we do a project, we can provide a CO2 number using the actual data," Tufts says. "We can break it down and say, 'Here's how much is in the walls; here's how much is in the roof.' That's been huge because we can compare our projects to others and show our clients that we can help them hit their goals."

"It's been at the forefront of the company since the get-go, which means that we have a team whose sole role is sustainability. They're working with all our departments, all the time, on how we can keep sustainability front-of-mind when we're making decisions."

—Callahan Tufts, Design Lead, Nexii

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Conclusion

AECO leaders worldwide continue to face challenges in hiring and cost management, though there is renewed optimism and a greater sense of resilience after enduring—and overcoming—pandemic supply chain disruptions and seeing the global economy avoid a global recession.

Approaches to building business resilience are diverse, and budgets are shifting to reflect changing priorities. To address continued hiring challenges, some organizations are investing heavily in training and upskilling their current workforce along with technology to help fill the skills gap. Almost universally, organizations are increasing their investments in AI, signaling a high level of trust for emerging technology, although concerns remain.

The volatility of recent years has put many organizations in a reactionary position, having to adapt quickly to changing market conditions. Now that leaders are feeling better equipped to handle business challenges, they have started making plans for a more certain future. Along with this new sense of optimism comes exploration of new technologies, processes, and ideas that will uncover new opportunities for growth— and shape the future of design and make.

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Appendix

Methodology

Glossary

Thank you

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Methodology

For this year's global report, Autodesk surveyed and interviewed 5,399 industry leaders, futurists, and experts in the architecture, engineering, construction, and operations; design and manufacturing; and media and entertainment industries from countries around the globe. This report contains key findings from this research, including details at the sector and regional level.

The quantitative data in this AECO subsample (n= 2002) was collected between July and September 2023, through a 20-minute online survey. Autodesk partnered with Qualtrics for the collection of this data.

* The full questionnaire used in the survey can be found here.

AECO
2,002 total

- **31%** Construction services
- **20%** Architecture services
- **14%** Engineering service providers
- **11%** Civil infrastructure owners
- **9%** Utilities and telecom
- **7%** Building owners
- **7%** Mining, oil, and gas

This subset of AECO contains:

- **25%** AMER
- **47%** EMEA
- **28%** APAC
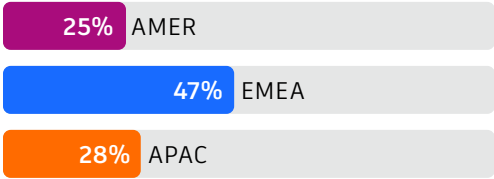
75%
of AECO survey participants are decision-makers in their companies

11 years
is the average experience AECO respondents have in their industry

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Glossary

Company size:

- **Small:** 1–19 employees
- **Medium:** 20–4,999 employees
- **Large:** 5,000+ employees

Digital maturity:

Respondents were asked how far their companies were in their transformation journeys. Organizations that respondents said are in the "early stage" or "right in the middle" of their digital transformation journeys are considered less digitally mature companies. Those that respondents identified as "approaching the goal" or having "achieved the goal" of digital transformation are considered more digitally mature companies.

Industry:

AECO: Architecture, engineering, construction, and operations

- Architecture services
- Building owners (i.e., developers, real estate companies, governments)
- Civil infrastructure owners (e.g., transportation infrastructure, water infrastructure)
- Construction services
- Engineering service providers
- Mining, oil, and gas
- Utilities and telecom

D&M: Design and manufacturing

- Aerospace and defense equipment
- Automotive and other transportation (including supply chain)
- Building products and fabrication
- Consumer products
- Industrial machinery
- Life sciences manufacturing
- Process manufacturing

M&E: Media and entertainment

- Advertising, publishing, and graphic design
- Film and TV
- Games

Leaders and Experts:

- **Leaders:** Seventy percent of survey participants are decision-makers in their companies. In this report, this group is referred to as "leaders." Job roles for the leaders group include business owner/ entrepreneurs, directors, VP-level and C-level.
- **Experts:** The remaining 30% of respondents are referred to as "experts." This group includes respondents at the non-managerial level and managers.

Performance:

Companies whose leaders and experts rated their organization's performance on top business metrics as "above average" or "excellent" are considered top performers.

Region:

APAC: Asia-Pacific

- Australia, China, India, Japan, South Korea

EMEA: Europe, the Middle East, and Africa

- France, Germany, Italy, Middle East (Saudi Arabia, United Arab Emirates), Netherlands, Nordics (Denmark, Finland, Norway, Sweden), Spain, Turkey, United Kingdom

AMER: North, Central, and South America

- Brazil, Canada, Mexico, United States

Sustainability:

The survey questions about sustainability, for example in the list of changes companies are making, focus on environmental sustainability, however, this definition was not explicitly stated.

In one-on-one interviews, a descriptive definition was used incorporating the United Nations definition: "Meeting the needs of the present without compromising the ability of future generations to meet their own needs." Respondents were told this includes efforts related to the environment (mitigating the effect on climate change), the community (social well-being, improving the life of populations), and corporate governance.

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About Autodesk

Autodesk is changing how the world is designed and made. Its technology spans architecture, engineering, construction, product design, manufacturing, and media and entertainment, empowering innovators everywhere to solve challenges big and small. From greener buildings to smarter products to more mesmerizing blockbusters, Autodesk software helps customers design and make a better world for all. For more information, visit autodesk.com or follow @autodesk on social media.

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