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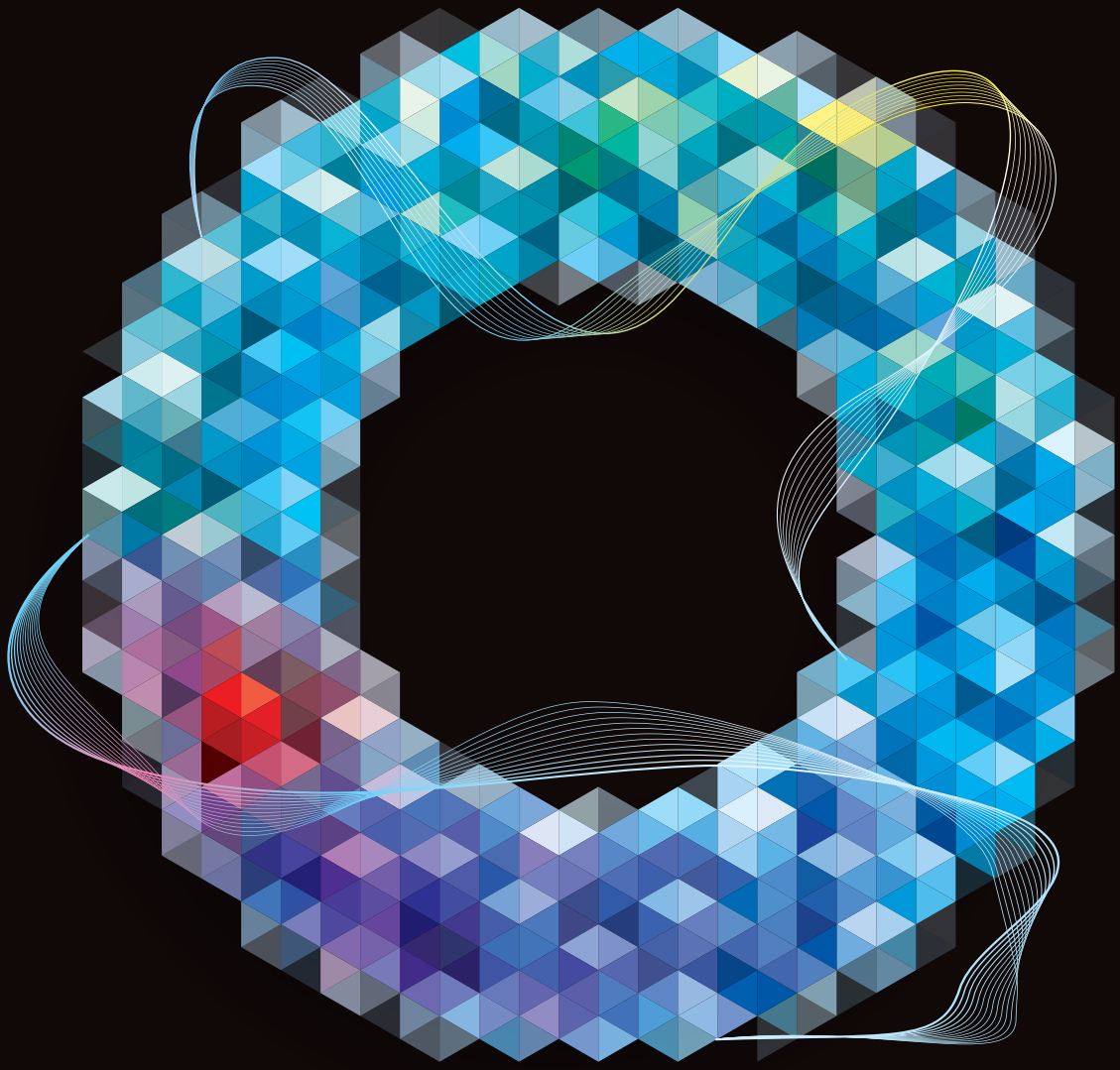


State of Digital Adoption in the Construction Industry 2024

Autodesk

April 2024

Deloitte Access Economics

Contents

State of Digital Adoption in the Construction Industry 2024

This report is the second edition of the *State of Digital Adoption in the Construction Industry* and finds businesses that integrate **digital technology into their operations experience improved project outcomes and a financial dividend.**

Each additional technology implemented into business operations leads to a **1.4 percentage point increase in revenue growth per year.** For a business with USD $100 million in revenue, this is equivalent to USD $1.4 million in additional revenue.

Ensuring future growth in this important industry will require businesses across the Asia Pacific expanding their use of digital technologies and integrating them successfully into business operations.

>> STATE OF DIGITAL ADOPTION

Key enabling technologies such as data analytics , construction management software and mobile apps are the most used technologies.

- Data analytics (47%)
- Construction management software (43%)
- Mobile apps (41%)
- Prefab and modular construction (40%)
- Building Information Modelling (BIM) (38%)

More businesses plan to implement cutting-edge technologies, with **AI to be used by 68% of businesses** when fully implemented.

Businesses are following up on these plans with funding- **investing 18% of expenditure in new technologies.**

>> BARRIERS TO DIGITAL ADOPTION

42%

Report digital **skills gap** as a barrier to greater digital adoption, with 87% reporting a technical skills gap related to digital technology

39%

Report **cost** as a barrier to digital adoption, which comes with an **overall increase** in cost pressures

34%

Face a barrier from a **lack of budget** allocated to technology

>> PRIORITY AREAS FOR IMPROVING DIGITAL ADOPTION

Start small by piloting projects and account for change management costs when scaling.

Select a **digital champion of tech transformation** in your business

Track a range of measures of success, including efficiency, employee use and satisfaction.

Build a digital ecosystem to support your digital journey.

Ask whether **your business is AI ready.**

Digital adoption snapshots

Variation in digital infrastructure, technology applications and workforce skills means that the benefits and barriers facing businesses in the markets across the Asia Pacific differ.

India

Indian businesses used an average of **7.5** technologies, the highest level reported by surveyed markets. They reported a median spend of **28%** on new technology.

- Improved efficiency
- Reduced costs
- Enhanced customer relationships

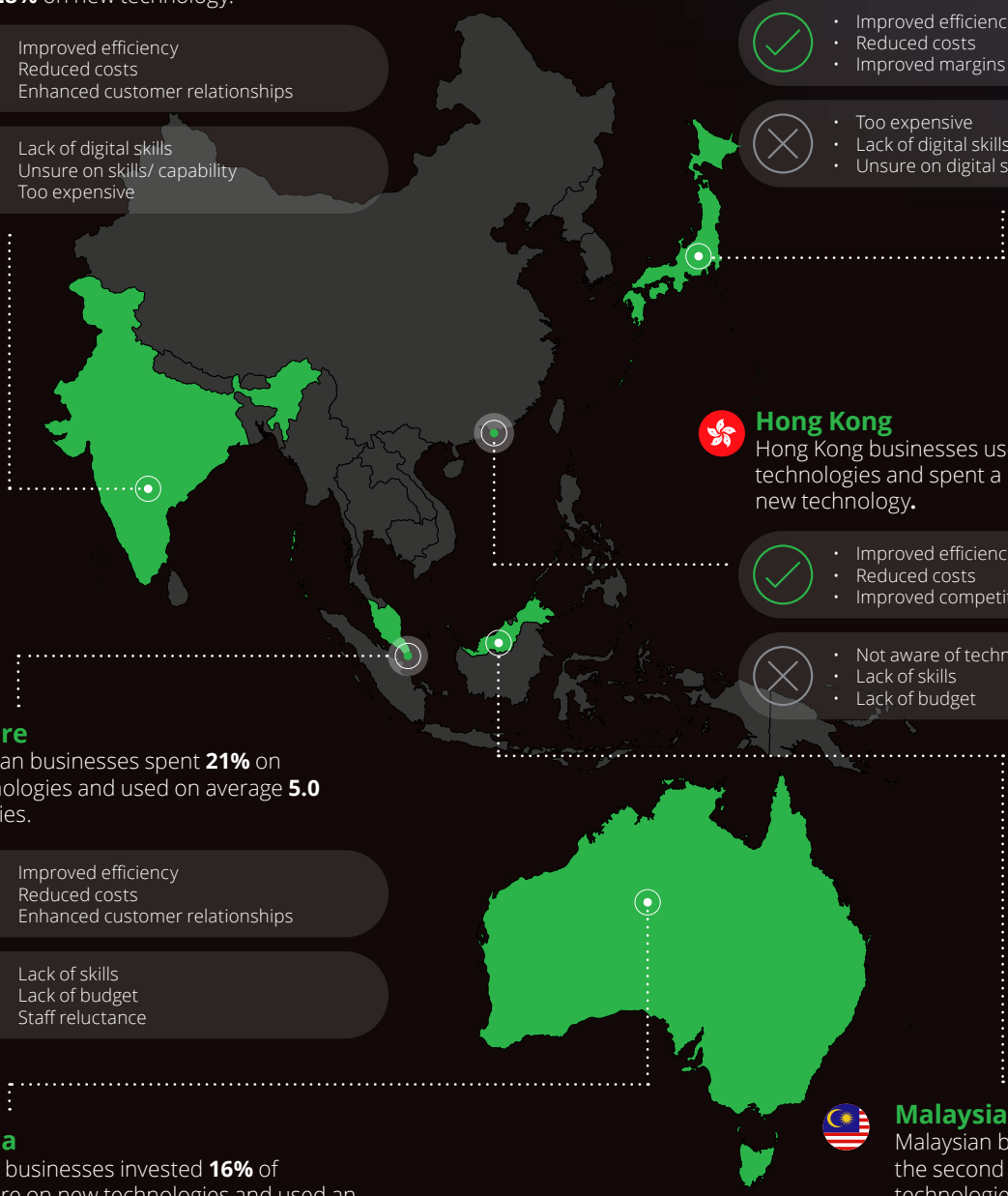
- Lack of digital skills
- Unsure on skills/ capability
- Too expensive

Japan

Japanese businesses used **2.9** technologies on average and spent **14%** of expenditure on new technology.

- Improved efficiency
- Reduced costs
- Improved margins

- Too expensive
- Lack of digital skills
- Unsure on digital skills/ capability



Hong Kong

Hong Kong businesses used an average of **5.3** technologies and spent a median of **25%** on new technology.

- Improved efficiency
- Reduced costs
- Improved competition

- Not aware of technologies
- Lack of skills
- Lack of budget

Singapore

Singaporean businesses spent **21%** on new technologies and used on average **5.0** technologies.

- Improved efficiency
- Reduced costs
- Enhanced customer relationships

- Lack of skills
- Lack of budget
- Staff reluctance

Australia

Australian businesses invested **16%** of expenditure on new technologies and used an average of **5.0** technologies.

- Improved efficiency
- Reduced costs
- Improved competition

- Too expensive
- Lack of skills
- Lack of budget

Malaysia

Malaysian businesses used the second highest number of technologies on average (**6.9**) and reported median expenditure of **23%** on new technology.

- Reduced costs
- Improved efficiency
- Improved competition

- Too expensive
- Lack of skills
- Lack of budget

Executive summary

Disruptive new technologies combined with a challenging business outlook means that construction and engineering leaders across Asia Pacific are having to seriously rethink their tools, workforce skill needs and how they interact with clients and contractors.

Efficiency gains for construction businesses could be significant. Generative AI means that a new project proposal doesn't need to start from scratch, instead leveraging material and pricing based on projects completed by the company with similar specifications. Optical recognition paired with visual data analytics can identify hazards in real time, reducing potential accidents on-site. A Common Data Environment (CDE) facilitates seamless communication within a business and with clients and contractors.

Integrating technologies like these into business operations will be no small feat. Construction and engineering in Asia Pacific accounted for 45% of the global industry in 2022, and is forecast to account for nearly half of the global industry by the end of the decade.

The construction and engineering industry also continues to face volatility in material prices and increasing labour costs, as well as ongoing shortages of skilled labour and disruption to supply chains.

To help construction and engineering leaders make informed decisions in this fast paced environment, Autodesk has commissioned this research exploring digital adoption in the industry and best practice for businesses looking to get the best returns from their technology stack.

This is the second edition of the *State of Digital Adoption in the Construction Industry,* and expands upon the previous edition by providing additional insights about important trends in the industry – including the rapid rise in AI, growing importance of environmental sustainability and important demographic shifts in the construction workforce. The insights in the report are informed through a survey of 933 businesses from six markets (Japan, Singapore, Australia, India, Malaysia, and Hong Kong) and consultations with industry leaders.

So what are the key findings in the latest State of Digital Adoption in Construction report?

- We find the **critical role of technology in supporting business growth is increasingly being recognised.** There was an increase in both businesses seeing new technology as assisting with new project work (up from 38% to 45%) and technology in improving internal processes (up from 37% to 43%).
- **Foundational technologies are the most commonly used** with data analytics (being used by 47% of businesses), construction management software (43%) and mobile apps (40%) providing the backbone of construction operations.
- **Generative AI is expected to become as pervasive in the construction and engineering industry as these foundational technologies,** with 94% of businesses now having plans to integrate AI and machine learning into their business.

"We don't believe in technology shopping, because every now and then, there is a new technology that comes on the block and people run behind it. **Instead, our philosophy has been that you identify a technology that solves the problems you are currently facing.**"

– Sagar Gandhi, Head of Strategy and Business Excellence, Shapoorji Pallonji

While many construction and engineering firms are experimenting and integrating digital technologies into their business there is significant room for improvement across the industry. When businesses across Asia Pacific were asked about the use of 16 different construction technologies, we found businesses use an average of 5.3 of these technologies in their operations.

The majority of businesses that do adopt technologies such as AI and the other 15 technologies receive a dividend from the investment. Over 80% of businesses believed they received strong business returns or a positive return on investment from implementing data analytics, mobile apps, robotics, prefab and modular construction and construction management software.

These technologies also enable greater returns from more advanced technologies. **Businesses using data analytics, construction management software and mobile apps were more likely to report successful implementation of advanced technologies such as augmented and virtual reality (15% increase in success), AI and machine learning (13%) and digital twins (11%).**

Businesses with higher rates of digital adoption are already seeing impacts on project performance. While our survey found that only half of projects were delivered on time and on budget, econometric analysis found that adoption of digital technologies can improve the likelihood that a project was delivered on time or under budget.

Adopting one additional technology was found to lead to a 0.75% increase in the share of total projects delivered under budget and a 0.5% increase in the share of projects delivered on time, after accounting for a business' size, years in operation and location.

These benefits extend to financial performance as well. An additional technology is associated with a 1 percentage point increase in profit growth and a 1.4 percentage point increase in revenue growth over the past year.

For a business with USD $100 million in revenue and $20 million in profit, adopting an additional technology is associated with an increase in revenue of USD $1.4 million and a USD $200,000 increase in annual profit.

Realising the benefits of digital technology will require overcoming a number of barriers to adoption, with 94% of businesses experiencing a barrier to adopting digital technology in their business.
The three most common barriers that businesses need to overcome are:

1. **A lack of digital skills among employees** (cited by 42% of business), with this barrier more likely to impact large businesses. This was the most common barrier to digital adoption in the 2023 report as well, demonstrating the persistence and prevalence of this issue.
2. **Technology being too expensive,** which was the 2nd most highlighted barrier this year, from 6th in 2023) and is consistent with a high inflationary environment
3. **A lack of budget allocated to technology** (34%), which is closely related to the cost of technology.

Addressing these barriers while maintaining business operations is a daunting challenge for the industry. In order to help address these challenges and successfully integrate digital technology into the business, this report identifies five key priority actions for the construction industry, which are outlined on the next page.

Key actions to improve digital adoption in the construction and engineering industry

Action 1
Start small by **piloting projects** and **account for change management costs** when scaling up to increase likelihood of successful digital transformation.

Action 2
Select **champions of tech transformation** in your business. These champions are key to keeping motivation high when fully implementing a new solution.

Action 3
Track a range of measures of success when it comes to digital adoption. This should include traditional metrics like efficiency and avoided costs alongside employee use and satisfaction.

Action 4
Building the digital ecosystem – including other industry members and trusted partners to support your digital journey to **help find the right solutions and best practice.**

Action 5
Ask whether your business is AI ready in terms of both skills and data systems and architecture.

1. Challenges facing the construction industry

Construction facilitating growth across Asia Pacific

The construction and engineering industry plays a critical role across Asia Pacific. With its growing population and diverse range of individual economies, Asia Pacific continues to transform rapidly, facilitated by residential and commercial infrastructure projects delivered by the industry.

The construction and engineering industry across Asia Pacific produced an estimated USD $4.36 trillion of output in 2022, representing 45% of the global construction industry. By the end of the decade, Asia Pacific will account for just under half of the industry.[1]

Given the significance of this contribution, Autodesk has commissioned this research to analyse trends impacting businesses and the level of digital adoption across Australia, Japan, Singapore, Hong Kong, Malaysia and India.

This report is the second edition of the *State of Digital Adoption in the Construction Industry,* providing an update and expansion to the version published in 2023 ('the 2023 report').[2] In this edition, the countries of focus has extended beyond Australia, Japan and Singapore to also include Hong Kong, Malaysia and India.

To inform this analysis, Deloitte Access Economics fielded and analysed a survey of 933 businesses and consulted industry leaders to understand their digital adoption journey and conducted extensive desktop research on the industry in each of the six markets. Further details about the methodology and characteristics of survey respondents are available in Appendix A.

Continued challenges facing the industry

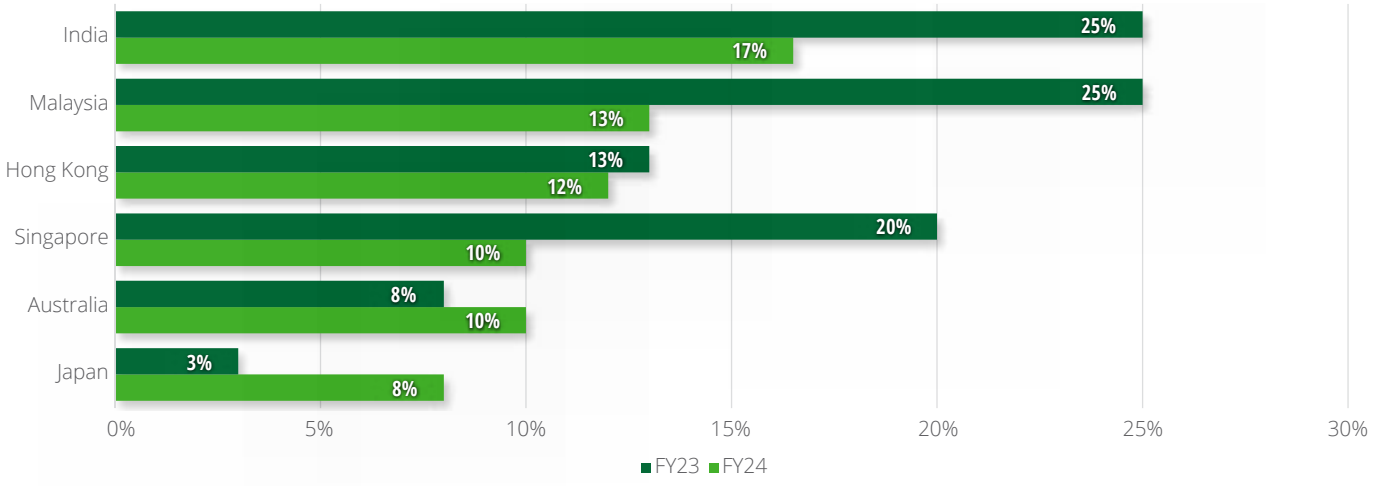
Global economic growth has been resilient despite downbeat forecasts. World GDP growth is forecast to moderate from 3.2% in 2023 to 2.5% in 2024, weighed down by higher interest rates to deal with an inflationary surge.[3] Growth across Asia Pacific is also forecast to slow from 4.2% in 2024 to 3.9% over the medium term, as structural slowdown in China continues and lower productivity growth in many other economies dampen the region's potential.[4]

This outlook presents a challenging environment for construction businesses as interest rates continue to constrain demand and pandemic era 'excess savings' fall, meaning consumers may have less disposable income for discretionary spending.[5]

The challenging global macroeconomic environment is slowing the recovery within the construction and engineering industry, with our survey finding revenue growth in FY24 to be slower than the previous year.

Across all countries, businesses are expecting median revenue growth to be 10%, in comparison to actual revenue growth over FY23 of 13%, as shown in Chart 1-1.

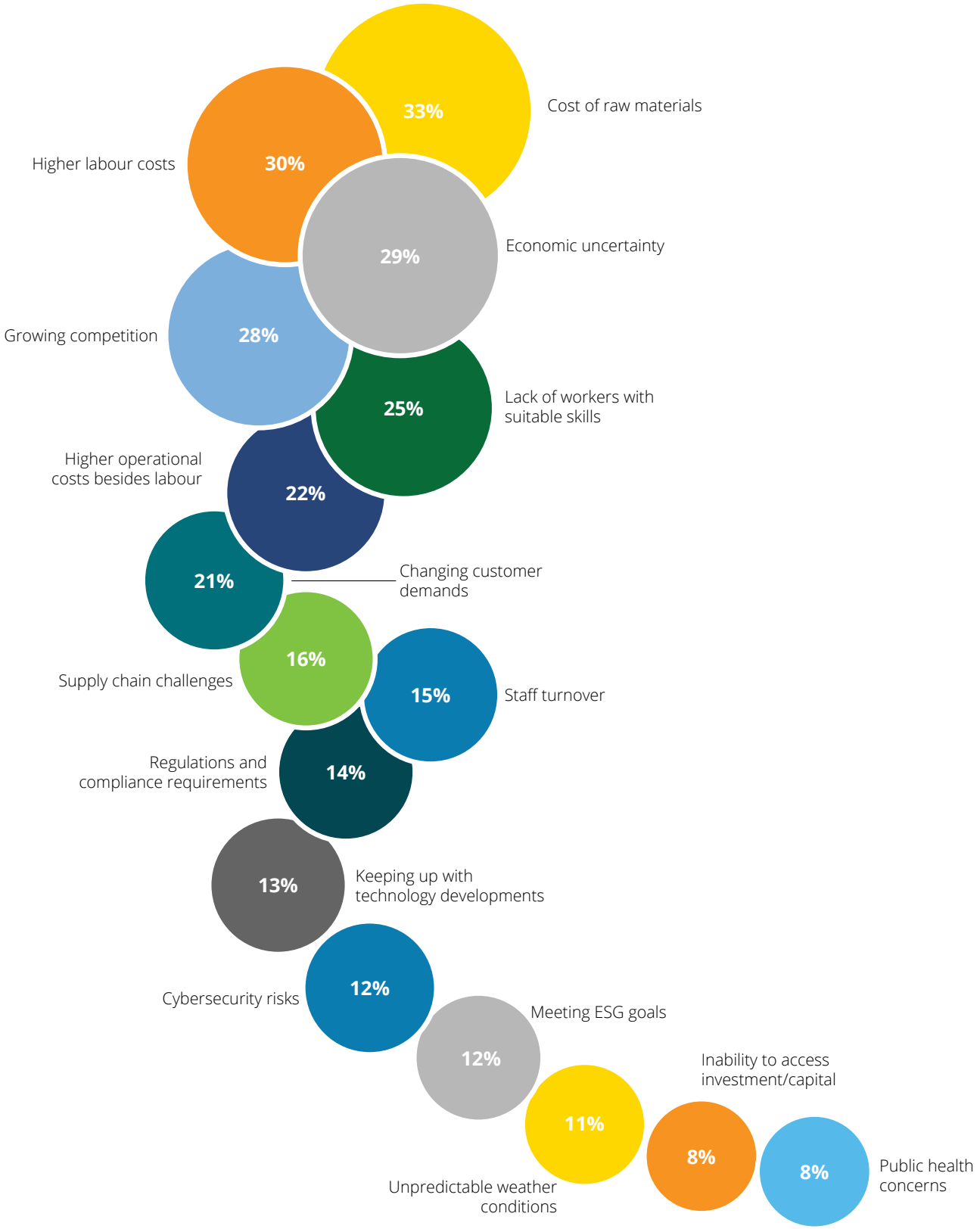
Chart 1-1: **Median revenue growth for FY23 (actual) and FY24 (forecast), by country**



Source: Deloitte Access Economics based on construction and engineering business survey (2024).
Sample: 933

Cost pressures for raw materials (cited by 33% of businesses) and labour (30%) were the most common barriers to growth, as shown in Chart 1-2. Compared to the 2023 survey, economic uncertainty has dropped from the most common barrier (cited by 56% of businesses) to the third most common barrier to growth. This may reflect increasing stability as more time passes from the COVID-19 lockdowns. Meanwhile, a lack of workers with suitable skills has dropped from the third main challenge (48%) to the fifth (25%).[6]

Chart 1-2: **Main challenges for businesses**



Source: Deloitte Access Economics based on construction and engineering business survey (2024).
Sample: 933

Technology helping businesses survive and thrive

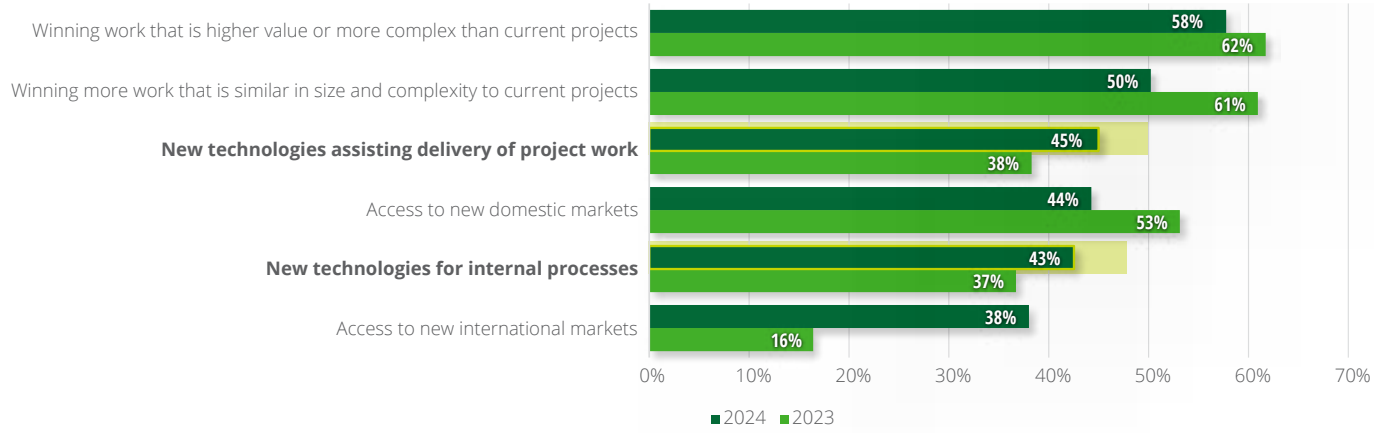
The successful integration of technology into business operations is increasingly seen by construction businesses as a crucial enabling factor to navigate these challenges. Compared to the 2023 report, new technologies assisting delivery of project work has risen to the third most common source of growth from the fourth most common previously reported. There has also been a similar rise in the number of businesses expecting growth from introducing new technologies for internal processes (reaching 43% of businesses, up from 37% last year).

More than three quarters of businesses believe technology will be required to stay competitive. This suggests that technology is critical to grow and survive in the current business environment.

This is consistent with Deloitte Research Centre for Energy & Industrials analysis which identified digitalisation and generative Artificial Intelligence (AI) as a key trend likely to be foundational for value realisation in the construction industry.[7]

While winning work that is of higher value or similar size to current projects is still the most common strategy for generating growth, we are seeing a drop in the number of business citing this as a source of growth (Chart 1-3). This indicates the industry is recognising that following a business-as-usual approach will not be enough to navigate the challenges facing the industry.

Chart 1-3: **Sources of construction industry growth, 2023 survey and 2024 survey**



Source: Deloitte Access Economics based on construction and engineering business survey (2024 and 2023).
Note: Responses relating to the increasing role of technology are highlighted

Sample: 689

Cultivating a culture of continual experimentation and innovation at Gamuda

Gamuda is an engineering, property and infrastructure company based in Malaysia. Established in 1976, the company has since expanded to nine countries, and currently employs over 5,000 people.

John Lim, the Chief Digital Officer at Gamuda, understands the importance of remaining agile in a fast paced industry like construction. As a multinational construction company, Gamuda is facing increasing regulatory requirements that vary across countries, rising client expectations about service delivery, escalating material prices and a push for construction to become more sustainable.

Gamuda has established an internal Innovation Hub to help find innovative solutions to these changing trends. The Hub ensures the latest technologies are systematically integrated into the company operations and focuses on solving real challenges facing the business. The Innovation Hub also provides pathways for people to meet the needs of clients through experimentation with technology at a business-wide level, rather than at a project level which means innovative ideas end when the project ends or the person leaves the business. This experimentation is seen through award winning work at Gamuda, including the inception of the world's first autonomous tunnel boring machine (A-TBM) and BIMAR, which uses augmented reality (AR) to enable users to overlay Building Information Modelling (BIM) design models onto construction sites. Regarding this experimentation, John says:

> ***"In many other companies, there is often a demand on getting a return on investment as soon as possible. But one thing Gamuda has been doing for many years is experimentation. It's about being able to try new things, in an environment where it is fine to make mistakes or fail. We take it as a lesson learned moving forward. And that's where the groundbreaking things happen."***

Through the Innovation Hub, it became clear that teams across multiple geographic locations were using different software and digital tools. Having multiple point solutions meant that there was a need to manage these products at an enterprise level. However, this was not feasible as it required multiple teams to be trained differently due to different software and was not cost effective. Instead, Gamuda focused on streamlining its processes and management of various teams across the region. One of the effective ways for Gamuda to do so was through the implementation of a Common Data Environment (CDE) for all internal use cases and projects, in collaboration with their stakeholders, such as their clients, suppliers and subcontractors.

The CDE in Gamuda is now used to manage design workflows, project management workflows, data collection onsite, correspondences, requests for information, scheduling and cost management, amongst other use cases. Employees can track project issues with photos, monitor weather events and make data-informed decisions in real time using the CDE. This has sped up decision making and enabled projects to all apply the same level of quality control, collaboration and process. According to John:

> ***"The CDE platform is great because now we have a common platform that seamlessly brings everybody together from our entire supply chain. Our teams in Singapore or Australia can leverage the team in Malaysia where there are lots of subject matter experts. Everybody is collaborating together."***

The company uses Application Program Interfaces (APIs) in conjunction with its CDE to extract data further and triage service dockets with AI, supporting cost management and data visualisation.

Gamuda has also built a platform of AI bots, called Bot Unify. This platform enables users to create their own AI bot that is tied to their data, with a vision that in the future, each employee will have an individual AI bot that knows their own individual specific information. The company is currently trialling the bot for multiple purposes, including to leverage previous work to create new tenders, produce summaries of their marketing reports, support business intelligence, provide a central database of suppliers and pricing, and generate an easily accessible source of internal organisational information on health, safety, quality and HR policies.

Given the fast pace of digital adoption, John acknowledges that one of the biggest challenges of digital transformation at Gamuda is supporting people to be upskilled in these technologies and understanding how they support and streamline the work of the business. John shares that:

> ***"The need to build these skillsets will become more prevalent as needs increase and clients expect more. I could be very good at delivering my digital solutions, but if people don't understand it, we have a problem. How do you get the whole grassroots to understand what we're trying to do? How do we get everybody to speak the same language?"***

Gamuda has been working to address these gaps in understanding and skill by putting staff through certification courses and programs to upskill their knowledge of digital tools and innovation. The company also holds regular TechTalks, masterclasses and an incubator series to create avenues for staff of every level in the business to engage with technology topics. One key program run by Gamuda is the Data Hero Programme, which aims to identify digital talents and encourage innovation within the team. The program has seen over 100 participants since its inception in January 2022. The Innovation Hub also serves as a retention mechanism to provide non-traditional career paths for their young talented engineers who are keen to pursue careers in technology. Many members of the team are engineers who started their careers in projects.

2. The changing face of the construction industry

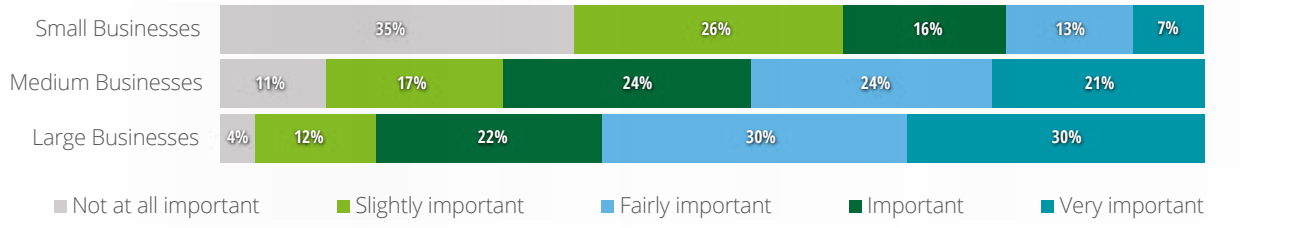
Compounding the challenging business outlook, the construction and engineering industry faces a number of large-scale trends that are transforming the way the industry operates. This chapter explores three of the most impactful trends influencing the industry.

Growing importance of AI for construction

Generative AI has exploded onto the agenda for senior leaders with the rapid adoption of tools like ChatGPT, Midjourney and Github Copilot. No industry is immune from the transformative potential of this technology. In fact, our survey found almost 95% of businesses across Asia Pacific believe AI will be important for their business' prospects in five years' time.

Larger businesses are more likely to consider the technology to be a core element of future growth, with four times as many large businesses considering AI to be very important when compared to small businesses.

Chart 2-1: **Importance of AI for business' growth**



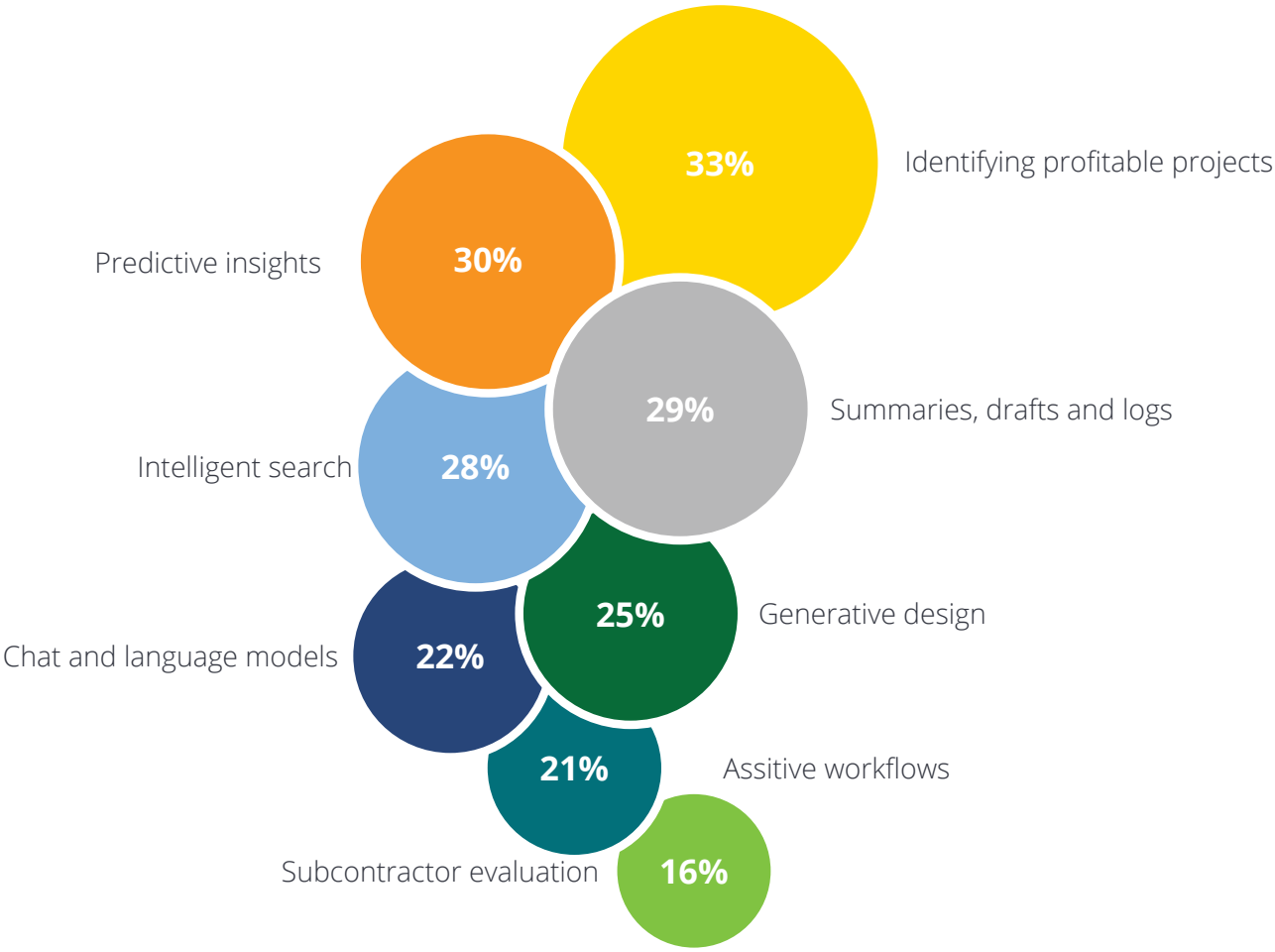
Source: Deloitte Access Economics based on construction and engineering business survey (2024).
Sample: 933

The industry is exploring and experimenting with a wide range of use cases for AI. The highest priority use case is using AI to assess and identify profitable project opportunities, with predictive insights and summaries, drafts and logs the next highest priority.

"Worker safety is one of our foremost concerns at Sunway. Pairing AI technology with image recognition software has allowed us to have real-time interventions for safety that can prevent potential accidents."

- Ziqing Liew, Head of Digitalisation Sunway Group

Chart 2-2: **Highest priority AI use cases for adoption**



Source: Deloitte Access Economics based on construction and engineering business survey (2024).
Sample: 933

Effectively using generative AI will require finding more people with skills in this emerging area. AI and machine learning had the largest technical skills gaps for businesses within the industry, with almost two in five businesses (38%) experiencing a skills gap in this area. This was more common than skills gaps in Building Information Modelling (BIM), and data analytics and construction management software, with 29% of businesses experiencing gaps in these three areas.

Creating a more sustainable industry

Considering environmental sustainability of operations is now a 'must have' for all industries, with 70% of businesses considering it a necessary or important strategic goal.8 Construction plays a key role in supporting the transition to a sustainable economy. The built environment is currently responsible for 40% of global CO2 emissions annually. Of these, 27% of emissions are generated by building operations and a further 13% by building and infrastructure materials.9

Consultations with construction leaders revealed how customers are increasingly looking for bids to consider environmental impacts, and this may end up being a regulatory requirement in certain markets in the near future.

The use of digital technology is a strong enabling factor for improving environmental sustainability in the construction and engineering industry. Businesses that use 5 or more digital technologies have double the number of environmental initiatives than those that use less than 5 (Chart 2-3). These initiatives can include more efficient building design, sustainable business materials and the use of digital software to minimise carbon footprint while executing processes during the project lifecycle.

Chart 2-3: **Environmental initiatives by use of digital technologies**

Source: Deloitte Access Economics based on construction and engineering business survey (2024).
Sample: 933

Emerging technologies in construction also offer potential significant improvements in environmental sustainability, with key examples including:

- Digital twins and BIM eliminating the need for physical prototypes and neatly summarising data on materials required to build infrastructure, which can be used to closely consider environmental impacts when comparing designs.
- Prefabrication reducing waste and improving business scheduling due to its consistency and predictability.
- Data-driven carbon calculators allowing for greater information and choice about the most carbon-efficient construction materials, both in terms of direct emissions from the material and their impact on future emissions from the operation of the infrastructure.10

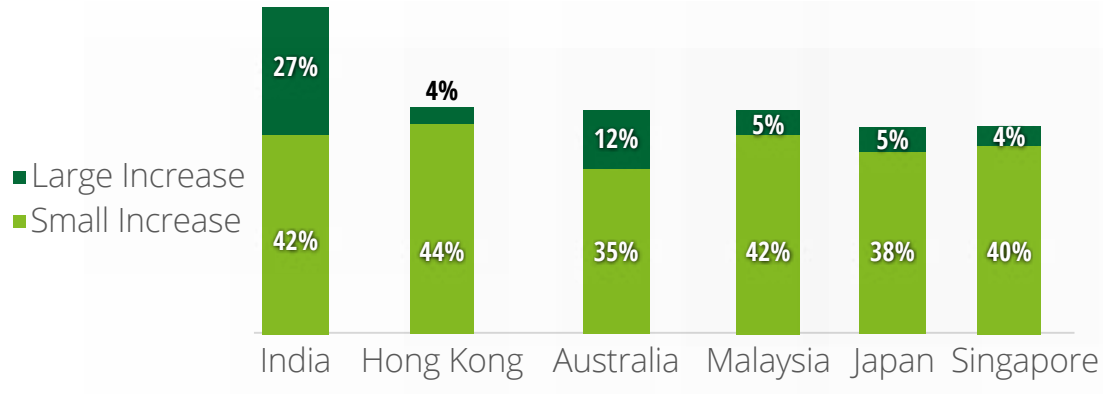
Growing diversity in construction

The face of the construction and engineering industry is changing. Increasing diversity can help address skills challenges facing the business though increasing the talent pool under consideration by the industry. Other studies have also shown that businesses with greater levels of gender diversity have been found to outperform competitors.11

There is a strong need to improve gender diversity in the construction and engineering industry. Only 13% of workers in the Australian construction industry are women, falling to just 4% of construction Chief Executive Officers,with similar levels of under-representation across other Asia Pacific markets.12

There are signs of progress in this area. Our survey found an increase in the share of women in the construction workforce across all markets over the last five years, with businesses in India, Japan and Australia reporting the largest increases as shown in Chart 2-4.

Chart 2-4: **Increase in women's employment over the last five year, % of businesses**

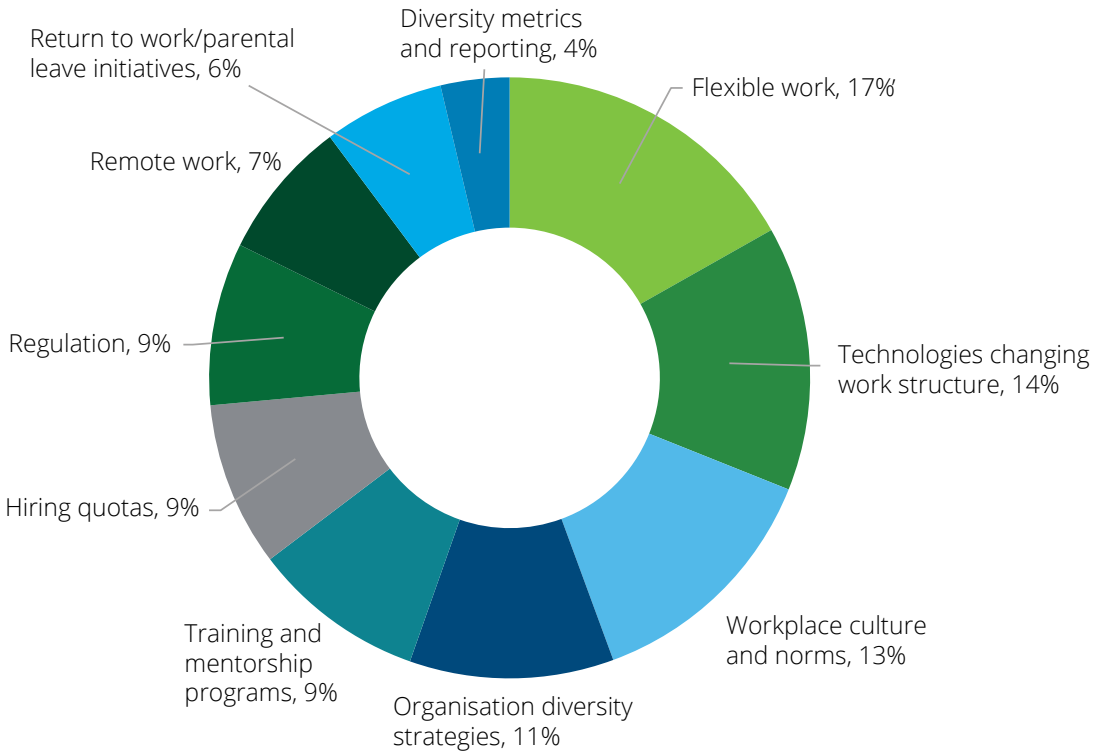


Source: Deloitte Access Economics based on construction and engineering business survey (2024).
Sample: 933

With populations ageing across Asia Pacific, the construction industry is facing an older workforce. Our survey found that one in five construction workers were aged over 55 years old. This is set to increase, with more than a quarter of the population of Asia Pacific being older than 60 by 2050, representing a tripling since 2010.13 Further, this suggests that a large share of the construction workforce could reach retirement age in coming years, and the industry will need to either encourage workers to continue working or find new workers.

Technology was identified by businesses as a key factor enabling greater workforce diversity, being the second-most common factor cited by businesses as most impactful (14%), behind only flexible work (17%). This aligns with previous research carried out by Autodesk highlighting the importance of technology as a gender equaliser.[14] Together, these suggest that moving away from the traditional workplace towards a more flexible, technology-enabled future can support workers and enable businesses to reap the rewards of a more diverse workforce.

Chart 2-5: **Most impactful driver of increased workforce diversity.**



Source: Deloitte Access Economics based on construction and engineering business survey (2024).
Sample: 933

Strategically streamlining technologies at John Holland

John Holland is an end-to-end infrastructure, building, rail and multi-modal transport company in Australia and New Zealand that employees over 5,700 people, working across 80 different projects.

Adam Plunkett and Mitchell Erickson, leaders in John Holland's Technology and Digital Engineering teams, understand the importance of integrating new technologies in a strategic and secure way. In 2021 John Holland launched its Digital Transformation Strategy to embrace technology to drive efficiencies and productivity, and improve health, safety, environment, and sustainability outcomes on its projects. This deliberate strategy has applied modern digital delivery methods such as building information modelling (BIM) and digital twins, built digital capability, leveraged digital information, and connected teams to support innovation and knowledge sharing.

Given the different types and sizes of projects, John Holland recognises it can be challenging to integrate new technology across multiple projects without impacting project outcomes. To overcome this, the team slowly develops, pressure-tests and implements technologies within a particular project, phase or team, before scaling it to the rest of the business. Mitchell says:

> ***"We have to be really pragmatic around what we do and what we deploy. We don't want to be too disruptive to the project because it's still in flight. This means we use a more modular-based approach, rather than a wholesale change of process or an operating system."***

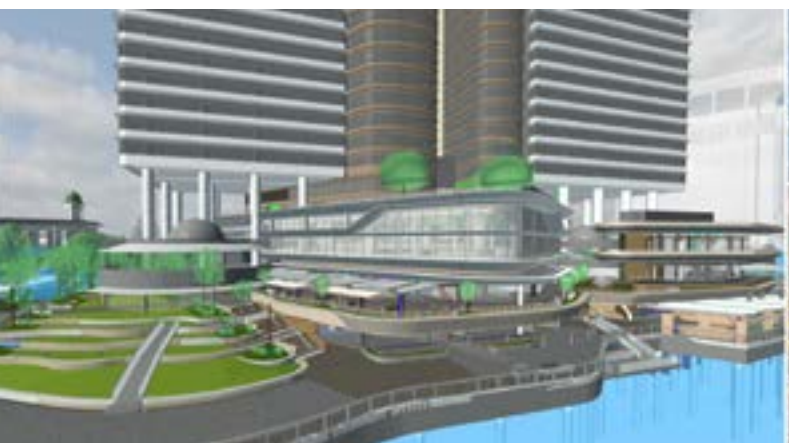
This purposive technology deployment has seen the steady and simultaneous digitisation and automation of previously lengthy administrative and paper-heavy processes associated with projects. One example of this was the digitisation and automation of the permit to excavate on high-risk scopes of work. The process was used in conjunction with other technologies, such as integrated geospatial tools and automated forms, to plan below ground-level utilities works, and reduce the risks and burdens associated with project delivery. John Holland is using a similar approach to deploy emerging technologies, including artificial intelligence (AI), internet of things (IoT) and digital twin. According to Adam:

> ***"We're not just deploying these technologies for the sake of it. We have a structured approach involving critical stakeholders from across the business, including projects, to ensure the right controls and support are in place, otherwise, there is the risk that it becomes too sporadic and disruptive in what we are doing."***

When looking to scale multiple technologies and applications, Adam and Mitchell say that ensuring these technologies meet the enterprise requirements is paramount, especially when it comes to security, customer support and maintenance. As such, John Holland has sought to streamline its technology stack, transitioning towards cloud-centric tools and digital project management software, and enabling integrations into its Common Data Environments (CDE). This has supported an approach that leverages the right applications and capabilities which are proven and can be scaled over time to meet the individuals needs and enterprise requirements. The company's CDEs have enabled teams to collaborate more effectively through knowledge sharing and innovation across the project life cycle.

This is demonstrated through a recent project building the Sydney Football Stadium, where John Holland used a digital whiteboard to coordinate stakeholders across the same platform. The whiteboard allowed supply chain subcontractors to schedule their work and deliveries on site, refining cycle times and streamlining project coordination.

There is also a recognition at John Holland of a continued need to upskill and educate the workforce, particularly as the company continues to expand, partner with different stakeholders, and use different technologies. Mitchell notes that enabling project teams to be more efficient is not only about providing access to digital tools, but also supporting people to learn naturally and organically to build their digital capabilities. For John Holland, this has involved tailored five-minute bite-size chunks of training that employees can access in their own time, rather than lengthy training sessions, helping to upskill in the use of appropriate solutions as needed.



3. State of digital adoption across Asia Pacific

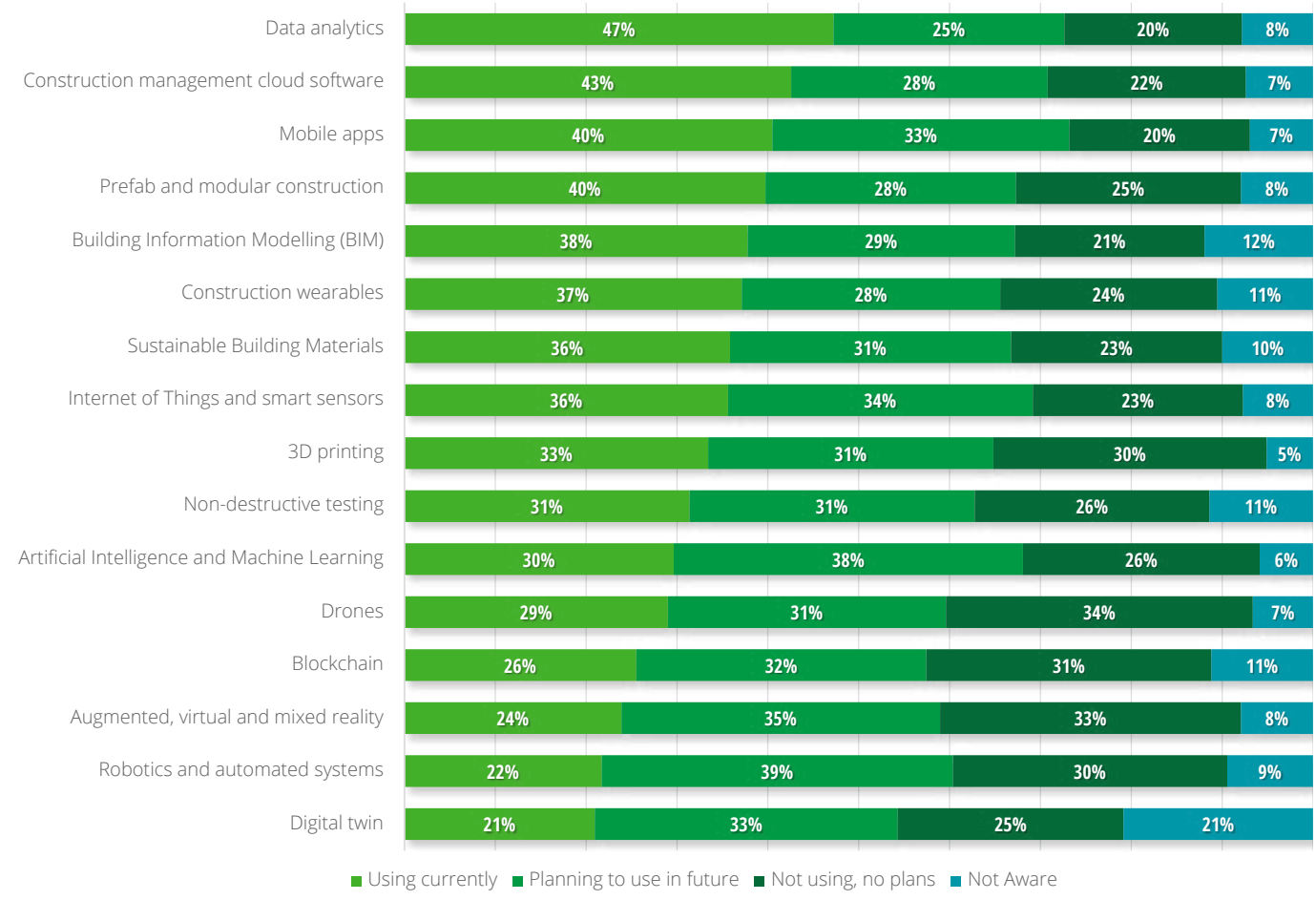
State of digital adoption in the industry

Disruptive new technologies are changing the way construction businesses operate. For instance, Singaporean concreting company Pan-United has developed an AI-powered digital platform known as AiR (Artificial Intelligence for Ready-Mix Concrete), centralising inventory management, plant production, batching, quality control and trucking fleet management for the first time.[15]

Adapting to these challenges will be difficult for many businesses. The construction and engineering industry has historically been viewed as lagging when it comes to digital technology adoption, with an Autodesk report on data capabilities in the construction industry finding that less than 30% of businesses in Asia Pacific were rated as 'leaders' in terms of their data capabilities, suggesting significant room for improvement.[16]

To understand the broader technology stack used by the construction industry, surveyed businesses were asked about their current and planned use of 16 different technologies ranging from core, enabling technologies like mobile apps and construction management cloud software to advanced and specialised technologies like digital twins, blockchain and AI. Current and planned usage is summarised in Chart 3-1.

Chart 3-1: **Current and planned use of technologies**



Source: Deloitte Access Economics based on construction and engineering business survey (2024).
Sample: 933

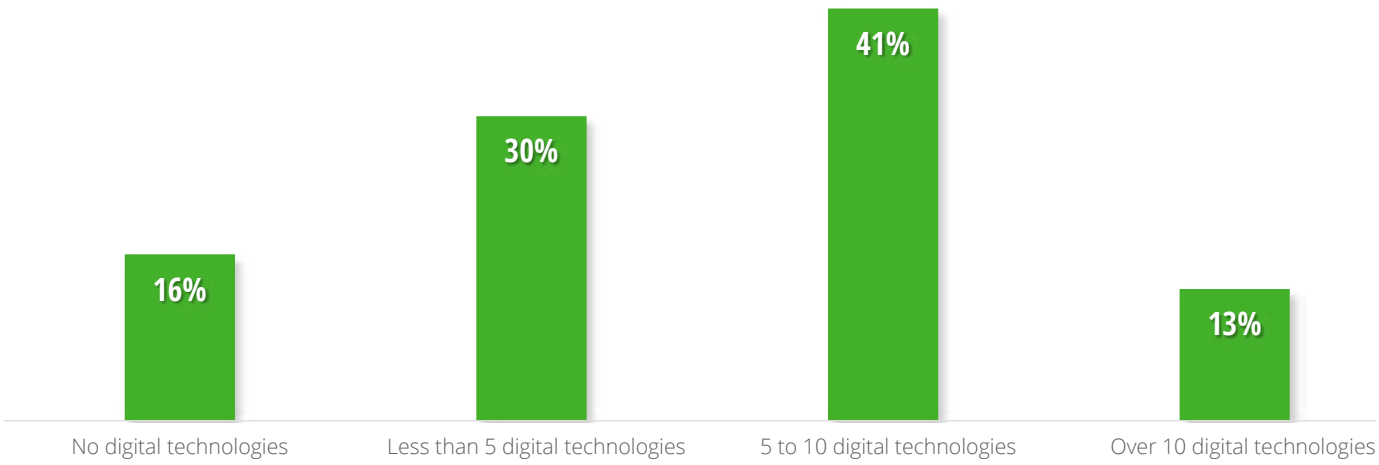
The technologies most commonly in use by businesses are data analytics, in use by 47% of businesses, followed by construction management cloud software (43%) and mobile apps (41%). The relatively high use of these technologies demonstrates their effectiveness in terms of organising workflows, analysing project performance and communicating with stakeholders.

More specialised technologies and those with fewer direct use cases in construction and engineering had significantly lower levels of usage, such as blockchain (25%), augmented reality (24%), robotics (22%) and digital twin (21%).

Businesses are using an average of 5.3 out of the 16 technologies presented. There remains a significant opportunity for businesses to increase their adoption of digital technologies and harness their potential.

Construction and engineering businesses have clearly signalled the desire to increase their level of digital technology adoption. These ambitions are backed up by significant financial investment, with the average business investing 18% of budgets on new technology in 2024 compared to 15% in the 2023 survey.

Chart 3-2: **Number of digital technologies in use**



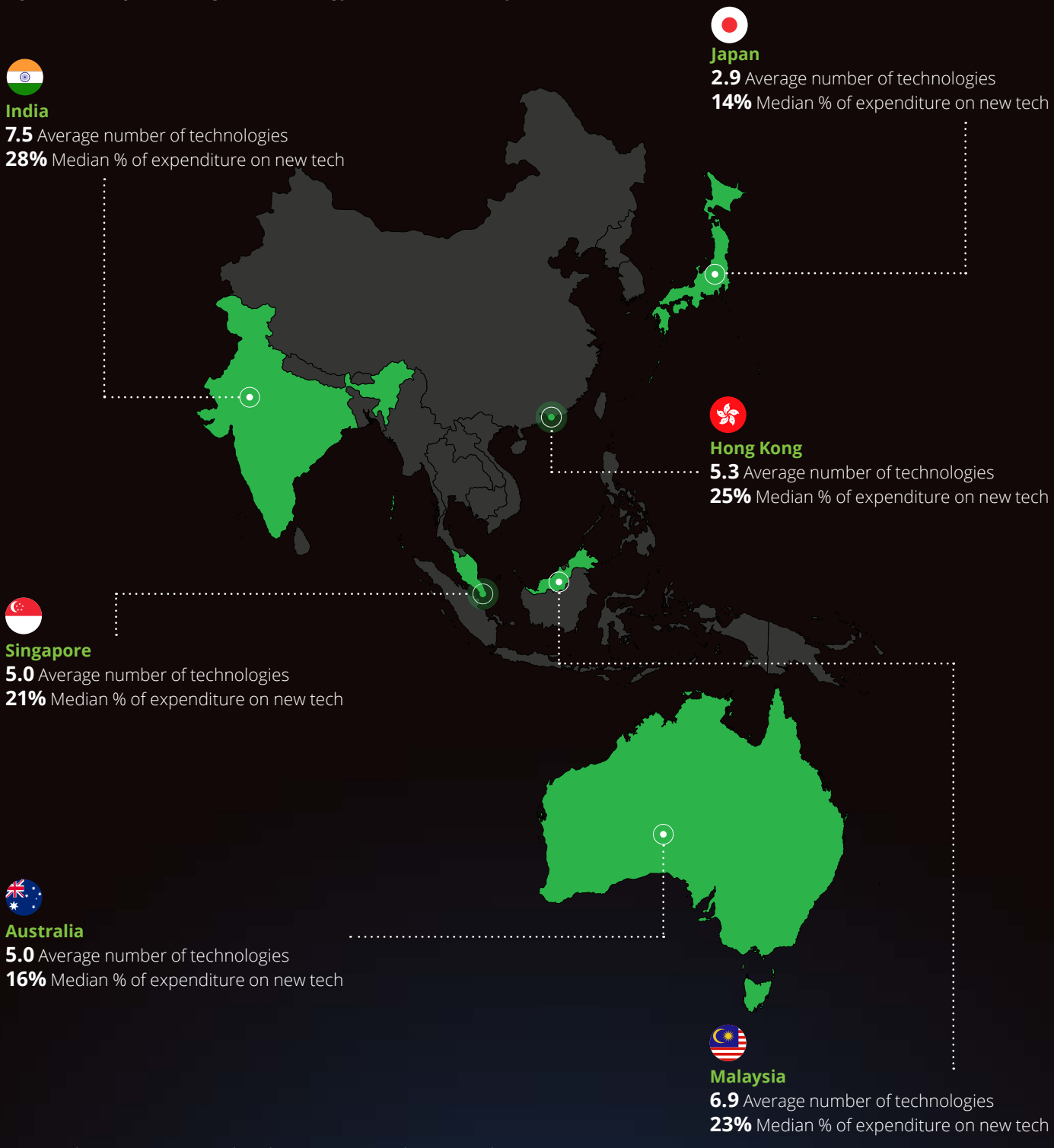
Source: Deloitte Access Economics based on construction and engineering business survey (2024).
Sample: 933

State of digital adoption across Asia Pacific

There is significant variation across markets when it comes to adoption of digital technologies. **India and Malaysia are leading the charge with digital adoption, with both markets using around 50% more technologies compared to the regional average** (Figure 3-1). Australia, Singapore and Hong Kong are middling in terms of their adoption of digital technologies while Japan had an average use of just 2.9 technologies. This result is a combination of relatively lower digital intensity in Japanese businesses and the relatively higher number of smaller businesses in the Japanese sample.

The gap in digital adoption between markets is likely to persist with higher levels of business investment in new technology closely aligning to current levels of use of technology. For example, **the average Japanese-headquartered businesses invested only 10% of expenditure in new technology, while the average Indian-headquartered business invested 25%**.

Figure 3-1: **Adoption of digital technology and investment by market**



Source: Deloitte Access Economics based on construction and engineering business survey (2024).
Sample: 933

Spotlight on Australia

Average number of technologies used:

5.0 TECHNOLOGIES

New technology investment as a share of total expenditure:

16%

Top 3 benefits of digital technologies:

- Improved efficiency
- Reduced costs
- Improved competitive advantage

Top 3 barriers to using digital technologies:

- Too expensive
- Lack of digital skills
- Lack of budget

>> Economic and Construction outlook

The Australian economy is forecast to grow modestly by 1.3% in 2024, making it the weakest year of growth since the early 1990s recession excluding the pandemic period. Real household income per capita has declined given the burst of inflation which has been seen over 2022 and 2023.[17]

The construction industry employs over 1.3 million people across the country.

In recent years, supply chain issues have led to construction material shortages across Australia, disrupting the industry. Material prices have soared in conjunction with rising housing demand, delaying new construction and putting cost pressure on construction businesses and consumers.

Despite these challenges, Australian business are reporting average revenues of $142 million Australian Dollars (AUD) in FY23. Business sentiment is optimistic with revenues forecast to increase by 10% over the next year.

>> Tech adoption

Australian businesses are middle of the pack when it comes to digital adoption, with businesses using an average of 5.0 technologies, rising to 6.1 technologies for medium and large businesses. Australian businesses are also planning to implement fewer technologies than other countries – with an average of 4.3 technologies lower than all other countries except for Japan.

However, businesses that are implementing technologies are seeing strong benefits, with almost 80% of technologies being successful. For example, Coates, a major equipment rental company, uses its cloud-based 'Coates Connect' platform to offer real-time information to customers and managers on the location, use and status of equipment – allowing for higher utilisation rates and greater productivity.[18]

>> Overcoming barriers to greater tech adoption

The cost of technology is the most common barrier to technology adoption. This is in the broader context of the high inflation period seen recently in Australia, where cost pressures in the construction industry's supply chain was a significant challenge.

Skills gaps have also been a major barrier to Australian businesses, with overall skill shortages reported in the construction industry and technical skill gaps reported by 76% of businesses.[19] However, this is the lowest level of technical skill gaps across Asia Pacific. Having a defined and measurable technology strategy may be a priority for technology adoption in the country, with only 23% of businesses having one, compared to 30% in Asia-Pacific.

Spotlight on Japan

Average number of technologies used:

2.9 TECHNOLOGIES

New technology investment as a share of total expenditure:

14%

Top 3 benefits of digital technologies:

- Improved efficiency
- Reduced costs
- Improved margins

Top 3 barriers to using digital technologies:

- Too expensive
- Lack of digital skills
- *Unsure on digital skills/capabilities*

>> Economic and Construction outlook

High inflation and weak wage growth are presenting challenges to Japan's economic recovery with economic growth expected to be less than 1% in 2024.[20] Over the longer term, Japan faces major challenges due to its rapidly ageing population and shrinking labour force.[21]

The construction industry in Japan supported 485,000 jobs in 2023, constituting 6% of total employment in Japan.[22] Japanese business reported average revenues of ¥8.4 billion Japanese Yen (JPY) for FY23. Revenues are forecast to increase by 8% over the next year, which is the lowest increase predicted out of surveyed markets.

>> Tech adoption

Japanese businesses are still in the early stages of their digital adoption journeys. On average, businesses were using 2.9 technologies, lower than any other market. This is likely to persist, with few businesses planning to increase their use of technology substantially, and the lowest share of expenditure on new technologies of all countries surveyed, at only 14%. These results align with other research showing Japanese businesses with scope to extend their use of technologies.[23]

However, Japanese businesses implementing technologies experience rates of return similar to other countries, suggesting that further adoption could deliver significant benefits. For example, Shimizu Corporation has deployed technology allowing a single worker to control multiple robots on a worksite, leading to significant labour productivity gains. Leveraging technology will be crucial for ensuring that construction businesses are able to continue operating efficiently.

>> Overcoming barriers to greater tech adoption

Japanese businesses see the cost of technology as the largest barrier to technology adoption, followed by skill gaps. The cost pressures may be compounded at present by inflation rates in Japan, which are above their historical average.

Skills gaps, particularly for digital technology, may be expected in Japan as an ageing population causes the workforce to shrink.[24] AI and machine learning, cybersecurity and data analytics were identified as skills gaps by over a third of Japanese businesses. Despite facing skills shortages as a barrier, Japanese businesses were the least likely to undertake measures to overcome skills shortages, with 58% of businesses hiring new workers and 66% upskilling existing workers compared to 75% and 80% in Asia Pacific. The Japanese government, which has accepted fewer immigrants compared to other countries, particularly those without university degrees, has begun to take steps to provide immigration opportunities for workers skilled in the construction sector, doubling its skilled worker cap to 820,000 workers over 5 years.[25] This aims at decreasing skills barriers, however, would need to be supported by technical training and recruitment from Japanese businesses.

Spotlight on Singapore

Average number of technologies used:

5.0 TECHNOLOGIES

New technology investment as a share of total expenditure:

21%

Top 3 benefits of digital technologies:

- Improved efficiency
- Reduced costs
- Enhanced customer relationships

Top 3 barriers to using digital technologies:

- Lack of digital skills
- Lack of budget
- *Staff reluctance to change*

>> Economic and Construction outlook

The Singapore economy is projected to grow by 2.4% in 2024, while its headline inflation is forecast to come in at 3.1%. Singapore's central bank raised their economic growth forecast in March 2024 mainly on expectations of faster growth in manufacturing and construction.[26]

499,000 construction jobs were supported in Singapore in 2022, constituting 7.4% of total employment.[27] Singapore businesses reported average revenues of $56 million Singapore Dollars (SGD) for FY23. Revenues are forecast to increase by 10% over the next year. This forecast growth is the second lowest out of surveyed markets.

>> Tech adoption

Singaporean businesses are planning to rapidly expand their use of digital technology. The average Singaporean construction business is planning to implement an average of 7.0 further technologies – more than any other country, and are investing more than 20% of expenditure in new technologies. In particular, Singaporean businesses are prioritising AI deployment, with over 98% of businesses considering AI important to their business' growth, the highest share of any country.

This has been substantially driven by government policy, with its Built Environment Industry Transformation Map (ITM) prioritising 'common data standards' and the use of BIM being mandated.[28]

Interestingly, technologies were less likely to be rated as delivering strong returns than any other country at 68%. In particular, building information modelling (BIM) and construction wearables were rated as successful far less often than in other countries.

>> Overcoming barriers to greater tech adoption

Singaporean businesses highlight a range of barriers to technology adoption. For Singapore, the most identified barrier to technology adoption is a lack of skills, however, only 34% of businesses identify this, compared to 21% for the least identified, a lack of leadership support.

Research by The Economist has found that digital skills are most in-demand by Singaporean employers,[29] and high demand for workers can result in overall skill shortages for workers with digital skills, meaning the construction industry may struggle to recruit or retain these workers.

Despite skills gaps, Singaporean businesses were the most likely to find actions to reduce skill gaps not effective. While 79% of Singaporean businesses had hired new workers, 32% found this strategy not effective, which is well above Asia Pacific average of 16%.

Spotlight on India

Average number of technologies used:

7.5 TECHNOLOGIES

New technology investment as a share of total expenditure:

28%

Top 3 benefits of digital technologies:

- Improved efficiency
- Reduced costs
- Enhanced customer relationships

Top 3 barriers to using digital technologies:

- Lack of digital skills
- *Unsure on digital skills/capabilities*
- Too expensive

>> Economic and Construction outlook

The Indian economy is projected to grow by a rapid 6.9% in 2024, continuing a period of healthy economic growth. Domestic investor sentiment is improving linked to improved corporate sector profitability and a healthier banking sector. Annual inflation is forecast to moderate to around 5% in 2024, with the ongoing challenge of modernising India's economy.[30]

Rapid urbanisation is one of the most important trends in the Indian economy, with more than 70% of GDP expected to be produced in cities by 2030.[31] The construction sector will face strong demand to build the homes, workplaces and infrastructure required to support a growing urban population. 13% of all Indian employees worked in the construction industry in 2023.[32] The industry is also set to grow with revenues are forecast to increase by 17% over the next year. This forecast growth is the highest out of surveyed markets.

>> Tech adoption

Indian businesses are leading the way for technology adoption, using more technologies and investing more in technologies than businesses in any other market considered in this research. On average, 28% of business expenditure was invested in new technologies.

Mobile apps (in use by 57% of businesses), construction wearables (61%) and prefab and modular construction (55%) were used by a greater share of Indian businesses than any other country. These investments have been successful, with businesses rating 85% of their technologies as delivering strong business returns – 6 percentage points higher than the overall average. For example, Eversendai recently utilised BIM technology to deliver the complex 'Statue of Unity' project two months ahead of schedule, with engineers assessing the efficiency gain from BIM at close to 25%.[33]

These findings mirror previous research by Deloitte Access Economics which identified Indian businesses as leaders in the use of data for construction operations and environmental sustainability.[34]

>> Overcoming barriers to greater tech adoption

A lack of skills is by far the common barrier to technology adoption in India, with 13% more businesses reporting it as a top 3 preference than the next most common barrier, cost of technologies. Indian businesses most frequently report technical skill gaps in AI and machine learning, BIM and cybersecurity, with 90% of businesses experiencing technical skill gaps.

Indian businesses are the most likely market in Asia Pacific to take action over skill gaps, with 90% upskilling existing workers and 86% hiring new workers to alleviate skill gaps. They are also the most likely in Asia Pacific to find these actions highly effective, with 35% finding upskilling highly effective and 43% finding hiring new workers highly effective, compared to 20% in Asia Pacific for both.

Spotlight on Malaysia

Average number of technologies used:

6.9 TECHNOLOGIES

New technology investment as a share of total expenditure:

23%

Top 3 benefits of digital technologies:

- Reduced costs
- Improved efficiency
- Improved competitive advantage

Top 3 barriers to using digital technologies:

- Too expensive
- Lack of digital skills
- Lack of budget

>> Economic and Construction outlook

Malaysia grew by 3.8% in 2023 and is expected to grow a further 4.3% in 2024.[35] The Malaysian Ringgit fell to the lowest levels in 26 years in early 2024, impacted by high interest rates in the US and slow growth in China affecting Malaysian exports. Malaysia's inflation rate was contained at 2.5% in 2023.[36]

The construction industry in Malaysia supported 14% of total employment in 2023. Malaysian business reported average revenues of RM1.1 billion Malaysian Ringgit (MYR) for FY23. Revenues are forecast to increase by 13% over the next year. This forecast growth is the second highest out of surveyed markets.

>> Tech adoption

Malaysia is a leader in the adoption of technology, both using more technologies and investing a higher share of expenditure in new technologies than average.

This has been driven by government planning and investment, with the government's Construction Strategy Plan 4.0 building on previous strategies to facilitate digitalisation and the implementation of emerging technologies in the sector. As a result, businesses are undertaking long-term strategic planning, with 48% of businesses having an effective, organisation-wide strategy for adopting new technologies, the highest of any country and more than twice the rate of Australian, Japanese or Hong Kong-based businesses.

Malaysian businesses have a particular advantage in the use of technology for building design, with the highest share of businesses using BIM of any country in the survey, and the most successful implementation of this technology.

>> Overcoming barriers to greater tech adoption

The cost of technologies (50%) and skill gaps (49%) are the main barriers to technology adoption in Malaysia. Businesses most commonly face technical skill gaps in AI and machine learning (48%), cloud-based construction management software (44%) and cybersecurity (38%).

For technology adoption, Malaysian businesses find that project management (52%), leadership (44%) and conflict resolution (40%) are the most important skills. This contrasts the rest of Asia Pacific, where conflict management is rarely highlighted as an important skill.

Overall in Malaysia, digital skills are the top focus in Malaysia, with basic digital skills remaining the largest skill gap.[37] To address skills gaps, the International Labour Organisation and Master Builders Malaysia have coordinated to increase the representation of young people and women in the construction industry.[38] This aims to improve education among these groups, particularly in specialised trades.

Spotlight on Hong Kong

Average number of technologies used:

6.5 TECHNOLOGIES

New technology investment as a share of total expenditure:

25%

Top 3 benefits of digital technologies:

- Reduced costs
- Improved efficiency
- Improved competitive advantage

Top 3 barriers to using digital technologies:

- Not aware of these technologies
- Lack of digital skills
- Lack of budget

>> Economic and Construction outlook

Hong Kong's economy grew by 3.2% in 2023. Further modest growth of 2.8% is projected for 2024. Hong Kong continues to face challenge due to post-pandemic recovery, China's slowdown and geopolitical tensions as China tightens control.[39]

The construction currently employees 10% of the Hong Kong workforce.[40] Businesses in Hong Kong reported average revenues of 975.4 million Hong Kong Dollars (HKD) for FY23. Revenues are forecast to increase by 12% over the next year. This forecast growth is mid-range compared to other surveyed markets.

>> Tech adoption

Businesses in Hong Kong are looking to increase their use of digital technologies. Despite relatively low current levels of technology use, Hong Kong-based businesses are planning on implementing the second-most technologies in the future, with the average business planning to more than double their use of technology. This is reflected in businesses' expenditure, with businesses investing an average of 25% of expenditure on new technologies, the second-highest of all countries.

Digital twins were a strength for Hong Kong, with more businesses using and succeeding from using this technology than any other country. AI is another key focus for Hong Kong's businesses, with the second highest share of businesses considering it important for the future. MTR, Hong Kong's train system operator, has already deployed AI technology to assist with coordinating construction and maintenance with services on one of the busiest metro systems in the world.[41]

>> Overcoming barriers to greater tech adoption

Hong Kong businesses have the most varied barriers to greater technology adoption, with a difference of only 12% between their most and least common selected barrier.

Businesses in Hong Kong have the highest level of technical skills gaps in Asia Pacific, with 94% of businesses experiencing a skills gap. In particular, AI and machine learning is a common skill gap, along with design for manufacture and assembly. Data analytics are the least common skill gap, with only 20% of businesses reporting a gap. There is supported by other research, which found a large talent gap in skilled professions in Hong Kong, with the Royal Institution of Chartered Surveyors (RICS) estimating that there is a 20% gap in skilled professionals.[42]

Despite reporting skill gaps, Hong Kong businesses are the most likely to report that their employees have all the technology-related technical skills they require for current business operations.

Adopting advanced technologies at Straits Construction Singapore

Straits Construction Singapore is an industry leader in technology integration in construction, focusing on residential, commercial, and industrial projects in Singapore over the last 50 years.

Edmund Leong, head of ICT, BIM (building information modelling) and VDC (virtual design and construction) at Straits Construction Singapore, recognises the importance of bringing emerging digital technologies into traditional construction sites, helping to streamline the building processes from design to completion.

Relying on automation, robotics and BIM as well as other Autodesk products, Straits has established one of Singapore's leading prefabrication hubs, under Greyform. In fact, Greyform was one of the early adopters of robotics for precast manufacturing in Singapore. During the design stage of a construction project, Greyform can provide a catalogue of precast components so designers and contractors have visibility over the prefabricated elements from design to installation. This improves accuracy for production and predictability of timelines, reducing the resources and time required. According to Edmund:

> ***"The catalogue of precast components we have created in the system is able to surface changes upfront in the design cycle, meaning the fabricators can pre-empt the production they need to do. The precast manufacturing turnaround timelines are increasingly getting very compact, so the precast catalogues allows us to increase the predictability of project delivery."***

Straits have also been exploring the use of visual data gathered from their sites to monitor site progress and improve worker safety. Digital cameras on tower cranes provide a bird's eye view of construction sites. This is paired with visual analytics software, which can immediately detect if employees are in zones that have not yet been cleared, avoiding the potential for accidents. Straits are also adopting similar techniques to perform project progress monitoring and taking stock of deliverables at the project site. Edmund shares that:

> ***"We are taking stock of the visual data that we already have, which was not as appreciated in the past. It enables us to reflect upon risk and be more preventive rather than reactive to any situation that happens on the ground."***

Given the recognition software adopted by Straits has been developed overseas, it is often limited by context, particularly for prefabricated works. Edmund admits this has been a challenge, but Straits is working to adapt it to their own local construction context.

Another key barrier noted by Edmund is that education can often not keep up with the rapid pace of technology development. Additionally, the adoption of digital technologies means the redefining of existing roles. Straits realises the need to accommodate this shift and the importance of providing additional on-the-job training to facilitate the adoption of digital technologies, noting that:

> ***"Even within the organisation, roles are constantly being redefined, meaning employees can find it difficult to absorb some of the new technologies. It will be a journey in terms of education and realising opportunities for creativity, even with automation and robotics."***

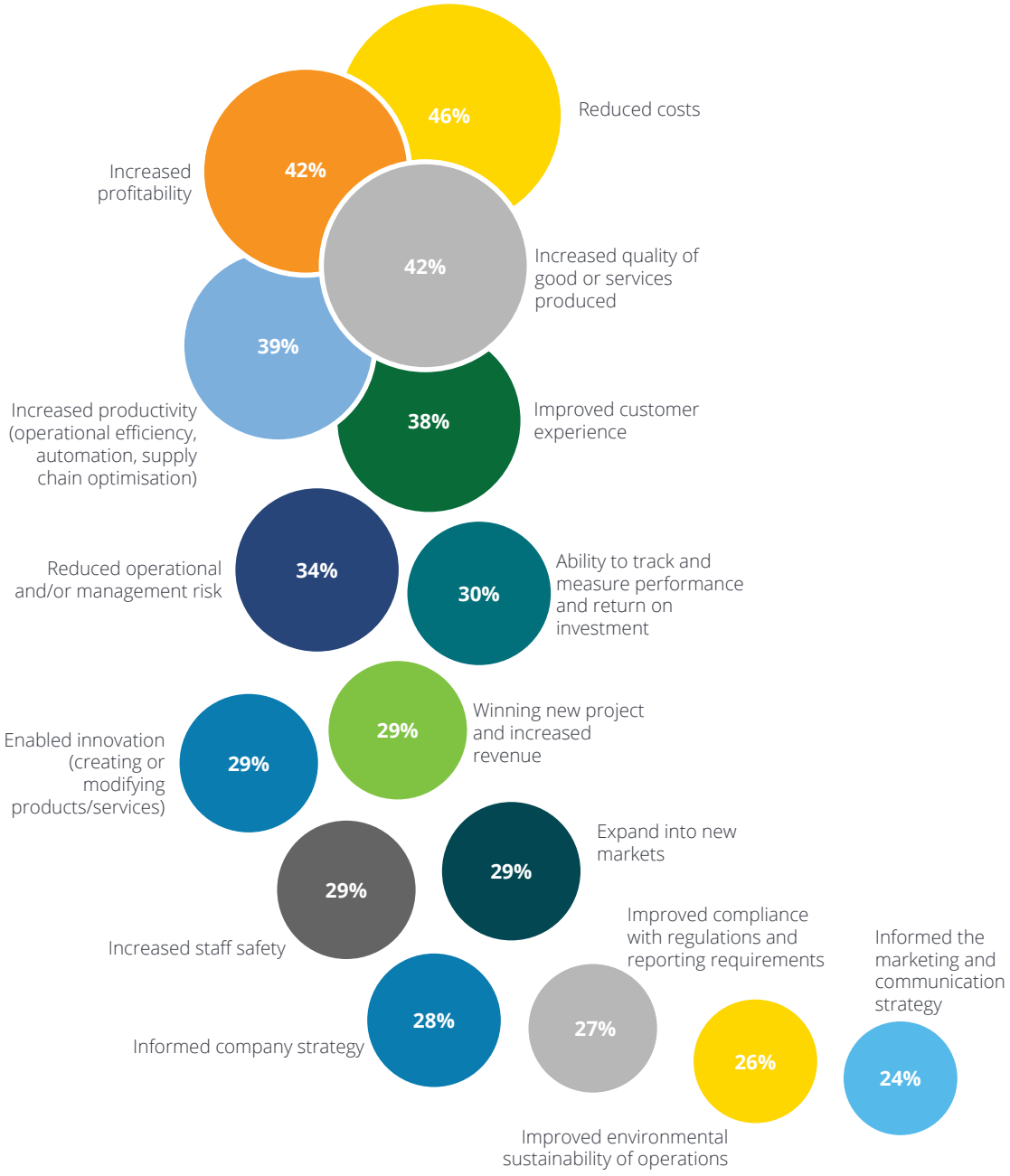
Looking towards the future, Edmund sees great promise in artificial intelligence (AI), although he admits it is still an emerging trend in construction. With Straits having an integrated business model from design and construction, he sees AI as a tool that could simulate workflows and identify solutions to conduct advanced feasibility studies incorporating the social elements in the design stage that are often difficult to quantify, such as how to minimise noise and maximise natural light in a unit complex.

4. The dividend from greater technology adoption

Digital technologies can address the key challenges facing construction and engineering businesses: lowering costs, improving efficiency and driving growth. With ongoing cost pressures and supply chain disruptions (kick started by the COVID-19 pandemic), businesses are being forced to adapt to new tools and ways of working, and are discovering the benefits that technologies can bring to their operations.

In fact, the most commonly cited benefit from introducing technology is directly linked to the key challenge facing construction and engineering businesses – reduced costs, which was cited by 46% of businesses. Other commonly cited benefits included increased profits (42%) and higher productivity (41%).

Chart 4-1: **Benefits observed since introducing new technologies**



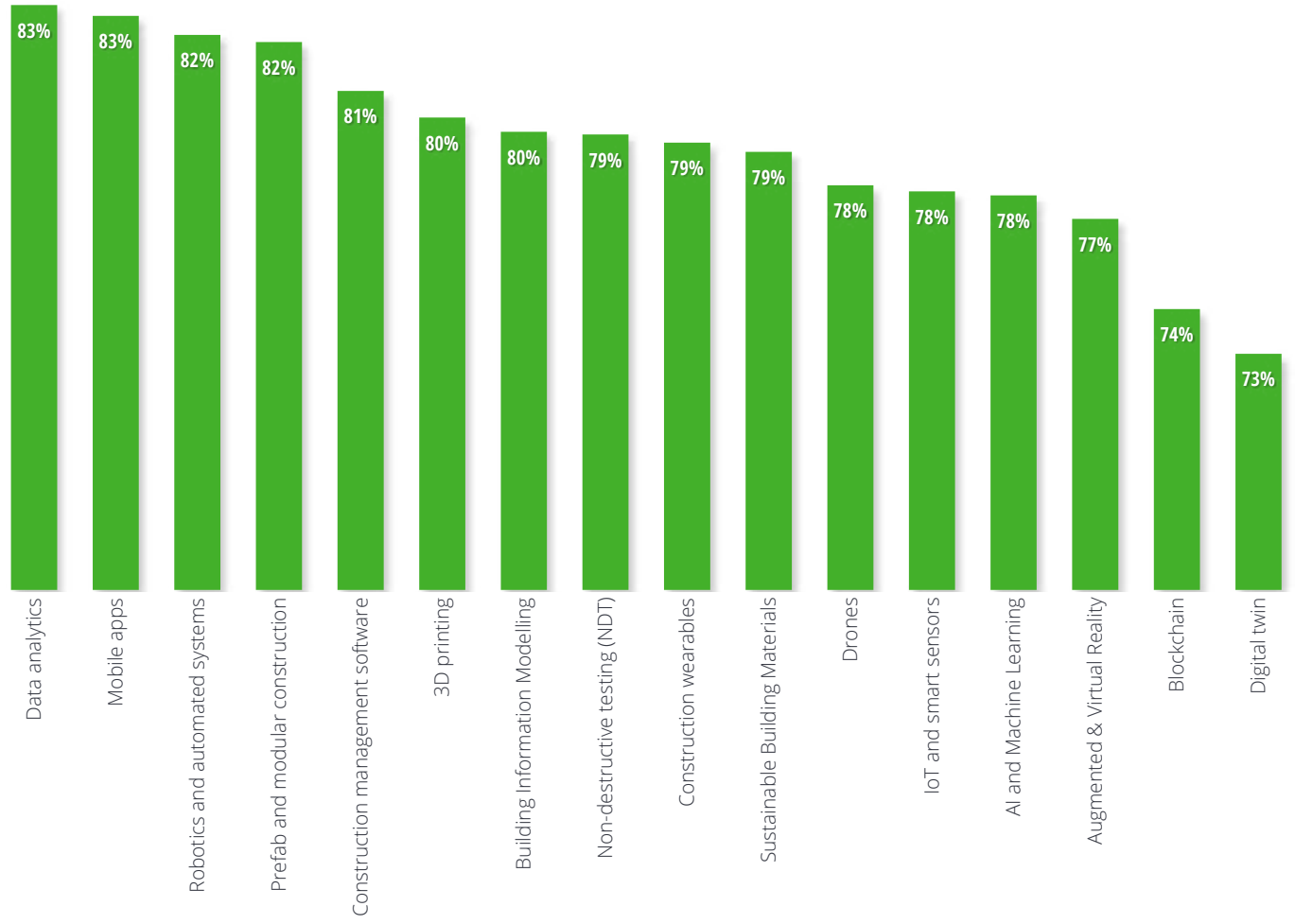
Source: Deloitte Access Economics based on construction and engineering business survey (2024).
Note: Businesses could select up to three benefits.
Sample: 744

Hansen Yuncken, an Australian construction business, provides an illustrative example of the benefits from adopting new technology processes. Spurred by pandemic-related restrictions and challenges, the company deployed drones and cloud-based analytics to capture real-time footage of worksites to be uploaded to cloud based project files, allowing workers to remotely track progress of a project and share with relevant stakeholders. This technology has continued to be utilised post-pandemic – **contributing to savings of AUD $20 million on a recent major project by assisting with cost-saving redesigns.**[43]

In fact, almost all businesses that introduced technologies found that they delivered strong business returns or a positive return of investment. The technologies that generate strong business returns are the key enabling technologies – with data analytics, mobile apps, robotics, prefab and modular construction and construction management software all generating strong business returns over 80% of the time as shown in Chart 4-2. Even the least successful of these technologies, digital twins, were rated as being successful 73% of the time by businesses that introduced the technology.

These success rates improved even further when three key enabling technologies – data analytics, mobile apps and construction management software – were already in use in the business. These businesses were between 5-15% more likely to rate their implementation of other technologies as more successful, with every single technology seeing a benefit. **Advanced technologies saw the largest increases in successful implementation, such as augmented and virtual reality (15%), AI and machine learning (13%) and digital twin (11%).**This demonstrates that establishing a baseline of enabling technologies helps to prepare businesses for successful adoption of more advanced technologies.

Chart 4-2: **Share of businesses experiencing strong business returns or a positive ROI once implemented**



Source: Deloitte Access Economics based on construction and engineering business survey (2024).
Sample: 780

Improved project and financial performance from tech

Businesses with higher rates of digital adoption are already seeing impacts on project performance, with more projects being delivered on time and on budget as a result of digital technologies. . While our survey found that only half of projects were delivered on time and on budget, econometric analysis found that adoption of digital technologies can improve the likelihood that a project was delivered on time or under budget. Adopting one additional technology was found to lead to a 0.75% increase in the share of total projects delivered under budget and a 0.5% increase in the share of projects delivered on time, after accounting for a business' size, years in operation and location.

These benefits also extend to financial performance as well. An additional technology is associated with a 1 percentage point increase in profit growth and a 1.4 percentage point increase in revenue growth over the past year.

›› For a business with $100 million in revenue and $20 million in profit, adopting an additional technology is associated with:

$1.4
million higher
revenue growth

$200,000
higher
profit growth

0.75%
more projects delivered
under budget

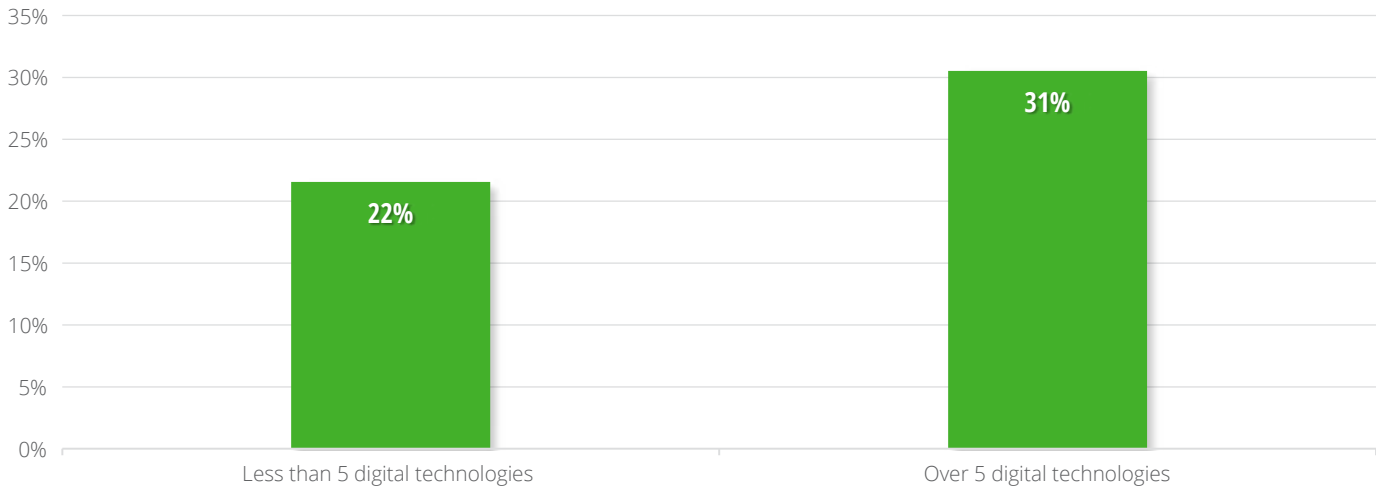
0.5%
more projects delivered
on time

Access to international markets

Access to international markets was identified by businesses as the most rapidly growing source of new business, with more than double the number of businesses selecting this option compared to the 2023 survey. Digital technologies enable further international growth by supporting scale and allowing staff to collaborate with colleagues and customers around the world.

Businesses using a higher number of digital technologies were 40% more likely to have international operations. 31% of businesses using more than 5 digital technologies had international operations, compared to 22% of those using less than 5.

Chart 4-3: **Share of businesses with international operations**



Source: Deloitte Access Economics based on construction and engineering business survey (2024).
Sample: 933

Integrating digital technologies at Sunway Group

Sunway Group is a leading conglomerate in Malaysia, with a portfolio in construction and real estate. Sunway Group has 20 million m^2 of property across Malaysia and further construction operations in Singapore, India and Vietnam among others.

Ziqing Liew, Head of Digitalisation, Development and Delivery at Sunway Property, explains the important role digital technologies have in Sunway to connect expertise in the business, streamline knowledge sharing and improve safety practices.

Since its introduction, the use of the Autodesk Construction Cloud as a common data environment (CDE) has been pivotal for Sunway. The company currently maintains approximately 60 active projects on its CDE platform, where more than 100 of its external consultants, contractors and subcontractors can access project data. Before the adoption of a CDE, Sunway was using multiple vendor-provided systems, which entailed cloud and on-premises offerings. Moving to a CDE has resulted in significant efficiency gains by enabling greater collaboration, simplifying the scaling of digital applications, and reducing reporting times and increasing transparency for reviews and administration. In particular, CDE has improved pre-delivery inspections, which ensures quality control in new builds. Before the adoption of a CDE, this was a very manual process, involving the use of colour tape to show issues. Ziqing shares that:

> ***"With the cloud-based digital tool being accessible on mobile devices or tablets, the client or any other project stakeholder can just walk on the site, take photos and immediately pin issues on the virtual drawing or 3D models. We can have 20-30 people doing this, simultaneously raising multiple issues relating to their area of inspection. Once the issue is raised, the system can then allow the user to allocate the type of issue to the responsible party for a resolution. The reporting and sharing of information is much faster due to this digital infrastructure, so we are able to speed up our project delivery time."***

The Cloud has further enabled other digital technologies, such as the use of AI too. In the past, Sunway's internal knowledge sharing platforms were decentralised and highly sensitive to keyword prompts. When OpenAI was released, Ziqing saw an opportunity to reduce their reliance on multiple point solutions and improve their processes to enable a more efficient flow of information with the development of an in-house solution. Sunway leveraged Autodesk technology to pull and synthesise information from their CDE platform into an AI system. This personalised and secure AI system uses Sunway's data to answer prompts asked by employees, helping to share knowledge across projects without extensive searches and labour intensive support. Ziqing notes that:

> ***"Even if you put information into a repository, people may not know how to find it. Previously, we would have to do a keyword search and parse through many documents. Now, with the use of AI, the return of information is much more relevant, making the knowledge search process faster."***

Sunway has also been using AI technology, paired with cloud, to improve worker safety. Previously, static images of non-compliances were captured by the users using their mobile phones and shared within the site for safety monitoring. However, this process was inefficient as it did not allow for real-time interventions in safety. Using image recognition and cloud technology has enabled Sunway to boost worker safety, providing live detection and identification of non-compliances in accordance with the safety protocols.

A key barrier to adopting more digital technologies has been reluctance towards change from certain stakeholders who are used to non-digital methods of working. Addressing concerns with transparency is key to helping the workforce transition according to Ziqing.

Ziqing sees digital technologies as crucial to improving Sunway's financial performance and incorporating sustainability considerations in their project delivery. Technologies such as Design for Manufacturing and Assembly (DfMA) and 3D printing, in conjunction with cloud technologies and AI, are currently being studied and used by Sunway to reduce errors and material waste, which in turn reduces the contingency costs and enhances sustainability.

5. Taking the next step

Overcoming barriers to technology adoption

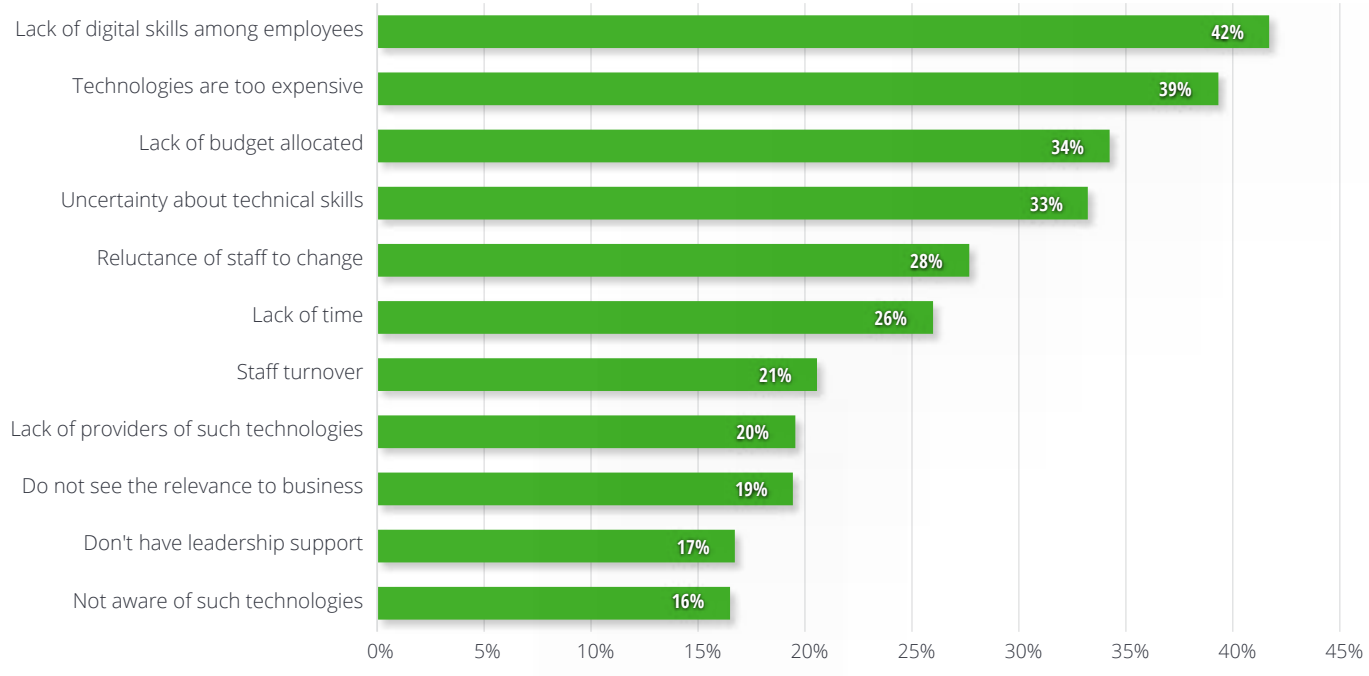
Business face a number of barriers to integrating digital technologies into their business operations. In fact, with 94% of businesses reporting they face barriers to adoption.

The most common barrier to adopting digital technology is a lack of digital skills among employees, cited by 42% of business across Asia Pacific.

Digital skills gaps are most commonly reported in Malaysia (49%), followed by India (48%). Interestingly the digital skills gap in Singapore has closed significantly over the last year, with 34% of businesses citing this as a barrier compared to 55% in the 2023 survey, making this the least commonly reported challenge. Larger businesses are more likely to report skills gaps as a barrier to digital adoption (43%) compared to smaller businesses (29%).

Businesses are increasingly citing the expense of technologies as a barrier to greater adoption. This has increased from being the sixth most common barrier in the 2023 survey to being the second greatest obstacle reported in 2024. Japanese businesses were most likely to report the cost of technology as a major barrier (50%) followed by 47% of Malaysian businesses and 35% in Australia. Relatedly, the third most common barrier reported by the industry globally was a lack of budget allocated to technology investments.

Chart 5-1: **Barriers to digital technology adoption**

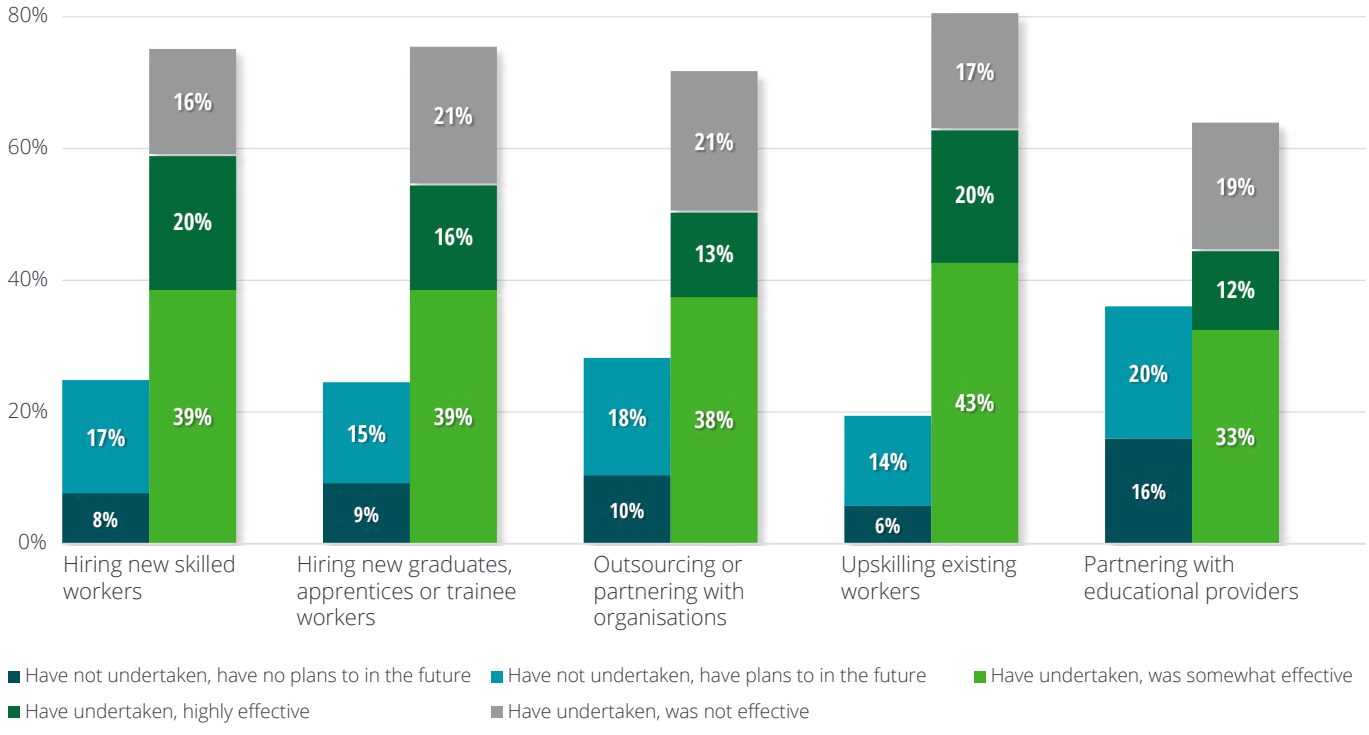


Source: Deloitte Access Economics based on construction and engineering business survey (2024).
Note: Businesses could select up to three barriers
Sample: 880

Addressing the digital skills gap

The prevalence of digital skills gaps across all countries and industries has been well documented, with **75% of businesses across Australia, Japan, Singapore and India identifying a significant digital skills gap in 2023.**[44] This poses a significant challenge within the construction and engineering industry, as businesses are forced to compete with other industries for a tight supply of in-demand digital skills. Countries reporting the high demand for and importance of digital skills included Singapore (69%), Japan and Malaysia (both 65%), whereas 69% of Australian businesses placed the highest value on self-management skills.[45] **Businesses are primarily seeking to upskill their existing workers first and foremost, with 81% reporting this as the most common and most effective approach to tackling the digital skills gap**. Other commonly reported solutions included hiring new skilled workers (75%), hiring graduates (75%), outsourcing (72%) and partnering with educational providers (64%) (Chart 5-2).

Chart 5-2: **Actions taken to address skills gaps**



Source: Deloitte Access Economics based on construction and engineering business survey (2024).
Sample: 933

Providing training for existing employees increases their capability to meet the specific digital needs of the business, without having to expend resources on recruiting externally. **85% of businesses currently offer some form of digital skills training, usually offered multiple times a year.** Businesses have shifted to more hands-on training delivery methods, with 42% providing digital skills training directly to employees. The provision of self-paced learning resources dropped to 33%, having been reported as the most common training delivery method in the 2023 survey. This is attributable to the introduction of India and Malaysia to the sample, which typically favour a more direct training approach.

Using digital technologies to drive change at Shapoorji Pallonji Engineering & Construction

Shapoorji Pallonji Engineering & Construction (E&C) has been involved in India's residential, commercial, institutional, and industrial construction for over 150 years. The company has now expanded its global reach to deliver projects in over 40 countries.

Sagar Gandhi, Head of Strategy and Business Excellence at Shapoorji Pallonji E&C, recognises that technology has transformed the way projects are completed at Shapoorji Pallonji E&C. Shapoorji Pallonji E&C has carefully identified and curated their technology stack across its business to solve its problems end to end with a goal that the technology will generate value for every user. According to Sagar:

> ***"The core philosophy of our technology implementation has been that it needs to be easily adaptable and scalable. We don't believe in technology shopping because every now and then, a new technology comes on the block, and people run behind it. Instead, our philosophy has been that you identify a technology that solves the problems you are currently facing."***

To integrate new technologies smoothly and effectively, Shapoorji Pallonji E&C created a standardised roadmap for integrating new technologies from identification and proof of concept to scaling across the business. An example of this integration is seen with SPACE, a digital platform used to connect employees, manage construction data, provide project management oversight, digitise site processes and eliminate manual data entry. Implementing the SPACE platform across a three-year roadmap enabled necessary safety and quality processes and reporting to be completely digitised.

The SPACE platform acts as a first level of review for issues commonly arising on projects, triaging and allocating tasks to relevant employees. Combined with the automation of data entry, report generation, and data tracking through dashboarding, SPACE has been pivotal in offsetting skills shortages in key areas and free up labour for more technical and specialised roles. Sagar explains that:

> ***"We have reduced about 65% of the time that safety and quality personnel spend on computers entering data or generating reports. Now, they have the additional bandwidth to find new ways to improve safety and quality on project sites."***

The company has adopted digital technologies such as Building Information Modelling (BIM) and Virtual Design and Construction (VDC) to streamline its operations and visualisation capabilities on projects. It has successfully completed over 200 building projects using BIM.

However, Shapoorji Pallonji E&C subsequently has faced challenges managing the vast quantities of data generated by its projects with these new technologies. As such, the company has also leveraged digital project management and Common Data Environment (CDE) software to collate project information from the beginning through completion and streamline the transfer of information between project planning, site work, billing, and field engineers. Clearer information flows have enabled less time to be spent on data generation and retrieval and more time on analysing the data to make informed decisions.

Given the complexities of the construction projects Shapoorji Pallonji E&C undertakes, multiple platforms are often needed to solve problems faced at different project stages. Shapoorji Pallonji E&C is currently investigating the integration of these platforms to ensure maximum value for employees, subcontractors, and clients.

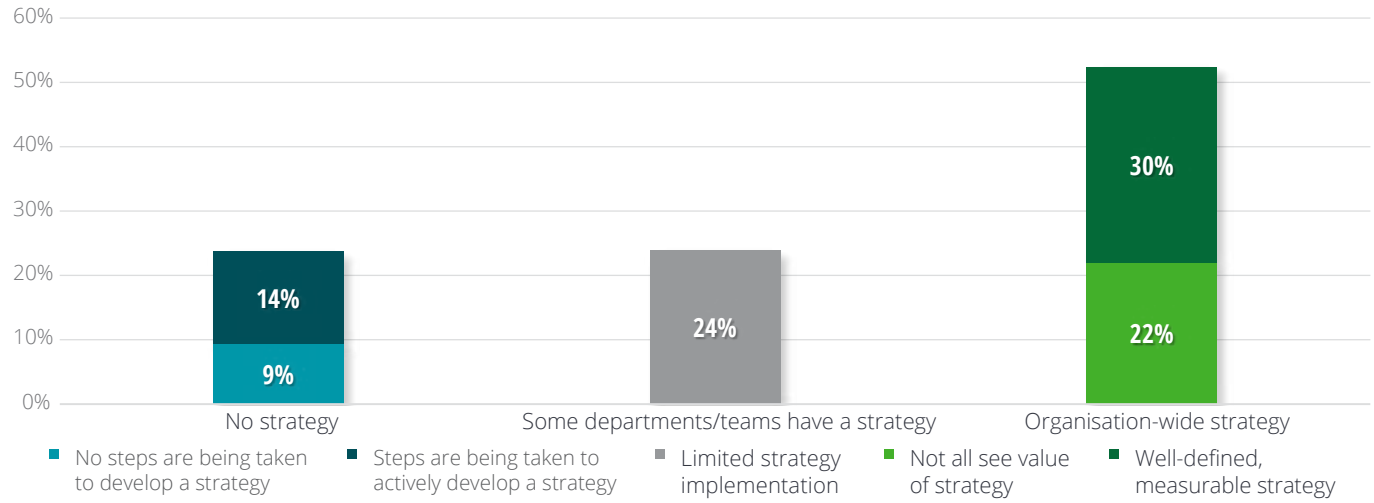
> ***"The solutions are coming in fragments. So from a project management perspective, you end up having three or four solutions doing three or four things. The largest uplift in value will come from a comprehensive end-to-end solution***

Looking ahead, Sagar expects that virtual reality (VR) and digital twin will help project managers easily access contextual data from one location and improve the speed and quality of construction output. Though he acknowledges that its adoption will be dependent on tailoring VR technology to this specific context and ensuring the degree of accuracy meets that of standards and regulations, Sagar sees it as an opportunity to more quickly and accurately identify and address issues arising on larger projects where it can be difficult to maintain oversight over each individual aspect of the build.

The importance of a digital strategy

A well-developed digital strategy can enable greater technology adoption and address budget constraints. By clearly identifying, prioritising and planning technology investments, a digital strategy is the key to unlocking the benefits outlined in Chapter 4. Over three quarters (76%) of businesses currently have a digital strategy in place, of which 30% are organisation-wide and highly valued (Chart 5-3). This represents a seismic shift since the 2023 survey, when just 65% of businesses had a digital strategy in place and fewer than one fifth saw the value of it.

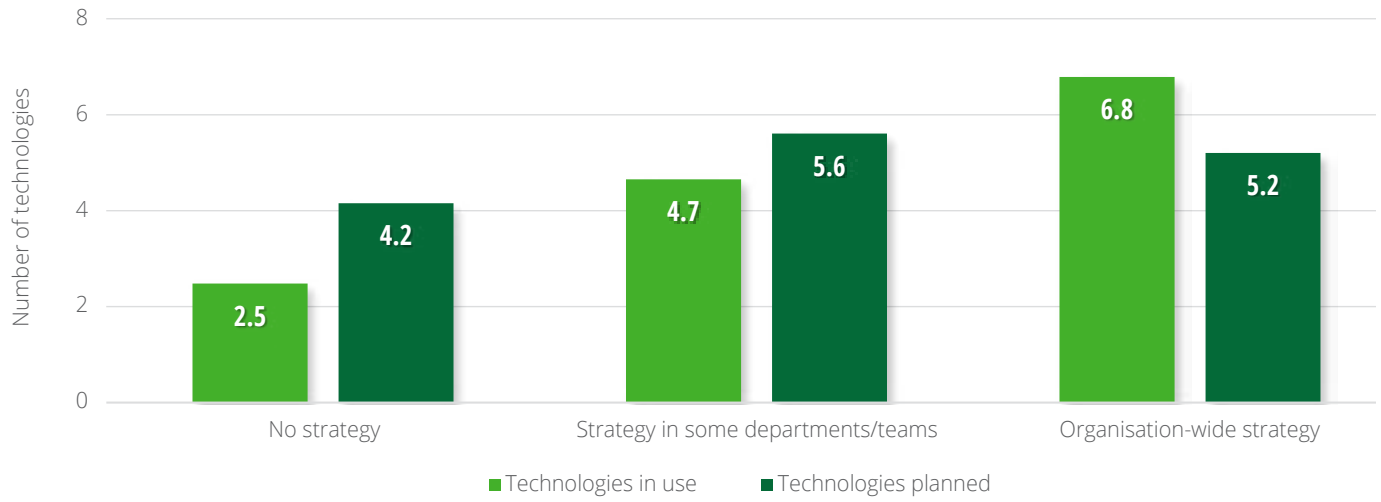
Chart 5-3: **Business strategy for adopting new technology for projects**



Source: Deloitte Access Economics based on construction and engineering business survey (2024).
Sample: 894

A strong digital strategy provides a roadmap to greater digital adoption, enabling businesses to clearly plan and grow their technological investments over time. Introducing an organisation-wide digital strategy is associated with driving both greater growth and higher technology adoption. **Businesses with an organisation-wide digital strategy have on average 4.3 more technologies in use than those without.**

Chart 5-4: **The relationship between digital strategy and number of technologies adopted**



Source: Deloitte Access Economics based on construction and engineering business survey (2024).
Sample: 894

Five priority actions to improve digital adoption

For businesses looking to improve the integration of digital technologies within their business operations, this report recommends focusing on the five key priority areas:

1. **Start small with digital transformation and account for change management costs when scaling up.** Digital transformation projects can be expensive and time consuming for a business that needs to continue operating while also trialling new devices or workflows. According to one study, 70% of digital transformation projects fail due to poor planning, with one common area being businesses failing to fully transition away from legacy systems, and failing to communicate change to employees and ensure they understand how to effectively use the new technology. These steps are critical for success but often get cut from a transformation project at the planning stage in order to reduce costs. The construction and engineering industry is realising the importance of planning with the number of businesses with a digital strategy increasing from 65% up to 76%. Yet less than a third have foundational components that make up the strategy – including considering budget being allocated. Ensuring the strategy accounts for a piloting phase for any new technology and having a detailed change management strategy when scaling up will be key to success. Businesses with an organisation-wide digital strategy that has an allocated budget have on average 4.3 more technologies in use than those without.

2. **Select champions of tech transformation in your business.** Any tech transformation project that transitions from pilot phase to full roll out needs a champion in the business to internally promote the project. Motivation for change can wane after a successful pilot due to a long roll out phase or unexpected challenges when the scale of implementation increases. Having a champion in the business that advocates the need to continue on the journey will help overcome fatigue or setbacks in the project. There also will likely be lessons from the pilot phase or the initial implementation phase that a champion of tech transformation will help to address in larger implementation stages to develop a best practice when rolling out and using the solution. Businesses should actively look for and support the tech transformation champions within their staff by actively fostering Learning from other champions across the business.

3. **Track a range of measures of success when it comes to digital adoption.** With the cost of technology being the second most cited barrier to digital adoption, there is an increasing need to demonstrate a Return on Investment (ROI) on the use of technologies to justify the initial investment. Estimating the ROI can be difficult in large construction projects when specific circumstances of the project differ widely, and other factors may influence project outcomes beyond the investment. New technologies may also require longer lead times to generate the ROI as employees become familiar with the technology. Not adequately capturing the impact of technology at a pilot stage can stifle the case for further investment. This will only be compounded in a more challenging business environment. Ensuring there is a plan to track progress before and after a new technology is introduced to measure improvements in efficiency, avoided cost and increased profitability are critical for justifying the investment. With these benefits taking longer to show up in the numbers means also having broader measures that account for employee use and satisfaction with the technology are important complements to also measure until financial benefits materialise or can be measured more accurately.

4. **Building the digital ecosystem.** Digital transformation needs to be inherently collaborative for success. The pace of change in the industry is only accelerating such that it becomes difficult to keep up with game changing technologies like AI. Listening and learning with other industry members and partnering with expert technology providers can help find the right solution for problems facing your business. Learning from the broader construction ecosystem means businesses can learn from each other and leverage the collective expertise within the industry.

5. **Ask whether your business is AI ready.** AI is expected to be as commonly used in construction as mobile apps with 94% of businesses expecting to implement it within their business. Understanding the different applications and uses for AI will be key to make sure businesses realise the potential of this technology. Training AI models on high quality internal data – whether financial, project, employee or customers – is expected to lead to the larger dividends compared to open-sourced models.

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Appendix A – Construction industry survey 2024

Data for this project was gathered using an online survey to understand trends affecting the industry, the use of digital technology and key barriers and enablers to greater digital technology adoption.

Respondents to the survey were either Chief Executive Officers, Directors, business owners or managers of a construction businesses with headquarters in Australia, Japan, Singapore, India, Malaysia or Hong Kong.

Respondents were provided a link to the survey through newsletters for construction businesses circulated by Autodesk and through Dynata, a survey provider.

A total of 933 businesses were surveyed. A breakdown of respondents is provided below.

A-1-1. Survey breakdown of location of headquarters

Table A-1: **Business breakdown by headquarters**

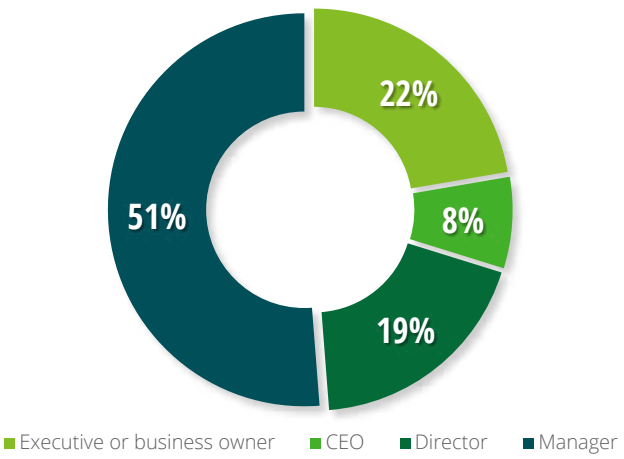
Economy	Number of Responses	Percentage of businesses
Australia	219	22%
Japan	215	23%
Singapore	107	12%
India	204	22%
Hong Kong	85	11%
Malaysia	103	9%
Total	**933**	**100%**

Source: Deloitte Access Economics based on engineering and construction business survey (2024).
Sample: 933

A-1-2. Survey breakdown of responder occupation

The responders to the survey held the following roles in their businesses: 478 responders were Managers (51%), 177 were Directors (19%), 208 were Executives or Business Owners (22%) and 70 were CEO's (8%).

Chart A-1: **Survey respondents by role in business**

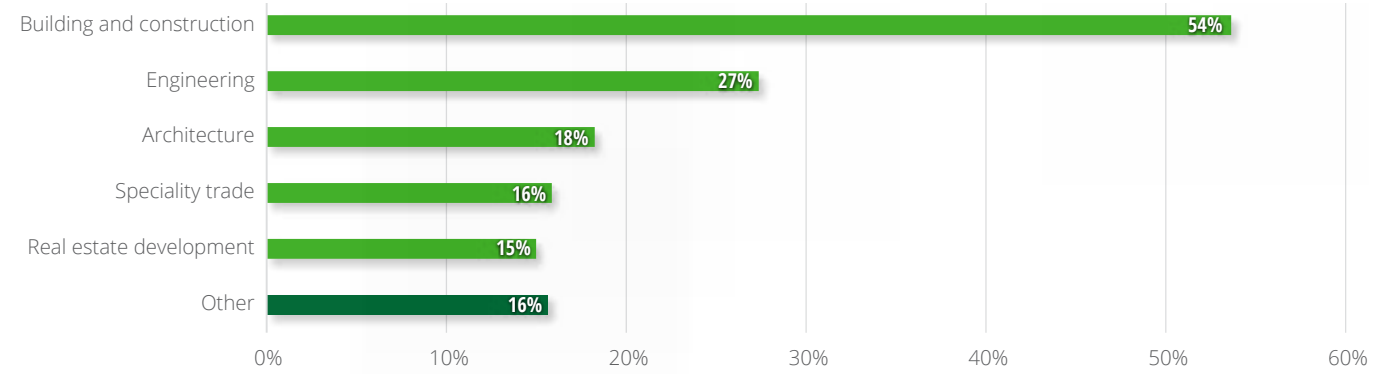


Source: Deloitte Access Economics based on engineering and construction business survey (2024).
Sample: 933

A-1-3. Survey breakdown of services provided and business size

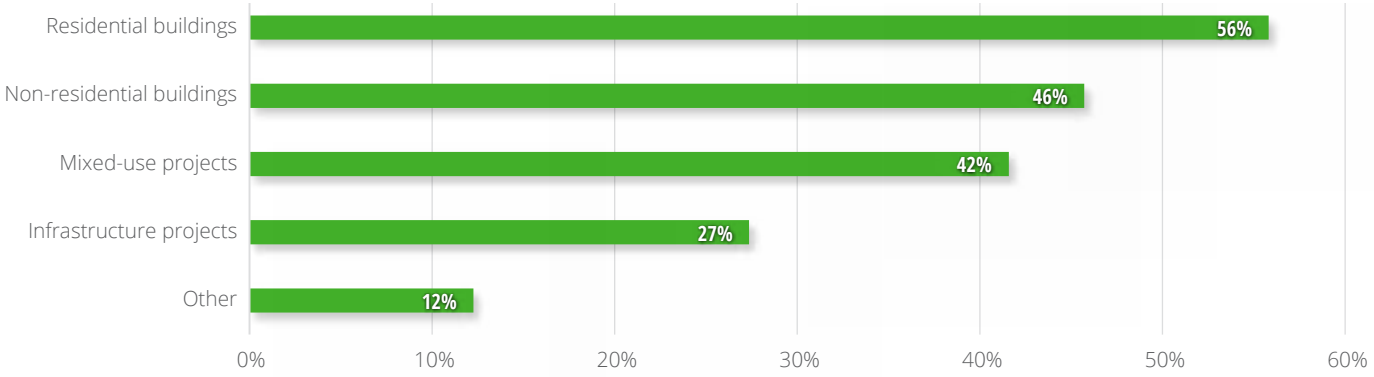
Businesses surveyed provided the following services: 498 businesses provided building and construction services (54%), 171 provided Architecture services (18%), 255 provided engineering services (27%) and 138 provided real estate development services (15%) and 146 provided specialty trade services (17%). Businesses may provide multiple of these services, with 41% providing at least two services or more. For the types of projects worked on, residential buildings were the most common, with 56% working on them. Business size covered a large range, with a notable increase in large businesses since the 2023 survey.

Chart A-2: **Business breakdown by service provided**



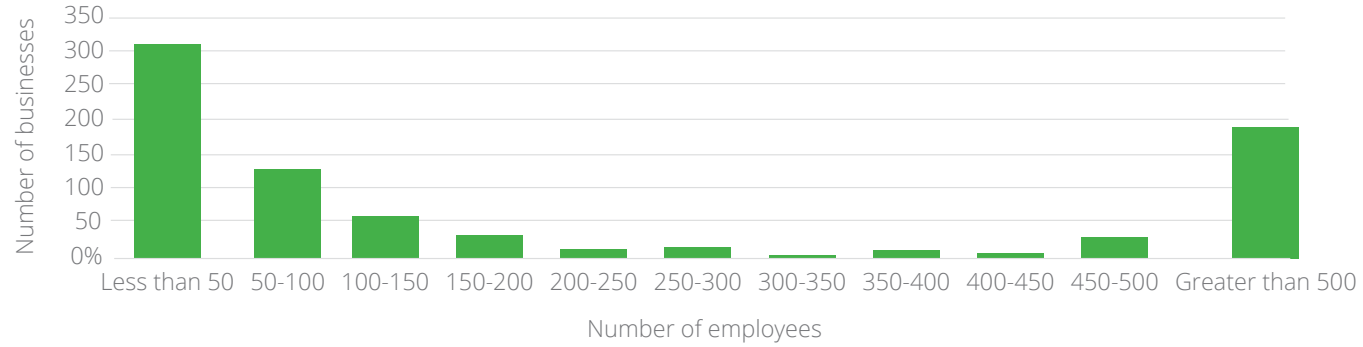
Source: Deloitte Access Economics based on engineering and construction business survey (2024).
Sample: 933

Chart A-3: **The types of projects worked on**



Source: Deloitte Access Economics based on engineering and construction business survey (2024).
Sample: 933

Chart A-4: **The size of businesses by number of employees**



Source: Deloitte Access Economics based on engineering and construction business survey (2024).
Sample: 829

A-1-4. Use of digital technologies

Businesses were asked about the use and intentions to adopt 16 different technologies applicable to the AEC industry. A summary of responses are provided below.

Table A-2: **Use and intentions of digital technologies responses for all businesses**

	Not aware of such technology	Not using and we do not have plans to implement in the future	Not yet, but planning to implement in the future	Using it already
Drones	7%	34%	31%	29%
Digital twin	21%	25%	33%	21%
3D printing	5%	30%	31%	33%
Building Information Modelling (BIM)	12%	21%	29%	38%
Non-destructive testing	11%	26%	31%	32%
Artificial Intelligence and machine learning	6%	26%	39%	30%
Prefab and modular construction	8%	25%	28%	40%
Robotics and automated systems	9%	30%	39%	22%
Construction wearables	11%	24%	28%	37%
Construction management cloud software	7%	22%	28%	43%
Sustainable building materials	10%	23%	31%	36%
Blockchain	11%	32%	32%	25%
Augmented, virtual and mixed reality	8%	33%	35%	24%
Internet of things and smart sensors	8%	24%	33%	35%
Data analytics	8%	20%	26%	47%
Mobile apps	7%	20%	32%	41%

Source: Deloitte Access Economics based on engineering and construction business survey (2024).
Sample: 933

A-1-5. Barriers, trends, and sources of growth

Businesses were asked about barriers to growing the use of technology, trends impacting on their business operation, and main sources of growth for their business. A summary of responses, broken down by location of headquarters is provided below.

Table A-3: **Use and intentions of digital technologies responses for all businesses**

	Overall	AU	JP	SG	IN	MY	HK
Barriers to growing use of technology (top 3)							
Staff turnover	20%	21%	12%	24%	21%	17%	27%
Reluctance of staff to change	28%	29%	26%	31%	28%	22%	21%
Lack of digital skills among employees	42%	34%	41%	34%	48%	49%	31%
Don't have leadership support	17%	13%	15%	21%	14%	21%	22%
Uncertainty about the required technical skills and capabilities	33%	26%	36%	27%	37%	31%	28%
Do not see the relevance to business	19%	21%	20%	25%	12%	15%	21%
Lack of time	26%	29%	24%	29%	21%	21%	24%
Technologies are too expensive	39%	35%	47%	29%	35%	50%	24%
Lack of budget allocated	34%	32%	35%	34%	30%	39%	29%
Lack of providers of such technologies	19%	19%	13%	24%	21%	15%	26%
Not aware of such technologies	16%	18%	7%	22%	14%	11%	33%
Challenges impacting business operation (top 5)							
Lack of workers with suitable skills	41%	46%	43%	40%	39%	40%	23%
Supply chain challenges	26%	36%	14%	26%	29%	29%	22%
Cost of raw materials	47%	51%	43%	37%	49%	59%	40%
Staff turnover	25%	25%	25%	32%	21%	23%	35%
Economic uncertainty	46%	49%	53%	45%	33%	55%	45%
Regulations and compliance requirements	27%	30%	25%	33%	23%	23%	30%
Inability to access investment/capital	16%	12%	10%	22%	17%	23%	19%
Higher labour costs	47%	51%	45%	40%	47%	51%	46%
Higher operational costs besides labour (rent, maintenance and repair, marketing, etc.)	40%	40%	43%	30%	44%	49%	31%
Unpredictable weather conditions	20%	21%	17%	25%	18%	26%	18%

Public health concerns	16%	9%	9%	25%	20%	17%	29%
Keeping up with industry technology developments	25%	20%	29%	23%	26%	22%	30%
Cybersecurity risks	21%	14%	25%	25%	21%	17%	29%
Changing customer demands	37%	34%	49%	32%	41%	17%	32%
Growing competition	40%	38%	43%	39%	47%	35%	32%
Meeting environment and/or social responsibility goals	23%	21%	22%	24%	25%	11%	37%
Main sources of growth (top 3)							
Winning more work (similar in size and complexity to the projects currently being won)	50%	55%	52%	59%	40%	48%	52%
Winning more work (that is higher value or more complex than projects currently being won)	58%	64%	58%	52%	51%	64%	58%
New technologies assisting delivery of project work	45%	32%	41%	48%	55%	51%	40%
New technologies for internal processes	43%	43%	38%	41%	49%	34%	46%
Access to new domestic markets	44%	44%	41%	40%	48%	43%	46%
Access to new international markets	38%	27%	41%	46%	34%	46%	46%

Source: Deloitte Access Economics based on engineering and construction business survey (2024).
Sample: 933

Appendix B – Economic modelling

Methodology and result

Businesses were asked about their use of 16 digital technologies, and the number of technologies that were indicated in use counted. The average number of technologies in use was 5.3, with responses covering the whole range from 0 to 16.

An ordinary least squares regression model was used to estimate the association between technology and several measures of business performance. Results controlled for businesses' country, age and size (using the categories for these characteristics from the survey). This ensures that estimates are not biased by the known correlations between these characteristics and business performance measures. The four metrics of business performance were:

1. Share of projects completed under budget
2. Share of projects completed on time
3. Reported profit growth over past year (%)
4. Reported revenue growth over past year (%)

The regression can be summarised by the equation:

$$y_i = \beta_0 + \beta_1 * \text{Number of Technologies} + \alpha * \text{Number of Employees} + \delta * \text{Age of Business} + \gamma * \text{Headquarters Location}$$

After controlling for businesses' size, age and location, technology use has a statistically significant, positive relationship with all four metrics of business performance. These results suggest that similar businesses that use more technologies perform statistically better in these metrics. The full regression results are below. These results should be interpreted with caution as other omitted variables, such as an innovative business culture, may be contributing to the greater performance and are being partially reflected in the technology variable. These results align with previous studies such as the 2023 report which found statistically significant results for expected revenue growth.

Table B-1: **Regression Results**

	Profit Growth (1)	Revenue Growth (2)	% of projects under budget (3)	% of projects on time (4)
count_techs	0.11*** (0.003)	0.014*** (0.003)	0.005*** (0.002)	0.007*** (0.002)
num_employees	0.00000 (0.00000)	-0.00000 (0.00000)	0.00000 (0.00000)	0.00000 (0.00000)
Hong Kong	-0.027 (0.050)	-0.004 (0.040)	0.029 (0.031)	0.036 (0.026)
India	0.046 (0.038)	0.104*** (0.031)	0.033 (0.025)	0.004 (0.020)
Japan	-0.071* (0.038)	-0.022 (0,031)	0.089*** (0.025)	0.00004 (0.024)
Malaysia	0.008 (0.047)	0.053 (0.038)	-0.018 (0.029)	-0.008 (0.024)
Singapore	0.065 (0.046)	0.029 (0.037)	0.034 (0.028)	0.009 (0.023)
More than 1 year, up to 3 years	-0.303 (0.232)	-0.303 (0.194)	0.245 (0.158)	-0.051 (0.107)
More than 10 years, up to 20 years	-0.380* (0.227)	-0.216 (0.191)	0.159 (0.155)	-0.106 (0.104)
More than 20 years	-0.367 (0.227)	-0.256 (0.191)	0.122 (0.155)	-0.143 (0.104)
More than 3 years, up to 10 years	-0.361 (0.227)	-0.235 (0.191)	0.206 (0.155)	-0.089 (0.104)
R^2 **Adjusted R^2**	0.059 0.043	0.111 0.097	0.048 0.033	0.058 0.044

*** indicates significance at the 0.01 level, ** indicates significance at the 0.05 level, * indicates significance at the 0.1 level

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