Digital Transformation: The Future of Connected Construction

An IDC InfoBrief | March 2020

IDC ANALYZE THE FUTURE

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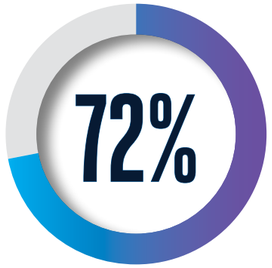
The state of digital transformation in construction across the globe

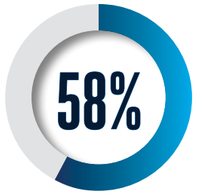
Why is digital transformation (DX) a priority for construction companies worldwide?



of construction companies worldwide said this is a key priority to drive much needed changes to their processes, business models and/or ecosystems.

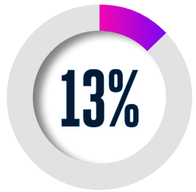
Through DX, construction companies can ensure operational excellence and improved customer engagement by effectively managing risk, completing projects on time and on budget, improving workforce safety and, overall, support infrastructure growth across world economies.

However, majority of these companies are still in the early stages of their DX journeys, with



of companies in stages* 1 and 2 out of 5.

In fact, only



of companies are well on their way to succeeding on their DX journeys.

This IDC InfoBrief takes a closer look at the worldwide construction industry and the challenges encountered by organizations as they embark on digitalization, the deadlocks they must surpass and the investments they must make to bring the industry into the digital era.

*The stages are defined on page 4 of this report.

The construction industry is ripe for digitalization

Many organizations worldwide have embraced DX and are bringing new innovations into their businesses. However, the construction industry has yet to fully reap the benefits of digitalization due to the unique challenges it faces compared to other industries.

Customer demand

Increased personalization brought forth by the utilization of digital technologies in improving customer experience is driving organizations to reassess their processes and business models. How can construction companies meet individual customer specifications without sacrificing assembly and material efficiency?

Competitive environment

The marketplace is evolving, where every industry is being disrupted and needs to keep pace. For the construction industry, this means being aligned with the level of progress expected by governments and the public sector.

Smart everything

Smart devices have become part of the fabric of everyday life. Worldwide, there is a proliferation of smart buildings and cities, along with green technology and sustainability initiatives to reduce waste generated from construction activities amounting to billions of dollars annually.

Political and economic factors

The construction industry is heavily affected all over the world – lower infrastructure spending and market demand, labor movement, rise in materials costs and decreased productivity vary across countries.

How can construction companies benefit from digital transformation?

Improved productivity and better performance

Automation and informed decision-making from a single source of truth for construction projects can lead to improved workflow, lowered costs, better resource management and faster turn-around times.

Connected construction

Cloud-based software and mobile apps ease collaboration among all stakeholders, from design to construction and inspection for better reporting and documentation, quality assurance and control.

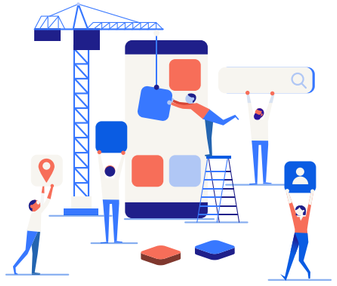
Safety and risk management

Digital technologies can be utilized for proactive onsite safety and risk management through offsite manufacturing, along with predictive maintenance.

Improved cost of construction

Creation of offsite, prefabricated materials and modular construction continue to gain popularity, addressing time constraints and costs.

Construction companies are still in the earliest stages of digital transformation



IDC defines digital transformation (DX) as the application of 3rd Platform technologies such as cloud, mobile, big data and social; coupled with organizational, operational and business model innovation to create new ways of operating and growing businesses.

Stage 1
Ad Hoc

DIGITAL RESISTER

Business and IT digital initiatives are disconnected and poorly aligned with enterprise strategy, and not focused on customer experiences.

Stage 2
Opportunistic

DIGITAL EXPLORER

Business has identified a need to develop a digitally enhanced, customer-driven business strategy, but execution is on a project basis. Progress is not predictable nor repeatable.

Stage 3
Repeatable

DIGITAL PLAYER

Business-IT goals are aligned at enterprise level around creation of digital products and experiences, but not yet focused on the disruptive potential of digital initiatives.

Stage 4
Managed

DIGITAL TRANSFORMER

Integrated, synergistic business-IT management disciplines deliver digitally enabled product/service experiences on a continuous basis.

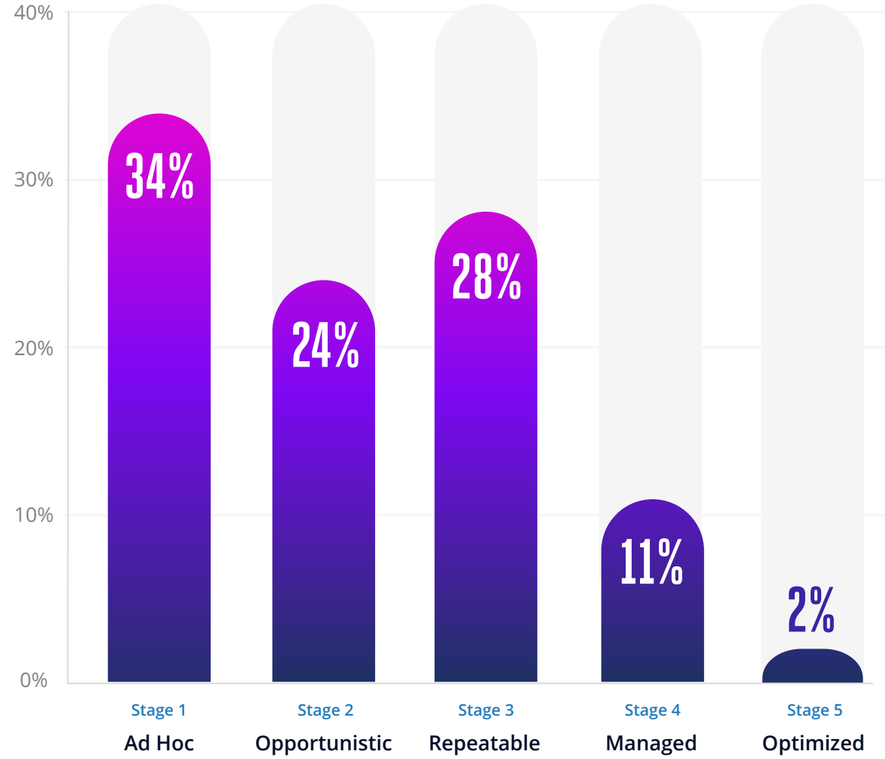
Stage 5
Optimized

DIGITAL DISRUPTOR

Enterprise is aggressively disruptive in the use of new digital technologies and business rmdels to affect markets. Ecosystem awareness and feedback is a constant input to business innovation.

Source:
IDC Digital Transformation MaturityScape Framework, 2015
IDC-Autodesk DX Construction Maturity Pulse, n = 835

Almost 60% of construction companies worldwide are only starting their DX journeys.



Note: Numbers may not be exact due to rounding.

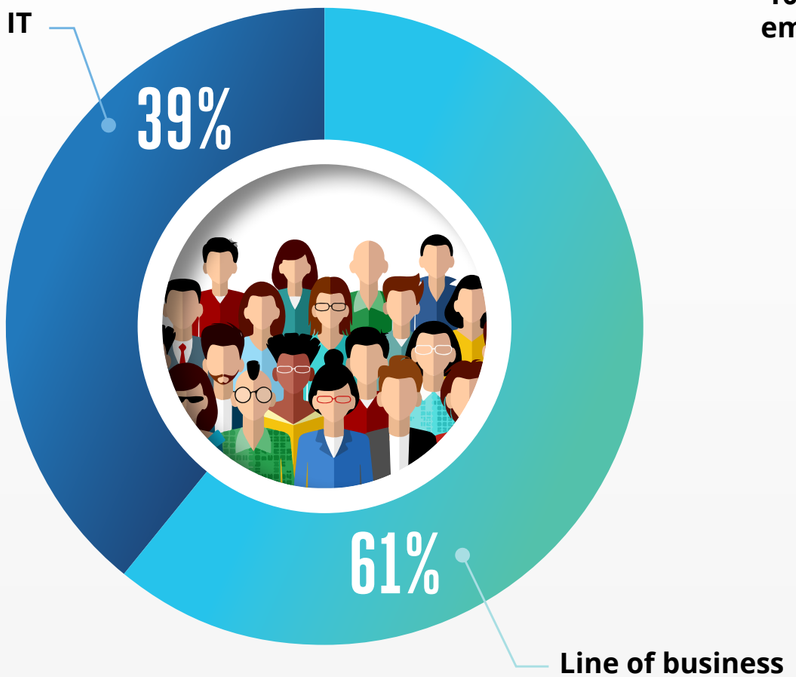
Methodology

The Digital Transformation (DX) Construction Maturity Pulse was conducted in April 2019 to assess organizations in 12 countries across Europe, Asia Pacific including Japan (APJ), and the Americas on their DX maturity, as well as their challenges, priorities and requirements in digitalizing, particularly looking at construction-specific challenges and priorities.

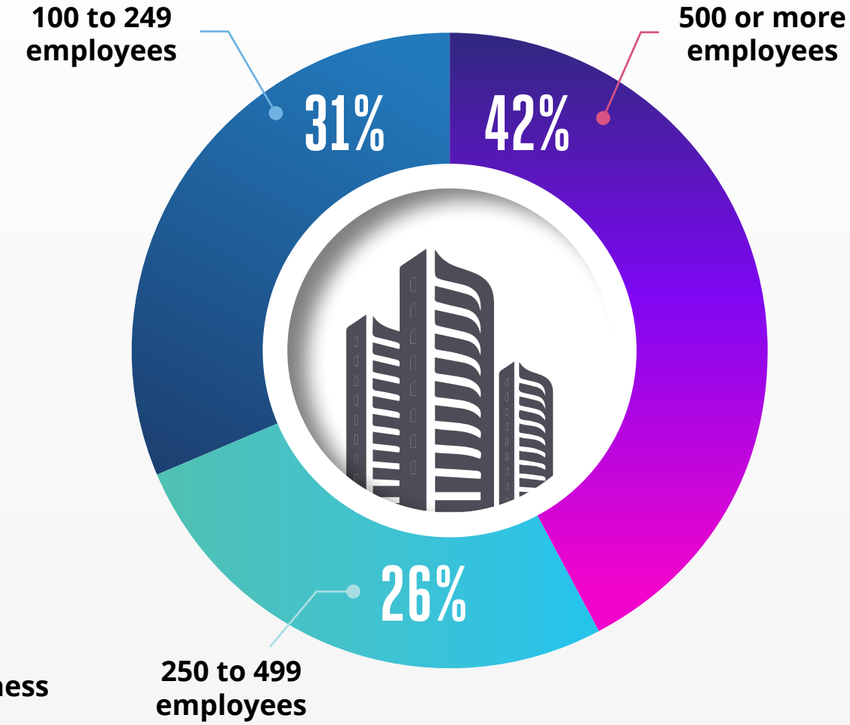
Country	Sample Size
UK	52
GERMANY	51
FRANCE	51
ANZ	44
CHINA	130
JAPAN	50
KOREA	50
INDIA	154
SINGAPORE	49
US	90
CANADA	69
BRAZIL	45
TOTAL	835

Demographics

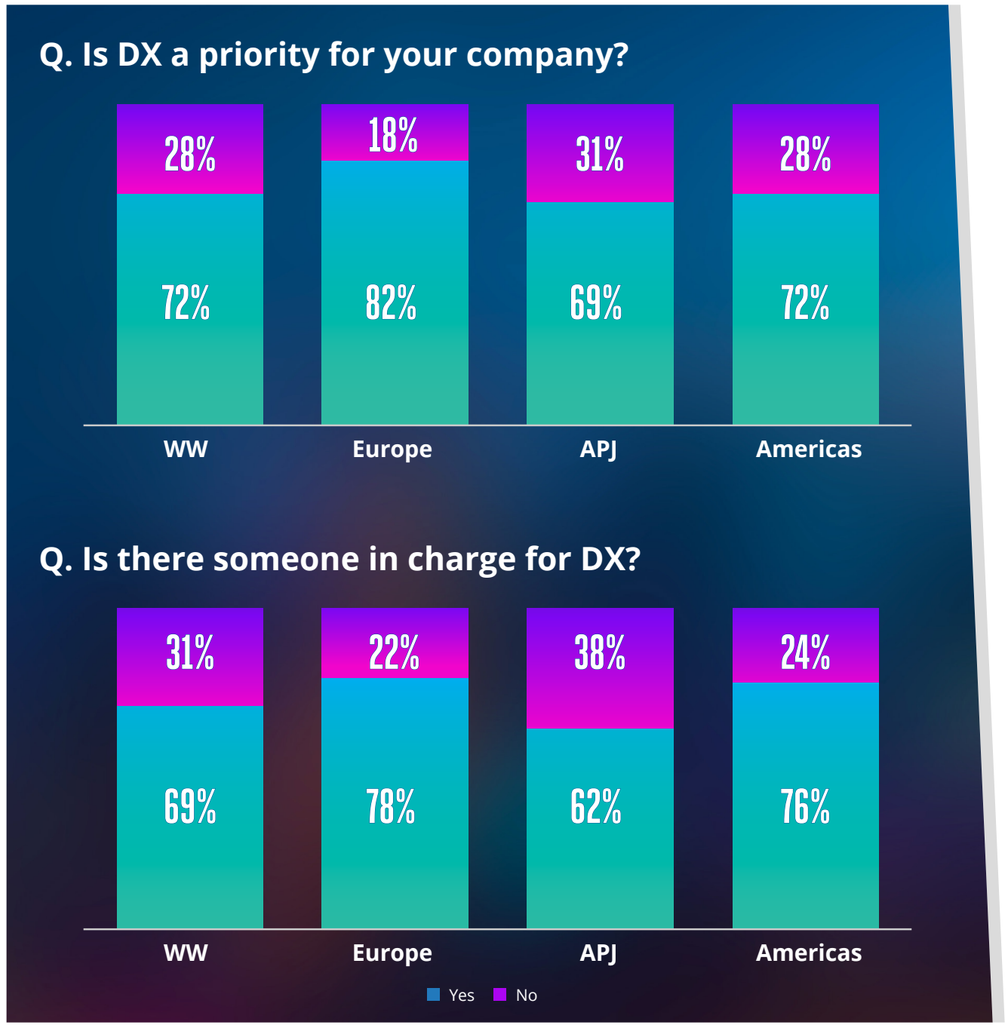
By Job Role / Function



By Company Size



How are construction companies prioritizing digital transformation?



of construction companies worldwide are prioritizing DX, which cuts across five different dimensions. DX allows organizations to evolve into a digital native enterprise (DNE), which can support innovation and digital disruption rather than enhancing existing technologies and models.

Leadership Transformation	Omni-Experience Transformation	Information Transformation	Operating Model Transformation	WorkSource Transformation
• Ecosystem awareness and insight • Business model innovation • Organizational and cultural disruption • Agile planning and governance	• Ecosystem experience definition • Continuous innovation orientation definition • Platform service delivery definition • Omni-dimensional marketing definition	• Data discovery • Value development • Value realization • Knowledge & collaboration • Information architecture	• Connected products/ services • Connected assets • Connected processes • Decision making • Organizational structure	• Manage talent • Source talent • Optimize work • Facilitate a digital transformation mindset
An "outside in" business environment	**Blended physical and digital experiences**	**Information as a competitive advantage**	**New digital revenue streams**	**Ecosystem-based workforce**

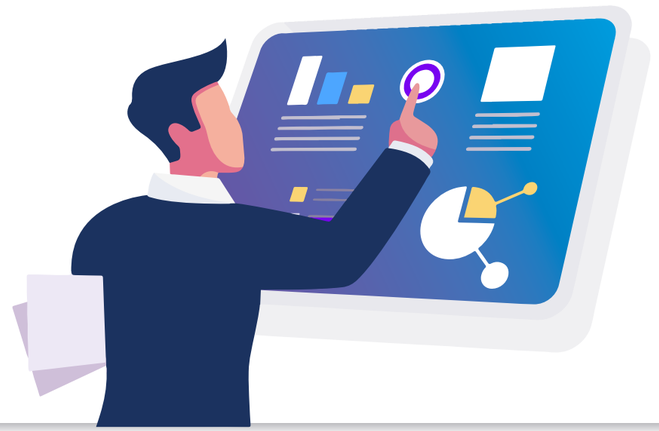
While a majority believe DX is a priority, it is clear that many construction companies worldwide are struggling to unlock its full potential. To truly become a DNE, construction companies must identify their challenges and address the digital deadlocks in their business.

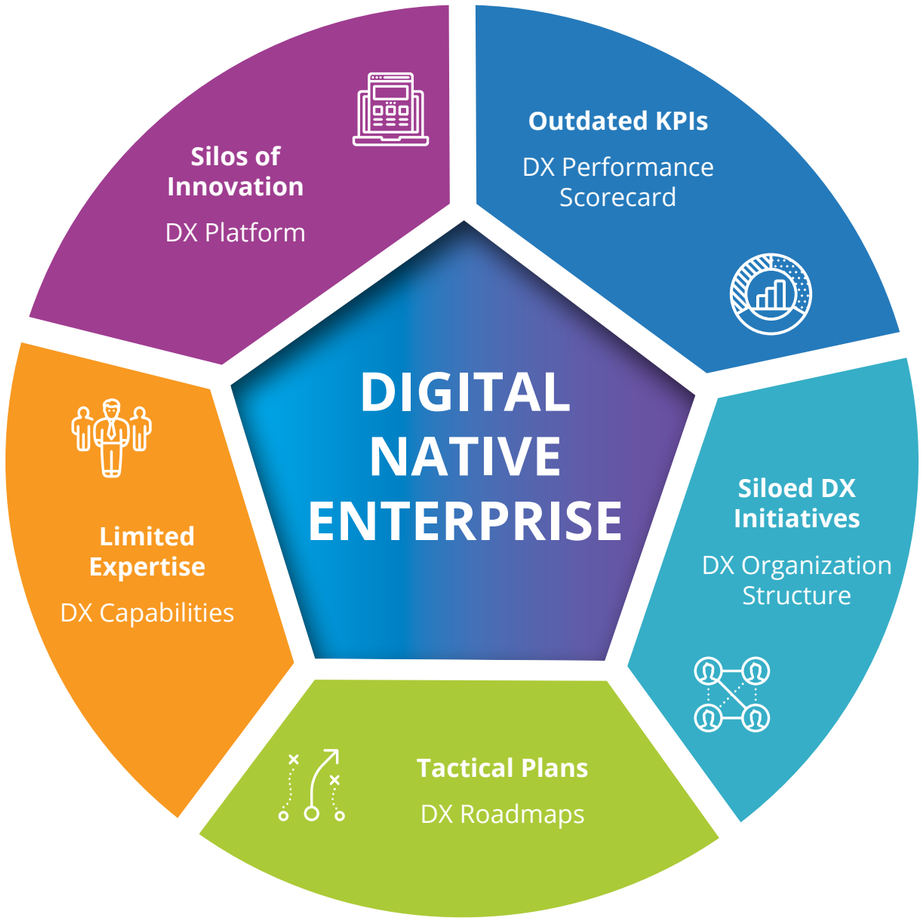
Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

Five key challenges of construction companies – the 'Digital Deadlocks'

of construction organizations worldwide have reached a digital impasse and are stuck in stages 2 to 3 of their DX journeys.

Unlocking these digital deadlocks will help companies evolve into digital native enterprises (DNEs) and experience the full benefits of digital technologies.





46% **DX roadmaps**
Prioritizing the industry use case journey

42% **DX platform**
Rearchitecting for scale

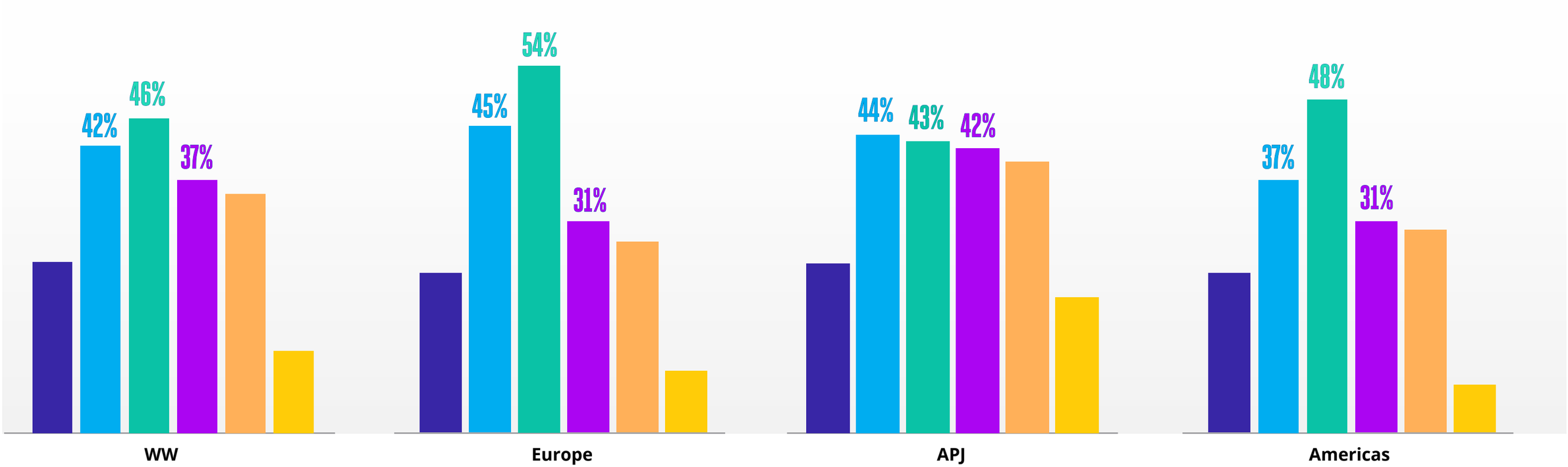
37% **DX performance**
Scorecard critical success metrics and KPIs

36% **DX capabilities**
Reshaping business and technology expertise

29% **DX organization**
Structure embedding digital in the business

Regional view of construction-specific roadblocks

Along with the five digital deadlocks, creating a strategic roadmap for digital investments is the top DX challenge for 46% of construction companies worldwide. This is followed by integrating digital projects across the organization (42%) and finding KPIs and metrics to measure digital success (37%).



Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

Organization concerns in the construction industry by region

The top challenge in the worldwide construction industry is effectively managing risk. This is closely followed by completing projects on time and on budget, data security and workforce safety.

Effectively managing risk
12%

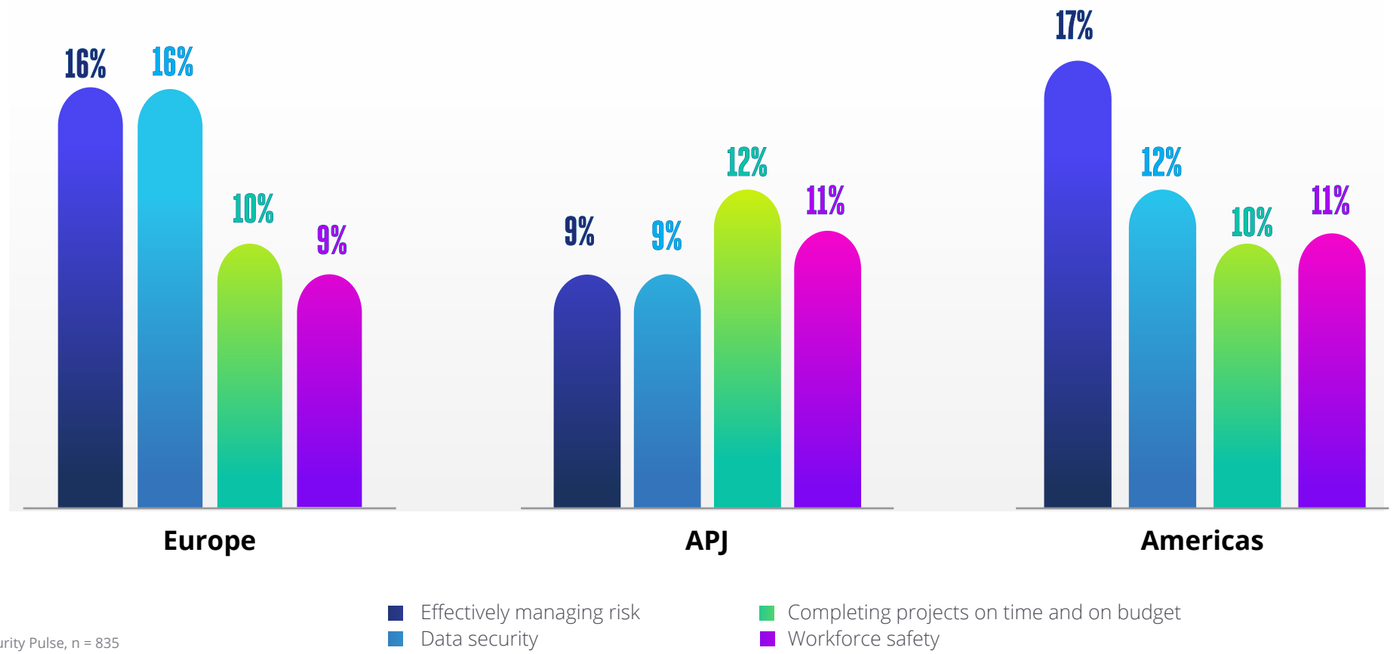
Completing projects on time and on budget
11%

Data security
11%

Workforce safety
10%

View by Region

Effectively managing risk is in the top 3 organizational challenges of all countries in Europe and the Americas.

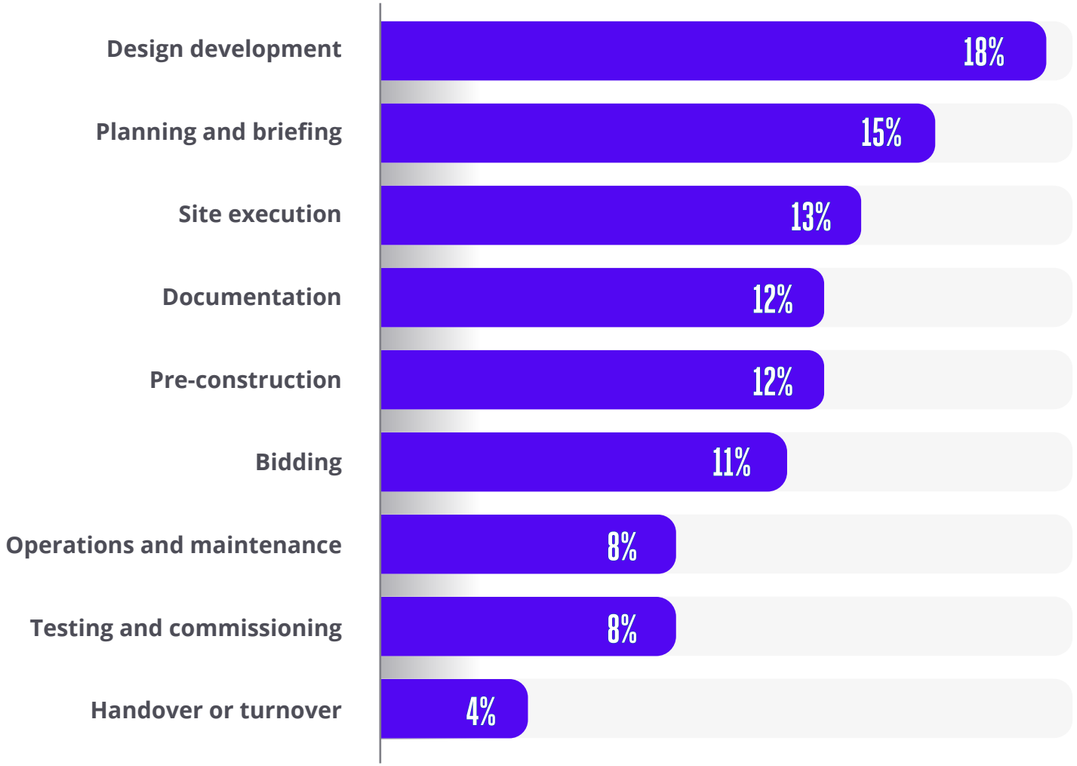


Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

Top challenges viewed by country

Data security is most important for construction companies in France and Singapore, while completing projects on time is a top priority in India. Finally, workforce safety is most common in Asia Pacific countries, particularly China, Japan, India and Australia/New Zealand (ANZ).

	Effectively managing risk	Data security	Completing projects on time and on budget	Workforce safety
UK	1	2	3	
GERMANY	1	2		3
FRANCE	2	1		
ANZ	1			2
CHINA				3
JAPAN				2
KOREA			2	1
INDIA	3		1	2
SINGAPORE	2	1		
US	1		2	3
CANADA	1	2		3
BRAZIL	1	2		

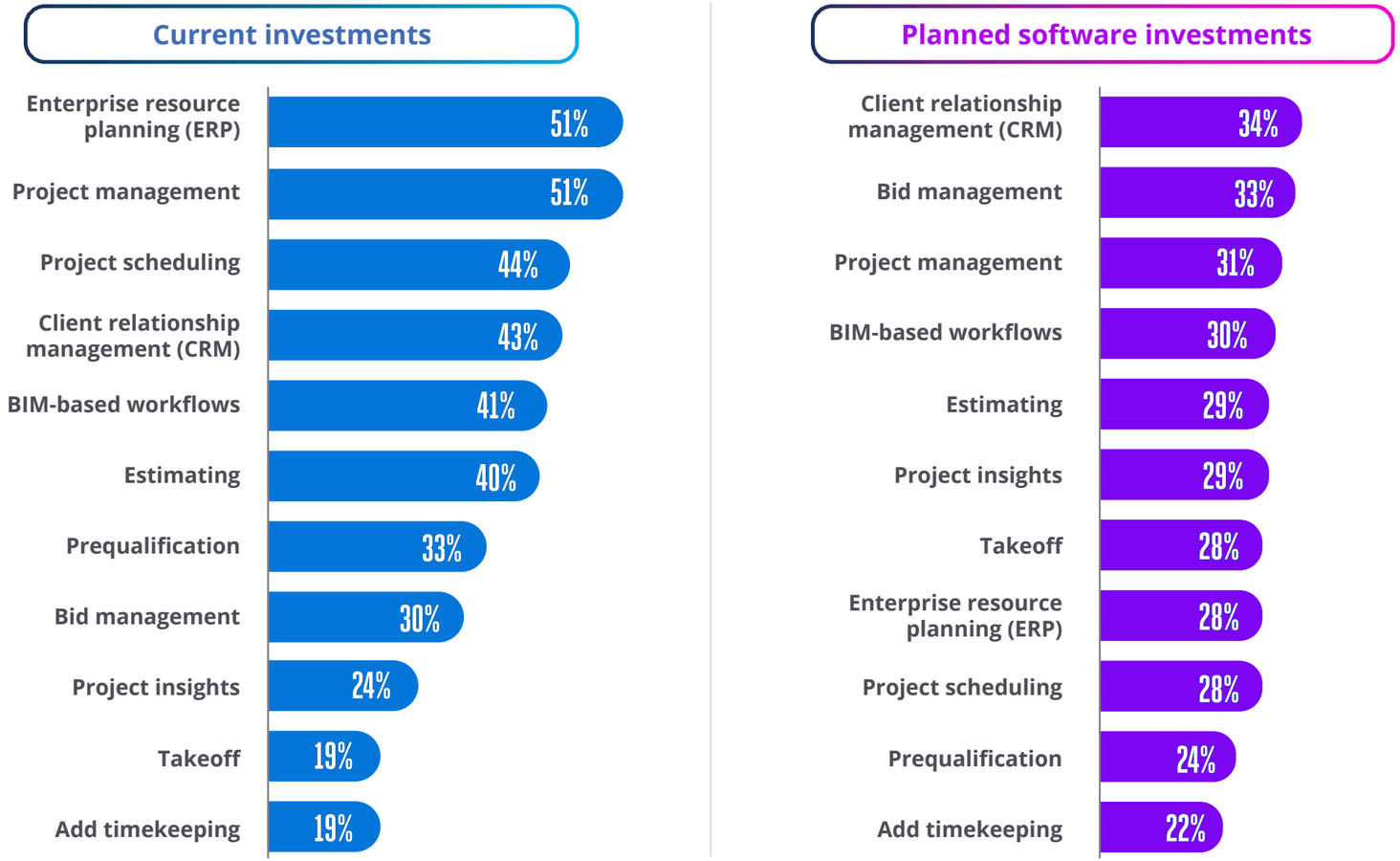


In addition to organization challenges, construction companies also believe that these construction phases need the most improvement.

Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

Software investments to address construction industry challenges

Construction organizations are looking into new, innovative technologies to accelerate their digital transformation.



Top 3 innovative technology investments construction companies planned in the next 18 months

- Predictive analytics/ big data
- Internet of Things (IoT)
- Drones

Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

United Kingdom – top challenges and technology investments

	Challenges	Current Software Investments	Planned Software Investments	Innovative Tech Investments
1	Effectively managing risk	Client relationship management	Estimating	Predictive analytics/big data
2	Data security	Enterprise resource planning	Project scheduling	Internet of Things
3	Completing projects on time and on budget	Project management	Project insights	3D printing

The state of construction in the UK

Data-driven construction and informed forecasting are among the common trends in construction, along with investments in drones and robotics to address current issues such as labor shortage, resource management and operational efficiency. Currently, the UK is the leader in building information modeling (BIM) adoption, which has been mandatory in public sector projects since 2016. The Centre for Digital Built Britain is a government-funded organization established in 2017 to support the digital transformation of the UK construction sector.

Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

Germany – top challenges and technology investments

	Challenges	Current Software Investments	Planned Software Investments	Innovative Tech Investments
1	Effectively managing risk	Project management	Takeoff	Predictive analytics/big data
2	Data security	Enterprise resource planning	BIM-based workflows	3D printing
3	Workforce safety	Client relationship management	Client relationship management	Internet of Things

The state of construction in Germany

There is a growing demand for housing units caused by the increasing population, supported by low interest rates. There is also increased government spending on infrastructure, and the cost of building homes hit a nine-year high in 2018. Prefab materials and green technologies are in consideration in the industry, while BIM will be made mandatory in all transport projects by 2020. *Planen Bauen 4.0* is Germany's BIM Steering Group. The VDI 2552 describes the country's national BIM standards and processes.

Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

France – top challenges and technology investments

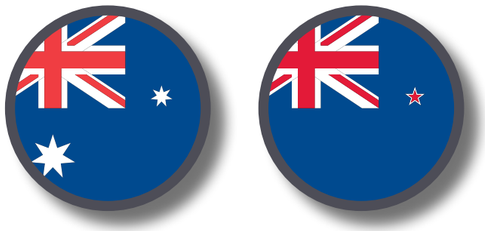
	Challenges	Current Software Investments	Planned Software Investments	Innovative Tech Investments
1	Data security	Project management	Client relationship management	Internet of Things
2	Effectively managing risk	BIM-based workflows	Project management	Augmented reality/virtual reality
3	Manual processes and time-consuming double entries	Enterprise resource planning	BIM-based workflows	3D printing

The state of construction in France

There are over 1,140 million people employed in the construction sector in France, but labor shortage remains a challenge in the industry. In 2017, 420,000 dwellings were built, partially using a BIM process although BIM is not mandatory in France. The government introduced the *Plan de Transition Numérique dans le Bâtiment* in 2014 with an investment of 20 million euros to digitalize the AEC industry. After its end in 2017, a new government initiative called Plan BIM 2022, led by a national organization called ADN Construction, has since taken over to recommend the use of BIM and help the transition of the AEC Industry through 8 main actions with ad-hoc working groups.

Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

ANZ – top challenges and technology investments



	Challenges	Current Software Investments	Planned Software Investments	Innovative Tech Investments
1	Data security	Enterprise resource planning	Client relationship management	Predictive analytics/big data
2	Effectively managing risk	Project management	Estimating	Internet of Things
3	Lack of effective technologies/ outdated technologies	Project scheduling	BIM-based workflows	Augmented reality/virtual reality

The state of construction in ANZ

Australia's construction industry is fast growing, comprising 8% of the country's GDP and employing 1.1 million people. New Zealand also expects its construction industry to grow by 20% in 2022. In both countries, robotics, 3D printing and drones are becoming more common. Technologies such as autonomous trucks, wearables and AR/VR will be used in the next 5 to 10 years. On the other hand, BIM adoption varies among states in Australia, while New Zealand has taken its first step toward implementation with the establishment of the BIM Acceleration Committee that consists of representatives from the government, construction and digital industries.

Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

China – top challenges and technology investments

	Challenges	Current Software Investments	Planned Software Investments	Innovative Tech Investments
1	Lack of real-time insights as to project performance	Project management	Client relationship management	Predictive analytics/big data
2	Delivering timely information to customers/ vendors/partners/ suppliers	Estimating	Bid management	Augmented reality/virtual reality
3	Workforce safety	Project scheduling	Enterprise resource planning	Artificial intelligence, machine learning

The state of construction in China

Opportunities for the construction industry arose in 2013, when the Belt and Road initiative was launched to increase China's connectivity to the rest of Asia through infrastructure developments. China has been using prefab materials to lead efficiency worldwide and leveraging 3D printing to create new construction materials. While BIM is not mandatory in China, the government is driving the 13th Five-Year-Plan to make BIM "business-as-usual." Notable structures constructed with BIM include Disneyland Shanghai, the Phoenix Media Centre and Shanghai Tower.

Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

Japan – top challenges and technology investments

	Challenges	Current Software Investments	Planned Software Investments	Innovative Tech Investments
1	Lack of effective technologies/ outdated technologies	Estimating	Enterprise resource planning	Predictive analytics/big data
2	Workforce safety	BIM-based workflows	Client relationship management	Drones
3	Manual processes and time-consuming double entries	Project management	Project management	Artificial intelligence, machine learning

The state of construction in Japan

Human and machine collaboration is supported by the government. Companies are incentivized to utilize technologies like robotics and artificial intelligence. These technologies, along with unmanned machines provide a partial solution to the labor shortage in Japan caused by an aging population. The Ministry of Land, Transport and Tourism is the driver of BIM adoption in Japan, and a policy for its utilization was created in 2017. The government has also increased its investments in reconstruction projects due to earthquakes and tsunamis. The Olympics 2020 also contributed to the boom of construction projects in Japan.

Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

Korea – top challenges and technology investments

	Challenges	Current Software Investments	Planned Software Investments	Innovative Tech Investments
1	Workforce safety	Project management	Bid management	Predictive analytics/big data
2	Completing projects on time and on budget	Estimating	Enterprise resource planning	Augmented reality/virtual reality
3	Lack of real-time insights as to project performance	BIM-based workflows	Client relationship management	Robotics - Hardware

The state of construction in Korea

In 2019, Korea's global construction competitiveness fell from 6 to 12, due to the lack of cutting-edge technologies used in more advanced markets. In response to this, the Ministry of Land Infrastructure and Transportation is driving the use of 3D printing, AI and robotics. The government also provided US$5.8 million in 2019 to create BIM-based building design standards and information technology. Korea is an early BIM adopter; BIM has been mandatory for public sector projects over US$50 million since 2016.

Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

India – top challenges and technology investments

	Challenges	Current Software Investments	Planned Software Investments	Innovative Tech Investments
1	Completing projects on time and on budget	Enterprise resource planning	Project management	Predictive analytics/big data
2	Workforce safety	Project management	Enterprise resource planning	Internet of Things
3	Effectively managing risk and data security	Project scheduling	Client relationship management	3D printing

The state of construction in India

The Indian government sees the need for technology in construction in response to the growing demand for housing spurred by a fast-growing economy and urbanization. When it comes to BIM, there is good adoption, but it is mostly used by India construction companies for overseas clients. Local clients do not see the long-term value of BIM, which is a concern the India BIM Association wishes to address through open collaboration with the community. However, despite opposing views on BIM, notable structures which made use of this technology include the Bangalore Airport and the Delhi Metro Rail.

Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

Singapore – top challenges and technology investments

	Challenges	Current Software Investments	Planned Software Investments	Innovative Tech Investments
1	Data security	Client relationship management	Client relationship management	Robotic process automation – Software
2	Effectively managing risk	Enterprise resource planning	Takeoff	Augmented reality/virtual reality
3	Lack of effective technologies/ outdated technologies	BIM-based workflows	Estimating	Internet of Things

The state of construction in Singapore

The governing body for the construction industry in Singapore is the Building and Construction Authority (BCA). BCA expects improvement in the industry, with projects to reach S$27 billion and S$34 billion for 2020 and 2021, respectively. The use of BIM is government mandated, with training support provided to workers. BCA also wants to increase the use of technologies in construction. BCA's Building Innovation Panel will assess innovations that can improve the industry, which includes the use of sustainable building materials, green technology, automation and 3D printing.

Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

United States – top challenges and technology investments

	Challenges	Current Software Investments	Planned Software Investments	Innovative Tech Investments
1	Effectively managing risk	Enterprise resource planning	Estimating	Predictive analytics/big data
2	Completing projects on time and on budget	Client relationship management (CRM)	Bid management	Internet of Things
3	Workforce safety and lack of effective technologies/ outdated technologies	Project management	Project insights	Drones

The state of construction in US

Labor shortage is one of the biggest challenges in the US and the construction industry is finding it difficult to attract Gen Z employees. Construction companies are positioning the use of tech innovations, including 7D modeling, to appeal to the digital savviness of this demographic. Digital technologies are prevalent in the construction industry, including AR/VR, RPA, analytics, drones and automation. While the construction industry is booming with the use of these innovations, BIM utilization has been limited to some departments within the government and is not mandatory in the private sector.

Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

Canada – top challenges and technology investments

	Challenges	Current Software Investments	Planned Software Investments	Innovative Tech Investments
1	Effectively managing risk	Enterprise resource planning	Project scheduling	Predictive analytics/big data
2	Data security	Client relationship management	Project management	Internet of Things
3	Workforce safety	Project scheduling	Client relationship management	3D printing

The state of construction in Canada

Canada's construction industry is seeing an aging workforce and rising costs as key issues. There is a push to increase usage of data analytics to address safety and productivity, as well as introduction of sensor and detection tools to pave the way for improved sustainability, green technology and smart structures. When it comes to BIM, it is mostly used in the private sector and there is no government mandate in place, leading to the fragmented usage of BIM.

Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

Brazil – top challenges and technology investments

	Challenges	Current Software Investments	Planned Software Investments	Innovative Tech Investments
1	Effectively managing risk	Enterprise resource planning	Project management	Predictive analytics/big data
2	Data security	BIM-based workflows	Client relationship management	Internet of Things
3	Manual processes and time-consuming double entries	Client relationship management	BIM-based workflows	3D printing

The state of construction in Brazil

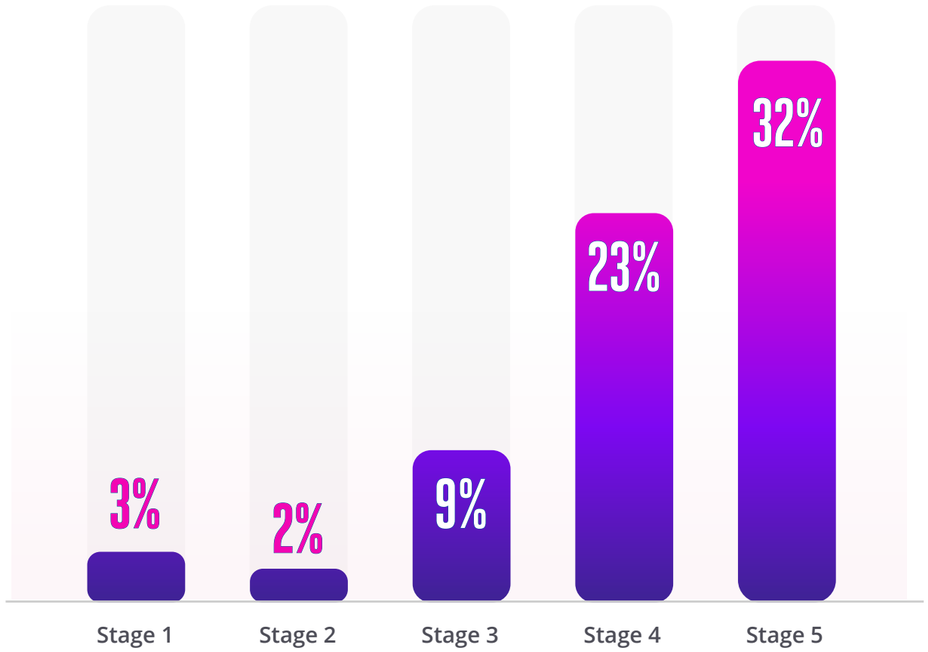
The growth of the construction industry is led by private-public partnerships. There is a decrease in financing for public infrastructure projects, but regulatory changes have been introduced to further attract investments from the private sector. When it comes to adoption of technologies, Brazil's construction industry lags behind its foreign counterparts in the use of the latest technology, particularly big data and analytics, artificial intelligence and 3D modeling, but there is a move toward international construction standards. BIM adoption will be made mandatory by 2021.

Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

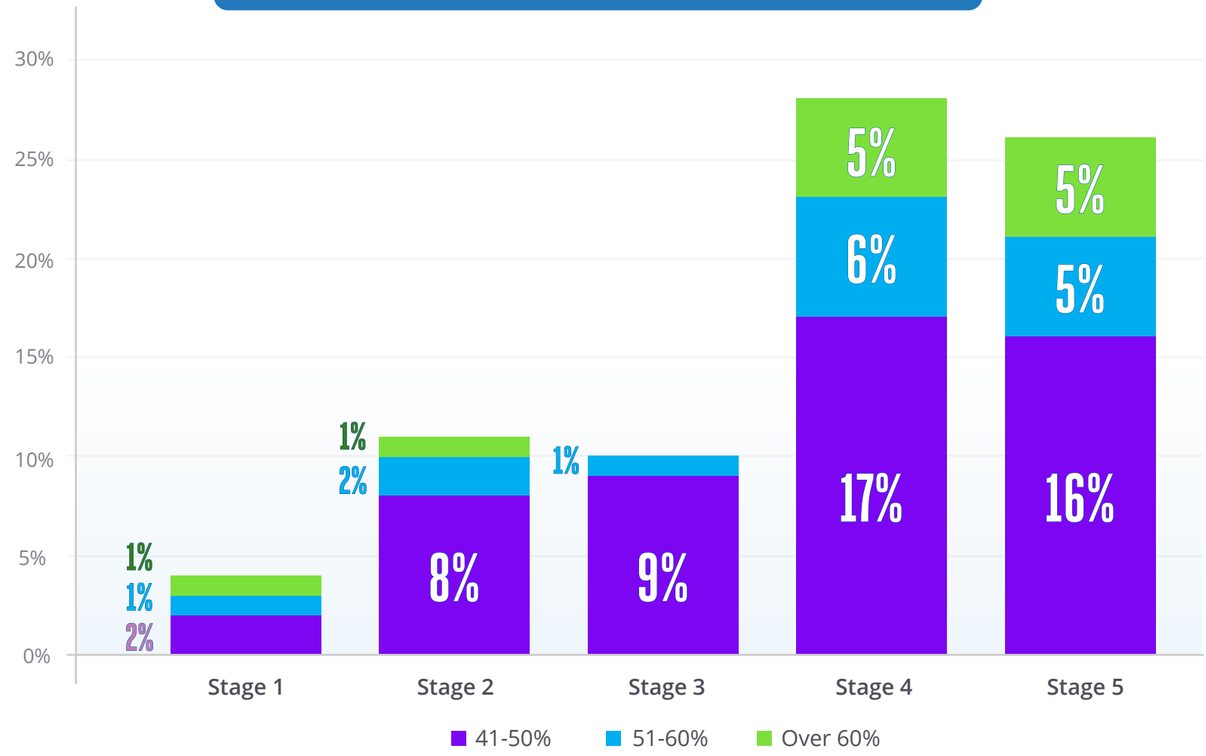
DX maturity correlation to use of digital construction solutions (like BIM)

IDC research shows there is a correlation between most mature organizations (stages 3 and above) and their usage of BIM-based workflows – the higher the maturity, the higher the proportion of BIM-based workflows in daily operations. Also, these organizations have automated a higher number of processes with digital construction solutions.

Everybody uses BIM-based workflows in their day to day operations



Percentage of your projects that uses digital construction solutions

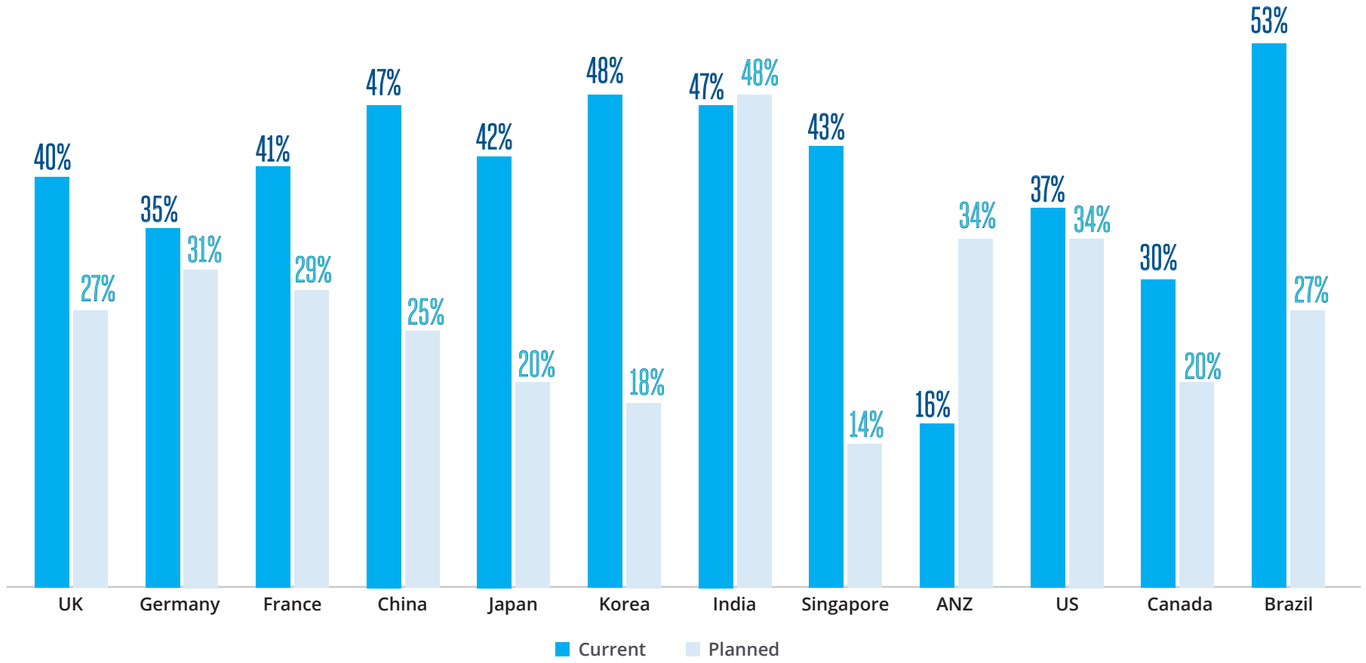


Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

BIM adoption varies worldwide

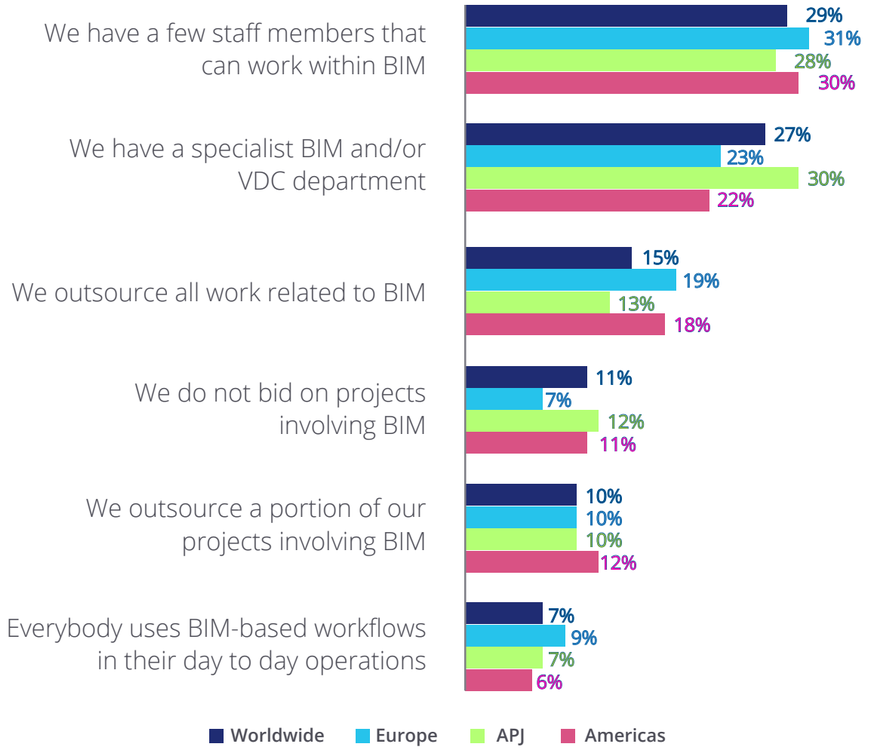
Its usage is integral to digital transformation in the construction industry.

Investment in BIM-based workflows



When it comes to investments in BIM-based software, Brazil's construction companies are in the lead, which can be attributed to the boom of public-private partnerships and the push for mandatory usage by 2021. Planned investments are higher for countries where use is fragmented or adoption is slower.

BIM projects and skills



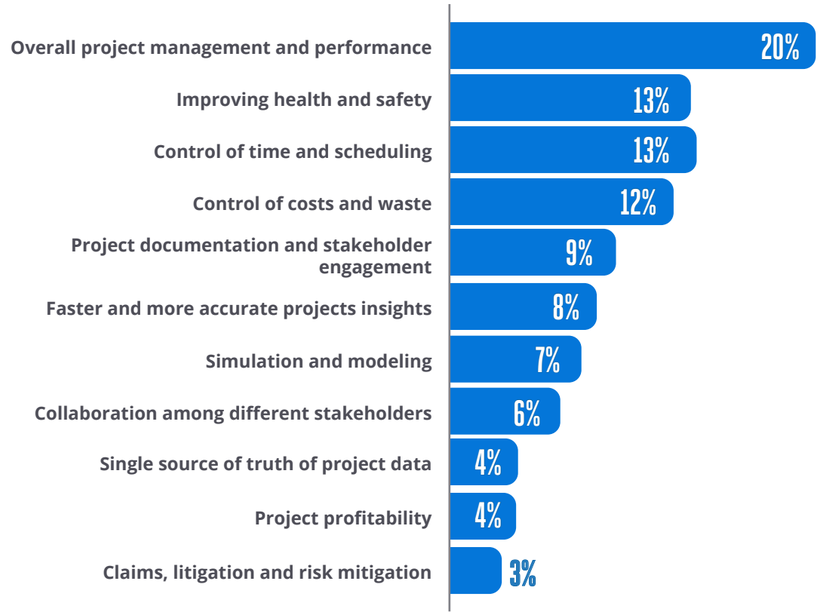
of organizations worldwide have a few staff members that can work within BIM, while 27% say they have their own BIM specialist and/or VDC department. About 7% of organizations use BIM-based workflows daily across all operations – however, 26% outsource a portion/all work related to BIM.

Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

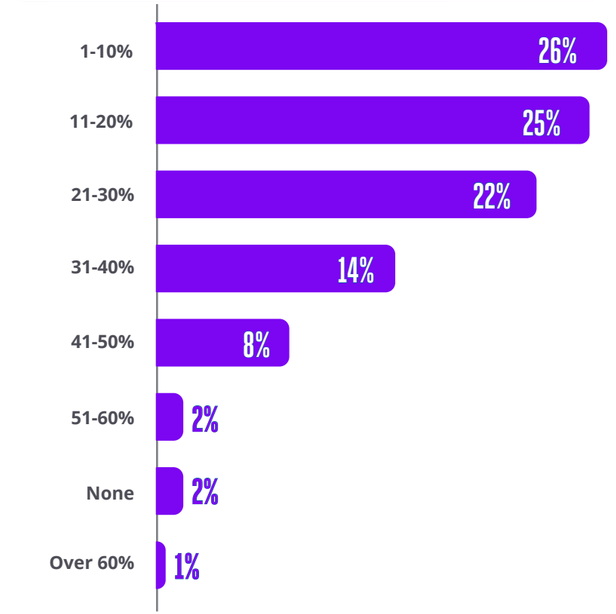
Top benefits where digital construction solutions help improve projects

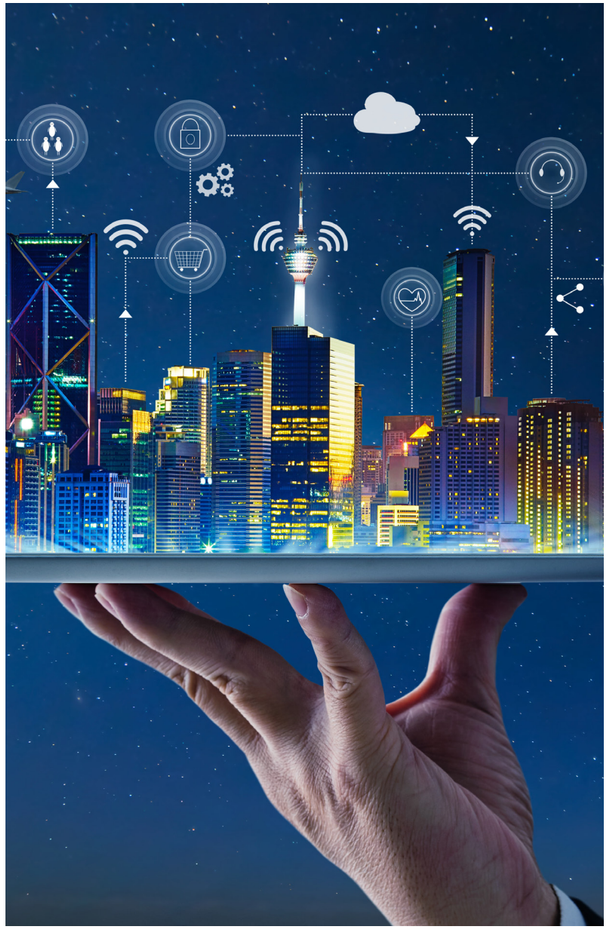
Construction companies worldwide believe that these are the top benefits/areas where digital construction solutions (such as BIM workflows, bid management, project management and insights) can help improve your construction projects.

Top benefits of digital construction solutions



Percentage of projects using digital construction solutions



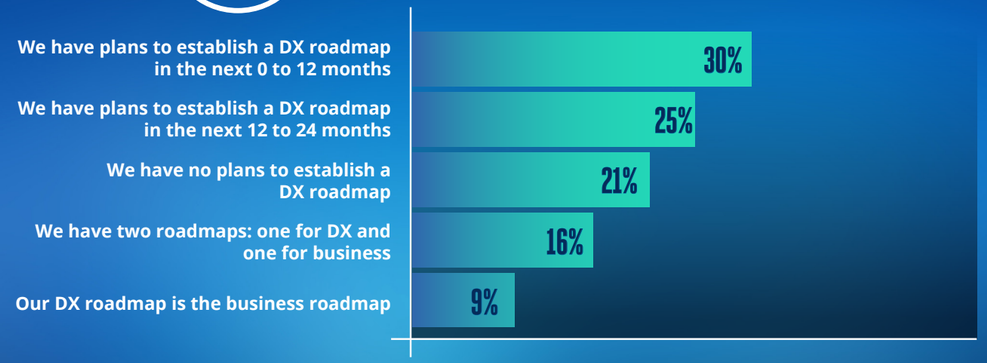


Despite the benefits identified, 95% of organizations worldwide use digital construction solutions in just 50% or less of their projects, while only 2% use digital construction solutions in over 60% of their projects.

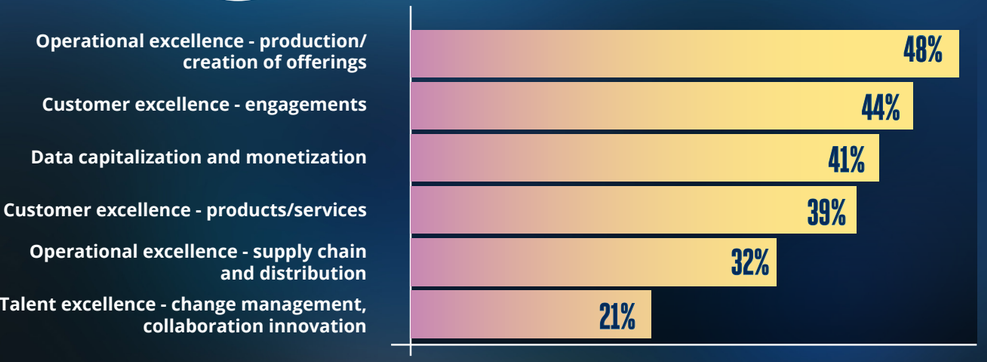
Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

What's next for construction companies worldwide?

Creation of a DX Roadmap

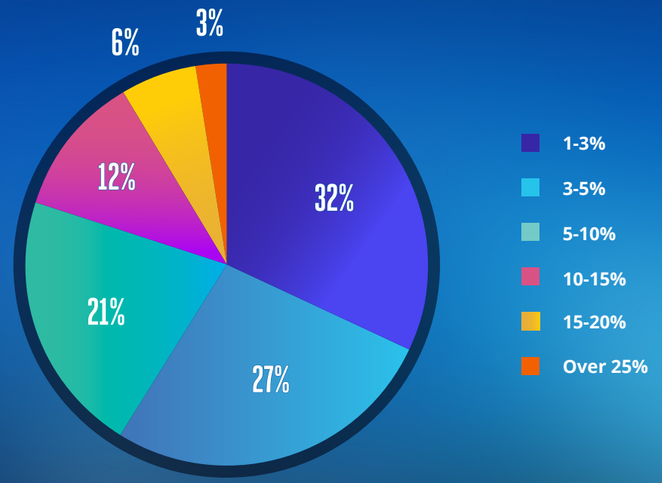


Improving Digital Capabilities



Source: IDC-Autodesk DX Construction Maturity Pulse, n = 835

Budget for Technologies (% of Annual Turnover)



To accelerate digital transformation (DX), 30% of construction companies worldwide are planning to create a DX roadmap within the next 12 months. In addition, plans to hone digital capabilities are in place, with operational excellence as a top priority for almost half of construction companies worldwide. Customer excellence in improving engagement and data capitalization and monetization round up the top 3 priorities for digital capabilities. For these initiatives to succeed, construction companies must increase their budgets for technology – 32% of construction companies currently only spend 1-3% of their annual turnover on technologies, while just 2.5% spend over 25%.

Message from the sponsor

Construction businesses understand the power of digital transformation for achieving new levels of operational excellence. But integrating different digital tools – and forming a strategic roadmap that will guide the whole business – can be difficult.

Autodesk Construction Cloud™ is an integrated construction management platform that gives teams unprecedented capabilities to overcome digital boundaries and reach a new era of connected construction. Construction businesses can benefit from powerful tools to design, plan, build and operate facilities, while making data more actionable across the lifecycle.

Outstanding solutions including Assemble, BIM 360, BuildingConnected and PlanGrid are all available in a connected platform, fully integrated with design authoring tools AutoCAD, Civil 3D, Revit and Navisworks. This ensures that digital transformation improves performance, rather than introducing more complexity.

Effectively managing risk is the biggest challenge that construction businesses identify. With Autodesk Construction Cloud, construction teams can make use of powerful predictive insights that helps to identify and mitigate risks before problems occur – reducing delays, rework and cost.

Autodesk Construction Cloud helps to connect people and data across the whole building lifecycle, enabling stakeholders to collaborate more easily and effectively. Advanced technology is combined with the industry's largest ecosystem of owners, designers, builders and trades, so that businesses can connect with the right partners and projects.

Construction businesses need digital transformation to meet rising customer expectations and improve productivity and performance. Autodesk is helping construction businesses worldwide to benefit from digital technology – and create an industry that's ready for the future.

Visit https://construction.autodesk.com/ to learn more.

Please get in touch to arrange a demo, or to speak with product specialist.

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