



# Future of Construction

A Global Forecast for  
Construction to 2030

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# Acknowledgements

Graham Robinson, Jeremy Leonard and Toby Whittington from Oxford Economics are the authors of this report and undertook the analysis and writing.

The authors are responsible for writing and presenting many leading reports on the global construction industry.

The authors and Oxford Economics thank Marsh and Guy Carpenter for their leadership and considerable input into shaping this report and to writing separately attributable authored features in this report on thematic areas that will shape the *Future of Construction*.

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The feature on *Climate Catastrophe* written by **Jessica Turner, PhD, ACII, Managing Director, Head of International Catastrophe Advisory at Guy Carpenter**, gives key insights into the way in which climate change will affect the risks and opportunities for construction.

The feature on the *Internet of Materials* written with **Norbert Pralle, Head of Innovation Management at Ed. Zublin AG, part of STRABAG SE Group and Chairman of ENCORD**, explains clearly how a deconstruction industry will emerge to reuse materials from existing buildings and infrastructure.

The feature on a *Carbon Calculator* tool developed by Balfour Beatty in collaboration with Innovate UK, Leeds Beckett University, Hertfordshire University; and White Frog Publishing, written by **Bekir Andrews, Associate Director, Group Sustainability, Balfour Beatty PLC**, provides insight into how disclosure of the carbon footprint of new buildings and infrastructure is emerging.

The feature on the *Global Flow of Funds* written by **Michael Watson, Partner, Head of Finance and Projects and Head of Climate Change Advisory at Pinsent Masons LLP**, explains how the sources and flows of funds for infrastructure globally, including ESG and green financing, are driving infrastructure investment.

# Foreword

The construction industry has demonstrated remarkable resilience during the worst of the coronavirus pandemic and over a period of significant disruption to the global economy — the worst since the Great Depression some 80 years ago.

The near-term outlook for the global economy remains clouded by a surge in inflation and supply chain bottlenecks, and the Delta variant remains a threat. However, Oxford Economics forecasts in this newly published global forecast *Future of Construction*, the global construction industry is set to lead global economic recovery from the pandemic over the medium-term and is expected to grow faster than the manufacturing or service sectors.

The global construction market is expected to grow by US\$4.5 trillion over the decade to 2020 to reach US\$15.2 trillion. To better understand this and prepare for the future with our clients, Marsh and Guy Carpenter chose to partner with Oxford Economics on this project because of its deep industry expertise which, underpinned by advanced data-led analysis, provides genuinely valuable insights to those determining their future strategic direction within industry segments.

As this report makes clear, climate change and its risk and opportunities represent the construction industry's biggest challenge. ESG and green financing will drive a greener recovery from the pandemic. This report also highlights that the emergence of a deconstruction industry that will reuse existing built assets and tools that will help in the disclosure of the carbon footprint for any new asset ahead of physical construction will become the new norm.

There are huge opportunities and risk factors for the construction industry from climate resilience driven by natural catastrophes.

The common themes that arise from this report – including key observations from construction firms operating in global markets – is changing risk and the opportunities shaping the *Future of Construction*.

It is therefore essential that the construction industry and insurance marketplace work closely together to ensure changing risk profiles are managed across stakeholders and that continued innovation will be a benefit to society.

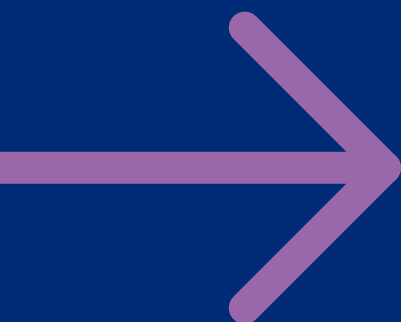
Marsh and Guy Carpenter are delighted to have worked with Oxford Economics to provide insight into the opportunities and developments expected within the construction industry globally in the coming years. It will undoubtedly be an exciting period of challenge, but one we should look forward to, as the construction and (re)insurance industries continue to play a vital role in the economic development and future prosperity of the world economy, and in helping to improve the global environment.



**Richard Gurney**  
Global Head of Construction  
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**Simon Liley**  
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# Executive Summary

## Construction set to be a global engine for economic growth and recovery from COVID-19

Global construction output in 2020 was US\$10.7 trillion<sup>1</sup> and we expect this to grow by 42% or US\$4.5 trillion between 2020 and 2030 to reach US\$15.2 trillion. The global construction industry is set to be a global engine for economic growth and recovery from COVID-19.

Shorter term, global construction output is expected to reach US\$13.3 trillion by 2025 – adding US\$2.6 trillion to output in the five years from 2020.

Asia-Pacific will account for US\$2.5 trillion of growth in construction output between 2020 and 2030, up by over 50% to become a US\$7.4 trillion market by 2030.

Construction output in North America will grow by 32%, or US\$580 billion from 2020 to 2030, to US\$2.4 trillion in 2030.

Western Europe is forecast to grow by 23% between 2020 and 2030 and is expected to push up construction output to US\$2.5 trillion in 2030.

## Growth in construction over the decade to 2030 will be higher than manufacturing or services

Growth in construction output is forecast to average 3.6% per annum over the decade to 2030 – higher than either the manufacturing or services sectors.

Growth in construction output is forecast to average 4.5% over the five years between 2020 and 2025 – again higher than either manufacturing or services sectors and driven by sharp recovery from the effects of COVID-19 and huge stimulus support by governments. Spending of accumulated excess household savings is expected to contribute to this heightened growth.

Supply chain bottlenecks constraining activity levels and causing inflationary spikes for construction are expected to be transitory but are a risk to our forecasts.

## Rising populations will drive construction demand across emerging markets

Growth will be driven by rising populations and urbanisation across emerging nations driving demand for infrastructure and residential construction.

## Permanent inward immigration will support construction demand across developed countries

Permanent inward immigration into the Anglosphere (US, UK, Australia, Canada, and New Zealand) as well as Germany and other OECD countries will help to support demand across those developed countries.

## Growing working age populations help drive need for workplace construction

Growth in working age populations in countries such as India and Indonesia as well as Canada and Australia will support demand for workplace construction where, we expect higher demand for industrial and logistics space to support growth in online retailing and manufacturing.

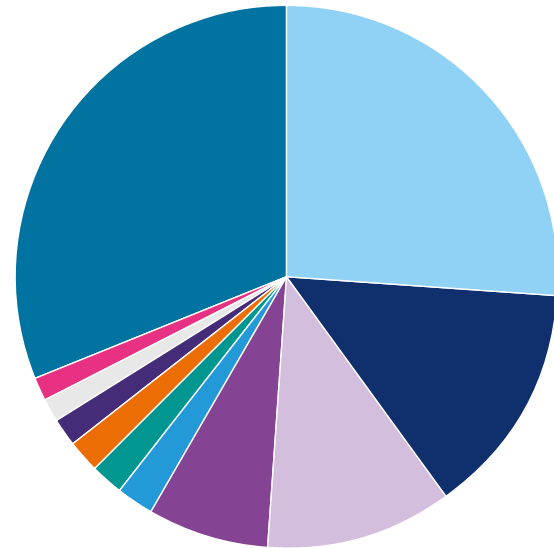
## A return to urban centers will support multifamily growth

A shift towards urban centres is gradually expected to regain momentum after COVID-19 and will support growth in multifamily residential construction.



## Contribution to global construction growth 2020-2030

2017 prices US\$bn



China 26.1%	France 1.8%
India 14.1%	Canada 1.7%
United States 11.1%	Spain 1.5%
Indonesia 7%	Italy 1.3%
Australia 2.3%	Other 31%
United Kingdom 2%	

Source : Oxford Economics/Haver Analytics

### China, India, US, and Indonesia to account for 58.3% of global growth in construction output

Growth will be concentrated in a small handful of countries. Just four countries – China, India, US, and Indonesia – will account for 58.3% of estimated global growth in construction between 2020 and 2030.

China alone will account for 26.1% of global growth. India is forecast to account for 14.1% and the US for 11.1%, while Indonesia is expected to account for 7.0% of global growth – almost the same as the combined growth of Australia, UK, France, and Canada, which are the next four largest contributors.

### Construction to reach 13.5% of global GDP by 2030

Spending on construction accounted for 13% of global GDP in 2020 and we expect this to reach over 13.5% in 2030.



## Strong growth and recovery from COVID of 6.6% for global construction in 2021

In 2021, we expect strong recovery from the COVID pandemic with global construction output growing by 6.6%.

## Higher growth in emerging markets with near double-digit growth in LATAM in 2021

We forecast emerging construction markets will rebound by 7.2% in 2021 – adding to acceleration in global construction output and with near double-digit growth of 9.6% in LATAM.

Sub-Saharan Africa is forecast to grow fastest of all regions globally in the longer-term with an average annual growth of 5.7% between 2020 and 2030.

## Decade of growth for construction to 2030 will be 35% higher compared to previous decade to 2020

Global construction output is forecast to be 35% higher over the next decade to 2030 compared to the previous decade to 2020. A cumulative total of US\$135 trillion in construction output is forecast in the decade to 2030.

## Residential construction driving short-term growth

Residential construction will drive growth in the short-term driven by the unleashing of excess household savings and demand for residential space – we forecast residential construction output will grow by 7.1% in 2021. Huge levels of excess household savings have built up across advanced economies – reaching more than 10% of GDP in North America.

## Infrastructure forecast to be fastest growth sector driven by unprecedented levels of government stimulus

Infrastructure is forecast to be the fastest growth sector for construction over the period to 2030. We forecast annual average growth of 5.1% globally for infrastructure construction output during the period from 2020 to 2025 – driven by unprecedented levels of government stimulus and the acceleration of pipelines of global mega infrastructure projects.



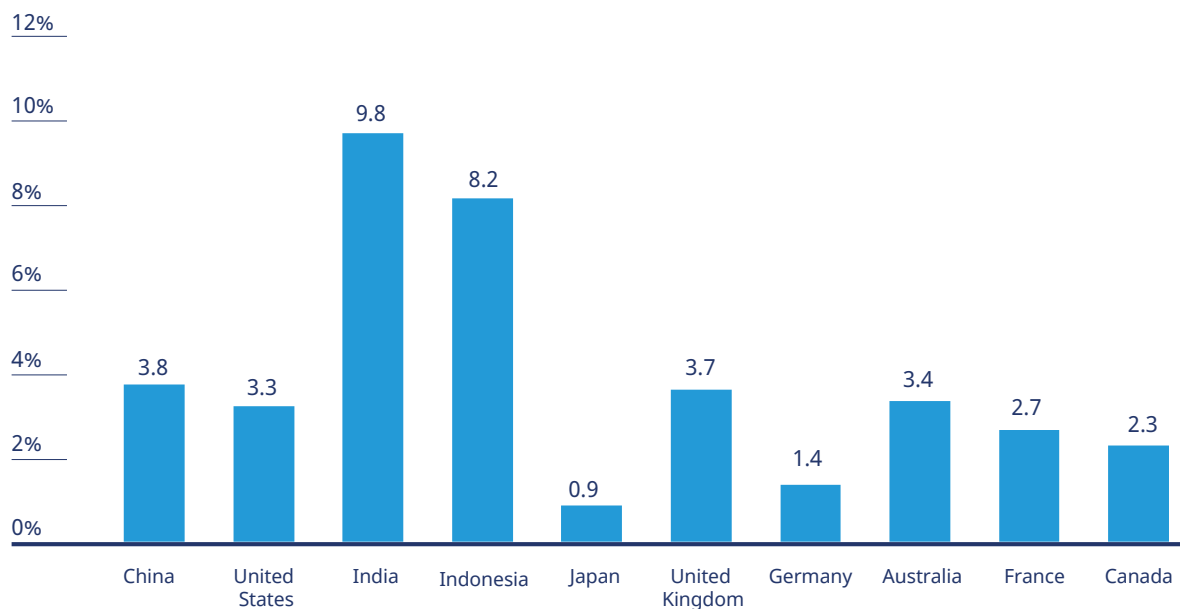
The US\$1.2 trillion Bipartisan Infrastructure Bill in the US will help push up growth in US transportation infrastructure put-in-place construction to an average of 8.9% over the period from 2020 to 2025. The the European Union €723 billion Recovery and Resilience Facility, which is part of the €806 billion Next Generation EU fund (often reported as €750 billion in 2018 prices) will meanwhile help support recovery of construction in Western Europe by 7.9% in 2021.

## Infrastructure pipelines are focus of government acceleration in stimulus — global mega infrastructure projects will help support growth

Acceleration of infrastructural investment is a focus for governments. The readiness of existing pipelines of infrastructure are key to this acceleration. Shovel ready projects help. The UK and Australia are well positioned to accelerate infrastructure development amongst the top 10 global construction markets.

### Growth in infrastructure construction 2020-2030

%, CAGR



Source : Oxford Economics/Haver Analytics

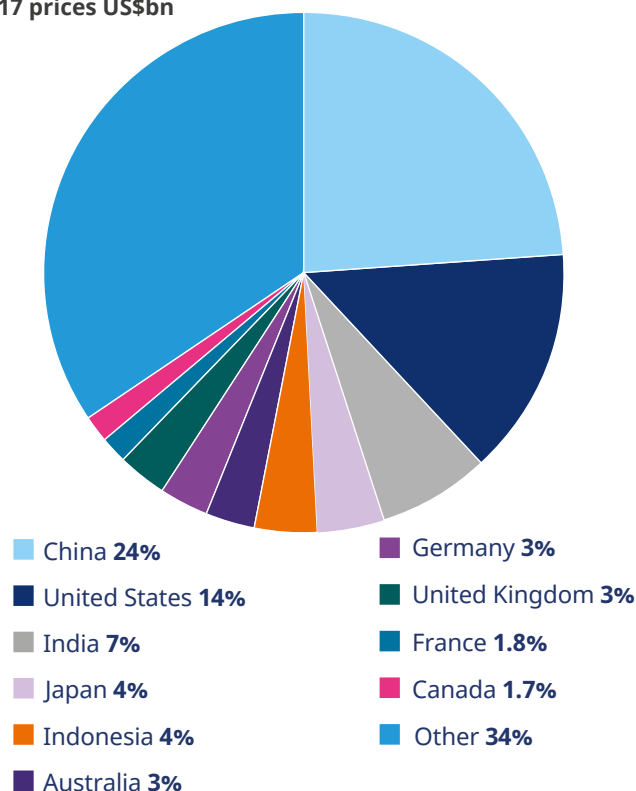
## Growth in UK infrastructure to rival China over the next decade to 2030 as UK mega projects provide heightened growth

Growth in infrastructure construction in the UK is expected to rival that of China over the next decade to 2030, with the UK's mega infrastructure projects providing heightened infrastructure construction output.

A significant pipeline of infrastructure in Australia will also see growth averaging 3.4% per annum over the period to 2030.

## Top 10 global construction markets 2030

2017 prices US\$bn



Source : Oxford Economics/Haver Analytics

## Global top 10 construction markets see continued shift to emerging markets, with China and US clear leaders in 2030

The global top 10 construction markets are expected to represent two-thirds of total global output in 2030.

India is forecast to become the world's third-largest construction market as it overtakes Japan in 2023.

Indonesia will become the world's fourth-largest construction market by 2030 when it is forecast to also overtake Japan. Indonesia will accelerate to overtake Germany in 2023 and UK in 2024.

UK will overtake Germany in 2023 to become the world's fifth-largest construction market but will be overtaken by Indonesia in 2024 to remain the sixth-largest market for the remainder of our forecast to 2030.

Germany will be overtaken by both UK and Indonesia in 2023, falling two places to seventh position in the global ranking for the same year.

Japan will drop two places to become the world's fifth-largest construction market in 2030 as it is overtaken by India and Indonesia.

## Elevated levels of debt to GDP ratios will drive the need for a new wave of PPPs

The ability of governments around the world to fund infrastructural development in the longer-term will be significantly weakened by elevated levels of debt to GDP ratios, increasing the need for Public Private Partnerships (PPPs).

## Climate change and the race to Net Zero are greatest challenges for construction and will drive new deconstruction opportunities

Climate change and the race to Net Zero are arguably the greatest challenges that face the construction industry.

The built environment is responsible for around 40% of greenhouse gas emissions globally. The need to radically reduce the amounts of carbon embedded in new construction is a huge challenge and will drive the growth of a deconstruction industry.

An emerging deconstruction industry that will reuse huge existing urban stockpiles of construction materials could reduce embedded carbon in the construction of new buildings and infrastructure.

The climate crisis is driving huge demand to decarbonise energy networks and develop renewable energy. Saudi Arabia's Giga Projects are leading in Net Zero.

Sustainable and quality infrastructure is a driver of economic growth and social progress and is an enabler to achieving Sustainable Development Goals (SDGs) and Paris Agreement commitments. In 2020, ESG-related capital for infrastructure grew 28% with a large part of the increase due to a flow of fundraising into sustainability-related strategies.

## Modern methods of construction expected to become new normal

Modern methods of construction, including off-site manufacturing, are expected to become the new normal and will radically transform construction productivity. Distributed factories using 3D printing technologies to make components for construction assembly using advanced robotics are rapidly developing — especially in the residential sector.

The key drivers shaping the *Future of Construction* will have a profound effect on the construction industry – not only the massive influence exerted by Emerging Asia, but also the significant changes that we expect from Net Zero and climate change. The rapid digitalisation and use of modern methods of construction will also have far-reaching consequences for the industry and its major players. These forces are changing risk profiles in ways that will require the sector to adapt to harness the massive growth potential for construction. Those companies



that are positioned to harness these drivers of change will flourish and are likely to lead the industry towards a completely different future.

*Future of Construction*, published by Marsh and Guy Carpenter — part of Marsh McLennan, the world's leading professional services firm in the areas of risk, strategy, and people — has been written by Oxford Economics, a global leader in economic forecasting and analysis.

We believe this report will be timely in giving clients of both Marsh and Guy Carpenter a view on the future of construction as the industry recovers from the unprecedented effects of COVID-19. It includes valuable insight for senior executives into the key drivers that will help shape the *Future of Construction* over the next decade.

<sup>1</sup> Construction output in 2017 prices and exchange rates



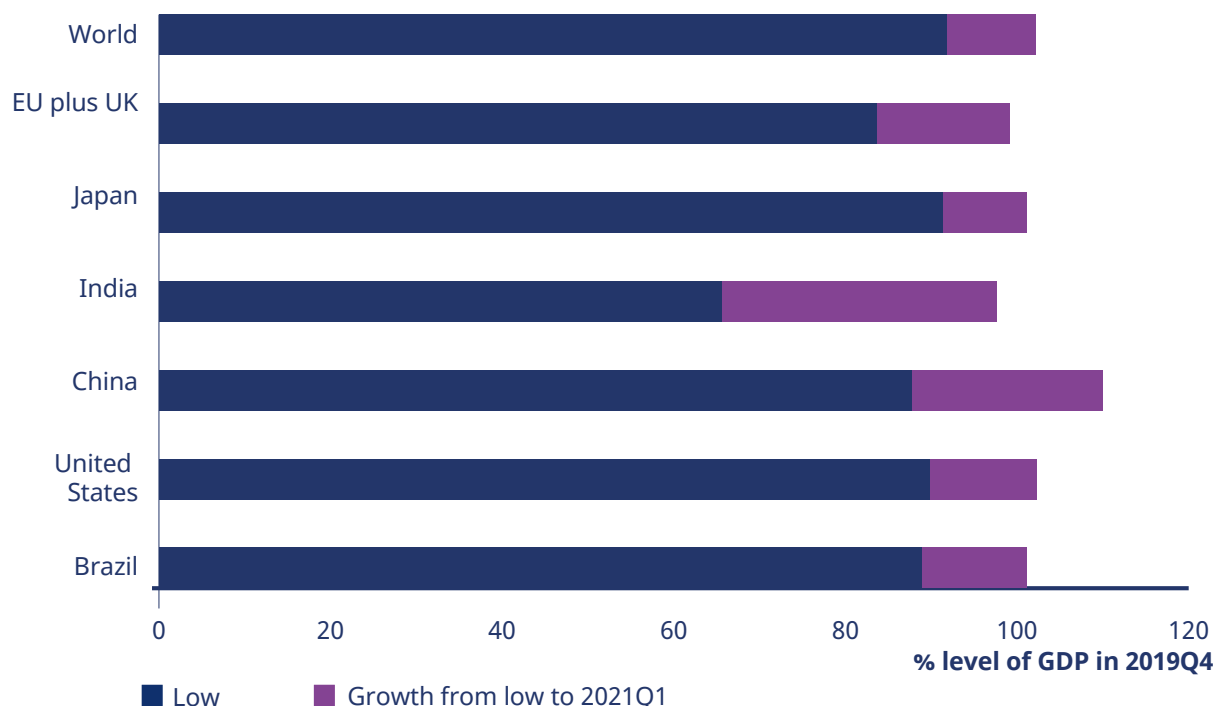
# Global Economic Outlook

## 1.1 RAPID INITIAL RECOVERY FROM PANDEMIC-INDUCED RECESSION

The coronavirus pandemic that began more than 18 months ago in China, and rapidly spread to Europe and across the globe, led to the largest contraction in global economic activity since the Great Depression more than 80 years ago. The disruption in the initial phases was severe, with large portions of economies essentially ordered to shut down by governments.

But initial lockdowns were coupled with unprecedented government spending to support both household incomes (in the form of furlough schemes for employees unable to work) and business balance sheets (in the form of loan guarantees, tax holidays and direct grants). This massive influx of fiscal support amounted to well over 10% of GDP in 2020 across the major advanced economies, orders of magnitude more than that following the 2008-09 global financial crisis.

## Evolution of GDP since 2019Q4



Source : Oxford Economics/Haver Analytics

In addition, businesses learned to adapt their activities to pandemic restrictions, and the second wave of the virus that affected most of the world in late 2020 proved less economically damaging.

As a result, as restrictions have gradually been lifted and vaccination rates climb, the global economy has roared back. Households are eager to spend money on the many activities they have been deprived of for the past 18 months, and businesses are equally eager to ramp up their productive capacity to meet this demand.

We estimate that the global economy has returned to its pre-pandemic size as of the second quarter of 2021. The main contributors to this accomplishment are China (which bore the brunt of the pandemic-induced downturn one quarter before the rest of the world) and the US (which began easing restrictions on movement well before most other countries).

## 1.2 DELTA VARIANT AND SUPPLY CHAIN BOTTLENECKS WEIGH ON NEAR-TERM OUTLOOK

Despite the strong economic rebound to date, there are several factors that make us somewhat cautious about near-term prospects.

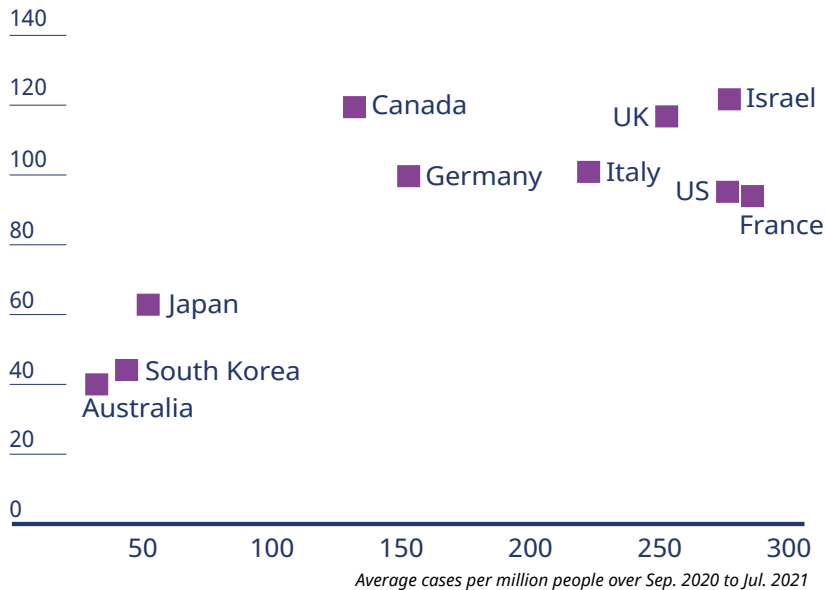
The key near-term uncertainty is whether the spread of the delta coronavirus variant will trigger another global surge in COVID-19 cases that necessitates the reimposition of restrictions. Governments in Europe and North America are taking the approach of focusing on increasing vaccination rates so that restrictions can be eased. They are willing to accept higher case levels so long as hospitalisation rates stay at manageable levels.

Asian economies, by contrast, have generally been much slower to roll out vaccines. Because their populations are therefore further from herd immunity, governments in these countries have needed to extend restrictions on movement to cope with new outbreaks.

Unless circumstances change, higher cases are unlikely to prompt a reimposition of the strictest restrictions to activity in economies with vaccine rollouts that are well underway. The delta variant is a bigger concern for economies where vaccination rates are much lower.

## COVID immunity: developed economies

### Vaccine doses administered per 100 people

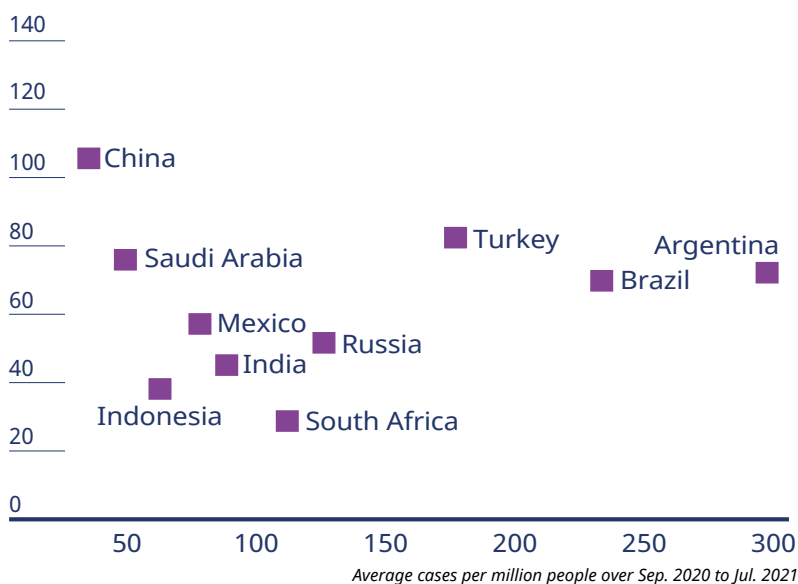


Emerging economies are at greater risk of economic damage from the delta variant in the near-term, mainly because low vaccination rates mean that populations are at higher risk of having delta-variant infections result in hospitalisation or death. The main exception to this is China, whose vaccination programme is on a par with the developed world in terms of doses administered per population. As a result, growth momentum over the remainder of 2021 is likely to be less than that for advanced economies.

Source : Oxford Economics/Haver Analytics

## COVID immunity: emerging economies

### Vaccine doses administered per 100 people



A second factor hindering growth prospects in the near-term is the supply chain bottlenecks and pandemic-related shortages that continue to cause problems for certain sectors. In addition to denting output in some sectors, such as motor vehicle production, it has also prompted us to raise our CPI inflation forecasts for 2021 and 2022 slightly to 3.9% and 3.2% respectively, up from 3.7% and 3.1% a month ago.

But even though these disruptions are likely to continue through the remainder of the year (and possibly into 2022 in the case of semiconductors), we think the worst is behind us. Prices of some key commodities such as lumber and iron ore have started reversing their strong gains earlier in the year, and incentives are strong for producers at all stages of supply chains to continue increasing capacity.

Despite these near-term headwinds, we expect global GDP to expand 6.2% this year, the fastest rate in more than 50 years. Advanced economies will play a much bigger role in this growth than in past economic recoveries, expanding 5.8%.

Source : Oxford Economics/Haver Analytics



### 1.3 LARGE BUILDUP OF HOUSEHOLD SAVINGS AND FISCAL STIMULUS TO DRIVE ACTIVITY INTO 2022

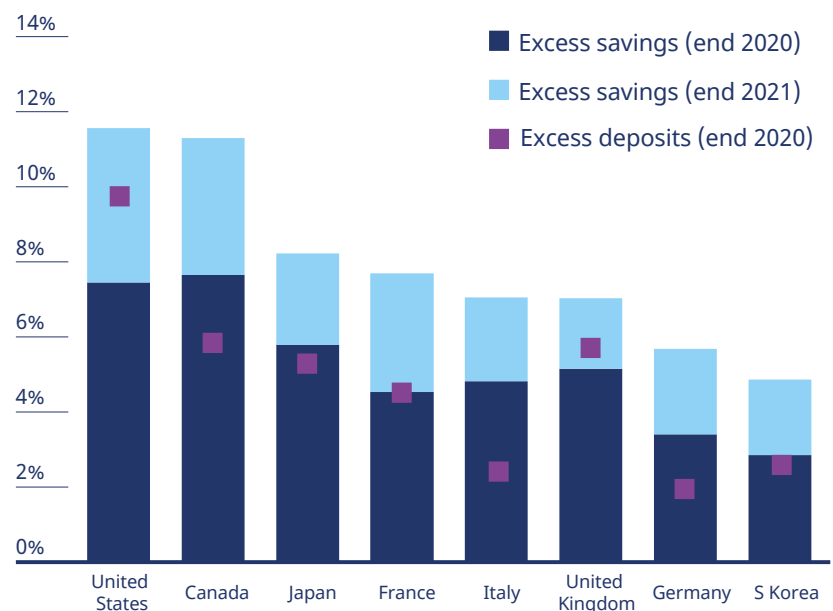
The early part of the pandemic recovery was driven by the industrial side of the economy, which returned to its pre-pandemic level in the fourth quarter of 2020. This was because some large industrial sectors (including construction) were deemed to be essential activities and were exempt from lockdown restrictions in many countries. Furthermore, as households were unable to spend money on contact-sensitive activities such as dining out, travelling, and attending leisure events, they shifted their spending toward manufactured goods, which boosted demand for things like furniture, renovation supplies and household appliances.

Consumers are anticipated to dive into a wave of post-pandemic spending as lockdowns begin to lift, spending some of their excess savings built during the pandemic, and rotating expenditure away from consumer goods and toward services such as travel and hospitality. The chart below shows that considerable excess savings have been built up over the pandemic across advanced economies, reaching more than 10% of GDP in North America. Even under very conservative estimates of how much of this excess savings will be spent, the growth profile across most developed countries will be strong through 2022.

Recent data have already begun to show the impact of this spending spree. US GDP grew by an annualised rate of 6.5% in the second quarter of 2021, and the Eurozone expanded by a better-than-expected 8.5% annualised rate in the same period. In both areas, consumer spending has been the dominant source of growth.

#### Excess household savings and deposits

%, GDP



Source : Oxford Economics/Haver Analytics

As a result of these factors, we expect the outsize contribution of advanced economies to global growth to continue next year, with GDP growth at 4.2%. This is only slightly less than the expected 4.6% growth for the world.

## 1.4 FACTORS IMPACTING THE LONGER-TERM OUTLOOK

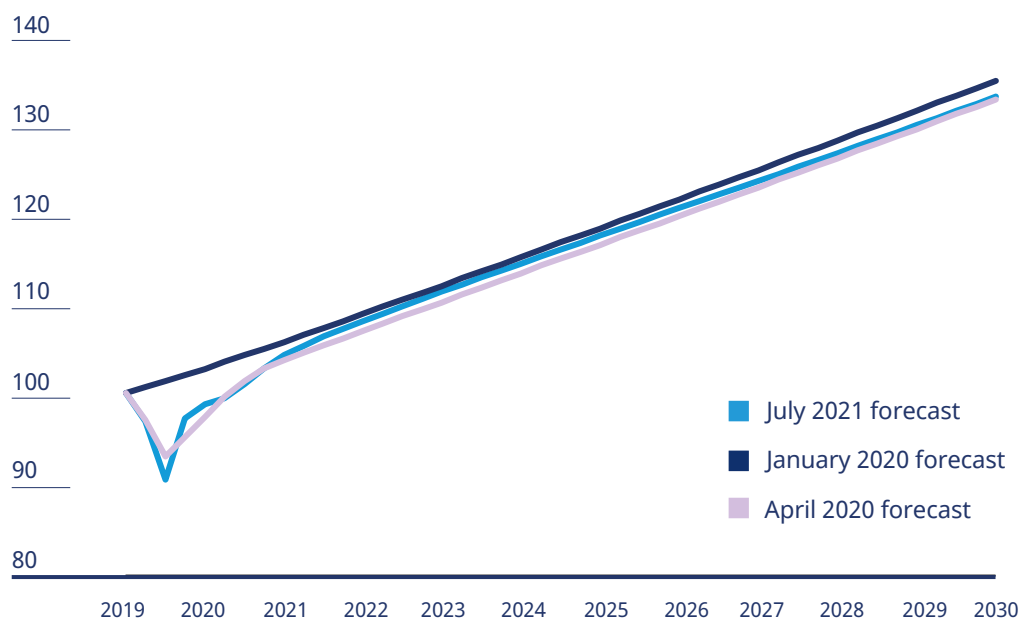
While the longer-term impact of the pandemic on global growth will only be known for certain in the coming years, several structural shifts are beginning to come into clear focus.

The first is the tremendous increase in government debt that has been taken on to support household and business incomes through the pandemic. By sustaining household and business finances, it has had the very important near-term benefit of minimising the scarring impact of the pandemic on economic activity. Indeed, the expected path of global GDP over the next several years is very close to what we were forecasting prior to the pandemic.

However, in the 2025-2030 period, we can see the level of global GDP is expected to drift back closer to the long-term view that we held at the worst of the pandemic. This is a direct consequence of the need to service and reduce this debt, which will have adverse impacts on construction.

### Global GDP forecasts at various points in time

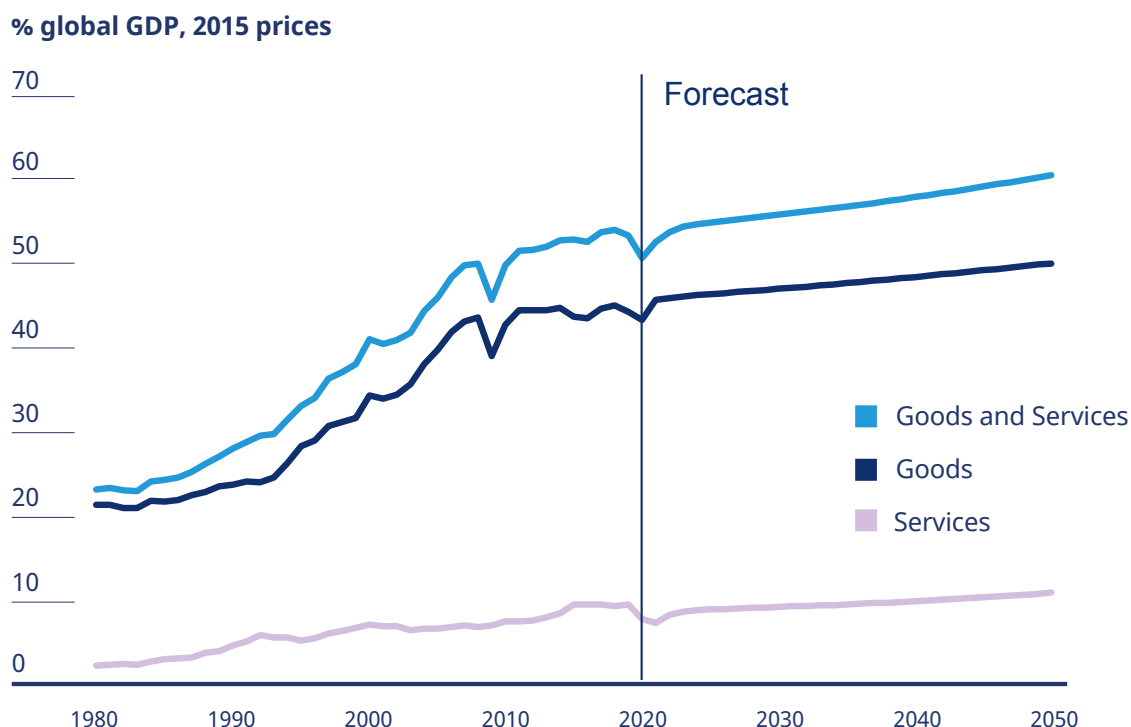
2019Q4 = 100



Source : Oxford Economics/Haver Analytics

The COVID-19 crisis is also likely to have long-term negative implications for globalisation. In addition to raising political tensions, it has led to anxiety among governments about supply-chain disruptions. The crisis will likely lead firms to shorten and/or diversify their supply chains to improve reliability. For certain sensitive industries, such as pharmaceuticals and medical equipment, many governments seem on track to force companies to ensure they have adequate domestic capacity to guarantee supplies in a time of crisis. More generally, the pandemic will likely increase nationalist sentiment and may re-energise protectionist trade policy agendas.

## Global trade (exports and imports)

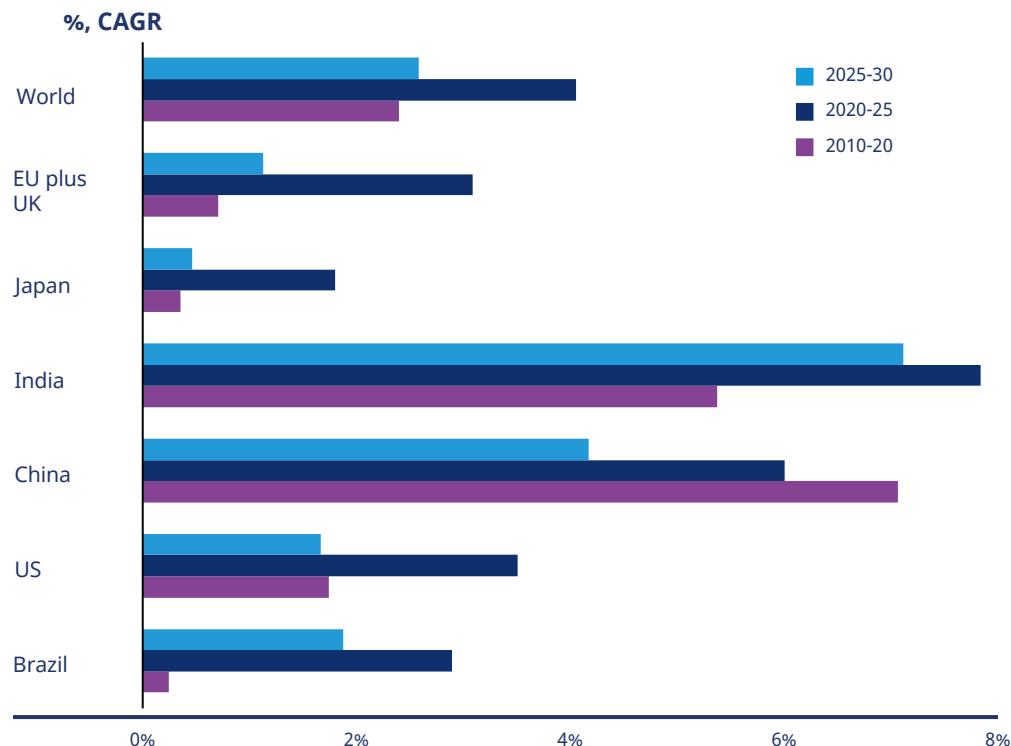


Source : Oxford Economics/Haver Analytics

We don't expect globalisation to go into reverse, but we think it will continue to proceed at a significantly slower pace than in the heyday of 1990-2010 and become more regionalised. The Asia-Pacific region is one area where opportunities abound, particularly for the ASEAN economies whose more competitive manufacturing costs have resulted in offshoring of production from China in some industries. But because rising international trade is strongly associated with productivity improvements, the growth slowdown in global trade flows will have an adverse impact on the long-term growth path, with the countries most affected being those for which exports are a primary driver of growth.

A final important, if highly uncertain, factor in the long-term growth path is the impact of climate change and policies to reach Net Zero. On the one hand, our modelling clearly demonstrates material economic impacts from an eventual temperature increase, with countries in warmer climates suffering and countries in colder climates seeing stronger economic growth. But the more important question is the degree to which policies to move countries to Net Zero can in and of themselves create new industries and innovations that could provide additional sources of economic growth. While the jury is still out on that question, there will clearly be big implications for the construction industry.

## GDP growth 2010-2030



Source : Oxford Economics/Haver Analytics

Looking at the growth profile of the major economies, we can clearly see the impact of the cyclical rebound from the COVID-19 pandemic in the 2020-25 period relative to the prior decade across all regions — especially in Brazil, which had suffered from a lengthy downturn in the years leading up to the pandemic.

But as we move into the second half of the decade, the advanced economies will return to GDP growth rates that broadly prevailed in the 2010-20 period. Europe is likely to perform a little better, but this is more a reflection of the impact of austerity in the wake of the sovereign debt crisis, which led to a recession in the early part of the last decade and sluggish growth thereafter.

The more important shifts are in emerging Asia. China is the only major country expected to witness a steady decline in average GDP growth over the 20-year period since 2010.



# feature

## How the internet of materials 4.0 will be transformational in driving a new deconstruction industry

### Norbert Pralle

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### Graham Robinson

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The IoM – Internet of Materials – is set to become the new gold rush and the construction industry is well positioned to take advantage. To achieve premiership status, companies across the sector must act fast to secure access to reuse existing construction materials – the reason is that to achieve carbon neutrality the industry must rapidly develop a circular construction economy. The industry and construction companies must invest in digitalisation and design for deconstruction of buildings and infrastructure and use big data to identify where valuable materials can be recovered from existing highly distributed urban stockpiles. Urban Mining is set to become the new normal.

The European Commission has set out a commitment in the European Green Deal for Europe to become a carbon neutral continent by 2050. The European Commission announced in July 2021 that it will commit to a 55% reduction in greenhouse gas emissions (GHGE) from 1990 levels by 2030. The European Green Deal also spells out the need for resource efficiency and for economic growth to become decoupled from resource use.

The European Commission has singled out construction as one of the most wasteful and polluting industries. Construction and the wider built environment accounts for around 40% of global GHGE and is a sector where much improvement can be made – construction and demolition waste (CDW) produced in Europe accounts for 850 million tonnes – equivalent to

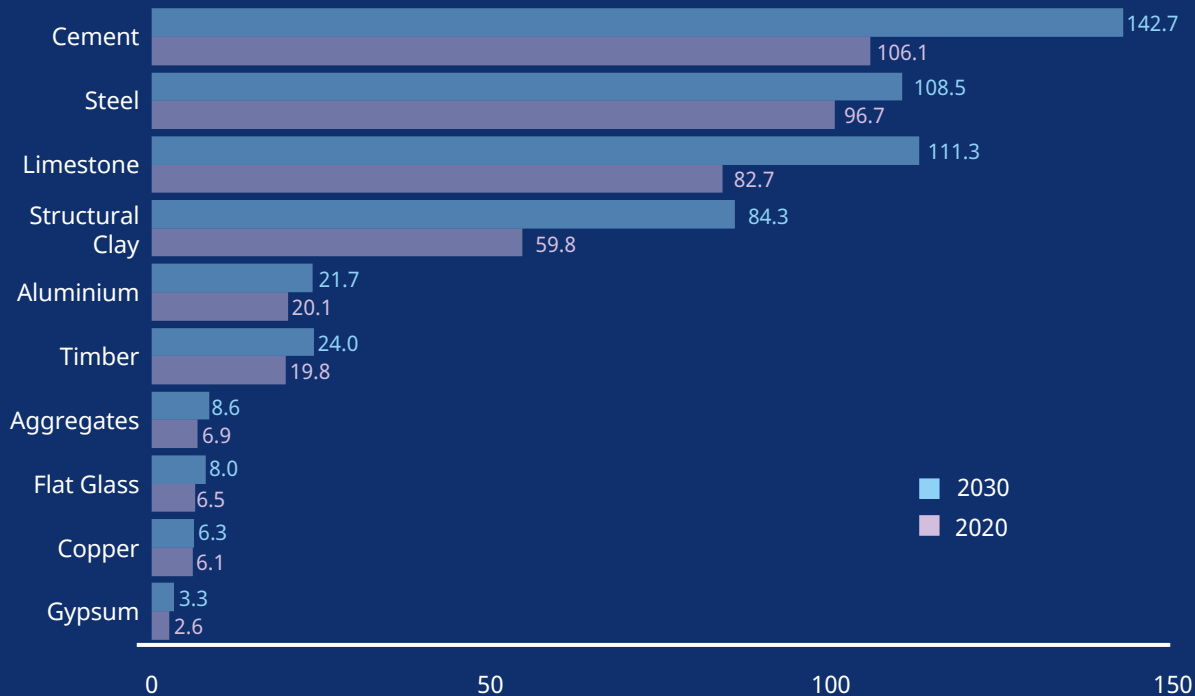
approximately 60% of the total waste produced by Europe.

Construction is a large and complex industry, and it does not generally adopt a whole of asset life cycle approach to the buildings and infrastructure it produces. There are complex and hierarchical supply chains within the sector that include a huge construction materials and heavy manufacturing sector. It can also be highly fragmented, with waste endemic in the fragmentation. As a result, it is expected that the GHGE impact caused by construction and the built environment has been underestimated.

It is estimated that total GHGE for the 10 commonly used construction materials consumed across EU28 countries will create an annual 518 million tonnes of GHGE by 2030 if no action to reduce the carbon embedded in these materials is taken. The GHGE for cement consumed in EU28 will rise to over 140 million tonnes if no carbon reduction measures are taken. This will be equivalent to over 3.75% of total GHGE across all EU28 countries in 2030. Levels of GHGE could be significantly reduced with measures to decarbonise cement production taken by the European cement industry. But the measures implemented may not meet the European Commission's target of a 55% reduction in GHGE by 2030. A gap may still exist in 2030.

## EU28 construction materials GHG emissions 2020 and 2030

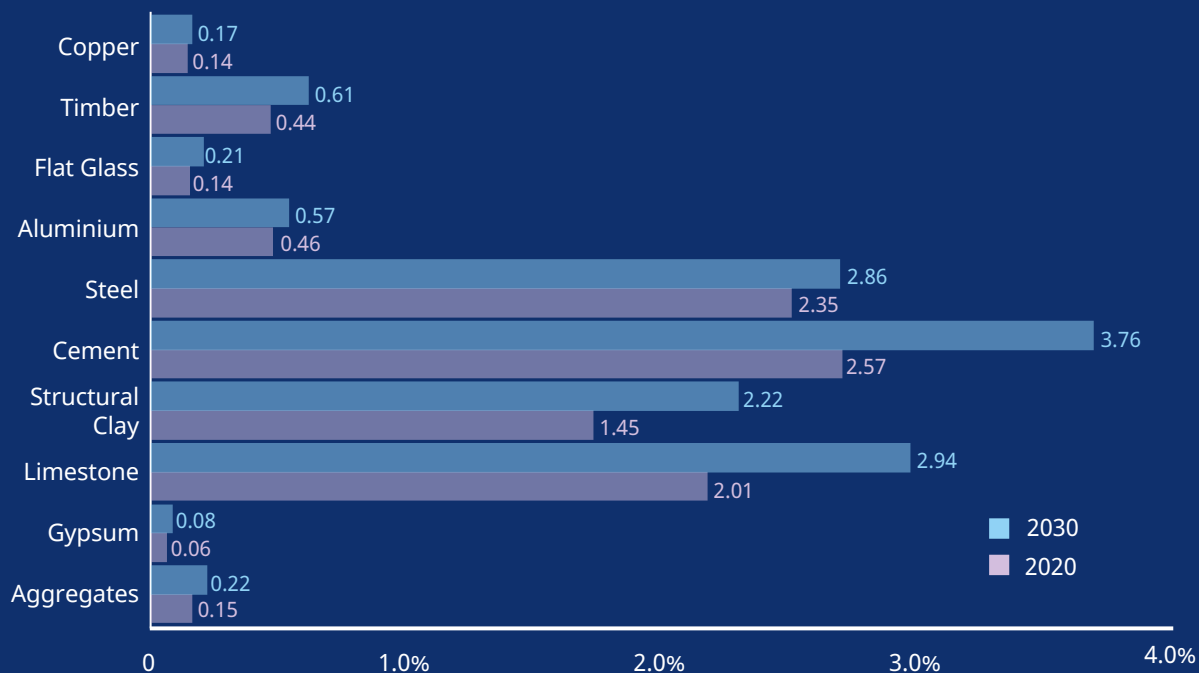
### Construction materials consumed in EU28 Mn tonnes



Source : Pinsent Masons, Strabag, European International Contractors and Oxford Economics

## Construction materials proportion of total EU28 GHG emissions 2020 and 2030

### Construction materials consumed in EU28

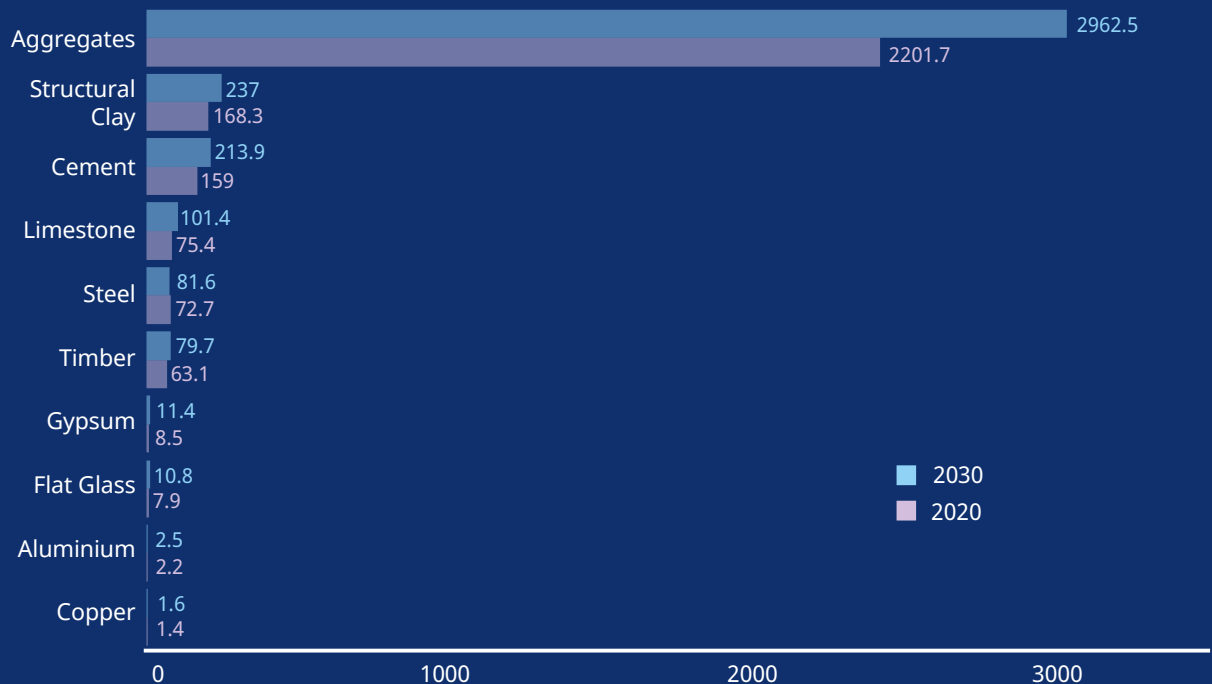


Source : Pinsent Masons, Strabag, European International Contractors and Oxford Economics

The construction sector consumes vast quantities of natural resources and materials. Across EU28 countries alone the construction industry consumed 2.8 billion tonnes across 10 commonly used materials. Unchecked, this is estimated to rise to 3.7 billion tonnes by 2030 and 4.6 billion tonnes by 2050. This consumption — if not replaced with the use of existing materials — will not only cause greater levels of GHGE but is also expected to cause greater loss of biodiversity.

## EU28 construction materials volumes 2020 and 2030

**Construction materials consumed in EU28**  
Mn tonnes



Source : Pinsent Masons, Strabag, European International Contractors, and Oxford Economics

With global populations set to rise to 8.5 billion people by 2030 and with an expected 2.5 billion additional urban population by 2050, the need for infrastructure and construction is set to rise.

Developed countries consume approximately 330 tonnes of construction materials per capita. In developing countries consumption is around 60 tonnes per capita.

Taking account of rising populations and if living standards across developing countries were to increase to a similar standard to industrialised economies. Construction of existing building stock would need to be rebuilt twice over by 2050.

The Federal Ministry of Environment has estimated that 27.7 billion tonnes of built assets already exist in Germany alone and is increasing by 10 tonnes per capita annually.

Traditional mining activity is generally concentrated in specific locations where there are deposits of natural resources.

Urban mining is very different – sources of materials that can be reused or reprocessed are highly distributed across built environments. An urban environment is the stockpile with myriads of materials as well as material compositions. The retrieval of materials and components from an extremely distributed stockpile requires life cycle-based data and information inventory using public domain databases. It could be possible for artificial intelligence (AI) algorithms to maintain the stockpile inventory.

To achieve carbon and resource neutrality, construction must undergo a major transformation, where deconstruction will play a pivotal role.

The current situation is that large quantities of CDW are being produced — circa 2.6 tonnes per capita per year in the EU. Only an estimated 50% is reused — mostly as subgrade for road construction or for other fill purposes, which is downcycling.

The mapping of urban stockpiles of existing materials will need to be undertaken together with data on expiry date for useful end of life within existing built assets. Each new building or infrastructure asset will need a coordinated and intelligent digital twin built to disclose the carbon content and designed for deconstruction and disassembly in the same way as other industries have become accustomed to disassembling products to reuse and upcycle existing materials. Rolls Royce now reuses and remanufactures 95% of existing aircraft engine parts.

In the same way that nations are investing in building national digital twins, at the city level, a database of construction materials should sit securely within the public domain.

Construction can then begin to reuse a much higher percentage of truly recycled materials. Building codes and regulation will need to be adjusted to enable the implementation of secondary materials. Developers and construction companies employing deconstruction and salvaged construction materials should also be able to gain credits and points in the LEED (Leadership in Energy and Environmental Design) rating system.

Newly built structures will also need to be built with less material using lightweight structural parts following the principles of biomimicry to consume less material and at the same time achieve structural strength.

Buildings and infrastructure will need to be fully designed for ease of deconstruction and reuse. Higher precision during fabrication and less use of chemicals such as glue and coatings and other treatments to materials will allow reuse. Simple construction approaches will help with deconstruction. The use of robotics will also allow for easier and safe deconstruction and at the same time improve productivity. Using explosives to demolish structures will become a thing of the past.

A deconstruction sector — essentially the development of a brand-new industry — will be highly data driven and it will become a valuable and modern industrial sector utilising advanced technologies such as robotics and AI. Since the material stockpiles are literally highly distributed, a vast data network will need to be operated for gold prospecting in the era of IoM.

The background is a complex, abstract digital composition. It features a dense network of thin, glowing lines in shades of blue and red, crisscrossing the frame. Interspersed among these lines are several bright, out-of-focus light points, some appearing as small clusters. The overall effect is one of high-tech connectivity and data flow. In the upper left corner, there is a faint, white, stylized graphic that resembles a large, thin-lined number '2' or a similar geometric shape.

# **Global Construction Outlook**

## 2.1 CURRENT CONDITIONS IN GLOBAL CONSTRUCTION MARKETS

We estimate the global construction market at US\$10.7 trillion in 2020 (in 2017 prices and exchange rates) after a decline of 4.3% from 2019 levels and the first contraction in global construction output for 11 years as COVID-19 paralysed activity.

A total of US\$5.7 trillion construction output in 2020 was in emerging markets.

Construction was among the most resilient sectors, with social distancing being more practical than in more socially intensive workplaces. Resilience was also borne out of comparatively low reliance on consumer spending and accommodative levels of public expenditure. We expect strong recovery in global construction output, rising by US\$700 billion or 6.6% in 2021.

Global construction's rebound was buoyed by a healthy second half of 2020 in China, which saw growth of 1.3% year-on-year in 2020, despite the pandemic. With output accounting for 24% of global production in 2020, growth in Chinese construction significantly supported the resilience of the sector globally. We expect double-digit growth in Chinese infrastructure construction in 2021.

The US construction market declined by 1.9% in 2020 — much less than the construction market in Western Europe, which dropped by 7% in 2020. The UK and France fared worse, with declines in construction output of 14% and 14.1%, respectively.

LATAM was the hardest hit region in 2020, with a near 14% decline in construction output, but is expected to see the fastest growth in 2021 of all regions.

The decline of 4.3% in global construction output in 2020 compares to a contraction of 2.7% in 2009 during the global financial crisis, when there was a prolonged and much slower recovery.

Near-term prospects for global construction remain healthy. A total of US\$1.75 trillion growth in construction output is forecast between 2020 and 2023. Apart from recovery in markets, further support in the way of significant stimulus programmes will support growth from 2022 onwards.

The US\$1.2 billion Bipartisan Infrastructure Bill passed through the US Senate includes US\$550 billion in new spending on infrastructure. Construction activity within the European Union, meanwhile, will be supported by the €723 billion Recovery and Resilience Facility (RRF), which is part of the €806 billion Next Generation EU fund (often reported as €750 billion in 2018 prices). Member states have agreed to allocate at least 37% of their RRF funds to green investments and at least 20% to the digital transition. Although large electricity generation projects can be a focus for the media, the fund will focus on making buildings more energy efficient and incentivising less carbon-intensive transport. The upcoming 2024 Olympic Games are also expected to support activity in France, spurring major projects. This includes the Grand Paris Express, a group of new rapid transit lines which will service the Greater Paris Region.

The bipartisan Infrastructure Bill will boost construction output in the US in both 2022 and 2023, when it is forecast to have its greatest impact.

Green recovery programmes are attracting significant Environmental, Social and Governance (ESG) financing, which is growing exponentially and is part of a special feature on the sources of financing for global infrastructure in this report.

Accommodative monetary policy and low interest rates means that capital flows to higher-risk and higher opportunity economies in sub-Saharan Africa and elsewhere as investors seek to increase returns.

The rapid recovery from the pandemic has caused problems with the shortage and availability of construction materials as well as skilled labour, driving prices of basic materials such as lumber up significantly in the short-term. Travel restrictions have meant that migrant labour, typically serving markets in the Middle East and elsewhere, are also holding back growth in the short-term.

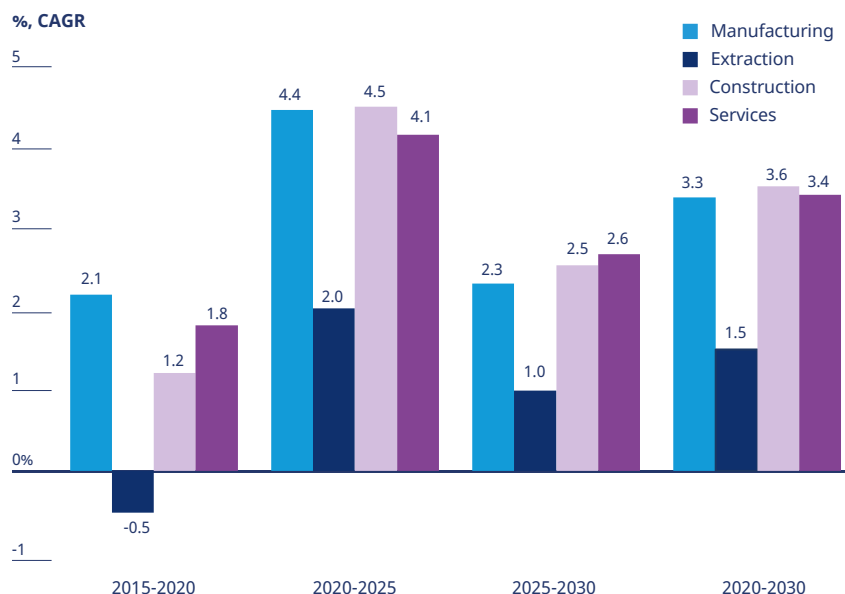
The long-term shortage of skills in many construction markets globally has meant a shift towards Industrialised Construction, where components for on-site construction assembly are manufactured off-site in factories. This will support the development of a new deconstruction industry which is the source of a feature contained in this report. The market for off-site construction is growing fast as digitalisation of the construction industry and skills shortages create demand for industrialised construction solutions.

## 2.2 CONSTRUCTION TO DRIVE GLOBAL ECONOMIC GROWTH

Construction will be a growth driver for the global economy over the medium-term, with growth averaging 4.4% between 2020 and 2025, which is higher than growth in both manufacturing and services. Looking over the period between 2020 and 2030, growth in construction output will average almost 3.5% per annum and will remain a major driver of growth for the global economy.

During the period 2025 to 2030, growth in construction will continue to be higher than manufacturing, lower than services.

### Global headline sector growth



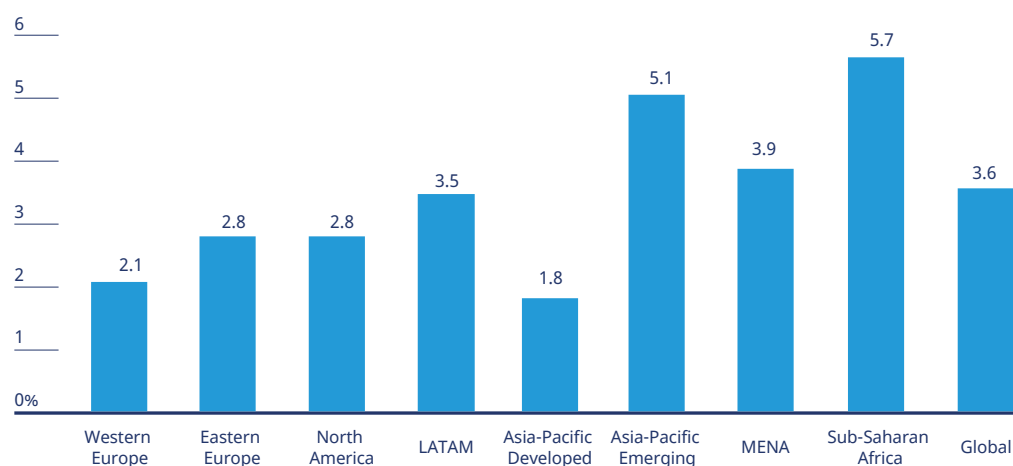
Source : Oxford Economics/Haver Analytics

## 2.3 REGIONAL GROWTH HIGHEST IN SUB-SAHARAN AFRICA FOLLOWED BY EMERGING ASIA

Growth regionally is expected to be highest in sub-Saharan Africa, with average annual growth of 5.7% to 2030, as rising populations and rapid urbanisation provide powerful growth drivers – particularly in East Africa and West Africa.

### Regional construction growth, 2021-2030

% CAGR



Source : Oxford Economics/Haver Analytics

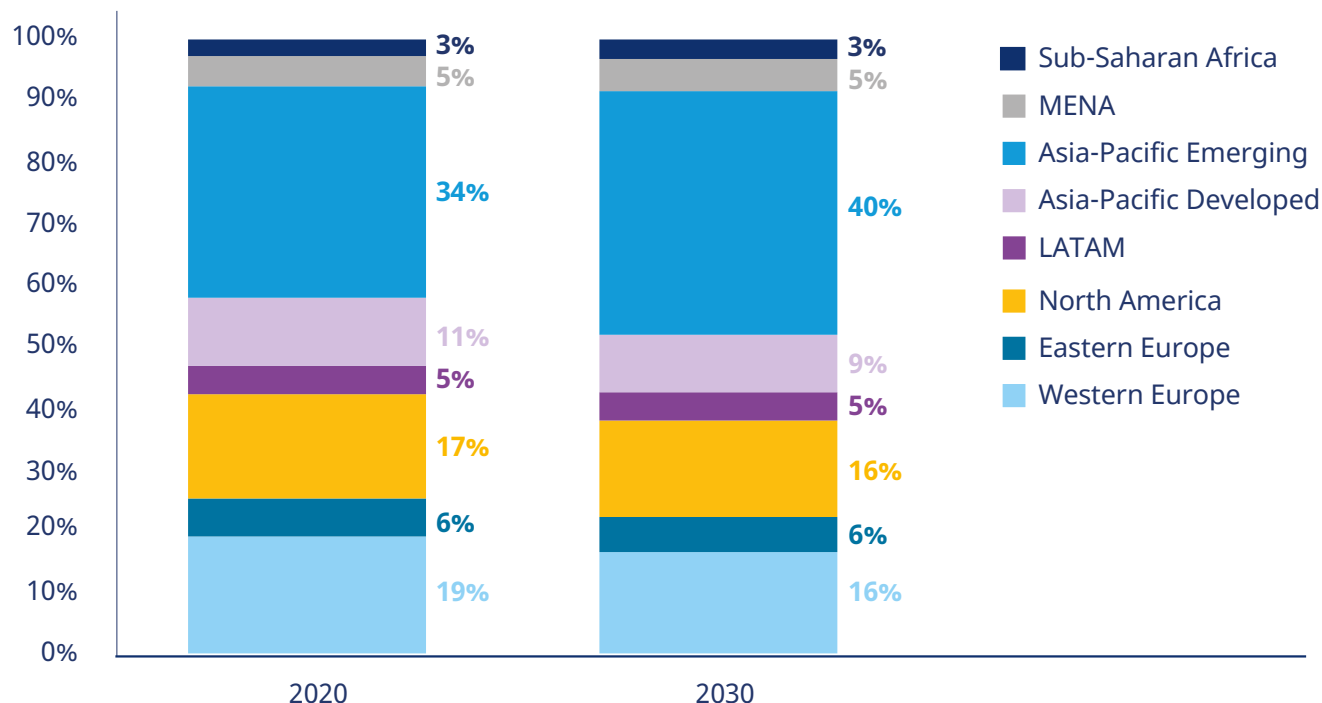
South Africa will experience low growth over the period to 2030, while faster growing sub-Saharan African countries such as Uganda, Kenya, Ethiopia, and Nigeria will propel growth for the region.

Growth in construction is also high in Emerging Asia, with average annual growth over 5% to 2030. Growth in China and India as well the ASEAN economies will provide plenty of support.

After a rebound from the pandemic over the next couple of years, there will be weak growth in Western Europe, which we forecast will drop to below 1% annually by 2030.

Low growth means that Western Europe's share of the global construction market will drop from 19% in 2020 to 16% in 2030, while Emerging Asia will rise from 34% in 2020 to 40% in 2030.

## Share of global construction output by region in 2020-2030



Source : Oxford Economics/Haver Analytics

## 2.4 FOUR COUNTRIES – CHINA, INDIA, US AND INDONESIA – ACCOUNT FOR 58.3% OF GLOBAL GROWTH IN CONSTRUCTION

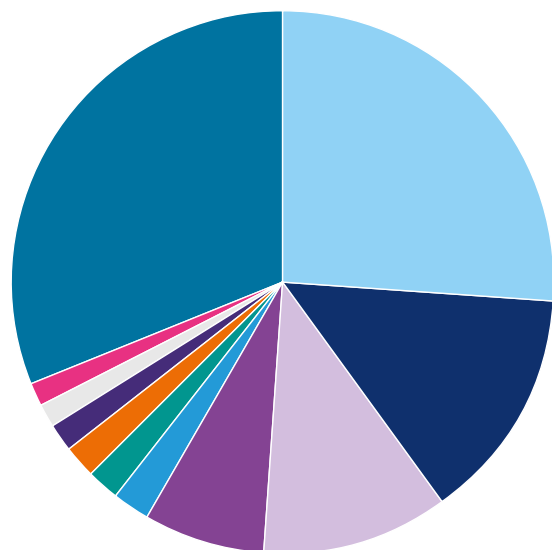
The global construction market is expected to grow by US\$4.5 trillion between 2020 and 2030, to reach US\$15.2 trillion. US\$8.9 trillion of this will be in emerging markets in 2030.

The construction sector was responsible for 13% of global GDP in 2020. This is expected to rise to over 13.5% by 2030 as construction leads the global economy in a recovery from the pandemic.

Growth will be concentrated in a small handful of countries. Just four countries — China, India, US and Indonesia — account for 58.3% of global growth in construction between 2020 and 2030. Ten markets account for almost 70% of the US\$4.5 trillion growth over the next decade.

## Contribution to global construction growth 2020-2030

2017 prices US\$bn



China 26.1%	France 1.8%
India 14.1%	Canada 1.7%
United States 11.1%	Spain 1.5%
Indonesia 7%	Italy 1.3%
Australia 2.3%	Other 31%
United Kingdom 2%	

Source : Oxford Economics/Haver Analytics

Both India and Indonesia will continue to emerge as key global construction markets.

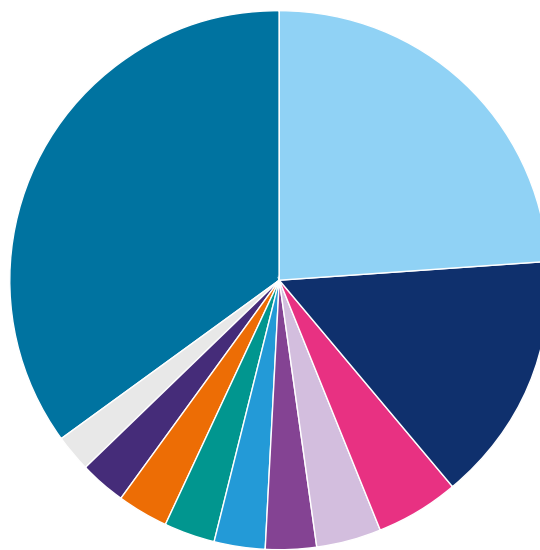
India will be a powerful engine for global growth, with construction output exceeding US\$1 trillion per annum by 2030 and an accumulated US\$7.9 trillion expected to be spent on construction in India during the decade to 2030.

We forecast India's contribution to global growth will exceed the US in the decade to 2030 and will account for 14.1% of global growth, compared to 11.1% for the US.

Indonesia will account for 7.0% of all global growth in construction — almost as large as the combined growth of Australia, the UK, France and Canada, which are the next four largest contributors to global growth in construction.

## Top 10 global construction markets 2020

2017 prices US\$bn



China 24%	Indonesia 3%
United States 15%	Australia 3%
Japan 5%	France 3%
India 4%	Canada 2%
Germany 3%	Other 35%
United Kingdom 3%	

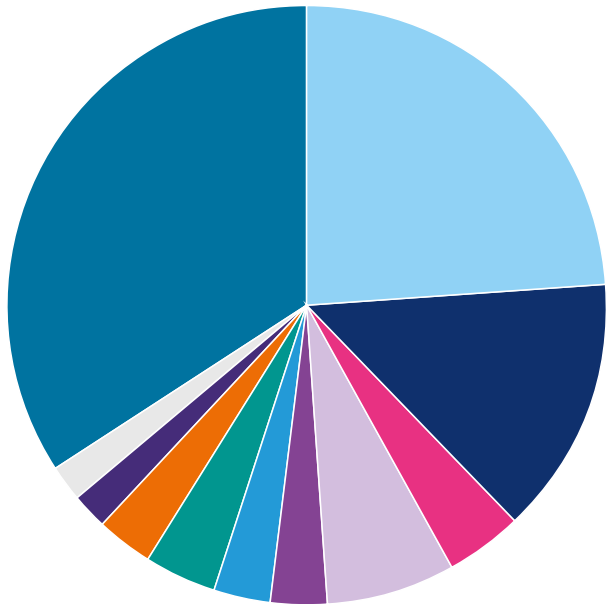
Source : Oxford Economics/Haver Analytics

India will overtake Japan as the third-largest global construction market by 2023. Indian construction recovery is expected to be particularly sharp in the short-term from a steeper decline seen in 2020.

Indonesia is forecast to move up three places in the global top 10 construction markets, overtaking the UK and Germany as well as Japan to become the fourth-largest construction market in 2030 — behind China, the US and India. Over US\$3 trillion is expected to be spent on construction in Indonesia over the decade to 2030 and Indonesia will be 50% larger in volume terms than the German construction market in 2030.

## Top 10 global construction markets 2030

2017 prices US\$bn



China 24%	Indonesia 4%
United States 14%	Australia 3%
Japan 4%	France 2%
India 7%	Canada 2%
Germany 3%	Other 34%
United Kingdom 3%	

Source : Oxford Economics/Haver Analytics



A cumulative total of almost US\$135 trillion is expected to be spent on construction globally over the next decade to 2030, with almost half attributed to growth in Asia-Pacific. This raises important questions around the race to achieving Net Zero and climate change action.

The Build Back Better and Build Back Greener recovery agenda announced by governments post-pandemic means a greater focus on clean energy and renewable energy sources as opposed to fossil fuels. There is still the key issue that remains in embedding more carbon in our cities and built assets — especially across emerging nations.

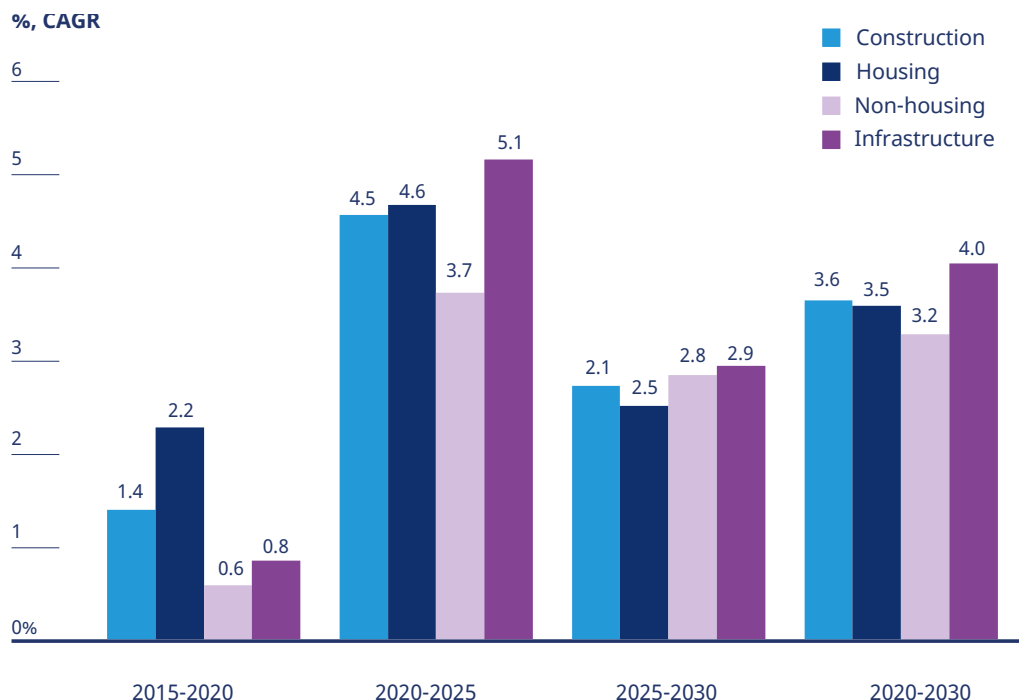
## 2.5 RESIDENTIAL CONSTRUCTION DRIVES SHORT-TERM RECOVERY

Residential construction activity is forecast to grow fastest globally in 2021 at 7.1%. With the residential sector accounting for 44% of total global construction in 2020, it is the largest subsector and a key driver of global growth.

While the Americas will be the fastest growing region for residential construction for 2021, the AsiaPacific region will continue to remain the largest market for activity.

In residential markets we are seeing sharp increases in house prices as pent-up demand in the wake of the pandemic kick-started the sector. While economic activity ground to a virtual halt across most economies during the pandemic, households had the opportunity to accumulate savings. The release of excess household savings by consumers will drive the housing market over the short-term and particularly residential renovation and upsizing of residential space as well as the repurposing of redundant space mainly from traditional retail sectors.

## Global construction growth by subsector



Source : Oxford Economics/Haver Analytics

## 2.6 NONRESIDENTIAL MARKETS TO BE SLOWEST TO RECOVER

The nonresidential building construction subsector will grow at 4.1% in 2021 to almost US\$3 trillion but will be the slowest growing subsector at an average annual growth of 3.2% over the period to 2030.

The nonresidential sector was the hardest hit during the pandemic and will be the slowest to recover. Growth in nonresidential construction over the period between 2020 and 2025 will average almost 1.5 percentage points per annum lower than the infrastructure subsector, which is the fastest growing subsector. A slowdown in international travel and a move toward working from home has paused a raft of projects in the commercial office and accommodation sectors.

While commercial office markets will be slow to recover, we expect some of the shift toward working from home to unwind as conditions normalise further.

The construction of industrial buildings is expected to grow strongly in the US to support manufacturing and a shift in spending patterns towards online platforms.

The industrial building sector is also expected to see strong levels of activity in Asia-Pacific, supporting the region's importance to global supply chains.

A strong uplift in the construction of education and healthcare buildings is expected in Europe.

## 2.7 INFRASTRUCTURE DRIVES MEDIUM-TERM OUTLOOK

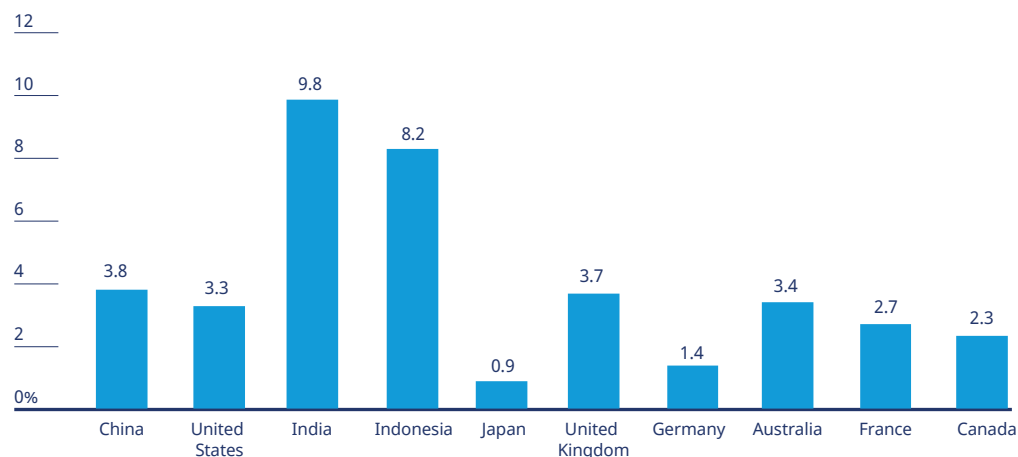
Infrastructure construction will grow at 6.8% in 2021 and will be the fastest growing subsector, with expected average annual growth of almost 4% to 2030, exceeding that of residential and nonresidential construction. This will predominantly be driven by expenditure in emerging markets as they look to develop energy, transport networks, sewage and waste systems, and other large-scale projects.

Governments around the world are focused on fast-tracking major transportation projects as infrastructure investments in productive potential have proven to be key drivers of economic recovery. The size and readiness of existing infrastructure project pipelines are critical to achieving government ambitions to accelerate infrastructure investment. Shovel-ready projects can be accelerated, whereas projects in early planning and design are more difficult to accelerate.

Growth in infrastructure construction in the UK and Australia is forecast to grow by an average annual rate of growth of 3.7% and 3.4%, respectively over the period between 2020 and 2030 – rivalling growth in infrastructure construction in China averaging 3.8% per annum over the same period. The UK's High Speed 2 project is Europe's largest single infrastructure project along with strategic roads investments. Mega infrastructure projects give the UK a heightened growth in infrastructure over the next decade to rival rates of growth in China.

### Growth in infrastructure construction 2020-2030

% CAGR



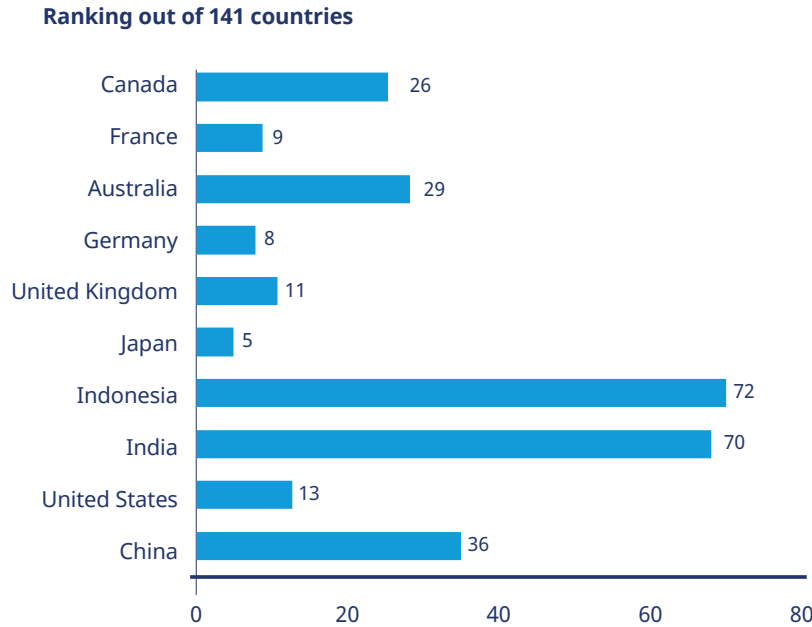
Source : Oxford Economics/Haver Analytics

A key driver of infrastructure construction output is the quality of existing infrastructure. Infrastructure is a key pillar of the competitiveness of nations. There is no coincidence that Singapore is ranked first globally for the competitiveness of its economy and is also ranked first for the quality of its infrastructure. High-quality infrastructure supports greater productivity and competitiveness and has a large economic multiplier effect. For many economies, investment in infrastructure also means that a very high proportion of spending remains in the domestic economy, providing a powerful stimulus.

The World Economic Forum (WEF) ranks the quality of infrastructure for 141 countries. A higher ranking indicates lower quality. The most recent ranking published by WEF in 2019 shows that, in general, more developed countries have higher-quality infrastructure, whereas less developed nations tend to have lower-quality infrastructure. India and Indonesia rank 70 and 72 respectively (considerably lower than any other major construction market) and as a result have some of the fastest growing infrastructure construction subsectors in the world. Australia has a large programme of urban infrastructure aimed at improving the quality of infrastructure across its major cities. Canada's aging infrastructure is also in need of renewal and upgrade.



## Quality of infrastructure ranking in top 10 construction markets

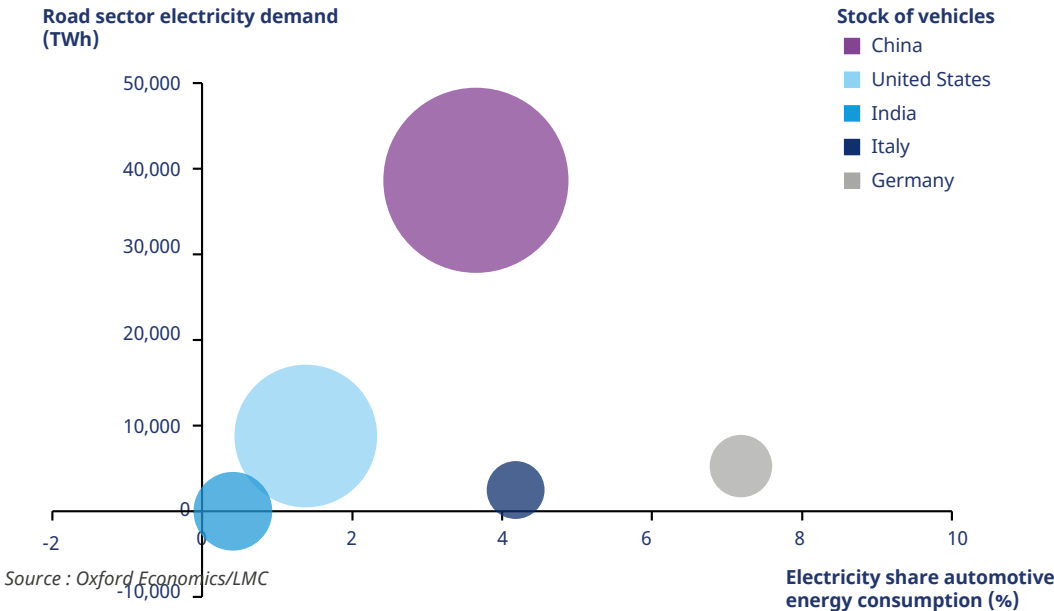


Source : World Economic Forum, *The Global Competitiveness Report 2019* (latest rankings)

The emergence of the electric vehicle (EV) market globally will require increased investment in electricity generation and the development of rapid charging infrastructure. It will represent a seismic change in the decarbonisation of ground transportation. The German automotive market is forecast to consume 7.2% of total electricity consumption by 2030, whereas China — the world's largest automotive market — is expected to account for 3.7% of total electricity consumption by 2030.

A report by the UK's Net Zero Infrastructure Industry Coalition identifies a fivefold increase in the development of renewable sources of energy in the UK to decarbonise heating of homes and commercial buildings.

## Five largest automotive markets in 2030



## 2.8 POPULATION AND URBANISATION

The Global population reached almost 7.8 billion people in 2020 and is expected to rise to over 8.5 billion by 2030.

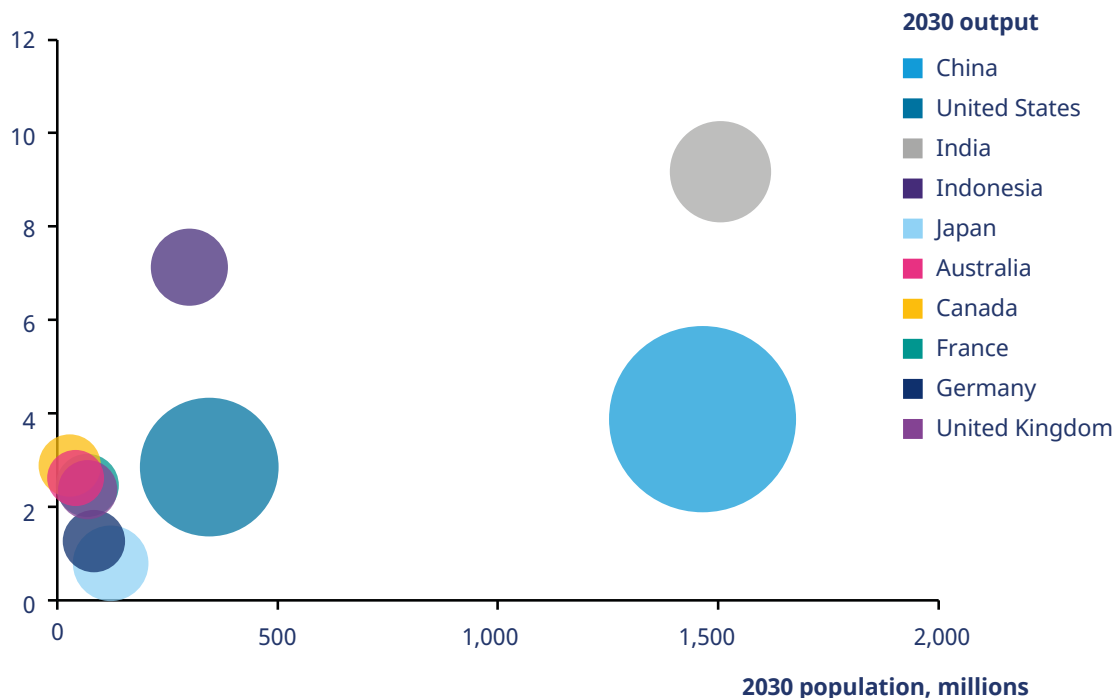
The highest growth will be in sub-Saharan Africa, with the population expected to reach 1.4 billion by 2030, adding over 300 million to the 1.1 billion people in the region as of 2020. The population of some African countries is predicted to explode. Ethiopia will add 30 million people to its population by 2030, to reach 145 million, and Nigeria will add almost 60 million people to its population.

More than half of global population growth between now and 2050 is expected in Africa. The population of sub-Saharan Africa is expected to double by 2050 from today's levels.

India will add 125 million to its population by 2030, pushing the country to 1.5 billion. India's population is expected to surpass China in 2027 to become the world's most populous country.

### Growth in construction v. population

2020-2030 %, CAGR



Source : Oxford Economics/Haver Analytics

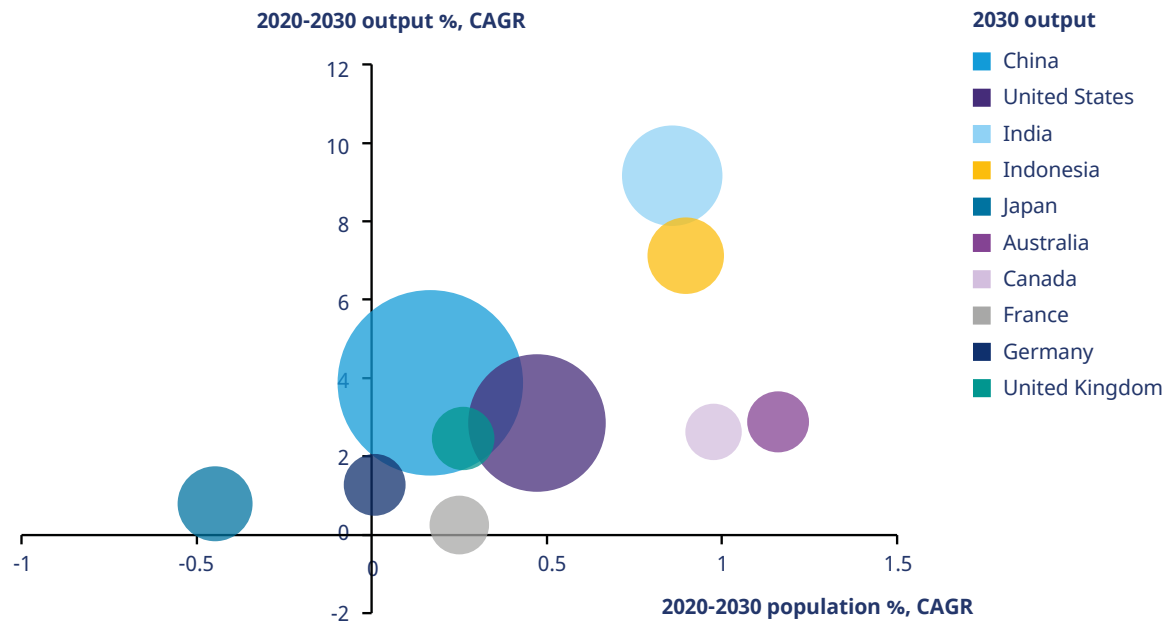
China's population is expected to decrease by over 30 million in the longer-term to 2050, while the percentage of those aged over 60 in China will be comparable to Europe.

The population of Europe is predicted to fall between now and 2030, driven by shrinking populations in Eastern European countries.

The population of Japan is already shrinking and is expected to decrease by 6 million people by 2030 and over 20 million by 2050.

Growth in population drives the need for basic infrastructure and housing.

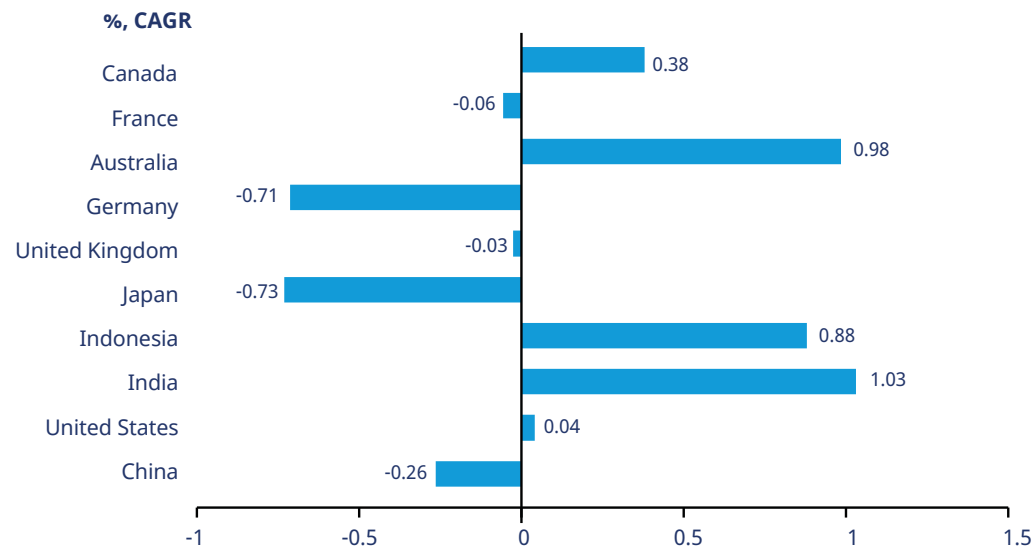
## Growth in construction and population



Source : Oxford Economics/Haver Analytics

Working age population is a driver of different types of construction activity and broadly translates into workplace construction.

## Working age population growth, 2020-2030

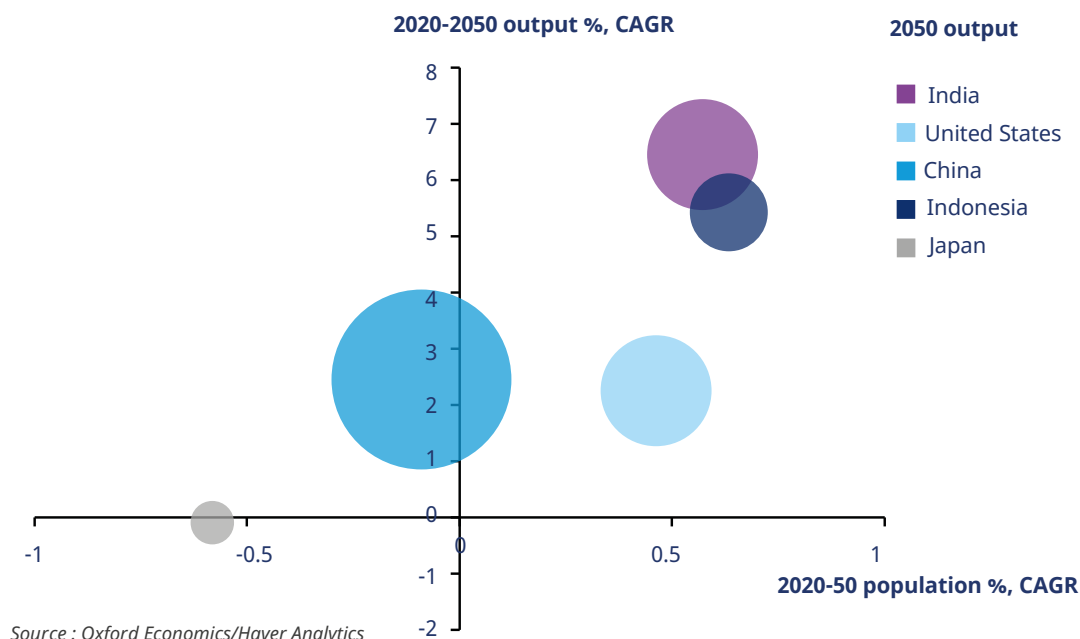


Source : Oxford Economics/Haver Analytics

While most developed nations will see a plateau in the growth of working age populations. Australia's working age population is expected to grow at an average of close to 1% per annum to 2030 but in the longer-term the numbers aged over 64 years will increase the dependency ratio. Population in Australia is expected to grow by almost 5 million by 2030, with migration expected to return by mid-2022.

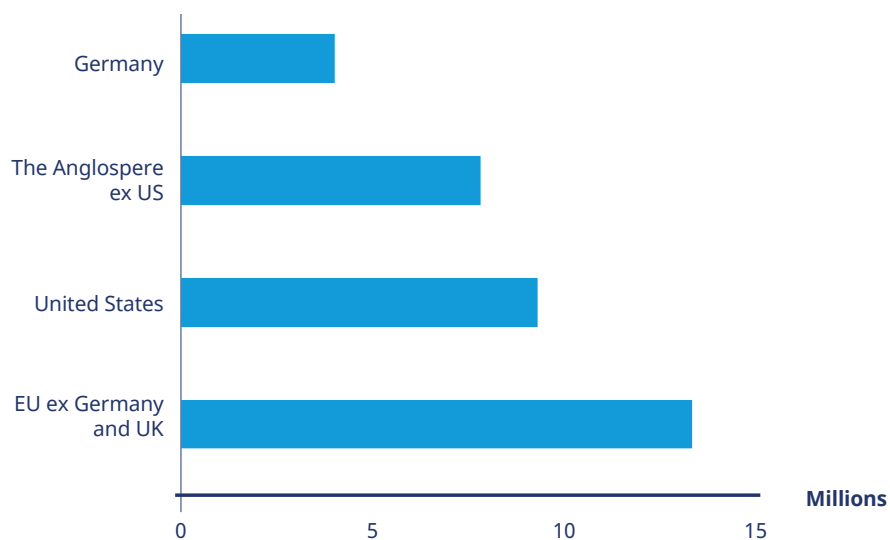
Population growth in both India and Indonesia will continue to underpin growth in construction output into the longer-term to 2050 and eventually see India surpass the US as the second-largest global construction market. By contrast, a declining Japanese population should see stagnation of construction. Average annual growth in output is expected to be negative between 2020 and 2050.

## Long-term construction and population growth



Annual average growth in construction output to 2050 for China will be around 2.4% as China settles to become a mature market with a similar profile to the US.

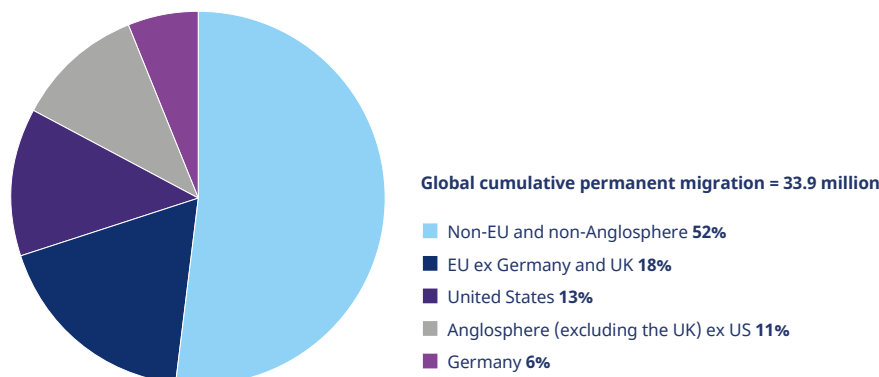
## Cumulative permanent migration flows, 2010-2018



Source : Oxford Economics/Haver Analytics

Within the Anglosphere (defined as US, UK, Australia, Canada and New Zealand), permanent inward migration will help to sustain population growth and construction demand. Almost a quarter of all permanent migration to OECD countries between 2010 and 2018 arrived in the Anglosphere. Migration to Germany made up 6% of all OECD permanent migration.

## Proportion of global cumulative permanent migration, 2010-2018



## 2.9 URBANISATION TO TURBOCHARGE GROWTH IN EMERGING MARKETS

Growth in urban population drives growth in urban infrastructure as well as multifamily residential construction. The pandemic has temporarily slowed the move into urban areas, where there is expected to be a gradual reversal.

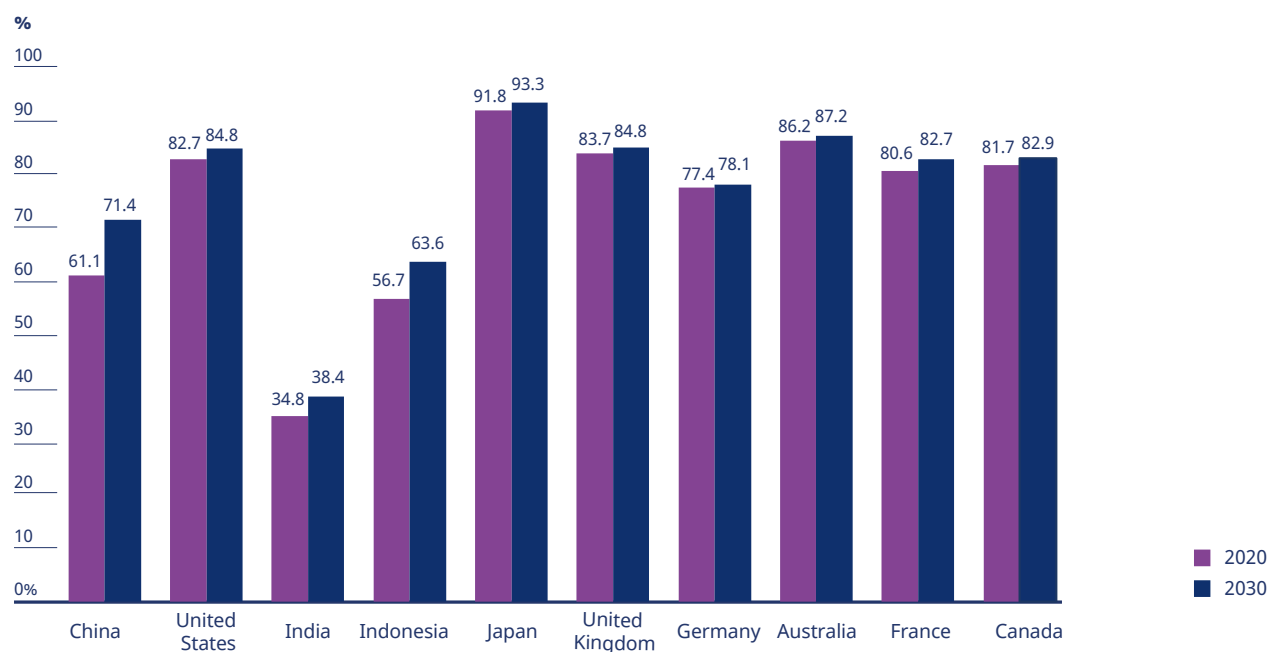
The gradual shift from rural to urban centres combined with the overall growth of the world's population could add another 2.5 billion people to urban areas by 2050, with almost 90% of this happening in Asia and Africa, according to the UN.

The urbanisation of over 140 million Chinese citizens in the decade to 2030 will support growth in all types of construction in China.

Both India and Indonesia are in the beginnings of a similar trend, with urbanisation starting at a lower base but expected to pick up notably over the next decade. A total of 125 million more of the Indian population will live in urban areas by 2030, according to UN - the equivalent to the entire growth in India's population between 2020 and 2030.

Source : Oxford Economics/Haver Analytics

## Urban population in 2020 and 2030



Source : Oxford Economics/Haver Analytics



# feature

## Global flow of funds for infrastructure

**Michael Watson,**

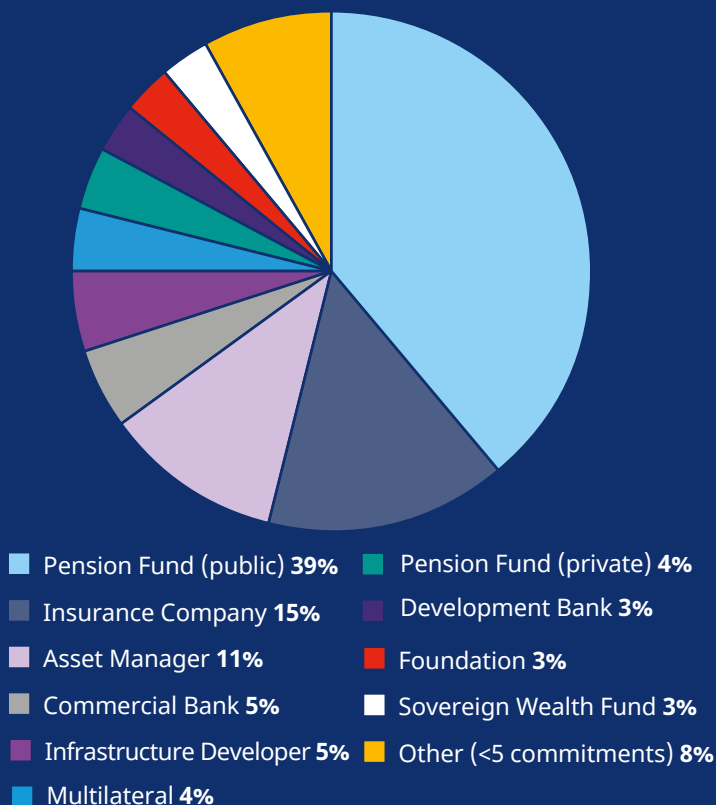
Partner, Head of Finance and Projects and Head of Climate Change Advisory, Pinsent Masons LLP

Sustainable and quality infrastructure is a well-known driver of economic growth and social progress and is seen by many as a critical enabler to achieving Sustainable Development Goals (SDGs) and Paris Agreement commitments.

Infrastructure funds raised over US\$61.3 billion for both operational and new-build infrastructure at final close in the first six months of 2021, with nearly two-thirds of funds closing above their initial target size<sup>1</sup>. Almost 75% (US\$45.6 billion) was equity and a further US\$8.7 billion was debt. A total 39% of Limited Partners (LP) commitments were from public pension funds, with a further 15% from insurance companies and 11% from asset managers. Geographically, 18% of the capital raised was solely focused on North America, 17% solely on Europe and 8% on Asia-Pacific. The remainder was targeting multiple regions or was globally focused.

Significant equity is usually allocated to infrastructure by major construction companies and developers, using their own corporate balance sheets. Equity capital is used in the development of new infrastructure assets. In addition, direct investment is also allocated by pension fund managers and sovereign wealth fund managers.

### Number of LP commitments by investor type –final close H1 2021

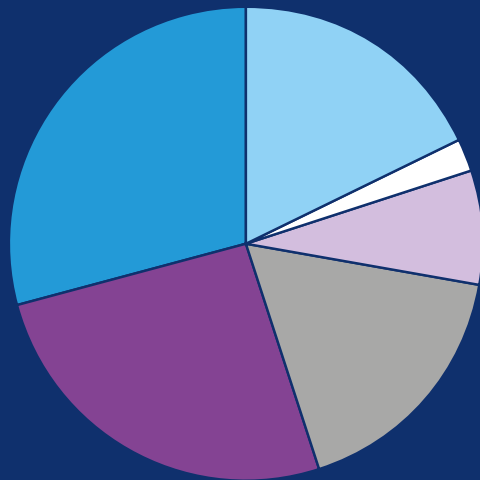


Fundraising for unlisted, closed-end funds during the first half of 2021 was dominated by a surge in dedicated renewables strategies, accounting for about a third (US\$19 billion) of the total raised. This compared with just US\$1 billion in dedicated renewables for the same period in 2020<sup>2</sup>.

The increase came at the expense of strategies targeting both 'traditional' and 'renewable' energy, which amounted to US\$1.1 billion in the first six months of this year, compared with \$14.7 billion in the first half of 2020.

Source : IJ Investor and Pinsent Masons analysis

## Geographic targets of capital raised — final close H1 2021



- North America 18%
- Global (OECD) 2%
- Asia-Pacific 8%
- Europe 17%
- Global 26%
- Multiple 29%

Source : IJ Investor and Pinsent Masons analysis

## Rise in green investing

Green investing is a central theme among funds currently in fundraising mode, with terms such as 'green', 'clean', 'sustainability', and 'energy transition' increasingly appearing in fund names, according to IJ Finance analysis<sup>3</sup>. Such funds are also looking beyond the power sector to energy efficiency and wider decarbonisation of other infrastructure subsectors, such as transmission, clean transport, and digital infrastructure.

Research in the clean energy investment space by consultancy bfinance<sup>4</sup> found that while 47 renewables funds are currently in market, a further 15 are dedicated to energy transition investments.

The figures confirm the belief that renewables and digital infrastructure are two of the most promising and resilient growth sectors in the post-pandemic environment. *Infrastructure Investor* established that all top five funds which closed during the first half of 2021 were specialised vehicles, either focusing on sectors such as renewable energy or digital infrastructure, or regions, notably Europe and Asia-Pacific. This should come as no surprise, given the Net Zero pledges and government plans to 'build back better'.

McKinsey estimates that the energy transition will require US\$3 trillion to US\$5 trillion per year in capital expenditures by 2030, a total far above current capital invested.

## Tipping point for ESG investment

In private markets, ESG impact has now reached an inflection point, according to McKinsey<sup>5</sup>, becoming crucial for a variety of stakeholders. These include regulators, LPs, consumers, and employees.

Capital flowing into ESG-related investment strategies saw unprecedented growth in 2020: Nearly \$400 billion in cumulative ESG-focused private capital was raised from 2015 to 2020, with over a quarter (about US\$100 billion) being raised in 2020 alone.

ESG-related capital grew by 28% per annum in infrastructure, with a large part of the increase due to a flow of fundraising into sustainability-related strategies.

The trend is set to continue, with a recent PGIM survey<sup>6</sup> finding that 58% of global investors are actively incorporating climate change commitments into their investment processes. However, the figure hides some geographical disparity, with only 47% of North American investors doing so, compared to over 80% of investors in Europe.

For many investors, the rise in attention paid to ESG will require a steep learning curve in terms of developing new skill sets, such as being able to source, organise, analyse, and report ESG data. One approach is simply to buy the analytics, with ESG software and data provider Sphera being acquired by Blackstone for US\$1.4 billion, for example.

Until recently, one of the main barriers to investors making a major move into sustainable investing was the lack of commonly accepted reporting standards. However, the ongoing consolidation of standards organisations and the growing acceptance of frameworks for measuring ESG criteria is leading to increased momentum from investors to 'get into the game'.

## Increasing opportunity in Asia-Pacific

It is not just developed nations such as the US that offer opportunities for infrastructure investment. Whilst President Biden's spending package aims to put infrastructure front and centre to boost the economy and upgrade crumbling roads, bridges, and dams, demand for infrastructure in areas like Asia-Pacific is seen by some as a huge opportunity for large institutional investors and private equity firms.

According to the Asian Development Bank, developing Asia will need to invest \$26 trillion from 2016 to 2030 if the region is to maintain growth momentum and respond to climate change. Of the total, climate-adjusted investment needs over 2016-30, US\$14.7 trillion will be for power and US\$8.4 trillion for transport. Investments in telecommunications will reach US\$2.3 trillion, with water and sanitation costs at US\$800 billion over the period.

Recent analysis of 'alternative assets' in Asia-Pacific by Preqin<sup>7</sup> suggested that "the alternative investment market in Asia is set to experience explosive growth in the coming years, with private capital assets under management (AUM) on course to reach \$6 trillion by 2025." It adds that private capital is playing a growing role in asset allocations across Asia-Pacific, with AUM of Asia-Pacific-focused private capital reaching US\$1.7 trillion as of September 2020 — a sixfold increase over the past decade.

Meanwhile, figures from Refinitiv show that in China, Hong Kong, and Taiwan, around 41 sustainable bond transactions worth US\$19 billion were recorded in first six months of this year, compared to 23 deals worth US\$7.6 billion in all of 2020.

Aside from the renewable energy focus in Asia Pacific, where utilities should be encouraged to develop as much renewable energy as possible, the infrastructure around digitalisation and data is becoming increasingly important in the region, too. Countries such as China and India had no real mobile phone network 20 years ago, but major rollout of 3G and 4G coverage in recent years has seen exponential growth in the take-up of data.

As Asia-Pacific economies grow — and with them the size of the middle-class —, we're likely to see rising demand for assets such as cell towers and data centres, followed by future investments in smart cities and electric vehicle charging.

Whilst there are positive undertones to the fact that if asset managers understand the impact of climate change on their portfolios, it will encourage a sustainable built environment and support the drive to decarbonise, there remains a significant challenge around stranded assets.

Lawrence Slade, CEO of the Global Infrastructure Investor Association (GIIA) perhaps summed up this best earlier this year when he said: *"Many investment opportunities will arise from increased digitalisation, green gas, electric vehicles (EVs), clean power, and other areas of innovation. However, companies must carefully manage these opportunities alongside challenges from stranded assets."*

The pace of change continues to accelerate, with investors having to combine mitigation strategies in relation to their existing portfolios and an aggressive focus on Net Zero or net positive impact in respect of new investments and capital allocation.

<sup>1</sup> Investor Funds Report, H1 2021, IJ Investor, 15 July 2021

Source: [IJInvestor Funds & Investors Report – H1 2021 | Research & Analysis | IJGlobal](#)

<sup>2</sup> H1 2021 Fundraising Report, Infrastructure Investor, 27th July 2021

<https://d16yj43vx3i1f6.cloudfront.net/uploads/2021/07/h1-2021-fundraising-report-infrastructure-investor.pdf>

<sup>3</sup> Investor Funds Report, H1 2021, IJ Investor, 15 July 2021

Source: [IJInvestor Funds & Investors Report – H1 2021 | Research & Analysis | IJGlobal](#)

<sup>4</sup> [Renewable Energy Infrastructure: Lessons from Manager Selection \(bfinance.co.uk\)](#), March 2021

<sup>5</sup> A year of disruption in the private markets

[McKinsey Global Private Markets Review 2021, McKinsey, April 2021](#)

<sup>6</sup> [Climate change investment approach has North American investors trailing the world: PGIM survey](#), April 2021

<sup>7</sup> [Markets in Focus: Alternative Assets in Asia-Pacific 2021, Preqin, 17th June 2021](#)

<sup>8</sup> [McKinsey, 20th Jan 2021](#)

## 2.10 ABILITY TO FINANCE INFRASTRUCTURE

Infrastructure development globally is heavily dependent on public spending, with taxation or receipts from user charges or a combination of both required to fund infrastructure.

In many markets, public-private partnerships (PPPs) are a way of developing infrastructure, using private financing with returns usually based upon receipts from government payments, which are either based upon the availability of the asset, or, less often, the volume of use. Governments in some markets grant concessions for infrastructure development such as high-speed rail or expressways. There have been high-profile failures of infrastructure PPPs in countries. In the UK, where the PPP model was first developed, its traditional use is now virtually nonexistent. Canada and Australia remain the most successful PPP markets, with both governments remaining firmly committed to the use of private financing for public infrastructure.

The US will remain a significant market for PPPs as high levels of government debt will constrain spending on infrastructure. Localised tax raising is one approach to raising funding needed for infrastructure spending.

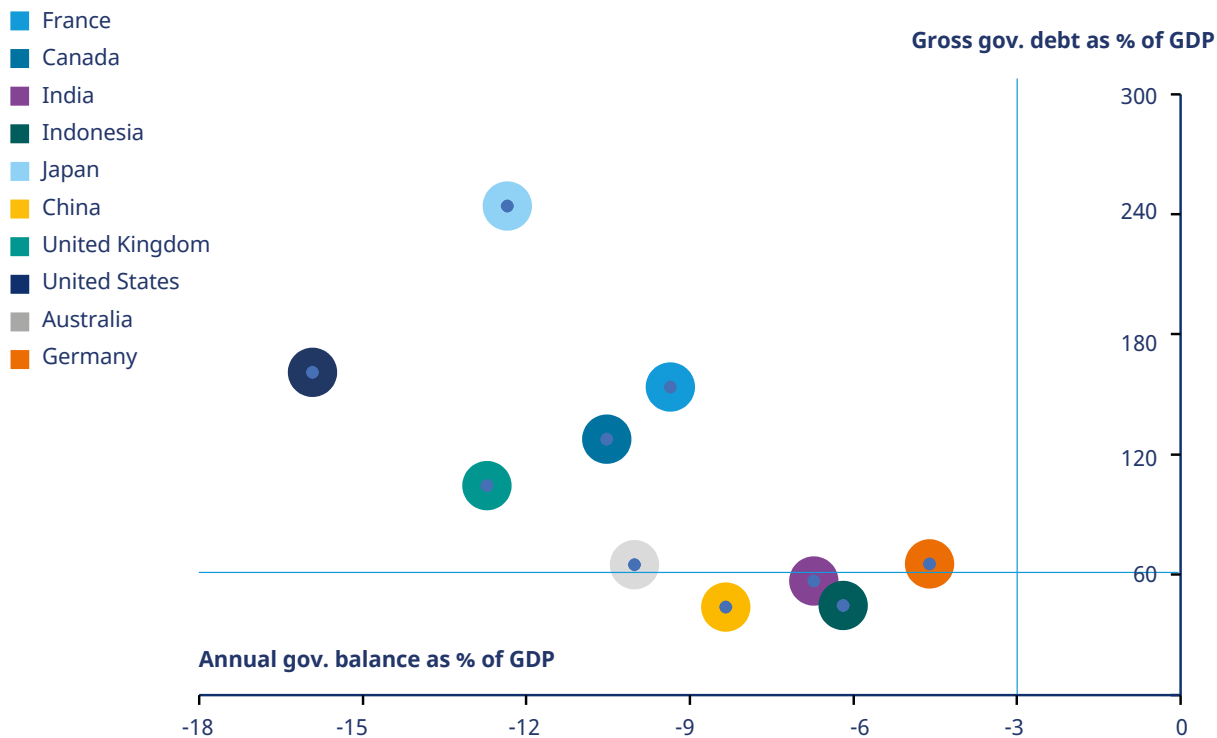
In some markets, such as the UK, moving infrastructure asset classes into a Regulated Asset Base (RAB) model is a mechanism for government to control private sector returns and ensure value for money, but it is also attractive to private financing. Another mechanism that has been trialled with limited success is land value capture, where increased land value around infrastructure development is leveraged – particularly around transport nodes. Various taxation approaches and levies have also been used to help fund infrastructure.

Increasingly, ESG and green financing is driving clean energy assets as well as emerging areas, such as the major deployment of carbon capture, usage and storage (CCUS) during the 2030s, and the development of renewable energy, including the use of hydrogen pathways to decarbonisation. There will also be a Contract for Difference (CfD) to support the development of blue and green hydrogen in the UK.

The use of multilateral development finance for infrastructure has been highlighted many times as a key to supporting private financing of infrastructure where there is significant risk during early-stage development. Financing from the World Bank or other institutions, such as the European Bank for Reconstruction and Development (EBRD) or African Development Bank, remains attractive to support private financing. The establishment of the UK Infrastructure Bank (UKIB) is seen as critical for future infrastructure development in the UK post-Brexit and is expected to provide first loss guarantees.

A driver of infrastructure construction is therefore the ability of governments to finance spending on infrastructure. There are two main measures of the level of government debt. First, there is the annual budget deficit which measures the difference between government revenues and spending. Second, there is the government's debt as a percentage of GDP. The latter is a more revealing indicator of long-term ability to finance infrastructure developments.

## Ability to finance public investment, 2020



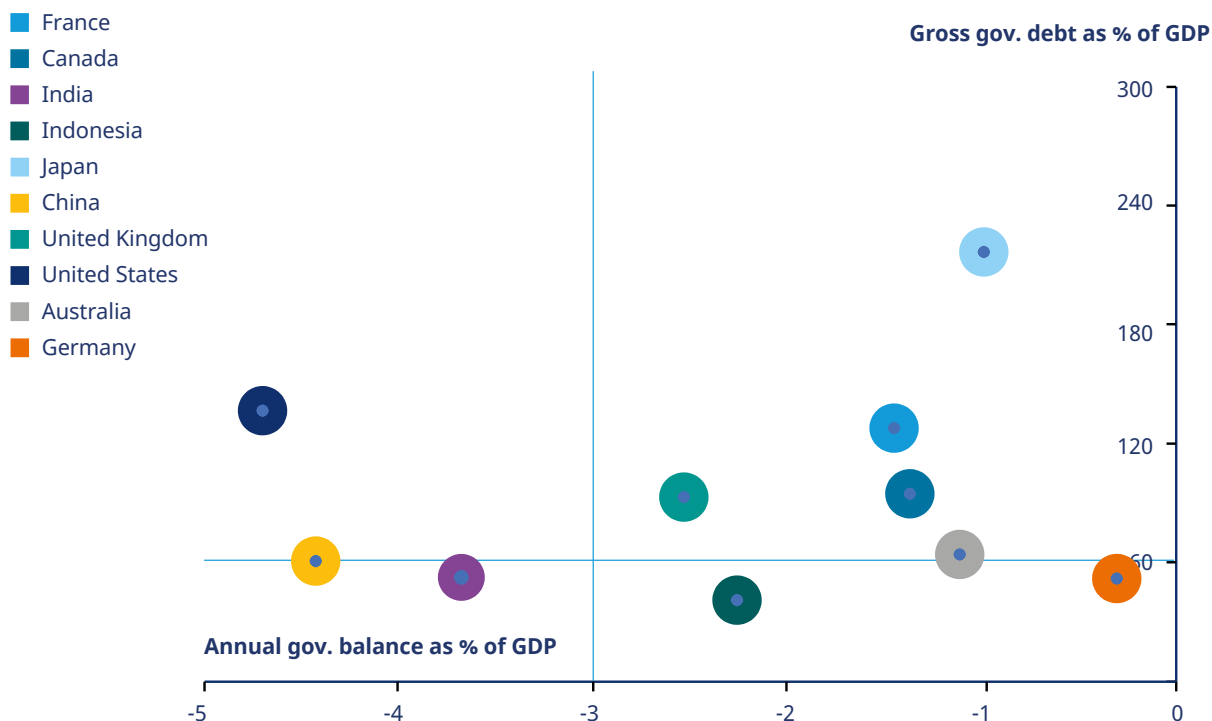
Source : Oxford Economics/Haver Analytics

The annual balances of most economies were inflated in 2020 as governments built economic safety nets in the wake of the COVID-19 pandemic.

Australia, Germany and Indonesia are among the best placed economies out of the global top 10 construction markets to utilise additional public financing to support infrastructure development. Using additional public financing for Japan, where government debt is at 236% of GDP, will be challenging. Coupled with a relatively high level of quality of existing infrastructure, we forecast virtually stagnant levels of growth in Japanese infrastructure construction over the period to 2030. Japan spent almost 60% more on infrastructure construction in the mid-1990s in real terms than today. German government finances will remain relatively healthy, but this is unlikely to translate to high rates of growth in infrastructure construction.



## Ability to finance public investment, 2030



Source : Oxford Economics/Haver Analytics

Although infrastructure development is heavily dependent on the ability of governments to finance it is not the sole driver. We expect to see a resurgence of PPPs in many markets. In the UK, where private finance initiative (PFI) has become unpopular, there is an expectation that other types of public private partnerships will play a part.

The long-term stable and index-linked returns from infrastructure are generally well matched to the needs of large superannuation funds. Construction risk remains a barrier and moving assets into more innovative financing structures will be key moving forward.

## 2.11 THE RACE TO ACCELERATE NET ZERO

The race to accelerate Net Zero will be a huge challenge for the construction sector globally. The European Green Deal sets out Europe's ambition to decarbonise and to become a carbon neutral continent by 2050. Both Europe and the UK have set ambitious targets for decarbonising economies. The European Commission has also targeted construction as a wasteful and polluting industry and circularity is identified as critical to carbon neutrality and the protection of biodiversity.

The construction sector and wider built environment accounts for around 40% of global GHGE. Developing countries will need substantial investment in new infrastructure. India and China will need to build over 100 million new homes over the next decade to keep up with demographic changes.

Construction is the most wasteful sector globally and construction materials consumed are expected to rise significantly, according to the OECD.

High levels of embedded carbon in new construction will need to be addressed.

Risk is usually pushed down hierarchical construction supply chains. Transforming business models and digitalisation is essential to decarbonise construction. Flatter and coordinated supply chains and a manufacturing approach is needed, while procurement and contract structures must change to support a shift toward industrialisation.



# feature

## Climate catastrophe – how should construction adapt?

**Jessica Turner PhD, ACII,**

Managing Director, Head of International Catastrophe Advisory, Guy Carpenter

Despite the disruption and widespread economic contraction of 2020 causing annual global greenhouse gas emissions to decrease by 7%<sup>1</sup>, the year was tied with 2016 for the warmest on record<sup>2</sup>. Climate change continues to be one of the most important issues of our day and making the necessary transformations to meet the challenge will transform every individual and every sector of the economy.

The construction industry will be impacted in two fundamental ways. The first is through the critical need to reduce its own carbon footprint, which is generally understood to consist of embedded carbon (the carbon used to produce materials), and operational carbon (the carbon used in operating the built asset). Combining these two types of emissions, the sector accounts for almost 40% of energy-related carbon emissions<sup>3</sup>. A 2020 report by the International Energy Agency (IEA)<sup>4</sup> found that emissions from buildings were not on track to meet climate goals. Governments around the world are reacting to the need to transition their economies; for example, in July 2021, the European Commission adopted a package of proposals to reduce the EU's greenhouse gas emissions by 55% in the next decade.

A variety of activities and innovations are needed to correct the current trajectory of construction sector emissions. It is critical that energy efficiency improves in design and construction, as well as the operations of buildings. This requires stricter energy efficiency codes on new builds to avoid locking in future emissions and the renovation of existing stock. Heating, especially in developed nations, must move away from fossil-fuel sources. Urban planning should consider carbon intensity, including district integrated smart grids to manage supply and demand. Incorporating clean energy, such as solar thermal or micro wind, into buildings is also important. Significant changes are also needed in the materials sector. Decarbonising steel and concrete production currently represent a significant challenge. The alternative is to substitute such materials, where possible, for lower-carbon intensity products, and increase recycling. To increase the ability to reuse and/or recycle materials, details of the materials included in built assets must be documented.

The second fundamental impact is through the increased physical risk to construction, property, and infrastructure from severe weather events, with attribution studies showing the role of climate change in increasing the likelihood of extreme events. Severe weather spans a variety of phenomena and the impacts of climate change on the frequency and severity of severe weather depends on the peril and the region.

Global temperatures are rising, and an increased risk of heat waves is one of the clearest consequences. At a certain level, extreme temperature can stop work on construction projects for health and safety reasons while also potentially compromising the structural soundness of materials, causing improper operation of machinery, and increasing fire risk on the site.

Heavy precipitation and flooding is another peril that is predicted to increase due to climate change. Severe circumstances can cause significant damage to project sites with excavations collapsing, exposed materials becoming waterlogged, and surfaces becoming slippery.

Although gales and high winds are also known to be a risk to construction, it is less certain how wind will be impacted compared to temperature and precipitation. Tropical cyclones are likely becoming more intense but mid-latitude windstorms have not yet shown to be influenced by climate change<sup>5</sup>.

Increasing frequency and severity of some natural hazards is not just relevant for construction projects themselves but also an important consideration during the design phase. The built environment is expected to be put under greater pressure from extreme events in the future, which will necessitate greater building resilience and require improved design, materials, and maintenance. Infrastructure in place now may not be fit for purpose under changed climatic conditions and may need to be retrofitted or replaced.

While the transformation to a Net Zero emissions construction industry will be difficult, it should and must be embraced. Enormous opportunities exist for those companies that develop new technologies, designs, and processes. Those that fall behind risk being made obsolete. If as a society we succeed in meeting the ambitions of the Paris Agreement, the construction sector will look fundamentally different in the next decades, but will be cleaner, more efficient, and more resilient.

<sup>1</sup> Global Carbon Project

<sup>2</sup> NASA

<sup>3</sup> 2019 Global Status Report for Buildings and Construction IEA. [2019 Global Status Report for Buildings and Construction \(windows.net\)](https://www.iea.org/reports/2019-global-status-report-for-buildings-and-construction)

<sup>4</sup> [Tracking Buildings 2020 – Analysis – IEA](https://www.iea.org/reports/tracking-buildings-2020)

<sup>5</sup> PESETA IV

# 5 Key Construction Markets

### 3.1 NORTH AMERICA

In the US, strong residential growth (that continued relatively unhindered by lockdown restrictions) is driving momentum in the construction sector. Growth was and is most significantly concentrated in the single-family sector, where demand for new affordable suburban homes remains strong. A lack of focus on building affordable housing in the past has led to pent up demand, particularly among millennials joining the housing ladder for the first time. By contrast, nonresidential growth is expected to continue to be sluggish with many areas such as office space, retail, and hotels all remaining subdued as the US moves out of lockdown.

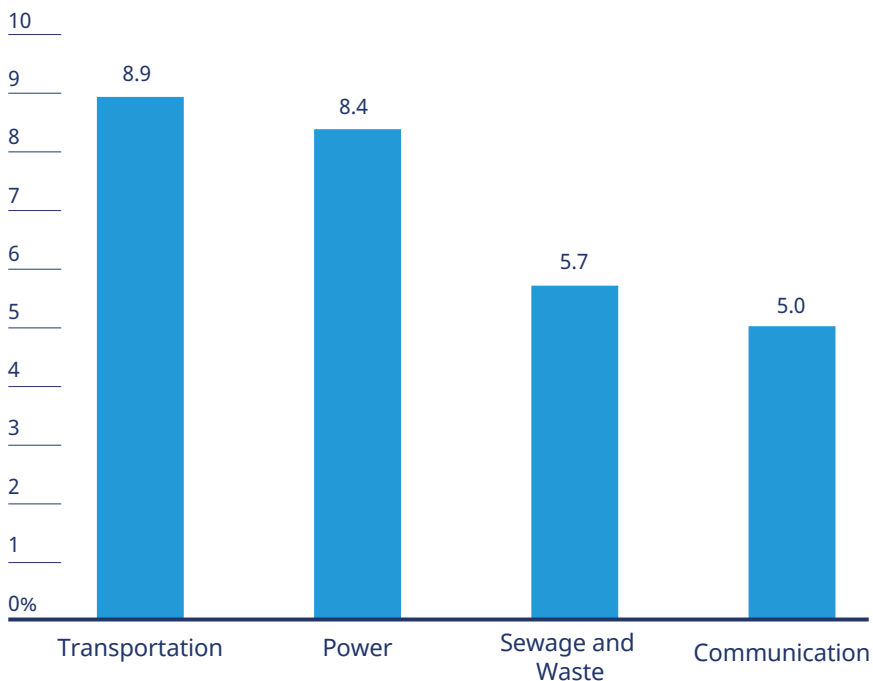
Looking ahead, the next iteration of the American Jobs Plan (AJP) will underscore US infrastructure construction. The primary recipient of the AJP stimulus will be the civil engineering sector. Plans for major spending in infrastructure will flow into rebuilding highways and railroads, repairing old bridges and boring new tunnels.

Much of the AJP's new spending will be focused on creating "green solutions" for the US economy. This will involve supporting new public transport infrastructure, connecting cities via high-speed rail and building new mass transit systems within urban centres. Construction of a new network of EV charging stations across the country will also be critical in transitioning the US away from internal combustion engine vehicles.

#### Growth in US infrastructure 2020-2025

##### Value of Put-in-Place Construction

%, CAGR



Source : Oxford Economics/Haver Analytics



The AJP stimulus plan will also support residential demand through the wealth effect on US homebuyers. The positive effect the stimulus will have on employment and wages will filter through to increased homebuying demand.

In Canada, many of the post-pandemic trends in the US relating to nonresidential construction will also be present. Areas such as office space and brick-and-mortar retail will take a particular hit as social and cultural changes surrounding work and leisure depress new construction demand. There will be some winners from these societal changes, however. For instance, warehouse construction, data centres, and telecom network infrastructure will see increased demand to support the growing digitisation of the economy.

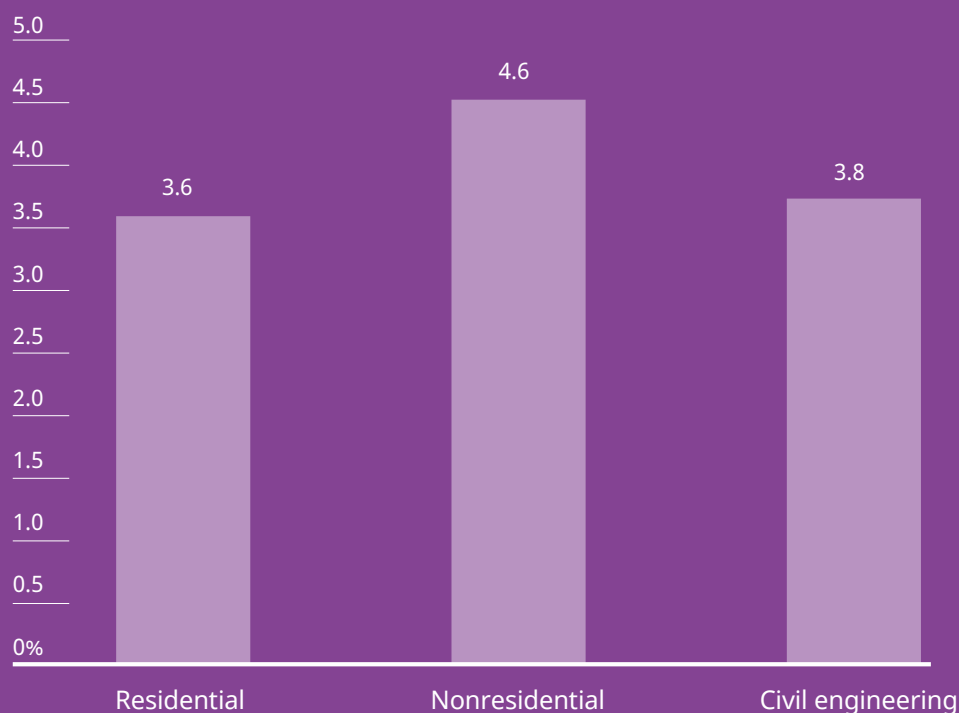
### 3.2 CHINA

As the initial global epicentre of the pandemic, China's construction sector witnessed its slowest construction growth in 30 years, expanding by just over 1%. Major government stimulus efforts, particularly focused on infrastructure, have seen construction activity rebound in 2021 and will support efforts in 2022. But over the medium-term, there will be less of an emphasis on infrastructure projects and more focus on developing nonresidential real estate investment.

The government has signalled the lesser importance of infrastructure spending by issuing smaller quota local government special bonds that are used for infrastructure spending. This is part of a general shifting of China's economy as the country moves away from its previous growth model that emphasised heavy industry, infrastructure and investment, and instead focuses on consumer-led growth. This will mean more construction taking place in the nonresidential sector — for example, retail, entertainment, health and education buildings. However, relatively high vacancy rates in Chinese office and business space will create some drag on new commercial construction.

#### Growth in Chinese construction 2020-2030

%, CAGR



Source : Oxford Economics/Haver Analytics

Residential construction in China is projected to remain important, but the great surge in new homebuilding that supported China's population urbanisation won't be repeated. There will, however, be a substantial amount of renovation and maintenance work to perform to support the mass of housing blocks that have been erected across China over the past 20 years, often to poor building standards.

In the long run, China's growth will gradually slow as the country's economic status matures. The double-digit growth boom in construction of the 2000s won't return, though there will be construction opportunities in some of China's emerging first-tier cities and special economic zones that will maintain construction growth. Over the next five years, we forecast construction to grow 3% to 5%.

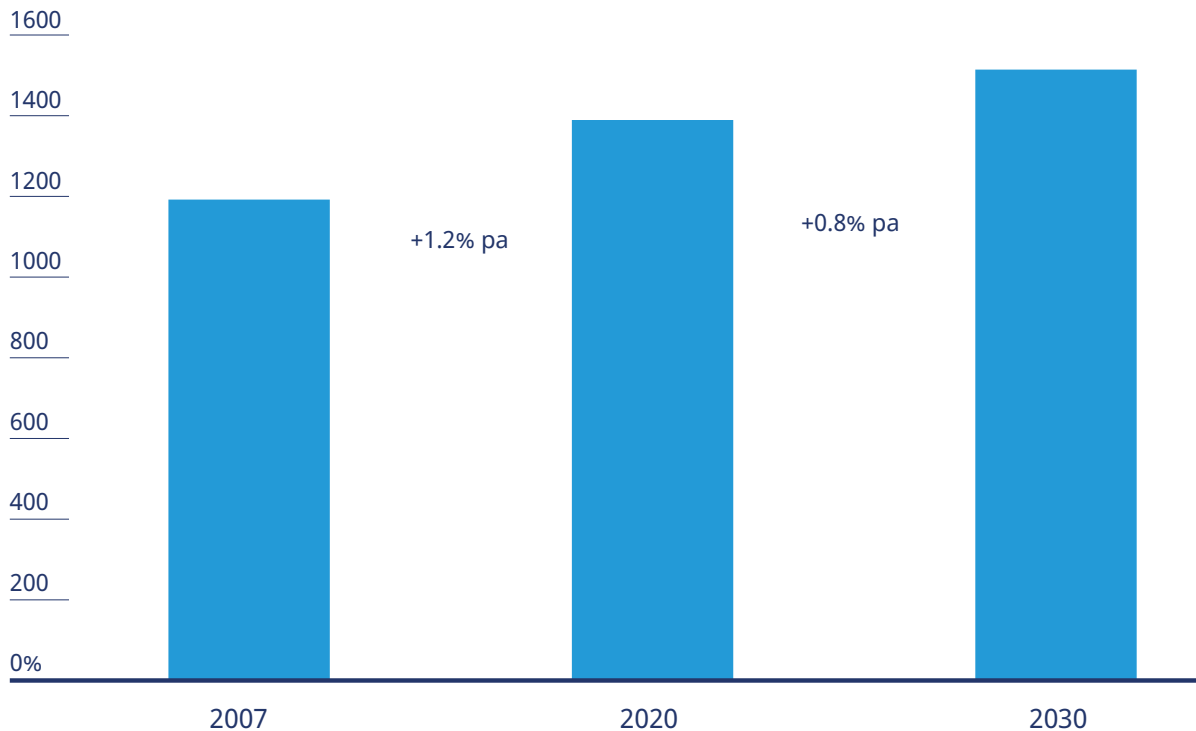
### 3.3 INDIA

Indian construction over the next decade will have two central drivers: demand for new homes and huge infrastructure needs. Need for new infrastructure is directly tied to the country's growth trajectory. As the India economy continues to develop, the need to develop new transportation infrastructure, new power grids and new utility works will be paramount. Government land reforms are attempting to make easier the implementation of large-scale infrastructure projects, but passing such reforms is proving difficult.

Demand for new housing is powered by strong population growth and need for new housing for India's growing urban middle class. Strong urbanisation trends will drive huge demand for new residential housing in India. India remains one of the least urbanised countries in the world at roughly 35%. To use China as a comparison, population urbanisation was at 35% in 2000; in the 20 years since, construction growth has averaged in excess of 10% per year.

#### Population in India

Millions



Source : Oxford Economics/Haver Analytics

It is tempting to view India as being in the position that China was in roughly 20 years ago, but such a comparison should be treated with caution. The decentralised nature of Indian democratic politics makes it much harder for a reforming government in Delhi to push through new reforms, as was seen with the GST bill and the attempts at land reform. This was clearly not the case in China, where a highly centralised, authoritarian government model made it relatively easy to push through major reforms. As such, we think that Indian construction will grow 7% to 8% annually, as opposed to the double-digit growth that China experienced during its construction boom of the last 25 years.

### 3.4 EUROPE

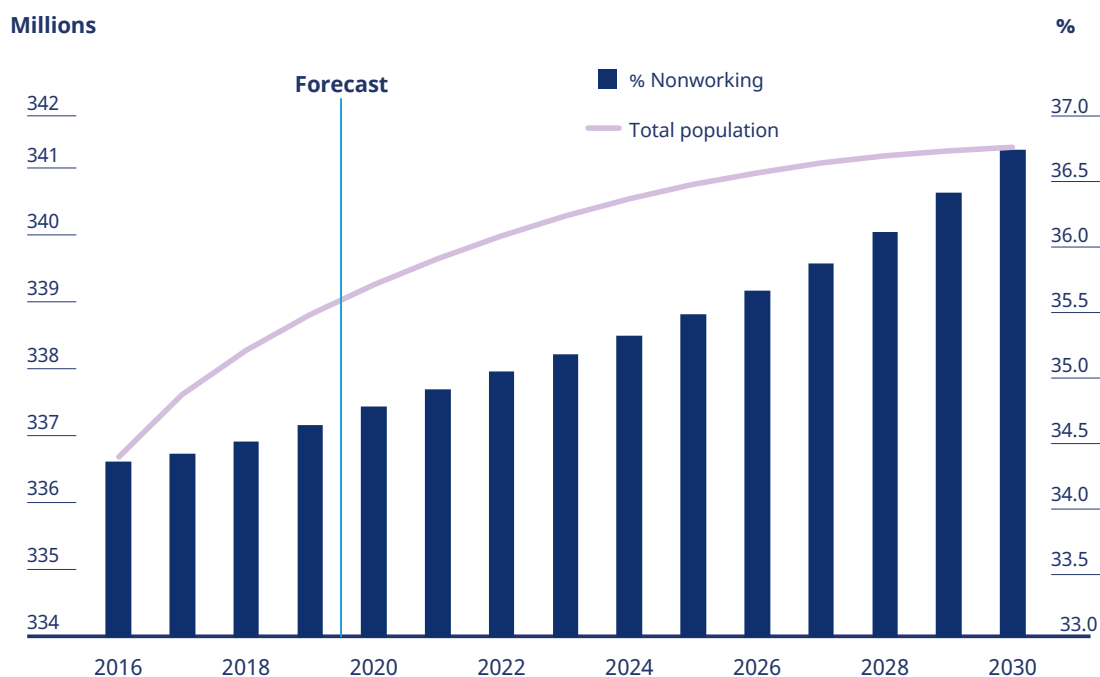
European construction will see major growth opportunities post-pandemic as stimulus recovery packages are enacted by the EU to support a refiring of the economy. The Next Generation EU fund is focused on supporting the rebound and raising the climate sustainability of the EU economy. Particular focus will go toward supporting new rail infrastructure and recharging networks for electric vehicles. Also of importance will be investment in shoring up old buildings to make them more energy efficient. Meeting this objective will drive a lot of renovation works on public buildings in the coming years. However, longer-term constraints from ageing population dynamics and declining total levels of population in some countries place a barrier on long-term construction demand.

Construction activity during the pandemic held up well in Germany, the only major economy to achieve positive growth in 2020 and 2021. As Germany progresses out of the pandemic crisis, construction growth will be supported by demand for new housing. Relative strength in the German residential sector is expected to continue into the two to three years, but over the longer-term, poor demographics will dent demand for new homebuilding. The other major pillar of German construction derives from the need for new infrastructure. Road construction is expected to see significant new investment. German infrastructure is in a relatively poor state, contrary to many expectations, resulting in a backlog of necessary works to be completed.

Relatively slow population growth in France will act as a drag on the residential sector. Nonetheless, efforts to increase affordability by building new lower-cost housing will drive activity. In addition, French infrastructure construction will benefit from the upcoming 2024 Olympic Games in Paris, with the government committed to building the new Grand Paris Express, which will include 200 km of new track and 68 new stations to serve the Greater Paris region.

In Scandinavia, modest population demographics and an oversupply of housing will curtail new residential construction in the coming years. Construction activity in Sweden has struggled in recent years due to sluggish investment and stricter mortgage amortisation requirements causing an imbalance of supply and demand of residential properties.

### Eurozone population vs. % nonworking



Source : Oxford Economics/Haver Analytics

While Norway's demographics are stronger than those of many Western European countries, years of rapid house price growth has led to a rise in household indebtedness. A gradually cooling housing market over the next decade is therefore expected to weigh on new homebuilding. Growth in the construction of engineering projects is also expected to cool as the oil sector becomes a relatively smaller share of the overall economy.

In Denmark, with population growth relatively low, demand for new residential construction will remain modest. The nonresidential sector will grow at a slightly faster pace as steady commercial and industrial demand drives construction activity. Strong growth in distribution and logistics will drive the construction of new warehouses and distribution centres. In addition, government investments into Danish infrastructure will see new road and rail projects come online. The Fehmarn Belt fixed link project to improve cross-border flows with Germany will include a road and rail tunnel link at an estimated cost of US\$8.2 billion.

Residential construction will be the major driver of new UK construction in the coming years as the government seeks a major expansion in housing stock. The government has outlined a "once in a generation" series of planning reforms aimed at shaking up planning permissions for new home construction. This means curtailing the power of local councils to oppose new developments and introducing simplified zoning rules. Multiple years of underbuilding has led to a supply-demand imbalance in the UK's housing market, with heightened prices and many first-time buyers unable to get on the housing ladder.

Infrastructure is the other major area of UK construction that has held up well during the pandemic. The current government has made investment in new infrastructure a priority and we expect robust growth in the sector going forward. Nonetheless, sharp rises in the government's budget deficits following the extraordinary measures enacted during the pandemic will constrain potential government infrastructure spending against what was originally envisaged.

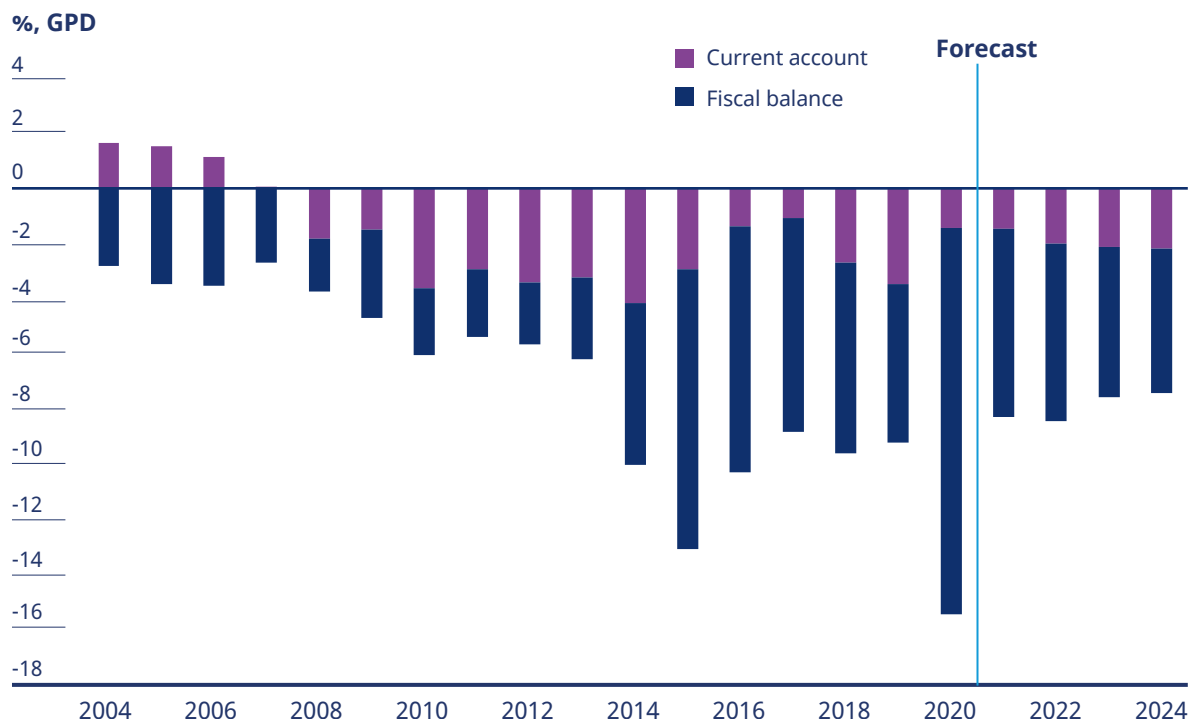
Nonresidential growth will be slower, with many areas such as office space and retail construction remaining subdued as the UK moves out of lockdown. The cultural shift toward working from home and online shopping will see relatively moderate rebounds in these areas compared to other sectors of construction. Indeed, private commercial construction remains sluggish, with activity still well below its pre-pandemic peak.

### 3.5 LATIN AMERICA

The Brazilian construction sector was just emerging from a five year depression when the COVID-19 pandemic hit last year. Though we expect rebound growth this year and into 2022, the prospects for the coming decade are far below the turbocharged growth of the 2000s and early 2010s. Construction growth is forecast closer to the 3% range over the course of the 2020s. Worsening demographics, restrictive labour laws, high business costs, and low productivity will all weigh on construction going forward. Nonresidential construction will be supported by government schemes to attract foreign manufacturing companies to invest in the country, in particular for auto manufacturers. Tourism is another area where the government hopes to push growth, leading to construction in the hotel and motel sector.



## Twin deficits in Brazil



Source : Oxford Economics/Haver Analytics

For Mexico, much of the economy's prospects are through linkages with the US and Canada. Ongoing supply chain integration with US manufacturing, particularly with the automotive sector, remains the key support for nonresidential construction in Mexico. Residential construction is also important in Mexico as strong population growth, increasing migration flows, and higher income trends will likely require a growing housing stock. Civil engineering construction will be less pronounced, in part reflecting the lack of government engagement in private-public investment vehicles that would support new infrastructure projects.

Chile's construction sector is largely dominated by civil engineering in its huge mining sector — most importantly, copper mining. Major investments are currently being made in expanding copper mining capacity as the importance of that metal to supporting the new electric revolution becomes more pronounced. With copper prices having risen roughly 50% over the past 12 months, the market signal for new copper capacity has been loudly heard in Chile. In the nonresidential and residential sectors, too, there is plenty of scope for rebound growth following very sharp declines in construction amid the pandemic.

## 3.6 SUB-SAHARAN AFRICA

In western Africa, a lot of major construction projects have been centred around the oil industry, but as is the case in the Persian Gulf countries, there is a gradual diversification away from oil infrastructure investments. Nonetheless, there remain significant modernisation efforts afoot in western Africa. In Nigeria, the principal economy in the region, building new infrastructure to support modernisation is a key government objective. For instance, the government has allocated funding to new road infrastructure to improve cross-country connectivity. One such new road project will connect Akwanga to Gombe at a cost of US\$1.1 billion. Spending on the energy sector is also a priority. To this end, a new hydropower project at Mambilla will become the country's largest power plant by the time it comes online by 2024 at a construction cost of approximately US\$5.8 billion.

But the most promising area of African construction remains in the eastern part of the continent. Ethiopian construction is currently going through a high-growth phase, witnessing continual double-digit growth over the past five years. Government expenditure

into social housing programmes has driven much of the recent growth, though we expect the source of finance to gradually shift to the private sector over the forecast period. There is huge potential for new homebuilding as the country sees a wave of new urbanisation. Nonetheless, challenges remain in the country, not least with access to finance for local building contractors. International investor sentiment remains positive and, looking forward, foreign direct investment flows will be essential in underpinning much of the new finance for construction.

Kenyan construction is set to continue its trend of outpacing the rest of sub-Saharan growth over the coming decade. Underpinning this performance are the residential and civil engineering subsectors. Urban population growth of 3.3% per annum out to 2030 will see huge numbers of people moving into the cities, generating massive demand for new housing. Despite a fiscal drive to reduce the deficit, infrastructure development is seen as key, which means the government will increasingly leverage private sector capital to fund further civil engineering projects.

### 3.7 MIDDLE EAST

In the past, much of the Middle East's construction market has been focused on supporting the oil sector. But as the world moves increasingly away from fossil-based energy, the investment into new oil sector infrastructure has become far less important. Saudi Arabia's Vision 2030 is a leading example of Middle Eastern countries, response to this global shift. The plan is to create new economic opportunities that allow diversification away from fossil-based economics. Building this

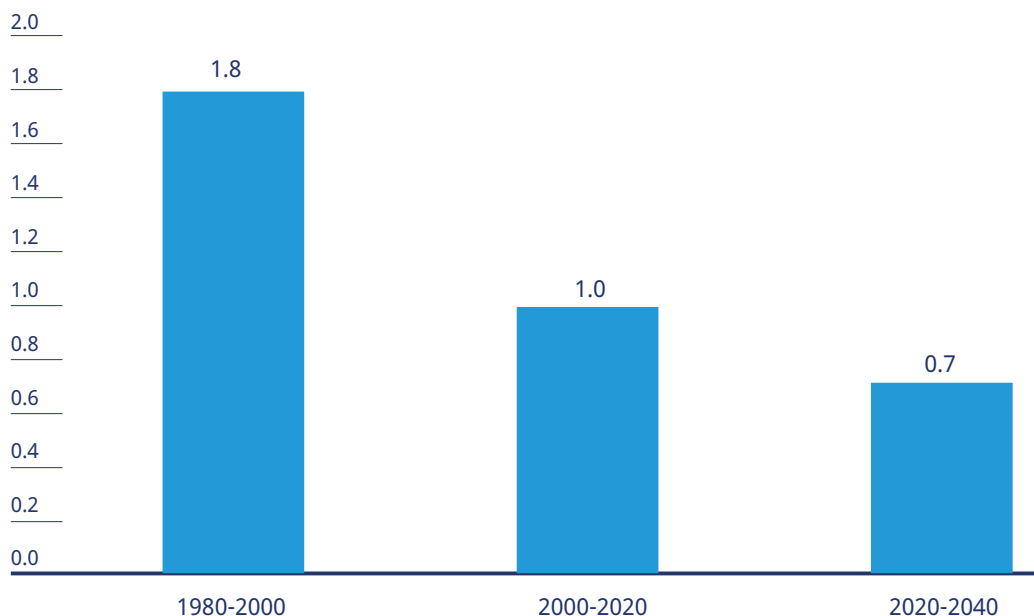
new economy will require huge construction investment. Saudi Arabia's Vision 2030 has US\$1.1trillion of projects in the pipeline as the country seeks to reshape its economy. These include a multi-billion-dollar expansion to the King Abdulaziz airport in Jeddah, building a new entertainment megacity of Qiddiya and a new eco-tourism resort on the Red Sea. Nonetheless, supply-side concerns hang over the construction outlook. A scarcity of construction expertise in the country will need to be overcome if Vision 2030 is to be realised.

As part of the diversification away from oil, there will be a transitory role for natural gas in supporting global energy needs until the renewable sector is able to fully meet the planet's energy needs. Operating as a bridge fuel between oil and coal power and renewable-based power, natural gas infrastructure investment will remain an important fixture in Gulf construction for some years to come. This is most significant within Qatar and Iran, the two major exporters of natural gas. 2021 has already seen record appreciation in global gas prices that will likely necessitate new investments in LNG port terminals in those countries.

The UAE already has achieved significant diversification away from oil dependence, with a vibrant economy centred around commercial, business services, and entertainment sectors, primarily located in Dubai.

### World oil production

%, CAGR

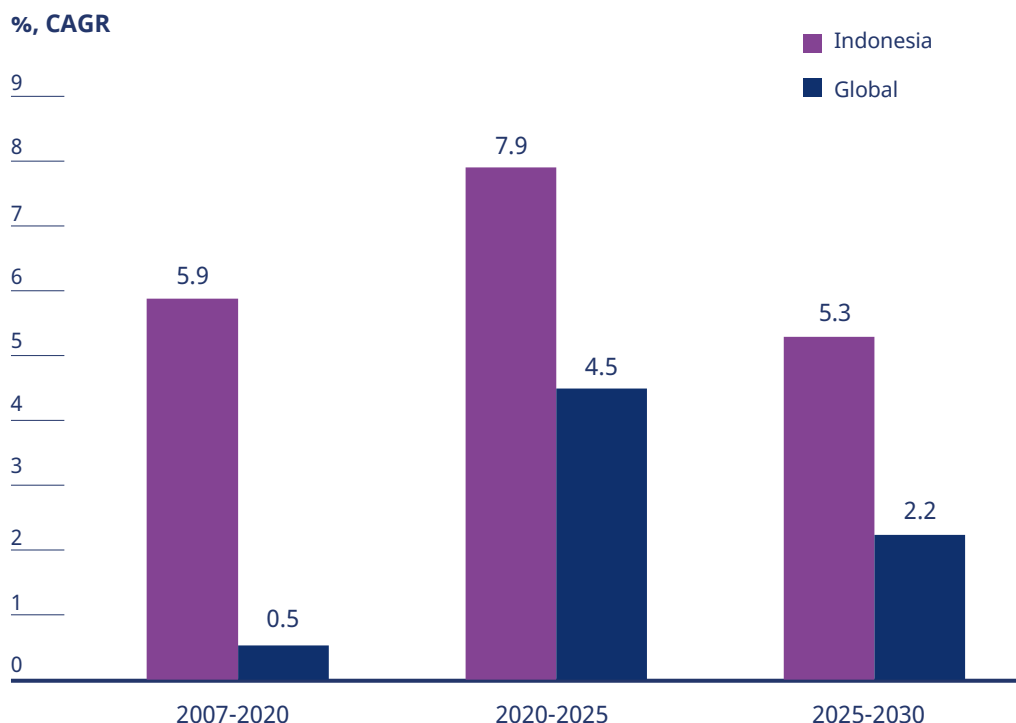


Source : Oxford Economics/Haver Analytics

### 3.8 ASIA-PACIFIC

The construction outlook for Indonesia remains positive, boosted by the construction of infrastructure projects and the recently announced new capital city in East Kalimantan. Continued expansion of investment, coupled with solid consumer spending amid a rapidly expanding middle class and improving business environments, will continue to underpin Indonesian construction activity. The East Kalimantan presents a significant opportunity for construction, especially toward the latter part of the forecast period. That said, Indonesia's short-term growth is facing downside risks associated with the increasingly clouded outlook for the global economy amid escalating US-China trade tensions, which could have a dampening effect on the construction sector.

#### Construction growth in Indonesia



Source : Oxford Economics/Haver Analytics

In Malaysia, the construction sector is expected to remain subdued in the short-term despite the government's revival of some mega infrastructure projects such as the East Coast Rail Link (ECRL) project and LRT3. The sluggish property market, led by a large volume of unsold private houses amid weak housing demand combined with a high level of office vacancies, continues to be a drag on construction investment. Nonetheless, we still expect a pickup in the latter half of the forecast period as excess capacity is gradually being absorbed amid still respectable economic growth. Furthermore, Malaysia's favourable demographics will aid longer-term growth, particularly in the residential sector.

Likewise, the Philippines will also see civil engineering leading construction activity, thanks to a number of government programmes supporting new infrastructure. For example, the Philippine Energy Plan is set to significantly upgrade the country's renewable energy capacity over the next 20 years, while other initiatives will see funding going toward improving road and rail infrastructure.

# Case Study

## Calculating the carbon footprint for the construction of built assets

**Bekir Andrews,**

Associate Director, Group Sustainability, Balfour Beatty PLC

With ambitious targets set by the industry to become carbon Net Zero, supported by our own 2030 targets and 2040 ambitions within our Building New Futures Sustainability Strategy, the requirement to track carbon at all stages of the supply chain is vital.

Calculating the embodied carbon of materials for construction projects is generally quite labour intensive and requires a complete recalculation if the design changes. Some automated software products do exist, but few extract data directly from the BIM model. They are usually expensive, require manual entry, do not allow comparisons of different designs, and do not allow tracking of carbon savings throughout the iterative design process.

To address these shortcomings, we were keen to develop an add-on module for Autodesk Revit, to pull the quantities of materials from the BIM module and automatically calculates the carbon quantity.

The aim was for the designers to be able to adjust the design and get instantaneous carbon figures which would allow them to hone in on an improved solution without having to be a sustainability expert.

### AutoBIM Carbon Calculator

In collaboration with Innovate UK, Leeds Beckett University, Hertfordshire University, and White Frog Publishing, Balfour Beatty created a carbon calculation tool for the construction and infrastructure industry – offering a consistent, practical solution for the measurement of embodied carbon.

The AutoBIM Carbon Calculator automatically links BIM data to embodied carbon data from the Inventory of Carbon and Energy (ICE) database, an online source which provides energy and embodied carbon information for construction materials.

In addition, the platform allows users to enter information from environmental product declarations sheets; verified and registered documents that provide transparent and comparable data about the environmental impact throughout the life cycle of a product or material.

During the design phase of a project, the innovative platform allows teams to compare products and materials, provide alternative solutions, and ultimately help those involved make informed, low carbon decisions.

The carbon calculator can demonstrate the benefits of different construction methodologies.

For instance, the general assumption might be that a steel frame has less embodied carbon than a concrete frame. Indeed, in the below example, a steel frame structure shows a 26% reduction in carbon over a standard concrete mix (Mix 1). However, a concrete mix with 55.5% Ground Granulated Blast-furnace Slag (GGBS) (Mix 3) provides a 39% reduction in carbon emissions against a standard mix (Mix 1). Therefore, in this example, a concrete frame with a high GGBS content is more favourable than a steel frame.

Concrete Mix 1	Concrete Mix 2 with 28% GGBS	Concrete Mix 3 with 55.5% GGBS	Steel
1,803 tonnes of CO <sub>2</sub> e	1,422 tonnes of CO <sub>2</sub> e	1,102 tonnes of CO <sub>2</sub> e	1,328 tonnes of CO <sub>2</sub> e

At present this tool is not interfaced for use on civils projects, which use different software.

A vibrant, futuristic cityscape at night, rendered in a cyberpunk style. The scene is dominated by tall, dark buildings with glowing windows and neon signs. The ground is wet and highly reflective, mirroring the intense blue, red, and yellow lights from the city. In the center, a large white text overlay reads "Risks to the Forecasts". The overall atmosphere is one of high-tech urban environment with a strong sense of depth and perspective.

# Risks to the Forecasts

## 4.1 NEAR-TERM RISKS

The main near-term risks to the economic outlook revolve around (1) whether or not the Delta variant will result in COVID infections that overwhelm health systems and require a return to lockdowns; and (2) whether or not the current uptick in inflation will persist, necessitating a premature tightening of monetary policy.

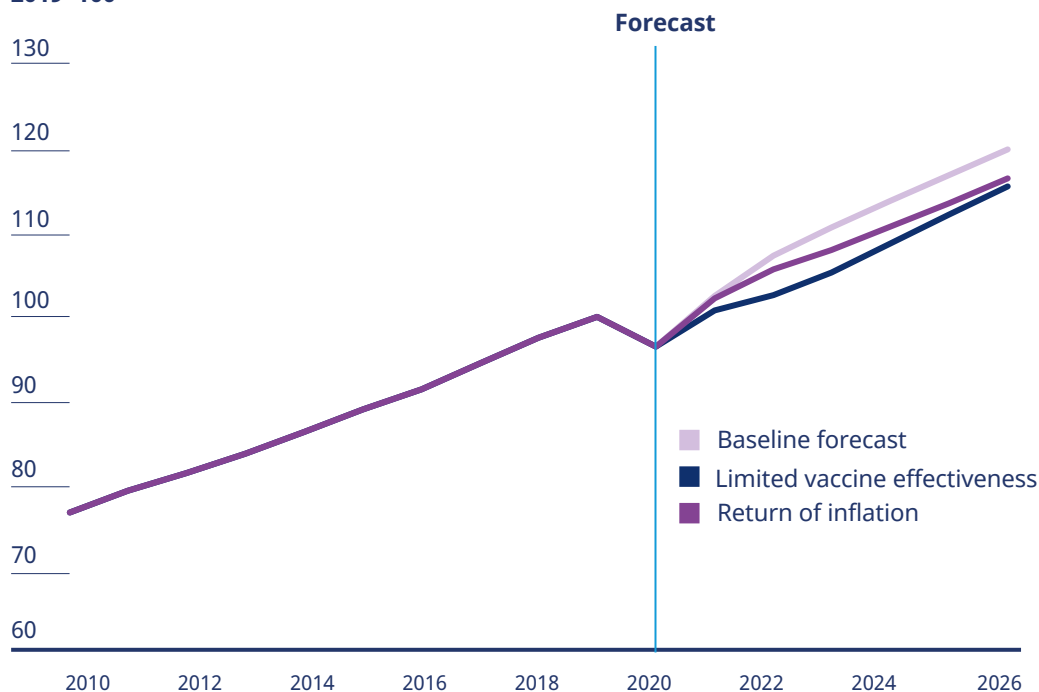
One potential scenario, which we think is very unlikely given recent epidemiological evidence, is that new virus variants result in renewed restrictions across a large number of countries. With vaccines failing to halt the spread of more transmissible forms of coronavirus, public health measures in such an event would be required for a protracted period.

The result in the near-term would be further financial market weakness, with the S&P 500 more than 20% below baseline by mid-2022, and weaker economic activity. World GDP growth would slow to just 1.7% in 2022.

The subsequent recovery would be sluggish, as the combination of persistent restrictions, increased risk aversion and long-term scarring weigh heavily on the global economy. In 2026, the final year of the scenario, world GDP would be still well below baseline and more than 4% lower than the level envisaged prior to the pandemic.

### Global GDP

2019=100



Source : Oxford Economics/Haver Analytics





A second possible path, which is more cause for concern in our opinion, is that financial markets and the real economy are rocked by a marked deterioration in the inflation outlook. Consumer prices surge on the back of higher commodity prices, higher inflation expectations and a disappointing recovery in labour market participation.

The result is a sharp bond market sell-off, amid heightened expectations of early policy tightening and a correction to equity markets. With consumers already struggling to maintain real incomes in the face of higher prices, domestic demand is hit hard. Global growth slows to 3.3% in 2022 and the pace of recovery disappoints throughout the scenario.

Because we have purposely been conservative in our assumptions about the degree to which consumers spend their accumulated excess savings, there are some upside risks to growth, especially in developed economies.

The effects of both scenarios provide considerable risk for the construction industry. Investment in infrastructure and real assets are sensitive to interest rates and early tightening will cause recovery from the pandemic to be impacted considerably.

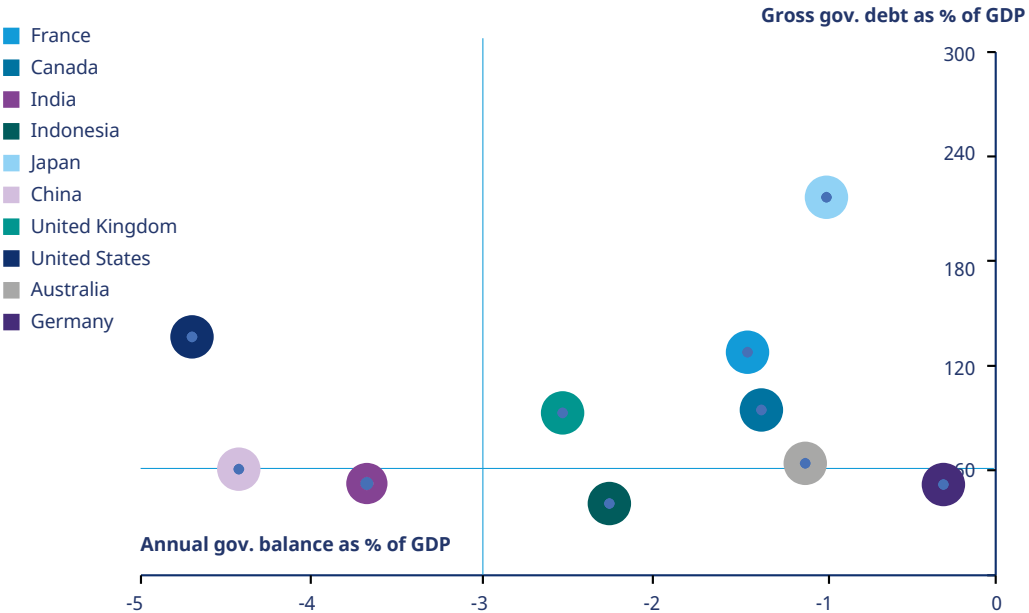
Supply chain bottlenecks have already caused significant shortages of construction materials to emerge in key construction markets. This has caused considerable price rises in key materials such as lumber which saw prices rising well over 100% in some markets where shortages have been acute. We do not expect this to last beyond the short-term recovery from the pandemic. The inflationary effects of significant increases in prices for key construction materials has caused damaging cost escalation on projects in the short-term and will impact profitability negatively.

Labour shortages also materialised in markets especially reliant on migrant labour due to international travel restrictions. This has particularly affected construction markets in the Middle East. As travel restrictions ease we expect the return of migrant labour.

## 4.2 LONGER-TERM RISKS

Looking longer-term, economic risks also relate to governments' ability to manage debt levels in the context of increasing demands on public spending brought about by demographic shifts.

### Ability to finance public investment, 2030



Source : Oxford Economics/Haver Analytics

Levels of government debt in countries such as Japan, where debt currently sits at 236% of GDP, means that funding infrastructure will become more difficult without the use of PPPs and even then much care needs to be taken about how infrastructure is funded to be treated as 'off balance sheet'. The landmark case that the Office for National Statistics (ONS) in the UK won against the Scottish Government and Scottish Futures Trust in relation to the Not for Profit (NFP) model is a case in point. Infrastructure programmes were ruled to be 'on the balance sheet'. The Mutual Investment Model (MIM) adopted by the Welsh government has been gaining traction in Wales and as far afield as Australia.

Simply transferring the financing risk to the private sector may not have the desired effect of removing expenditure from government balance sheets.

Demographic shifts and aging populations provide challenges for countries where healthcare facilities and infrastructure will need to be improved to cope with growing numbers of people over 80 years of age, while dependency ratios make it more difficult to fund construction of infrastructure.

This will be amplified as interest rates are normalised over the longer-term.

Climate change is arguably the biggest risk facing the construction industry over the longer-term and the need for the industry to reduce embedded carbon in infrastructure and buildings is already a key issue. The Task Force on Climate-related Financial Disclosures (TCFD) has set out a framework for reporting financial risks relating to climate change to investors. Measures for dealing with climate change will only become more stringent and with hierarchical and complex supply chains, the industry must rapidly decarbonise supply chains to meet Net Zero targets.

There is an upside risk to climate change for the industry in constructing large programmes of clean energy assets and investing in new solutions such as Carbon Capture Usage and Storage (CCUS) technology and blue and green hydrogen programmes.

Although off-site manufacturing and digitalisation is a key trend for construction, it must be remembered that output is classified as manufacturing, which is a different sector. Much depends on final assembly as to where output is counted.

The potential of significant market entry by the large global technology players that could disrupt construction is a key risk for the industry.

Out into the future, the decoupling of China from the US is a further risk. Decoupling does not appear to be the case looking at China's current capability and stickiness to serve export markets in developed countries. The emergence at the recent G7 meeting in Cornwall of a competitive global programme of infrastructure to rival the Chinese Belt and Road Programme is perhaps a sign of increased tensions. This may have a significant effect for the global construction sector in the longer-term.



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