Industry focus
Modular and additive construction

The road to recovery continues
APAC faces long-term challenges
High-level building costs
Welcome to Insight #3.

In this edition of Insight we take our usual close look at the trends in the global economy and how they might have an impact on you and your business.

Overall, the global economy is in recovery mode, but with sharply differing rates of growth between regions.

There are also significant continuing geo-political pressures affecting key economies. The world is still taking stock of the impact and implications of President Trump’s election last year, and the protectionism implicit within his ‘America First’ platform.

In the EU, the high-risk strategy of British Prime Minister Theresa May – who called a snap election in the belief that it would win her a strong majority with which to start Brexit negotiations, but who was left with no overall control – has been at the centre of attention. In France, although the isolationist manifesto offered by right-wing Marine Le Pen was strongly rejected by the electorate’s selection of Emmanuel Macron as president, his victorious LREM party comprises many novices in the new parliament and the jury is out on what this means for France, and further for the EU. For the upcoming elections in Germany, it may have calmed Chancellor Merkel’s political nerves and heralded a more stable union, for the short term at least.

While the Asia-Pacific (APAC) region remains the biggest single world engine of growth, it faces key structural challenges, not least the demographic challenge of ageing populations in some key economies.

The Middle East is fraught with uncertainty and a fragile security situation. The cutting off of diplomatic ties with Qatar by its Gulf neighbours, having accused the state of fueling instability, is a reminder that politics can have a significant impact on growth. Analysts are predicting serious economic problems for Qatar if no compromise is reached.

This edition of Insight also takes a special look at modular construction, which is growing in popularity as production methods improve and the construction industry and its clients realise the real efficiency gains achievable through off-site production. It is a fastgrowing trend in several key sectors within the growth economies of the Middle East and the Asia-Pacific regions.
Global economic growth is expected to strengthen to 2.7 per cent in 2017 amid a pick-up in manufacturing and trade, rising confidence, and stabilising commodity prices, according to the World Bank.

The bank expects growth in advanced economies to accelerate to 1.9 per cent in 2017, and achieve 4.1 per cent in emerging market and developing economies, as obstacles to activity diminish in commodity exporting countries. However, the bank also expressed concerns about protectionism – led by the Trump administration – and policy uncertainty in some key regions.

A similarly timed outlook from the International Monetary Fund (IMF) included a more optimistic growth forecast of 3.5 per cent for 2017, with further improvement expected next year. ‘Stronger activity, expectations of more robust global demand, reduced deflationary pressures, and optimistic financial markets are all upside developments,’ its analysts stated.

Emerging market and developing economies have become increasingly important in the global economy in recent years. They now account for more than 75 per cent of global growth in output and consumption, almost double the share of just two decades ago.

The still-considerable income gaps in these economies vis-à-vis those in advanced economies suggest further room for catch-up, favouring their prospects of maintaining relatively strong potential growth over the medium term.
The IMF noted that Asian financial markets have been resilient, reflecting ‘strong fundamentals’, with momentum likely to remain strong.

However, the IMF has also warned of ‘secular headwinds’ including population ageing, a little-recognised aspect in some of the developing economies of Asia, although it is a key issue in the more advanced countries. The IMF believes that demographic trends could subtract 0.5-1 per cent from annual GDP growth over the next three decades in countries like Japan and China.

‘Adapting to ageing could be especially challenging for Asia, as populations living at relatively low per capita income levels in many parts of the region are rapidly becoming old. In other words, parts of Asia risk ‘growing old before becoming rich’,' noted the IMF.

‘Another challenge for the region is how to raise productivity growth. Productivity convergence with the United States and other advanced economies has stalled, when external factors, including further trade integration, might not be as supportive as they were in the past.’

China Daily recently predicted that the PPP route would likely create a US$147 billion market within two years, and grow from there. More than 11,000 PPP projects were registered in China by the end of 2016, as advised by the finance ministry’s China PPP Centre. According to its research, typical transportation projects sit alongside a growing raft of urban renewal and redevelopment projects, and expanding land and environmental business deals.

### 'Old' countries: GDP – (0.5-1%) China, Hong Kong SAR, Japan, Korea, and Thailand

### 'Young' countries: GDP + (0.5-1.5%) Malaysia, Vietnam, Australia, New Zealand, India, Indonesia, and the Philippines

The share of working-age population has started to decline in many Asian countries and poses a drag on growth.

When this happened to other advanced economies in the past, they had much higher per capita income levels than Asia today.

Source: www.imf.org
The Asia-Pacific region continues to lead the world in economic growth, with a recent pick-up in momentum across its principal economies, according to the International Monetary Fund’s latest outlook.

Despite that, the IMF believes that governments across APAC need to do more to ensure their economies’ long-term resilience, and to address demographic issues such as ageing populations in several countries.

In addition, the IMF has voiced concern about the impact of external conditions – such as the increasingly protectionist attitude of the United States towards China and other East Asian economies in particular.

‘The continued tightening of global financial conditions and economic uncertainty could trigger volatility in capital flows,’ says the IMF commentary, published in May. ‘A possible shift toward protectionism in major trading partners also represents a substantial risk to the region. Asia is particularly vulnerable to a decline in global trade because the region has a high trade openness ratio, with significant participation in global supply chains. A bumpier-than-expected transition in China would also have large spillovers.’

The World Bank has taken a more positive view, predicting that East Asia should experience growth, driven by robust domestic demand and a gradual recovery in the global economy over the next three years. It predicts growth of 6.2 per cent in 2017 and 6.1 per cent in the following year. Risks identified include higher-than-expected interest rate hikes in the US, protectionist sentiment targeted at the APAC region, rapid credit expansion and high levels of debt in several East Asian economies including Vietnam, the Philippines and Laos.

‘The longer-term challenge for the region lies in sustaining rapid growth while ensuring greater inclusion,’ adds the bank’s Economic Update, published in April and entitled ‘Sustaining Resilience’.

‘Governments can address these challenges by increasing productivity and investment, which have slowed recently in several economies, as well as by improving the quality of public spending.’

The bank believes APAC economies can seize opportunities to advance regional integration, particularly in response to protectionist threats from the US. These include ‘deepening ongoing initiatives, lowering barriers to labour mobility and expanding cross-border flows of goods and services within the ASEAN Economic Community.’

A key example of cross-regional collaboration is the ‘Belt and Road Initiative’ (BRI), one of the most ambitious infrastructure programmes ever seen worldwide. Conceived and led by China but involving more than 60 countries, current BRI budget provisions are estimated at US$900 billion but will be much higher if every project envisaged under its umbrella is completed.
The latest country to sign up for the BRI scheme – also known as the ‘New Silk Road’ and the ‘One Belt, One Road’ – is Nepal, which has been promised Chinese funding for road network and power grid improvements, as well as a new railway connecting the cities of Kathmandu and Lhasa.

In Sri Lanka, China is planning a new port city with an initial US$1.4 billion investment near the capital Colombo, creating 80,000 jobs. Sun Ziyu, vice president of China Communications Construction, said the project, to be built on 269ha of reclaimed land, will accommodate 200,000 residents. It will include apartments, hotels, offices, shopping malls and commercial developments and is projected for completion by 2030.

Chinese commerce ministry spokesman Shen Danyang said recently that, since 2013 when President Xi Jinping first proposed the initiative, trade volume between China and economies along the trading routes amounted to US$3 trillion, with a total investment of US$50 billion to date.

The potential for the BRI goes far beyond infrastructure spending for ambitious China. Wang Shoujun, chairman of China National Nuclear Corporation, has stated that the huge untapped potential for nuclear power in ‘Belt and Road’ countries could reach up to US$580 billion. ‘About 72 countries have been or are planning to develop nuclear power, of which 41 are along the ‘Belt and Road’, and most of them are still in the earliest stages of nuclear power development,’ he told China Daily.

Hong Kong is being urged to support plans to make the city a major centre for ‘FinTech’, or financial technology. A report by the Financial Services Development Council called for a new office that will help develop key expertise in five sectors: cyber-security and payment and securities settlement, digital ID verification, wealth, insurance and regulatory technologies. It wants the Hong Kong government to begin with a new initiative for cyber-security.

Infrastructure projects prevail in Hong Kong. A 12km tunnel and viaduct link to the Hong Kong-Zhuhai-Macao Bridge is nearing completion and transport and housing secretary Anthony Cheung Bing-Leung has called for further express rail links from Hong Kong to Shanghai and Beijing.

Further south, the Australian construction industry reported three successive months of growth recently, although the greatest strengths were within house and apartment building and infrastructure investment. April was the third straight month of overall expansion for the construction sector with the near-term outlook bolstered by growth in new orders – particularly in house-building. Both activity and new orders improved in the engineering construction sector as the declining impact of the wind-down in mining-related projects was outweighed by growth in transport infrastructure work, industry group head of policy Peter Burn told Construction Index. Commercial construction remains sluggish, however.

Two major projects have had recent approval. Western Australia has agreed a deal with the federal government for a US$2.3 billion transport infrastructure package. The agreement, which will provide new investment in road and rail schemes across the state, will be included as part of the federal budget.

Meanwhile, a design team has been appointed for the next phase of the extension of the Sydney metro network, a project which will add 31 stations and 66km of rail, extending under Sydney Harbour and through the city centre.

In Indo-China, the Japanese government has approved a
US$200 million loan to Cambodia to build a second deep-sea port in the southwestern coastal city of Sihanoukville. The new port, adjacent to an existing facility, will be 350m long and 14.5m deep, allowing large vessels to dock. In June, the Japan International Cooperation Agency (JICA) participated in a stock offering in the Port Authority of Sihanoukville, a move which will increase handling capacity there by more than a third, to an annual equivalent of 680,000 TEU containers. The expansion will include more cranes and improved yard infrastructure.

The Chinese internet giant Alibaba has unveiled plans to open a data centre in Kuala Lumpur, growing the company’s footprint to 15 data centres worldwide. The data centre will be Malaysia’s first global public cloud hub.

In Thailand, Bangkok’s Mass Rapid Transit Authority has given the go-ahead for two key electric rail lines that will carry people from surrounding provinces to the capital. The monorail projects involve the 30.4km Yellow Line, worth US$1.53 billion, which will stretch from the Lat Phrao area in Bangkok to Samrong in Samut Prakan, and the 34.5km Pink Line (US$1.57 billion), which will run from Nonthaburi’s Khao Rai to Bangkok’s eastern Min Buri district.

The Vietnamese construction industry grew by 9.1 per cent last year, according to an analysis published recently by Timetric, which predicts continued growth during the period to 2021. The research points to the government’s long-term commitment to significant investment in transport infrastructure, energy and utilities, affordable housing projects, and education and healthcare buildings.

Asian consultancy Ken Research reports that the Hanoi government plans to construct one million affordable houses by 2020, including various social housing programmes for poor rural families, low-rent housing for industrial zone employees and low-income urban social housing.

‘The government focuses on the manufacturing sector with a target to attain middle-income status and turn Vietnam into a fully industrialised country by 2020. Accordingly, it is planning to help new start-ups and augment industries through various programmes and initiatives such as the ‘Mekong Business Initiative’, the Finland-Vietnam Innovation Partnership Programme and the National Technology Innovation Fund,’ the report added. However, with hindsight, the success of such initiatives will much depend on the continuity of government policy.

Myanmar’s construction industry is forecast to experience rapid growth of more than 10 per cent in the next five years, according to Timetric’s Construction Intelligence Centre (CIC). In real terms, the industry’s value stood at US$8.2 billion in 2015, and is anticipated to reach US$13.5 billion in 2020, albeit from a significantly low base.

According to the report, the growth will be supported by the country’s improving economic conditions, but will depend on the government’s sustained investments in residential, energy and utilities and transport infrastructure projects, as well as a rise in foreign investments.

Danny Richards, lead economist at Timetric’s CIC, comments: ‘Government flagship programmes (covering transport, energy and export strategy) will promote industry growth (in Myanmar) over the next five years. However, the underdeveloped regulatory and financing environment and a lack of transparency in the tendering process will prevent the construction industry from expanding at a faster pace.’ The government is, however, making progress in the establishment of new legal frameworks, such as the Investment Law and Companies Law, assisted by international law firms. Much will depend, however, on how such legislation is implemented and interpreted.

Chinese commerce ministry spokesman Shen Danyang said recently that, since 2013 when President Xi Jinping first proposed the initiative, trade volume between China and economies along the trading routes amounted to US$3 trillion, with a total investment of US$50 billion to date.
## High-level building costs - Q1 2017

Local currency/per m\(^2\) CFA

<table>
<thead>
<tr>
<th>City</th>
<th>Melbourne (AUD)</th>
<th>Sydney (AUD)</th>
<th>Beijing (RMB)</th>
<th>Shanghai (RMB)</th>
<th>Shenzhen (RMB)</th>
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### Notes:
- **Australia**: Industrial buildings assume pcc frame and exclude office provisioning. Office rates assume prestige CBD standard.
- **Australia, China and Singapore**: Costs exclude GST/VAT.
- **Data centres**: Costs dependent on Kw/m\(^2\).

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**Currency**
- Hong Kong (HKD)
- Japan (Yen)
- Singapore (SGD)
- Thailand (Baht)

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**City**
- High-rise
- Medium-rise
- Low-rise
- Retail mall
- Residential
- High-rise
- Medium-rise
- Town houses
- Villas/Houses
- Hotels
- Five-star
- Four-star
- Three-star
- Five-star FFE
- Four-star FFE
- Three-star FFE
- Industrial
- Data centres
Governments, clients and major industry players are increasingly seeking out new ideas and smarter thinking in order to tackle the daily disruptions in our rapidly evolving and intertwined political and digital lives. The construction industry and those bodies charged with its regulatory oversight have traditionally been slow to innovate and implement real efficiencies. As buildings become more ambitious in design, project teams are continually striving to improve efficiency, while achieving value for money is a perpetual challenge.

The answer has historically come in the form of modular design and construction, sometimes referred to as ‘soft modular’ for repeatable design and ‘hard modular’ for repeatable construction. This involves manufacturing large parts of a building or structure off site, sometimes in a factory environment, and transporting them to site for assembly or simple hoisting into position prior to testing, commissioning and final completion.

Successful modular construction depends entirely on intelligent design, so that all the component parts come together as seamlessly as possible. More recently, ‘additive manufacturing’, such as 3D printing, is increasingly being used in smaller-scale structures (although this process is not necessarily restricted to off-site production). In reality, these modern techniques involve advanced manufacturing technology combined with 3D computer models in an integrated design and manufacturing process.

Modular and additive manufacturing approaches will drive social and economic benefits, but will require a rethinking of the traditional design, procure and build process. Modular and additive manufacturing approaches can also contribute significantly to sustainability targets and can help in addressing the mandate for the construction industry to become more ‘green’ in its processes. Traditional on-site activities generate a huge amount of waste and noise, as well as safety and social welfare issues caused by large site-based workforces. Modular construction occurs in a controlled factory setting where materials can be better managed and put to more efficient use, resulting in less waste and improved quality as well as better on-site safety and worker welfare.
Focus

The movement towards this approach is particularly noticeable in high-growth economies, where the demand for large-scale new housing projects proliferates, such as in Kuwait, Hong Kong and Singapore.

Contractors working in the Gulf Co-operative Council (GCC) region are piloting various projects involving off-site fabrication. Dubai, in particular, is an incubator of innovation. It has been swift in adopting emerging technologies with a new code agreed for 3D-printed buildings, and the mandated use of building information modelling (BIM) for certain types of projects.

Dubai published new green building regulations in 2016, which will push the industry to become more efficient and to remain at the leading edge of new construction techniques as the emirate realises its significant growth ambitions over the next two decades.

Meanwhile, in China, where urban growth has been drawing millions of people out of rural living for many years, the provision of new housing is a major challenge. Chinese manufacturers have embraced 3D printing in the residential sector, using both off- and on-site techniques to create buildings up to five storeys high.

‘Modular construction is simply a different and more efficient manner to assemble the materials and components of a building,’ according to Tom Hardiman, executive director of the US-based non-profit trade association, Modular Building Institute (MBI). He told ME Construction News: ‘Construction occurs in a controlled factory setting where the use of materials can be better managed and put to more efficient use, reducing waste as well as the redundant procurement of components’.

Modular and additive manufacturing approaches will drive social and economic benefits, but will require a rethinking of the traditional design, procure and build process. The design completion and shop drawing process will be brought forward and the interfaces between traditional and modular must be resolved much earlier in the design stage. The project cashflow S-curve will be reshaped as the works are resequenced and front-loaded. As an example, a building’s foundations can now be constructed at the same time as the modular or additive construction process is happening off site.

This will reduce the overall duration of the project with an obvious triple bottom line in financial, social and environmental benefits. Firstly, the reduced time will lower overall costs through reduced contractor preliminaries and lower financing costs; secondly, earlier occupation provides more immediate provision to meet pressing needs and results in earlier income for the developer; and thirdly, the mandated requirements for increasing building systems efficiency are (quite correctly) demanding intelligent sustainable solutions and lateral thinking in solving project challenges, benefiting the industry as a whole.

Modular and additive construction is set to continue developing through rapid advances in 3D printing and material feedstocks, which will evolve past current scalability and materials limits to further drive down costs, reduce waste and improve sustainability credentials. It will reshape the ‘design into production process ahead of the inevitable design and construction role changes set to alter the future.

This is an exciting area of development, and all construction industry professionals should be embracing the challenges and opportunities that new building technologies are creating, as they will impact upon every single aspect of our professional lives for the foreseeable future.

Construction occurs in a controlled factory setting where the use of materials can be better managed and put to more efficient use, reducing waste as well as the redundant procurement of components.
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  +966 11 494 0049

### MEXICO
- **Mexico City**
  +52 55 52 81 5588

### UNITED ARAB EMIRATES
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  +971 2 671 6265
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  +971 4 295 5198

### UNITED KINGDOM
- **Belfast**
  +44 (0)2890 765 959
- **Birmingham**
  +44 (0)121 647 6220
- **Bristol**
  +44 (0)117 926 0785
- **Cambridge**
  +44 (0)1223 334 500
- **Cardiff**
  +44 (0)29 2083 9180
- **Edinburgh**
  +44 (0)131 313 7810
- **Exeter**
  +44 (0)1392 813 040

### UNITED STATES
- **Arizona (Phoenix)**
  +1 602 748 1470
- **California (San Francisco)**
  +1 415 235 4939
- **New Jersey (Princeton)**
  +1 609 759 7000
- **New Mexico (Albuquerque)**
  +1 505 503 8078
- **New York (New York City)**
  +1 646 512 5040
- **Oregon (Portland)**
  +1 503 714 6116