Global thought leadership
Issue 10

Turner & Townsend

360° view

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Disruption

Offering a series of perspectives on how to respond to change and improve the performance of projects and programmes.

making the **difference**

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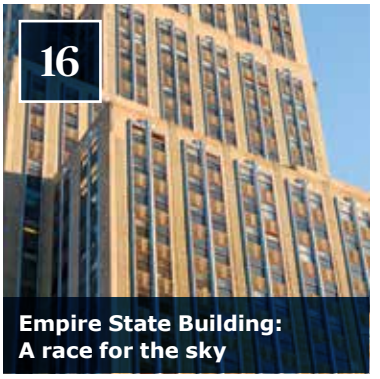
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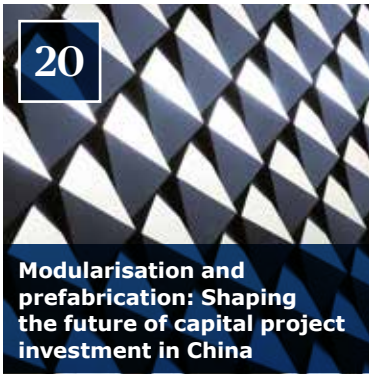
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Welcome to

360° view

Our magazine sharing insights, innovation and best practice drawn from our experience working on the world's most complex programmes.

The global economic downturn of 2008 was the worst since the Great Depression of 1929. Ten years on, we ask what governments, asset owners, operators and the supply chain might learn from this disruption and how to create significant competitive advantage in the years to come.

As an industry slow to embrace change, productivity gains remain low. In September this year, we published a global study, which found that the top three reasons major construction programmes fail are: insufficient time spent in the planning stages; poor governance and a lack of clarity on decision making processes.

It is clear that the construction industry is ripe for disruption, though the extent to which the industry responds and adapts is crucial.

A focus on disruption

In this issue of **360°view** we assess how to navigate disruption, offering a series of perspectives to respond to change and improve the performance of project and programmes in the real estate, infrastructure and natural resources sectors.

Starting with real estate, we discuss five strategic areas which will fundamentally transform the sector in the next five years.

Our interview with the UK's HM Revenue & Customs (HMRC) focuses on its Location Programme, the largest real estate programme in the UK, which will relocate 45,000 people from 170 office buildings to 13 regional hubs.

Millennials are purposeful, outcome driven and strive to make an impact. We explore the impact the new generation of talent is having on the construction industry and unearth the opportunities for learning.

In New York, the Empire State Building, built in 410 days, was a disruptor in its time. We examine the parallels between the real estate construction industries of then and now.

Modularisation and prefabrication are set to reshape the construction industry in China. We take a look at the opportunities modern methods of construction brings and how the industry will respond.

The media is full of owners announcing recent offshore oil and gas projects completing under budget and ahead of schedule. But are we actually seeing real improvements or is it just cautious optimism? We map out five steps to improve project performance.

Australia is ploughing billions of dollars into public transport. However, a rethink is needed to improve project prioritisation and ensure the sector and the Australian public benefit.

In Mexico we find a country with a long history of planning, yet projects tend to overrun on cost and schedule. If Mexico is to improve its performance, it must reject its prevailing culture and return to its roots.

Positive change

Disruption can hugely benefit the construction industry. Positive changes will lead to enhanced performance, high performing teams, value for money and environmental impact.

We have a responsibility to drive change. From the start we should embrace new methods, techniques and ways of working, to ensure projects and programmes are set up for success to help businesses and society profit. □

James Dand
Chief Operating Officer

The real estate revolution:

Why the time for change is now

Neil Bullen
Managing Director,
Global Real Estate

Disruption is finally coming to the real estate sector, unlocking major advantages for asset owners.

It's an exciting time to be working in real estate. The sector has the opportunity to significantly reduce risk and increase efficiencies, learning from more advanced sectors such as manufacturing, energy and transport.

The need for our industry to embrace disruption has never been more pressing: new players are entering the market and challenging traditional supply chains; occupants are requiring more flexibility; owners want a more sophisticated understanding of their portfolios and how they can contribute to business returns.

Over the next five years, the real estate sector will experience a fundamental change in five strategic areas. The extent to which tenants, landlords and the supply chain respond and adapt will be crucial for their long term survival.

"The sector has the opportunity to significantly reduce risk and increase efficiencies, aligning with other sectors such as manufacturing, energy and transport."

How to lead real estate disruption

1. 
Make real estate central to corporate strategy: agile, responsive and playing a key role in recruiting and retaining top talent.

2. 
Take a longer term view of a building's life cycle, maximising operational resilience for a greater return on investment.

3. 
Share standardised data across the sector to benchmark performance and drive up standards.

4. 
Embrace the manufacturing mindset, encouraging supplier eco-systems to produce standardised components for the entire industry.

5. 
Use the technology that is here now, such as blockchain, building information modelling (BIM) and machine learning, to enable more strategic and collaborative partnerships with your suppliers.

1.

Real estate becomes a strategic asset

For decades, buildings and assets were a marginal issue for companies. They were often regarded as a high cost necessity, with a limited role in their contribution to overall success. A building could be constructed, fitted out, and remain more or less static for years.

Today, real estate is becoming much more central to corporate strategy: productivity-enhancing, future-proofed and responsive to the changing needs of users. It can also play an important role in recruitment and retention, creating appealing high-tech environments to attract and retain top talent.

Organisations are realising that the cost impact of losing employees is many times higher than accommodating them. Leading companies are taking an increasingly holistic approach to employee well-being, focusing on creating the right employee experience and aligning real estate, technology and human resources. The best portfolio strategies reflect this shift in corporate thinking.

2.

Industry integration is coming, finally

The traditional approach to planning, construction and operation of an asset is fragmented and episodic. Risk lurks within each new transaction, adding to the costs of contingency. Each party has differing goals. Valuable information sits in silos and is not shared to benefit the broader project.

The pooling of standardised data across delivery and operational teams will be a major step towards a more integrated industry. Better integrated supply chains will unlock many benefits for real estate clients, helping them to focus on the entire life cycle of the asset, maximising operational resilience.

Rising demand for turnkey solutions in the building and provision of assets will help to accelerate this vertical integration of supply chains, as clients develop more in-depth relationships with strategic suppliers.

3.

Collaboration

The fragmented nature of the construction industry, combined with lowest-cost tendering, often gives rise to an adversarial working culture. Different parties have conflicting or misaligned goals, relying on contractual disputes to claw back profit.

Working to typically slim profit margins, companies are often reluctant to invest in research and development. Commercial strategies are risk averse, with individual companies playing "not to lose" rather than working towards mutual benefit.

The industry desperately needs to move to a new model that will encourage collaboration and a win-win mentality.

Ways of achieving this include forming strategic alliances and adopting more consistent standards in design, measurement methods and data benchmarks. Contracts will need to encourage collaboration between all parties.

4.

Modern methods of construction evolve

Too many buildings are still designed from scratch, using bespoke elements and requiring complex choreography to install services such as heating, ventilation and plumbing.

Modern methods of construction have started to disrupt this uneconomical and often inefficient system, as enlightened clients see that huge efficiencies can be gained from a more standardised approach and shift to offsite manufacture. Some well-established examples include panellised building systems to fully serviced bathroom pods.

But this is only the first step in an evolution that will take construction closer to a manufacturing mindset: some clients are already reducing buildings down to kits of parts that can be quickly assembled, and transported around the world in shipping containers.

Modern methods of construction will be a major contributor to the UK Government's industrial strategy for construction, which aims to reduce the costs of construction and of whole life assets by 33 percent, halving the time it takes to construct a building and also reducing greenhouse gas emissions in the built environment by 50 percent.

5.

The digital revolution takes hold

Many real estate players are still waiting for an idealised form of technology to arrive and transform their operations. But much of this 'magical' technology already exists: for example, blockchain will transform payment and delivery processes, and robotics used for prefabrication and 3D printing will help to accelerate the design for manufacture. Building information modelling (BIM) is expanding into more strategic applications. The next generation of digital models will link to cost libraries, helping asset owners understand the price implications of every decision.

In other sectors, such as transport and health, artificial intelligence and machine learning are increasingly being applied to different tasks. Although the real estate sector has been slower to adopt this technology, algorithms will become an essential business tool in the near future.

For example, schedule optimisers that consider multitudes of alternatives for project delivery, will accelerate and streamline project planning. Predictive applications will help project teams to understand and minimise project risks. Enhanced analytics platforms, using data collected from sensors, could build up a sophisticated picture of how an asset is being utilised, helping facilities management teams to develop effective maintenance strategies.

Moving to a trust-based culture

Our industry is on the brink of a seismic change. Technology, standardised data and digital working are paving the way for a trust-based culture where supply chains and clients work together for mutual advantage.

This will disrupt the way asset owners and suppliers interact. Multinationals are likely to slim down their supplier list, choosing one strategic partner to manage their global real estate portfolio. The client focus will shift from simply building new infrastructure, to finding the best solutions that match their long-term growth strategy.

Suppliers will have to respond to this changing client demand by creating strategic global alliances. Astute use of digital technology and data will help them hold their supply chains to account, reducing the need for heavy assurance mechanisms.

Those organisations at the forefront of this revolution will gain significant competitive advantage in the years to come. □

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In the next five years, the real estate sector will experience a fundamental change in five strategic areas. The extent to which companies respond and adapt will be crucial for their long term survival.

Transforming and reforming:

HM Revenue & Customs embraces its digital future

Client interview

Steven Boyd
Head of Estates, HMRC

Tax experts must be good at solving mathematical problems. Even so, HM Revenue & Customs (HMRC) has embarked on a fiendish brain teaser with its Locations Programme.

HMRC is taking a scattered 170-office portfolio, converting it into 13 regional hubs, five specialist sites and relocating nearly 45,000 employees in the process. At least ten new buildings are being constructed and fitted out, each the equivalent size of a corporate headquarters. To make the task even harder, the programme must be largely completed by April 2021.

Steven Boyd, HMRC's Head of Estates, is leading the £500m endeavour. "It's the biggest property programme in the UK by some distance," he comments without any sense of drama.

A chartered engineer who served with the British Army for 30 years (latterly as Head of the Army Estate), Boyd is used to working quickly. Two years into the programme, his goal is not merely to deliver, but to improve the end-to-end construction process. The effects are being felt everywhere from furniture design to facilities management (FM).

Harmonising building information modelling (BIM)

The termination of a major private finance initiative (PFI) contract in 2021 partly explains HMRC's pace. By moving to large leased regional centres, HMRC calculates that it will save £90m annually from 2028. HMRC is also taking the opportunity to become "one of the most digitally advanced tax authorities in the world," moving its people into buildings with high-speed digital infrastructure, facilitating collaboration and smarter working.

"It's a once in a generation opportunity," Boyd says.

It's an opportunity that extends to the construction community: with buildings at Croydon and Canary Wharf completed, seven projects out of the ground and others still in design or pre-design phase, the overlapping schedules present the client with a unique overview of how the construction process can be improved.

Strategic use of BIM is at the heart of the programme. It is the first government property programme to adopt level 2 BIM on such a scale. Every project has a 3D digital "twin" model, rich with data that is built and shared by all parties in the construction process. Once the programme is completed, HMRC will use the BIM models for facilities maintenance and to compare the performance of buildings across its portfolio.

In a nutshell: The Locations Programme

HMRC's Locations Programme is phase one of the government's hubs programme that will ultimately see civil service departments clustered together in different regions of the UK.

The transformation of the government department involves the fit-out and furnishing of an estimated 730,000 sqm of strategic hub space, including the delivery of 13 regional centres and a temporary transitional office in Canary Wharf. At least ten centres will be newly constructed, other projects involve refurbishments or fit-outs of existing buildings.

HMRC calculates that the programme will help it avoid additional PFI costs of around £75m a year. Moving to regional centres will save a further £90m in efficiency savings achieved annually from 2028.

The new offices will also help HMRC achieve its goals of improving customer service and delivering an extra £1bn in revenue by 2019–20.

The first new regional centre opened in Croydon in summer 2017 and the transitional office in Canary Wharf is operational. The busiest time for staff mobilisation is expected to be 2020, when up to seven buildings are scheduled for completion.

"It's really exciting, an opportunity to really make a difference to our people. To make a really big and lasting change."

Such vast resources of data are worthy of academic study, Boyd suggests. But he admits that challenges still remain, adding that the BIM dimension is "proving more difficult than we thought". This is because each part of the industry has adopted slightly different naming conventions for objects. As a result, one item could change names a couple of times as it passes from design to construction and then maintenance, affecting the quality of the data.

Early involvement

HMRC has brought together contractor and supplier forums to tackle this problem. One of its goals is to agree a commonality of terms and to encourage information to be properly passed from team to team as the project progresses.

"The commercial property industry has a whole series of discontinuities. We want to minimise them. Getting people to work across boundaries is a way of doing that," he adds.

One strategy is to bring FM companies to the table as early as possible. Boyd wants them to attend contractor forums long before they are usually engaged on a project.

"We want our FM suppliers to be witnessing things such as the commissioning of air conditioning systems. Hopefully, that will help us land the service in a smooth way," he says, adding that he is especially pleased by the way contractors are working together in the forums to identify and solve problems.

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Locations Programme in numbers

170
Office portfolio

13
Regional hubs

45,000
Employees relocated

10
New buildings

Now, he has the tricky task of keeping up the pace of delivery, while navigating multiple public sector approval processes.

"Getting departmental approval is one thing, but you've also got to get it past the Cabinet Office, the Treasury, and a huge amount of external engagement, including local authorities and MPs," Boyd says. In the past two years, he has learnt a lot about communication and forward planning, and in particular how to minimise any surprises for decision makers.

Given the approval regime, how does he ensure that such a complex programme remains on track and not mired in bureaucracy?

"We've spent a lot of time getting the governance right and ensuring that it's streamlined. And to make sure that decisions are pushed down to project level as far as possible," he says. "We're also working really hard with the Cabinet Office, Treasury and HMRC's investment committee. To give them the confidence that they don't need to review everything in triplicate."

But he adds a note of caution.

"That confidence is, of course, really hard won and easily lost."

A people-driven programme

Boyd is always mindful that the biggest stakeholder group is HMRC's 60,000 employees who will all be undergoing a seismic culture shift in the new smart working environment. An estimated 45,000 workers will also be moving to new locations. But he says that the endeavour has been very much "people driven" and staff consultations have formed a large part of HMRC's strategy.

The old estate was highly fragmented and becoming increasingly expensive to run. Staff in regional outposts complained of feeling isolated and struggling to progress their careers. The smallest offices held as few as ten people.

HMRC's transformation programme, by contrast, is ushering in flexible and collaborative working. Fixed desk seating arrangements are out. Instead, staff will be assigned state-of-the-art laptops and will store their belongings in lockers. They can then choose from a variety of seating options from traditional workspaces to sofas, kitchen tables and breakout spaces.

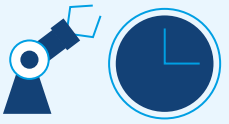
Boyd says that the new hubs have been strategically located. All are no more than 15 minutes' walk from a mainline rail station. Of the 45,000 employees affected, the vast majority are expected to move to

the new locations. For those that cannot, HMRC will help find them jobs in other government departments, or if this is not possible they will receive redundancy packages. It is also offering career transition support and training.

"I have a team specifically working on the people piece all the time. It's both worrying and exciting for employees, and managing that is a challenge," Boyd says.

But despite the complexity, he admits that he is enjoying this multi-faceted programme.

"It's really exciting, an opportunity to really make a difference to our people. To make a really big and lasting change. Our staff who have moved into the new locations are really enjoying the great workspaces," he adds. □



Flexible, sustainable and future-proofed

HMRC's Locations Programme is taking advantage of the repeatable work and economies of scale opportunities. This is affecting everything from carpet tile procurement to design and every new location will have a similar feel.

"We've adopted a standard approach. This avoids costly bespoke design solutions that could become quickly outdated," Boyd says. He adds that each floorplate of an HMRC building will be modular, so that layout can be quickly reconfigured, should the need arise.

Electronic entry systems are also being installed at each floor level. This will make it easier to let parts of the building out to other organisations in the future. And, with digital security a priority, HMRC's building data, such as the CCTV or building management systems, will be stored on a local access network (LAN) in each location, which will be entirely separate from other digital infrastructure.

"Regarding IT, we've gone massively over the top in terms of bandwidth into the buildings. We're assuming that there will be huge amounts of video conferencing and video-based training," Boyd says.

Mass procurement is also enabling HMRC to flex its muscles with suppliers. It is working with five furniture manufacturers to ensure that all the furniture in its new locations meets disability standards. Many items will also include USB and power sockets. In addition, HMRC's strong demand for carpet tiles has helped it persuade manufacturers to reduce the amount of plastic in the final product.

"Suppliers are telling us that no one has asked for these things before," Boyd says. "We're pushing the envelope on what's doable."

Millennials and the construction industry:

Opportunities to learn

Kiabi Carson
Head of Human Resources,
North America

An interesting thing is happening in the workplace, it's being taken over by millennials. In the USA, the millennial generation became the dominant one in 2016[1]; globally that moment will come around 2020[2].

More has been written about this generation – born between 1981 and 1996 – than any other, not all of it positive. We hear that millennials are purposeful, responsible, that they care about the environment and the impact they have on the world, yet they are sometimes labelled as narcissists or entitled.

Those that look for negative behaviours among this ambitious generation are overlooking the value they can add through their approach to life and work.

The millennial mindset is the missing piece in a jigsaw that brings together themes the construction industry has been attempting to pursue for years, if not decades: collaboration, sustainability and care for the environment; the power of infrastructure to raise communities out of poverty; and the value that buildings and structures add to society.

Time for change

The United Nations (UN) identified 17 Sustainable Development Goals[3] in 2015 and many businesses have used these as a blueprint for how they should conduct themselves in order to improve the world we live in. They encompass goals from ending poverty and hunger and providing clean water and sanitation to climate action and affordable, clean energy.

As a business, we identify strongly with many of the UN's goals; initially we are focusing our efforts towards those where we feel we can make the most impact, including sustainable cities, communities and industry, innovation and infrastructure.

The goals of gender equality, good health and well-being, quality education and reducing negative impacts on the environment are themes that run through our ethos, and that of our peers and clients. As well as working towards these goals at a project level, it's important to push for wider changes in approach.

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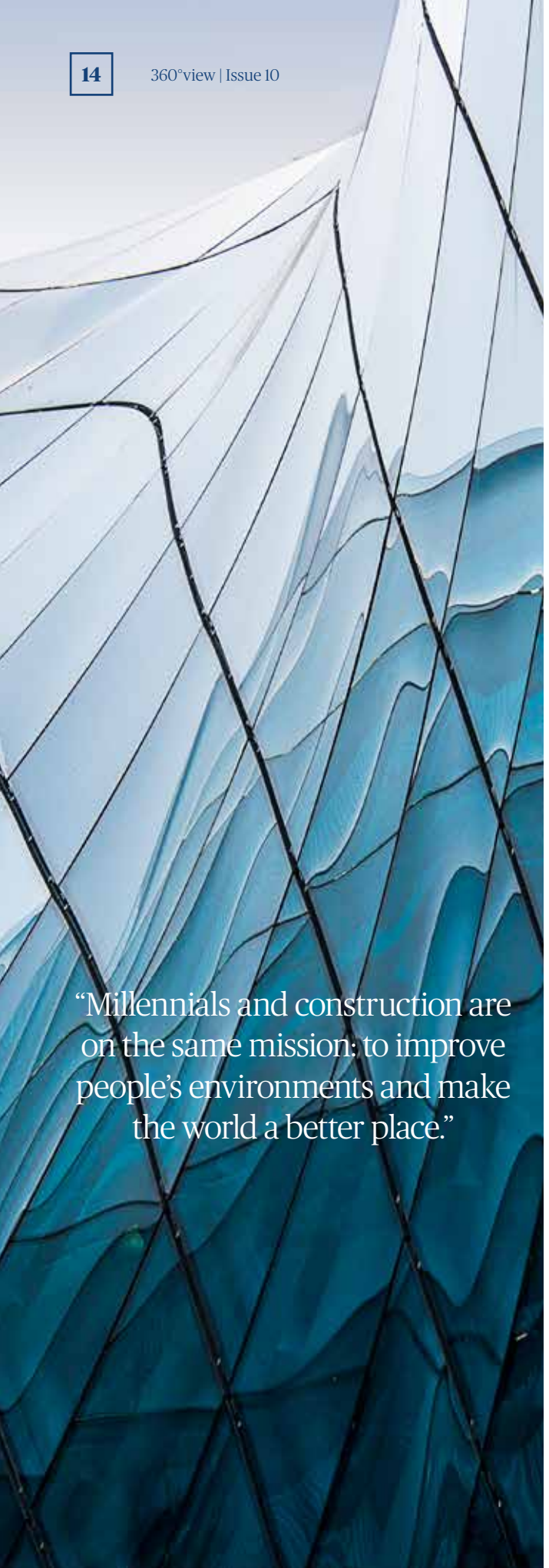
1. Pew Research Center, Millennials are the largest generation in the US labor force, 2018
2. Statista, Employment worldwide by 2020, by generation
3. United Nations, #Envision: 2030



"Millennials and construction are on the same mission: to improve people's environments and make the world a better place."

The case for collaboration

If we are to build roads, mass transit, utilities, schools and homes that better serve communities, more voices need to be heard, and more people involved in the process. With more players, the need for collaboration to define and deliver shared outcomes becomes more important than ever.

The good news is collaborative working appeals to millennials. They have been brought up in an environment where constant connectivity is the norm due to the rise of social media and the advancement in collaborative technology. That doesn't only mean everyone sitting together in a room or open-plan office; there are broader applications. The millennial generation is uniquely positioned to harness the best outcomes in construction through their approach to collaboration and their understanding of technology.

One thing to be aware of is that, as an outcomes-driven generation, millennials may shun the processes and protocols that previous generations have so painstakingly set up. Managers from the Baby Boomers and Generation X must be open to new ways of doing things, new tools, new work styles and structures. They may have to relinquish some of their hard controls and give more attention to maximising value of projects for communities, the environment and ultimate end users.

A shared mission

The message that we, as an industry, need to emphasise is that millennials and construction are on the same mission: to improve people's environments and make the world a better place. Input from the millennial generation will enable construction to transition more quickly towards an outcomes-based approach that delivers even more value for future generations.

This is not an attempt to put all millennials into a box, but to highlight some of the strengths they have already displayed in the workplace, strengths that cannot be ignored and are unique in many ways. Strengths that can have a profound impact on how built environments are delivered and sustained for years to come. One theme rings clear, if we are to achieve the delivery of more efficient, sustainable environments, we need to allow millennials, our future leaders, to disrupt our traditional ways of working. □

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Adelaide Botanic High School: A living lesson

What better way to explain the impact of buildings to the next generation, than to create an exemplary one for them to learn in? This is the ethos behind the Adelaide Botanic High School.

Students won't only learn about technologies such as rainwater harvesting and solar panels, they will see them in action in their school building. And they will also experience at first hand the powerful effect that elements such as sunlight, collaborative spaces and contact with flora and fauna can have on health and well-being.

Adelaide Botanic High School is the first vertical high school in South Australia and is being designed and built to achieve a five-star green rating from the Green Building Council of Australia. With a smaller footprint than a low-rise school, more precious inner-city land is preserved as green space for the pupils with a roof-top garden maximising outside space.

Empire State Building:

A race for the sky

John Robbins
Managing Director, USA and
North America Head of Real Estate

Against the backdrop of the Great Depression of the late 1920s, the 103-storey Empire State Building was built in just 410 days. Today, new towers are starting to soar again en masse in New York City for the first time since the boom of the 1980s. As the need for speed to market intensifies, we look back on this globally iconic building as a feat of innovative construction and one of the original market disruptors.

The Empire State Building was built on the site of the original Waldorf Astoria Hotel. This was a symbolic gesture as the former hotel represented an elitist gilded age, while the new structure was conceived to represent the might, skill and brawn of the American worker.

The design approach and collaboration of the building's supply chain was rooted in competitive spirit driven by the 'race to the sky' – a desire to construct a taller building before the competition. In the era of the first skyscraper boom of the late 20s and 30s, the client and its team were determined that the building should soar above the Chrysler Building which was also under construction. Consequently, the Empire State Building was originally designed as an 80-storey edifice but plans were altered several times to keep pace with and exceed the height of its rival.

The challenge to build tall, maintain programme and increase speed to market remains in New York and many global cities. Technology and globalised supply chains may be very different today, but there are many parallels between the real estate construction industries of then and now.

With a great need for market disruption in today's global construction sector, what can we learn from the Empire State Building?

A unique collaborative delivery model

Architectural historian, Carol Willis, cites two reasons for the incredible speed of build. The first was "a design team approach that involved the collaboration of the architects, owners, builders and engineers in planning and problem-solving and organisational genius of the contractors". Part of that statement sounds remarkably close to what defines today's best projects, which always have a highly collaborative and integrated supply chain and clear vision and leadership from the client team.

The modern equivalent could be seen as Integrated Project Delivery (IPD), a method that, when embraced by the project team, can increase the productivity of construction. Great projects today are characterised by teams focused on the right outcomes, where best value and performance is achieved, rather than solely lowest cost.

Just-in-time delivery

The supply chain of the Empire State Building focused on just-in-time (JIT) delivery methods, which allowed for more efficient inventory and less stock storage on site. This approach was required due to the crowded city environment around the building, but it also allowed for the structure to be constructed more efficiently.

Many of the components were prefabricated. The steel structure was produced in Pittsburgh, allowing for easy shipment on rail cars to the centre of Manhattan within only a three-day delivery timeline.

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Workers utilised a railway and materials hoist system to push cars full of building materials around the site to transport the ten million bricks needed to back up the exterior limestone.

In the market today we need to embrace offsite fabrication to increase production of building components exponentially, while also improving quality through controlled environments. While this is adopted on certain projects, there is still room for improvement in embracing modular construction. We have, however, fully embraced the comprehensive approach to logistical planning which the Empire State Building showed can ensure major projects remain on programme.

Material selection

Many materials for the Empire State Building were sourced locally. The granite used for the façade of the building was sourced from quarries in New York State, saving significant time and cost compared to importing the stone from outside the US.

Today in New York and around the US, the Trump Administration's trade tariffs are impacting the cost and time to import materials such as steel, aluminium, ceramics and many other building supplies coming from China and other foreign locations. Against this backdrop, understanding how material specifications and sourcing can affect cost and project timescales is critical.

Labour: the challenge of our time

What other factors increased the speed of construction? The Great Depression from 1929 to 1933 served up a cheap labour pool of 3,000 workers who worked day and night on the Empire State Building.

Apart from the poor health and safety record on the Empire State Building construction, which resulted in 14 people perishing during construction, the surplus labour is also a stark reminder of differences between then and now. While we have lived through a global crisis in 2008/9, the construction labour pool never fully recovered and our industry is impacted by an ageing workforce and a lack of new younger entrants.

Technology enabled

At the time of construction, the Empire State Building used innovative techniques of the time to drive efficiency and build tall. While technology has considerably advanced in many industries, construction has been sluggish to adopt and apply innovation. Today we have sophisticated means of building information

Fast facts

US$41m
cost of build in 1931

3,000
workers were employed but there was no overtime

410
days to build to a height of 1,454 feet

4.5
storeys were delivered per week, to a total of 120 storeys

Half the building was empty for most of the 1930s and wasn't profitable until after World War II

The building has a net rentable area of 2.1m sq ft

"The Empire State Building remains an icon of New York City but also a fitting reminder of the need for era-defining projects to help disrupt the way we build."

modelling (BIM) at our disposal to speed design, detect field clashes, increase efficiency, help control costs and improve ongoing facilities management. Yet on major projects in New York, the full power of technology is not consistently used. Often defaulting to replace technology with more labour. With the advent of digital manufacturing, production speeds have the potential to increase massively in construction.

Embracing new technology is also allied to the final area where clients and contractors can drive change by playing a part in attracting new industry talent. The increased adoption of technology on major projects is important to drive performance, but it's also fundamental to attracting new entrants who want to join a progressive, high-tech industry.

In New York, significant progress is being made in these areas. An initiative is underway to work with Building Employers' Trade Association (BETA), an organisation that represents major contractors in New York City, in attracting and recruiting new talent into the construction industry with technology as a major initiative.

Looking forwards and upwards

It is now impractical in the US to build skyscrapers in 410 days, but the construction principles used on the Empire State Building – supply chain collaboration, offsite manufacture, just-in-time and 'last mile' delivery models and a commitment to use the best possible technology – remain highly relevant today. The good news is, more and more of us are aligned around these issues and want to collaborate to deliver the change we need.

The Empire State Building remains an icon in New York City but also a fitting reminder of the need for era-defining projects to help disrupt the way we build. □

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Modularisation and prefabrication:

Shaping the future of capital project investment in China

Tino Chang
Director, Technology and Manufacturing, China

The Chinese Government is vigorously promoting prefabricated construction to improve efficiency, reduce pollution and lessen the labour intensiveness of the industry. By 2026, it wants 30 percent of new buildings to be prefabricated, representing a huge opportunity.

Prefabrication and modularisation are set to reshape the construction industry in China. In 2016, the government announced its 13th Five-Year Plan with a significant focus on this new method which is set to be worth US$755bn by 2026.

The industry as a whole is forecast to grow a healthy 7 percent year-on-year, reaching US$5,285bn over the next eight years, with the prefabrication market making up 30 percent of that[1]. Currently, prefabrication only makes up 5.5 percent of all new construction in China so the opportunity for the industry is significant.

One of the most impressive examples so far is in Changsha, south-central China, where a 57-storey skyscraper was assembled in just under three weeks in June 2015, after specialist firm Broad Sustainable Building prepared 2,700 modules in a factory over four months.

Why prefabrication now?

There are several reasons behind China's push towards this new construction method. The industry is the single largest consumer of resources and raw materials, with waste and pollution a huge problem.

The industry is also labour intensive. While employment in China's construction sector is expected to touch 60 million by 2019, the number of people working will reduce by about four million a year due to an ageing population.

There are political and economic reasons too. New technology will support China's enormous Belt and Road Initiative (BRI), a US$1tn-dollar project connecting the country to other parts of Asia, Europe and Africa by road and sea. Prefabrication also means Chinese raw materials can be used, with products exported around the world.

Traditional construction in China – and how it must change

Compared with many other industries in China, construction has been slow to develop new methods. More than 90 percent of construction activities are on-site.

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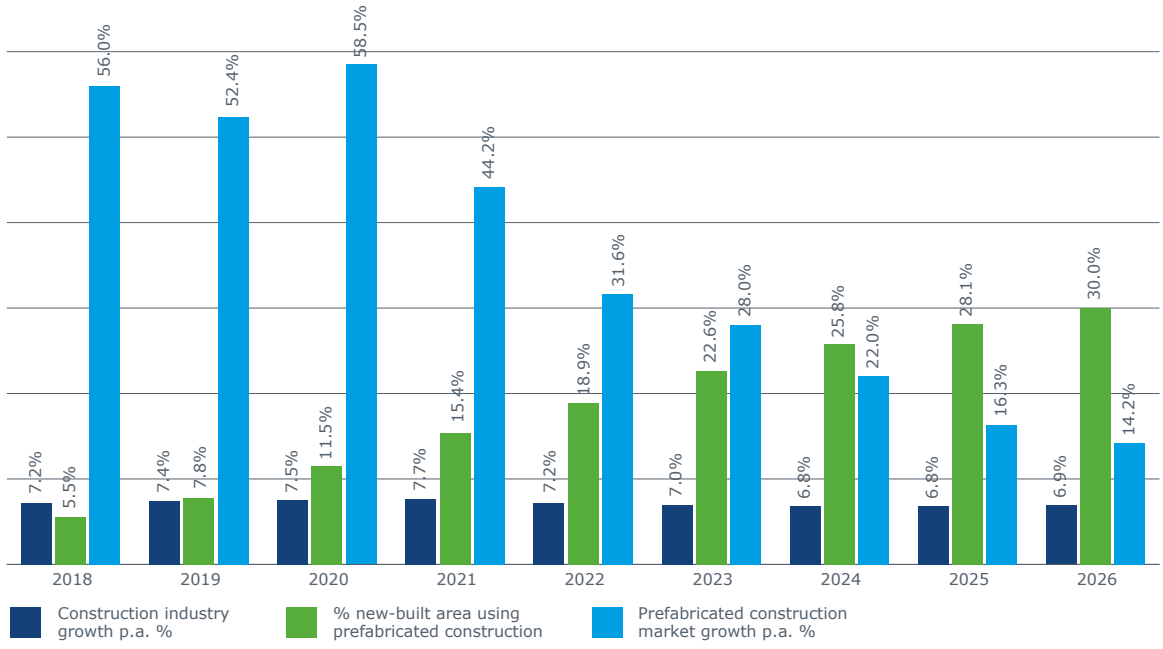
The construction outlook in China, 2016 to 2026



Source: Prefabrication and Modular Construction Association, China.

1 Prefabrication and Modular Construction Association, China

Japan - A leader in prefabrication and modularisation

Fifteen percent of the one million homes constructed every year in Japan are prefabricated, a practice that started during the post-war housing boom.

Unlike countries that focus on economy of scale and affordability, Japanese experts focus on quality. With their natural-born craftsmanship, today the level of quality and details in Japanese prefabricated buildings are matched with affordability and most importantly, seismic and fire safety.

The Japanese Government also promotes this type of construction through regulation and accreditation. It encourages professional associations, architects and interior designers to be creative in their designs for customised modular buildings.

"The onus is on the developers to commit to using prefabrication and modularisation technology in order for the supply chain to respond and invest accordingly."

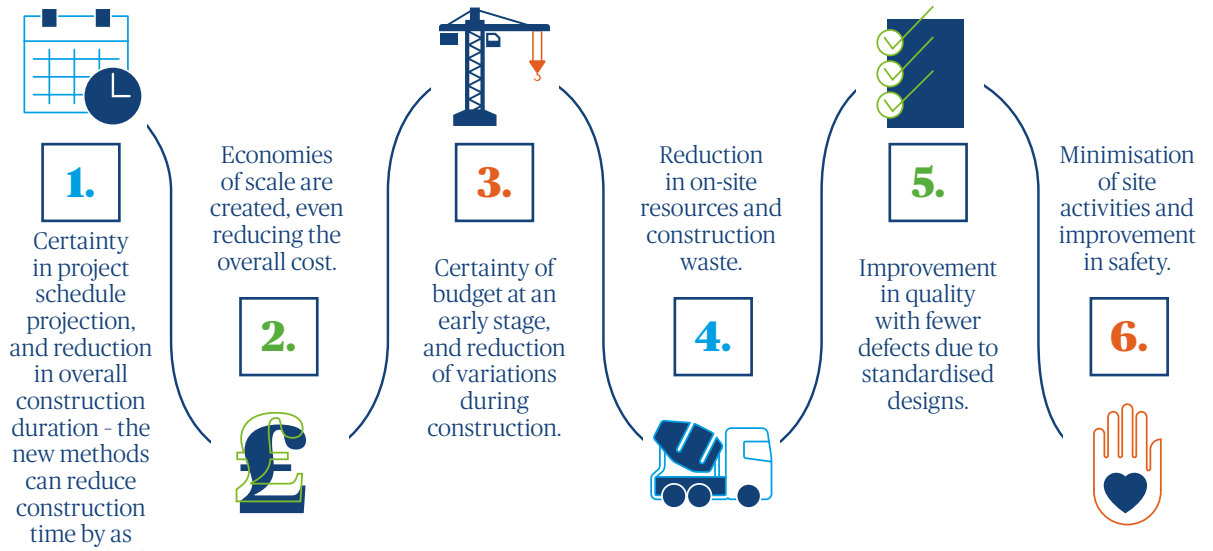
Except for a few prefabricated components such as doors, windows and mechanical and engineering (M&E) equipment, the entire process still relies on using raw aggregate materials and labour onsite. The quality, delivery time and cost are greatly subjected and influenced by local site constraints.

The onus is on the developers to commit to using prefabrication and modularisation technology in order for the supply chain to respond and invest accordingly.

There are several challenges to overcome:

- The design stage is often kept to a minimum to save time and construction often starts when designs are incomplete. Developers must demonstrate early commitment to engineering and design works to use new methods.
- Transportation logistics are often neglected. Issues such as production and delivery lead time, size, weight, route restrictions, site positioning and lifting requirements need to be considered.
- The cost of building elements appears higher than traditional construction, as the market is not yet well developed. There is also a limitation in sourcing options.
- People's perceptions that structures are temporary or of poor quality is an issue and designers can be concerned that prefabricated buildings are always standardised.
- Many construction experts and skilled workers are not familiar with this new way of building. The contractor and prefabrication specialists' knowledge of buildability is often lacking during the design stage, resulting in rectifications on-site.
- Schedulers need training to plan in a dynamic manner. The critical path method (CPM) is a logical system of one activity after another, but in prefabrication and modularisation, several activities can commence at once.
- The Chinese Government should also explore financial incentives, including preferential policies on land bidding, credit support, transportation and subsidies.

The benefits of prefabrication



Trends over the next ten years

Economy of scale and cost effectiveness will be the primary drivers of demand for new technology. To start with, applications will be mainly in sectors that are price-sensitive and need speed of delivery, such as warehouses, apartments and schools.

As the market develops, the focus will move towards more complex solutions. Hospitals, for example, need highly integrated facilities, such as in operating rooms where M&E services and cleanroom heating, ventilation and air conditioning (HVAC) systems need to work together.

For the pharmaceutical industry, typical drug manufacturing facilities can take three to four years to build. This can happen at the same time as products are in clinical trials, a financial risk because the new drugs may not pass them. When JHL Biotech needed to build a new factory in the Hubei province in China, it worked with GE to create 62 "KUBio" building modules that travelled to the site from factories in Germany, Sweden and the US[2]. In just eight days the 62 modules were assembled, ready for specialist equipment to arrive.

Modularisation and prefabrication can drastically improve project performance. Lean construction, building information modelling (BIM) and green construction can also work with the new method, so it offers huge potential in more ways than one. It is now up to the Chinese Government to continue pushing its agenda and for the industry to respond creatively and robustly. □

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2 GE Healthcare Life Sciences, The Story of KUBio

Improved offshore project performance, or cautious optimism?

Aileen Jamieson
Global Director,
Natural Resources

The media is full of owners announcing offshore oil and gas projects completing under budget and ahead of schedule. Finally, it appears we are hearing good news from the upstream industry. But are we seeing real improvements or is it cautious optimism?

Take, for example, Woodside Energy's Greater Western Flank phase 2 (GWF2) project which started up in October 2018. Woodside Chief Executive Peter Coleman announced: "The project has been delivered **US$630m below the expected cost of approximately US$2bn and six months ahead of schedule**". The final investment decision (FID) was taken in December 2015, meaning the duration was 35 months from sanction to start-up, instead of a planned 41 months.

However, data provided to the Performance Forum (PF) joint industry project (managed by Turner & Townsend) by 25 oil and gas operators from projects completed in the last ten years shows that the expected duration for similar projects should only be 28 months (chart one).

So is bringing GWF2 on six months early a real improvement or simply proving that the original schedule was too long, and further enhancements could have been possible?

Cost savings of *almost one third versus budget* should be congratulated, but being so far below budget might normally be a sign of poor estimating. The reality is most likely a significant cost saving on the drilling campaign, rather than a major improvement in project execution performance.

Shell, meanwhile, announced the early start of production from its deepwater Kaikias project in the Gulf of Mexico, "around one year ahead of schedule" in May 2018. It also said it had "reduced costs by around 30 percent at this deepwater project since taking the investment decision in early 2017".

According to Shell's website, Kaikias was sanctioned in January 2017 and started up in May 2018, versus a planned start-up of January 2019. Actual duration was therefore 16 months, versus a plan of 24 months.

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Chart one: sanction to start-up duration, Woodside GWF2 planned and actual versus PF industry trend

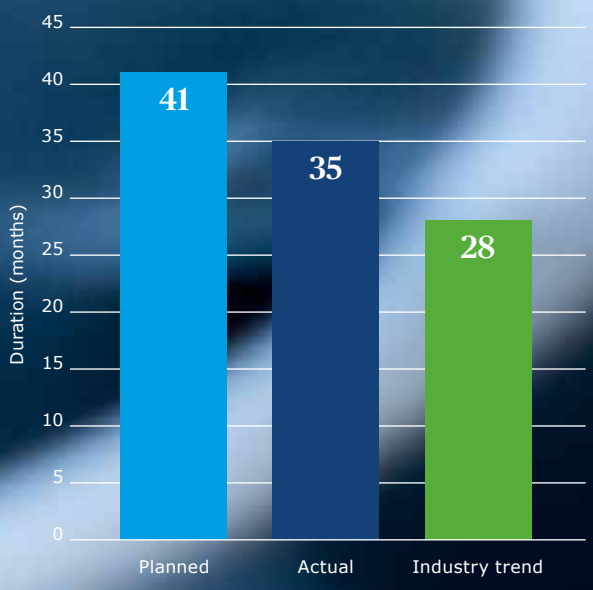
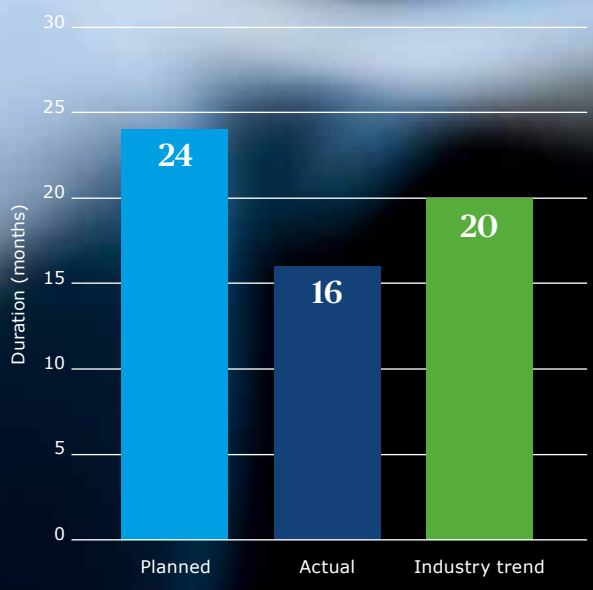


Chart two: sanction to start-up duration, Shell Kaikias planned and actual versus PF industry trend



Performance Forum (PF) trends show a similar project would be around 20 months (chart two), proving that Shell did achieve a real performance improvement on Kaikias. However, what likely drove the faster schedule, as well as the cost reduction, was a significant reduction in scope due to a simplification of the final design versus plan. As a result, the overall improvement may not be as groundbreaking as the media headlines suggest.

One project that has bucked the trend is the Eni-operated Zohr field in Egypt. It took only 28 months from discovery to start-up, and only 22 months from sanction to start-up for a 365,000 boed throughput. This is so unique that the data cannot be compared against any other historical project. Disciplines worked in parallel and Eni shared delivery improvement with contractors to encourage collaboration and a culture of speed.

Measure performance correctly or not at all

Project performance is measured by the PF by comparing the final cost and schedule against similar completed projects, with costs adjusted for inflation and market effects. Operators, however, typically compare their out-turn performance against the budget at FID. But there is often no evidence of **how accurate their estimate was at budget**. Adding large amounts of contingency to a budget provides greater opportunity to achieve the appearance of performance improvement. Announcements of performance improvement versus budget should be viewed with great caution.

The data doesn't lie

The PF has analysed cost and schedule data submitted by owners for projects completed in 2008 to 2011, 2012 to 2014 and 2015 to 2018.

Duration is typically now longer, not faster.

North Sea non-deepwater subsea tieback sanction to start-up durations for projects completed in 2015 to 2018 were **higher** than historical periods for five of the seven datasets submitted.

A similar picture emerged for the five facility completions in deepwater West Africa and Rest of World.

Compounding this, all of the non-deepwater subsea facilities that completed 2015 onwards started detailed engineering prior to sanction, which might let owners make sanction to start-up duration *appear* faster. A counter argument might be that moving engineering forward represents better project management.

> "The reality is most likely a significant cost saving on the drilling campaign, rather than a major improvement in project execution performance."

Projects are as likely to cost more than before, instead of less.

PF received costs from 15 subsea facility start-ups between 2015 and 2017, but in most cases the data does not show them to have performed better than projects in previous periods. In non-deepwater, there were just as many points plotting above the industry cost trend as below, for both North Sea and Rest of World.

We should note that it is too early to see all of the final data for subsea projects completed since 2015.

Achieving performance improvements

While individual projects have demonstrated better performance against their own budget, the data does not show them to have achieved the groundbreaking cost or schedule performance improvements as announced in the media.

But it may be too soon to judge the industry's efforts. Only a small number of projects sanctioned since the downturn are onstream. Projects completing in late 2018 and throughout 2019 could change the picture if sufficient capital discipline is achieved.

With costs on the rise once more, the best chance of achieving performance improvements is to be flexible, use your best people, think big and act small, reduce governance and share success by collaborating with the supply chain. □

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Five steps to achieve improvements

1. Smaller, flexible owner teams

Subsea facilities in the North Sea which started up from 2015 onwards have reduced owners' team costs by 40 percent as a result of shrinking headcount... Having the right people in the right place at the right time can save significant cost.

2. Put your best talent where it can be most effective

Tougher pre-FID screening has resulted in increased attention on project execution and capital discipline. With fewer projects making it through, there is a view that the best project directors and delivery teams are working on those sanctioned.

3. Make performance improvement a common goal

There has been a growing movement towards increased collaboration and alignment on contracts, resulting in alliancing with the supply chain to appropriately allocate risk and make profitability a shared goal.

4. Think big, act small

Operators have shifted tack in the last three years, focusing on near-field projects that can be completed as subsea tiebacks into existing infrastructure. These require less capital expenditure but generate returns much more quickly, increasing cash flow. Executing smaller, simpler scopes of work improves efficiency, removes interfaces and provides clarity of cost discipline.

5. Think fast, reduce governance

Embed a culture of speed, work fast in procurement, and examine whether working in parallel can reduce duration. Identify how quickly you can bring a project through the pre-FID stages.

Re-examine governance and stage gate processes. Consider a 'fast-paced process' for smaller, simpler projects with lower risk.

Seeking social value:

Increased investment requires modified governance models

Grant Bowery
Director, Australia

As Australia ploughs billions of dollars into its public transport infrastructure, a rethink is required to improve project prioritisation and ensure the public receives best value from extraordinary levels of investment.

The scale of Australia's current infrastructure investment programme is as welcome as it is unprecedented, fuelling growth and addressing growing population demands.

In particular, we are seeing an escalation in the transport sector, with the Australian Federal Government's Infrastructure Investment Program committing more than AU$75bn over the next ten years to boost the economy, reduce city congestion, and facilitate safer rural roads.

On the back of this federal support, a range of new state and territory sponsored projects have emerged, including Sydney Metro and Light Rail Programs, City Link Brisbane, Perth's Metronet, rail packages in Victoria, and Western Sydney Airport. The New South Wales (NSW) Government alone has committed AU$52bn over the next four years.

On the face of it, this is all good news for the infrastructure sector and the Australian public. However, closer inspection reveals that, as a consequence of this boom, we are actually witnessing a significant fall in the effectiveness of project planning and delivery and the public is not gaining the value that it deserves from this level of investment.

The need for reform

Reform of governance structures and policies across Australia's complex federal, state and local government structure is vital to ensure public infrastructure renewal continues. A rethink will ensure we capitalise across the project life cycle through:

- **Improved project prioritisation:** Identify and prioritise the business case for investment
- **Collaborative delivery:** Engage the project delivery supply chain to maximise return on investment

Capitalising on an investment boom

The driving force behind this investment boom is capital recycling, an innovative strategy which transfers the capital value of public assets to provide much-needed funding for new infrastructure projects.

The concept is simple; state governments sell or lease to the private sector their stock of public assets, such as ports, airports, power and water networks. They then reinvest the capital raised in new economy-driving assets such as roads and public transportation systems.

It has been a popular idea which the federal government has supported with incentives such as the Asset Recycling Fund. This mechanism provides states with an additional 15 percent of the estimated proceeds of each deal. To date some AU$3.3bn has been used to support AU$22bn raised from the sale of power grids and ports across Australia.

Government infrastructure investment across Australia

Infrastructure Australia, the body set up to prioritise the nation's infrastructure investment, agrees and in its 2016 infrastructure plan urged federal government to continue incentivising state and local government to recycle publicly owned assets where appropriate.

Yet after the flush of excitement, there is now evidence that many of these 50-100-year deals have resulted in a reduction in value to the taxpayer.

Improved project prioritisation

Capital recycling can provide a much-needed boost to the economy. But if not approached with a long-term view, this once in a lifetime opportunity can drive the wrong behaviours.

In major cities like Sydney, where competing social and political pressures make selection of the right infrastructure investment targets critical, problems are starting to show. Without the right level of governance, the cash raised from asset sales does not always find its way to the most needed projects.

Establishing robust business cases to sit behind each deal will ensure that community needs are properly understood and all options are considered, so countering the tendency of politicians to back voter-friendly projects rather than those with longer-term value.

Infrastructure Australia is aware of both the opportunities and the challenges of selecting the right projects and its investment priority list is a step towards countering this behaviour. Yet too often this list is overlooked as state or regional political priorities take precedence. Its recommendation for a set of National Governance Principles is crucial to ensuring that major public infrastructure investments deliver the best outcomes for the community and the best value for taxpayers.

Collaborative delivery to drive success

Greater collaboration across Australia's fragmented layers of government is an important step towards depoliticising the debate over how best to spend the funds raised through capital recycling and so ensure that investments contribute to a wider regional or strategic benefit.

New South Wales ten-point plan

1. Procure and manage projects in a more collaborative way
2. Adopt partnership-based approaches to risk allocation
3. Standardise contracts and procurement methods
4. Develop and promote a transparent pipeline of projects
5. Reduce the cost of bidding
6. Establish a consistent NSW Government policy on bid contributions
7. Monitor and reward high performance
8. Improve the security and timeliness of contract payments
9. Improve skills and training
10. Increase industry diversity

The formation of focused development authorities is one obvious way to do this. Acting alone, local authorities typically do not have the capability or capacity to deliver one-off major infrastructure projects. Success comes through working in collaboration with other stakeholders and the supply chain.

For example, both Melbourne and Sydney have over 30 local councils across their metropolitan areas, each competing for investment to deliver housing, transport and business growth. Yet state government retains a controlling interest, often creating a significant difference in public policies, standards and investment priorities.

But we can get it right. Western Sydney City Deal is a prime example of a forward-thinking collaboration which provides an alternative structure for infrastructure planning. As a partnership between the federal, local, and the NSW governments, it is a genuine leap forward in collaboration that will unlock opportunities in education, business and employment.

The NSW Government understands the need to improve project delivery. Its new ten-point plan recognises that infrastructure can only be delivered by engaging, supporting and collaborating with the private sector. It sets out to encourage supply chain capacity and in the knowledge that value for money does not mean lowest price.

The objectives of the ten-point plan are laudable and should be supported. However, the government should be held accountable in the delivery of these principles, and not allow them to be watered down by systematic procurement processes.

Obtaining social value

There is a once in a lifetime opportunity to capitalise on the investment being made available through capital recycling and other innovative financing vehicles. We must not only choose the right schemes to invest in but also work together to maximise the social value created by these huge investments.

Fundamentally, that means lifting the standard of business case planning and selecting projects that prioritise social outcomes for the public in return for the vast amounts of investment being driven into the nation's infrastructure. □

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Back to the future:

Setting up projects for success in Mexico

Jacquelina Dankfort
Country Manager,
Mexico

A report published in October in 2018 by think-tank México Evalúa drew some shocking conclusions about large public projects in Mexico: they tend to double in both programme and cost.

The reasons for these overruns, according to the authors of the report, 'iOjos a las obras!' (Watch the Construction Works!), is poor planning and preparation in the early stages of a project, leaving too many unanswered questions for later. Underlying this is a lack of competition and transparency.

It is ironic that poor planning is a problem in a country which is built using an orthogonal grid pattern. One only has to look at the layout of ancient cities, such as Cholula in Central Mexico, to understand how advanced the planning and execution of major developments were over 8,000 years ago.

If Mexico is to improve the performance of its projects today, it must reject its prevailing culture and return to its proud heritage of planning.

Emerging power

Despite its challenges, Mexico has come a long way since joining the North American Free Trade Agreement (NAFTA) in 1994. It is now perceived as a country rich in natural resources and agriculture, bursting with potential.

PwC considers the shift in global economic power from the established economies of the G7 to the emerging economies of the E7 will continue up to 2050. By then, Mexico, with its large internal market and growing export capabilities, could become the seventh-largest economy in the world.

To enable its economic growth, Mexico desperately needs new infrastructure, as people migrate en masse to its cities. As well as a chronic lack of quality housing, the 77 percent of Mexicans who live in urban areas require new transport systems and utilities to improve the quality of their lives.

Work is underway to increase social mobility. Mexico's US$97bn National Infrastructure Plan (NIP), launched in 2013, encompasses NAIM, rail projects, port upgrades and 6,500km of road works. However, this investment equates to just 1.6 percent of the country's GDP, compared to some of its Asian counterparts, which are investing between 7 and 8 percent. Additionally, the change in government after presidential elections brings with it a change in priorities.

"To enable its economic growth, Mexico desperately needs new infrastructure, as people migrate en masse to its cities."

Some ambitious projects remain on the drawing board due to funding problems. A Mexico City – Queretaro high-speed railway, which was to be backed by the Chinese, has faltered in this way.

Like many countries, Mexico needs to attract private sector finance if it is to create the new infrastructure it needs. To do this, those leading its projects must demonstrate to would-be funders that the necessary governance and controls are in place.

Change management

Setting up projects for success is not just about defining the scope, cost and schedule, though these things are important. It's also about defining the organisation that will oversee the project or programme: what its culture will be, how it will operate, and what the management controls will be.

As well as the immediate benefits of cost and time certainty, proper planning delivers a host of far-reaching outcomes. Greater efficiency creates more value for businesses and communities; the environmental impacts of a development can be better understood and controlled; and the teams who work on such projects will develop new skills and go on to deliver more successful jobs. Ultimately, well-delivered projects will lead to greater confidence and encourage more investment into Mexico.

Changing culture will take time and requires robust change management processes. However, if Mexico can go back to the future and return to its proud heritage of project planning, it can unleash huge opportunity. □

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