The Smart Infrastructure

BY
David McDonald
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Foreword

By Michael Thorpe,
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Commonwealth Bank

When considering the development and funding of infrastructure globally, it’s vital to consider not just what’s being built, but the logic behind the project and its impact in a much broader range of areas that may previously have been taken into account.

Infrastructure investment is an evolving dynamic right now. In the past, many investors would look predominantly at what’s required to make sure a project is delivered and whether an investment would be recouped with a return; but now, there are a number of factors influencing project outcomes that investors need to consider.

After a relative backlog of essential infrastructure built up in Australia over decades, the country is now seeing something of a boom for the sector. While this is a positive for the future – because infrastructure, by definition, is a long-term public commitment – it brings its own challenges, especially when it comes to ensuring efficient outcomes across these very large projects as the resources required to deliver major projects are in high demand.

Our country is at a fascinating crossroads between needing to upgrade legacy infrastructure and needing to invest in the types of infrastructure that will support the technologies our future generations will be relying on. For all current and future infrastructure projects, it’s crucial that investors – whether they’re government, private enterprise or community – understand the nature of the project, the nature of the workforce that exists at the time and the outcomes they’re seeking throughout the life of the asset.

Governments are looking to introduce global capabilities into the local marketplace, but investors must also consider whether they have the ability to deliver on time and on budget. Though everyone talks about infrastructure being such a wonderful boom for the jobs market and a long-term productivity gain, how much of that productivity gain is sacrificed if there is no transparency about the different roles and responsibilities required for efficient project delivery?

It’s now more important than ever to focus on delivering infrastructure that will enhance the lives of the communities that use it. Planning and execution is key to ensuring that the outcome will be an overarching benefit to the economy, and that is the responsibility of all stakeholders.
Why infrastructure matters

Infrastructure, at its core, is about connectivity. The transport system enables people and goods to get to and from places. Essential services, like water and electricity, connect homes and businesses, often through grids that are often hidden from view. Communication networks collapse the distances between physical locations. Education infrastructure enables the transfer of knowledge between people. Health infrastructure allows people to access the expertise of others. Shared community spaces, like libraries and parks, enable people to commune with each other.

The connections enabled by infrastructure are critical to the functioning and success and sustainability of the economy, the environment, and social cohesion. Ken Henry, the former secretary of the Australian Government Federal Treasury, once said:

*Infrastructure must serve a nation well. As Australia rises to the dynamic, economic, and social challenges ahead, so must the nation’s energy, transport, water, telecommunications and extensive social infrastructure and networks also adapt.*

The John Grill Centre at the University of Sydney emphasises that infrastructure must be focused on customers.

*Customer-led infrastructure is a simple acknowledgment that what customers care about is not the infrastructure as a physical asset, but the services delivered to them using that infrastructure.*

Infrastructure is often thought of as “hard infrastructure” such as roads and airports. The Victorian government has noted that its infrastructure strategy covers all infrastructure sectors, from providing better access to health, education and justice services to securing Victoria’s water supply and transitioning to a cleaner energy future. It found in surveying state residents that “need for improved internet and mobile phone connectivity was the message heard most often throughout consultation.”

This report, as well reviewing “traditional” infrastructure such as roads and utilities, takes a broad view on hard infrastructure. It looks at current developments in building technologies
and connected cities, and discusses what constitutes “smart infrastructure” and the benefits businesses could gain from it.

Climate change is an important element of the infrastructure matrix that business leaders now need to consider. The report canvasses the potential impact of climate change on infrastructure, and how businesses and governments can manage the risk.

Governments tend to lead the way on infrastructure developments. This is natural, given the scale and complexity of infrastructure projects, as well as the land acquisition requirements and other elements of major investments that are dependent on public policy and the executive powers of government.

However, private-sector involvement in infrastructure is not – and shouldn’t be – limited to tendering, financing, designing, building and operating. Businesses have an enormous stake in the development of infrastructure requirements. Companies often have a clear view of customer and social trends that can inform future infrastructure needs, so their input into public policy formulation on infrastructure can improve its eventual outcomes, supporting efficient connectivity networks, including those for human capital, which in turn can drive future business growth and success.

Good infrastructure planning is complex. It needs to account not just for nation-building priorities but also demographic, industry, and technology trends. This is clear when considering the likely impact on infrastructure pressures from ageing populations in advanced countries, the development of connected technology and more mobile workforces, and the coming revolution in self-driving vehicles.

This report aims to outline current trends in infrastructure and, through illustrative examples of current innovations in the sector, the relevance of infrastructure to Australian businesses in a way that will aid organisational planning and executive-level thinking on infrastructure needs.
The benefits of infrastructure spending

The Brookings Institution explains that infrastructure is the cornerstone of a country’s economic activity and that infrastructure bottlenecks stunt economic growth and increase poverty and inequality.

The institution’s research notes infrastructure investment can have three important positive economic effects:

1. In the short term, infrastructure spending provides a short-term demand stimulus to an economy and boosts output.
2. In the longer term, infrastructure spending can raise the economy’s productive capacity, thereby its trend growth rate.
3. Moreover, when financed by debt, the return on investment a country gets from increasing infrastructure investment can be large enough for infrastructure projects to pay for themselves.

For countries to reap the benefits of infrastructure investment, however, a number of conditions are needed. The IMF has found the short-term effect of increased investment is higher:

- during periods of economic slack and when interest rates are low;
- in countries with a high degree of public investment efficiency where new spending is not wasted and goes to projects with high rates of return, and; or
- when new investment is financed through debt rather than through higher taxes or lower spending.

According to a 2016 report, “Bridging Global Infrastructure Gaps” by global consulting firm McKinsey, the world today invests some $2.5 trillion a year on transportation, power, water, and telecommunications systems. However, McKinsey suggests this is not enough—and needs are only growing steeper. McKinsey point out that despite glaring gaps and years of debate about the importance of shoring up backbone systems, infrastructure investment has actually declined as a share of GDP in 11 of the G20 economies since the global financial crisis.

McKinsey estimated that if the current trajectory of underinvestment continues, the world will fall short of the investment needed by roughly 11 per cent, or $350 billion a year. The size of this estimated gap triples if the additional investment required to meet the new UN Sustainable Development Goals is included.
In terms of financing these infrastructure requirements, McKinsey notes a great deal of attention has focused on connecting institutional investors with projects that need their capital as well as creating an expanded role for public-private partnerships. Despite this, they believe the vast majority of infrastructure will likely continue to be financed by the public and corporate sectors.

The McKinsey report states that despite concerns over government finances in many advanced economies, there is substantial scope to increase public infrastructure investment. Governments can increase funding streams by raising user charges, capturing property value, or selling existing assets and recycling the proceeds for new infrastructure. In addition, public accounting standards could be brought in line with corporate accounting so infrastructure assets are depreciated over their life cycle rather than immediately adding to deficits during construction. This change could reduce pro-cyclical public investment behaviour.

Unleashing investment in privatised sectors requires regulatory certainty and the ability to charge prices that produce an acceptable risk-adjusted return, as well as enablers like spectrum or land access, permits, and approvals.

**To keep pace with projected growth, the world needs to invest $3.3 trillion in economic infrastructure annually through 2030.**

<table>
<thead>
<tr>
<th>Average annual need, 2016–30, in constant 2015 dollars, $ trillion</th>
<th>Aggregate spending, 2016–30, $ trillion</th>
<th>Annual spending, % of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>$3.3 trillion</td>
<td>49.1 trillion</td>
<td>3.8%</td>
</tr>
<tr>
<td>Ports</td>
<td>0.9</td>
<td>0.1</td>
</tr>
<tr>
<td>Airports</td>
<td>1.3</td>
<td>0.1</td>
</tr>
<tr>
<td>Rail</td>
<td>5.1</td>
<td>0.4</td>
</tr>
<tr>
<td>Water</td>
<td>7.5</td>
<td>0.6</td>
</tr>
<tr>
<td>Telecom</td>
<td>8.3</td>
<td>0.6</td>
</tr>
<tr>
<td>Roads</td>
<td>11.4</td>
<td>0.9</td>
</tr>
<tr>
<td>Power</td>
<td>14.7</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Source: McKinsey
Australia’s infrastructure planning

Infrastructure has become a focus for many governments around the world. It is seen as a way of boosting economic activity when global growth has been sluggish. It is also a necessity for improving infrastructure that is outdated or has been outgrown (Australia), or as a way to continued development beyond major cities (China).

In Australia, the G20’s global infrastructure hub lists 20 projects in New South Wales alone that are underway or in advanced planning. Some of these are outlined in the table below.

<table>
<thead>
<tr>
<th>Project</th>
<th>Government</th>
<th>Estimated cost A$ bn</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Broadband Network</td>
<td>Federal</td>
<td>47.0 – 51.0</td>
</tr>
<tr>
<td>Sydney Metro</td>
<td>NSW</td>
<td>30.8</td>
</tr>
<tr>
<td>WestConnex (road)</td>
<td>NSW</td>
<td>16.8</td>
</tr>
<tr>
<td>Inland Rail Project</td>
<td>Federal</td>
<td>10.0</td>
</tr>
<tr>
<td>North East Link (road)</td>
<td>VIC</td>
<td>10.0</td>
</tr>
<tr>
<td>Melbourne Metro</td>
<td>VIC</td>
<td>6.0</td>
</tr>
<tr>
<td>Western Sydney Airport</td>
<td>Federal</td>
<td>5.3</td>
</tr>
<tr>
<td>West Gate Tunnel</td>
<td>VIC</td>
<td>5.0</td>
</tr>
<tr>
<td>Melbourne Airport Rail</td>
<td>VIC</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Source: ANZIP

Governments have responded differently to new demands on them since the global financial crisis, with many raising spending on social services, some trimming public sector employment, and most stabilising day-to-day running costs at a lower level. Countries should now seek to correct the steady decline in public investment since 2009, according to a new OECD report.

The fifth edition of the OECD’s biennial comparison of public sector performance in major economies finds the biggest share of public investment -- a third -- goes into economic areas like transportation and energy. The next biggest share (15%) goes on defence. The OECD believes...
restoring public investment in areas like infrastructure, technology, green energy and education should have a positive impact on future employment and healthcare.

Australia’s federal government has committed over $75 billion for the next 10 years to transport infrastructure across Australia. This compares with total federal capital expenditure of only $18.4 billion in 2017 and total capital expenditure in 2017 across all levels of government of $86.3 billion. Canberra is funding the Inland Rail Project, a new rail freight route from Melbourne to Brisbane via central west New South Wales and Toowoomba, which will reduce travel time and cost for many businesses. The government has said the project will reduce supply chain costs and help export competitiveness. The project is also expected to enhance national freight connections to Adelaide and Perth.
Jim Salmon, Executive General Manager of Infrastructure at construction firm John Holland, notes this trend of building “mega projects” is likely to be a lasting one, given the backlog of infrastructure projects in Australia. Salmon also points out that changes in government funding methods have helped to boost infrastructure plans as some state governments have moved to using asset recycling rather than debt to fund projects.
Infrastructure and sustainability

Infrastructure is crucial to sustainability in both its role in configuring society and the way it functions, as is the infrastructure is planned, designed, constructed, operated and adapted.

The Infrastructure Sustainability Council of Australia defines sustainable projects as infrastructure “designed, constructed and operated to optimise environmental, social and economic outcomes for the long term”.

The challenges here are not insignificant, and span engineering, community expectations, politics, and more.

Part of the challenge is to ensure there is some measure of overall community acceptance and approval of projects. This means thinking beyond political support for a project and considering a long-term “customer satisfaction” approach. Road contracts tend to be “output based” – paid on traffic volume – but do not take into account congestion, reduction in accidents or pollution, or any measure of how happy people are with the eventual service.

The Victorian Government has taken a different tack with the contracts for the private train and tram operators. These contracts include incentive schemes for things such as on-time running and cleanliness. The government has just let new contracts for the running of the Melbourne train and tram networks which run for seven years from 30 November 2017. These new contracts are seen as tougher with increased penalties, higher performance targets and passenger experience central to the new agreements. The government says the new contracts introduce tougher penalties to address the issues that cause most passenger dissatisfaction: station skipping, short shunting, graffiti, poor communication and information, inappropriate advertising, and dirty rolling stock.

As mentioned earlier, the John Grill Centre at the University of Sydney notes customers care not about the infrastructure as a physical asset, but the services it delivers. So drivers on a new toll road would not see more cars using it as a positive, but would instead be focused on how quickly they can get to their destination and how much time they can save by using the new road over alternatives.

The United States National Academies of Science, Engineering and Medicine has published a report which notes that if "performance" is (as a dictionary defines it) the execution of a task or fulfillment of a promise or claim, then “infrastructure performance is the accomplishment of
tasks set for the system or its parts by the society that builds, operates, uses, or is a neighbour to that infrastructure.”

The tasks the community wants infrastructure to accomplish initially are about outcomes like moving goods and people, or providing clean water. But society sets broader tasks as well. Infrastructure provides jobs to the people who construct, operate, and maintain its facilities and services. The poses a critical challenge: by providing more or better services in some regions or to some social groups, infrastructure fosters differential patterns of income, economic opportunity, and growth. As a market and test bed for new technologies, infrastructure enhances or retards technological innovation and the resulting growth of economic productivity. The public objection that its facilities sometimes engender is evidence that infrastructure is failing to meet social, cultural, or aesthetic purposes. The effectiveness of infrastructure as a public investment serving these broader ends is also an essential aspect of infrastructure performance.

Then there’s the matter of engineering quality and durability. A report by consultants EY states that cities which many infrastructure projects neglect to build in a critical factor: resilience. This is the ability to respond to shocks -- such as floods and terrorist attacks -- and stresses, such as unaffordable housing.

Cities that build resilience into their planning for major infrastructure will see long term economic, social and physical benefits. If cities or countries build the right infrastructure, they can become better places to live – but building it well means the quality of life benefits are secured for the long-term.

Failing to consider resilience can be expensive.

EY cites the example of the 2011 Bangkok flood, which caused estimated damages of US$45 billion to the global supply chain, of which only $10 billion was insured. Yet few really ask about the cost of failing to build this kind of hard resilience into a project.

Securing long-term returns on infrastructure, both for the public and for firms financing them, involves making sound assumptions about how the assets will be used in the future. Because they are such large-scale projects, they need to take account of large-scale trends such as population trends and demographics, climate risk, technological change including automated vehicles and more connected cities. This report now examines those trends and the impact they may have on infrastructure planning.
Catering for a changing population

Australia is a highly urbanised country. The populations of Australia's major cities are at record levels, as is the number of people employed. It is in our cities that the overwhelming majority of jobs are located and where the most new jobs are being created. The economic output of our major cities has grown and their national importance remains extremely high.

![Population in the capital cities](chart)

The Australian government’s Intergenerational Report noted that the population is growing by 4 million people each decade and is projected to reach 40m by 2050. The OECD predicts that Australia will have the second-fastest population growth rate of any OECD country between now and 2050.
OECD projected average annual population growth rate 2016-2050

Population growth means there is more demand on transport systems in Australia than ever before. Population growth and economic growth lead to increased traffic flows through our ports and airports and on our roads and rail lines.

Issues of space and the potential conflicts of the usability of cities with the utility and long-term capacity of freight hubs, ports and airports and the movement of goods and people in cities is a challenge for policy makers.

Gary Seabury, Executive General Manager for Rail at construction company John Holland, says Melbourne and Sydney are seeing the same trends as other “global cities”. There is an increasing trend to denser living, with people expecting increased convenience. They want work, recreation, shopping and other services all located within close proximity to where they live. Seabury noted that in some cities people now live, work and shop without seeing the outside as they move from apartments to work via underground metro systems and connected shopping centres.
A recent report by the Australian federal government, "The State of Australia’s Cities" notes that about 80 per cent of Australia’s GDP is produced in cities, and 40 per cent in Australia’s two largest, Sydney and Melbourne (DIRD, 2015). Capital cities represent over two-thirds of total employment and accounted for 80 per cent of employment growth in 2015-16.

The report claims that despite the possibilities offered by communications technologies to further reduce physical proximity as a factor in being able to undertake work, it is far from certain that they will diminish the importance of proximity in ‘doing business’, with human contact and informal opportunities to learn remaining important.

Agglomeration economies increase the returns to businesses from physical proximity to each other and to suppliers. Services industries, in addition to generally requiring less land and other physical capital to operate, also benefit from locating close to each other, and having access to the pools of highly skilled labour that cities tend to provide on account of their size.
The presence of such industries, and the higher wages they tend to pay, often provides an incentive for skilled workers elsewhere to relocate to cities. This can add to population growth pressures over time but, managed well, contribute to cities’ growth potential.

The report also points out that views on how well cities are functioning will inevitably reflect personal preferences. Survey indicators of their good functioning usually include access to housing in the forms and locations desired; good mobility; a sense of safety on the part of those who live and visit; thriving businesses that provide good employment opportunities; access to quality services, and an environment that reflects appreciation for the social, environmental and aesthetic importance of urban design.

Conversely, features that usually signal poor functioning include sustained overcrowding, transport congestion leading to significant wasted time and costs, high levels of social unrest and crime, large-scale homelessness and large, entrenched, disparities in opportunity that can contribute to widening dispersions in income and social tensions.

The "State of our Cities" report also noted that access to suitable housing and increases in distances travelled to jobs is a problem in several capital cities. About 60 per cent of net
employment growth between 2006 and 2011 was within 10 kilometres of the CBDs of the largest five capital cities, but net population growth located in the same area was approximately half this amount. In Sydney, the majority of jobs that can be reached in 45 minutes by car are located in the inner city whereas on the city fringes this is the case for fewer than 20 per cent of jobs. Similarly for Melbourne, residents living in the inner city can reach more than half the jobs within a 60 minute public transport trip but residents living in outer urban areas, such as those in the western-suburbs and around Dandenong, can access fewer than one in ten of those jobs.

Peter Studley from property company Dexus has noted that state governments in both Sydney and Melbourne are working on the concept of “30 minute cities”. That is the idea that most people can live within 30 minutes of where they work, shop or spend leisure time. In Sydney, Studley highlights the example of development at Parramatta as an example. The state government is decentralising some of its own functions there and spending money on infrastructure to help boost the development of “another CBD”.

Yet again, this highlights the importance of well-functioning infrastructure to enable access to jobs and public services, as well as to ensure the economy is able to continue to grow smoothly. Even with these solutions, existing problems like congestion are not going to disappear.

According to the Australian Bureau of Industry, Transport and Resource Economics, the avoidable cost of congestion for the Australian capital cities was estimated to be around $16.5 billion for the 2015 financial year, having grown from about $12.8 billion in 2010.

Congestion and associated costs are not just an Australian problem. Cities are the heart of the global economy; according to a report from the McKinsey Global Institute, they account for more than 80 per cent of world GDP. Roads, rail, and other forms of transport are the arteries that nourish that heart. When these become clogged or weakened, businesses, residents, and cities all suffer, and the economic costs are high. The McKinsey report estimates as much as 2 to 4 percent of city GDP, in the form of lost time, wasted fuel, and higher costs of doing business.

The report from McKinsey outlines four trends that are rapidly changing passenger transport:

- electrification;
- autonomy and automation of vehicles;
- connectivity, and
- sharing.

McKinsey believes the same four trends will, to a large degree, also shape the future of commercial urban transport. Commercial vehicles contribute disproportionately to urban
pollution and congestion. They are more apt to idle, make stops and starts, and block traffic. In general, they generate higher environmental emissions. And there will likely be many more commercial vehicles on the road, given economic growth and the expansion of e-commerce.

McKinsey also points out how much worse traffic is getting in major cities. In London, a trip that took 20 minutes in 2012 takes almost 25 minutes now, while the average resident of Los Angeles spends the equivalent of more than two full work weeks in traffic every year. Congestion is not just inconvenient, but expensive: when commercial vehicles get stuck, businesses rack up higher fuel and labour costs.

A number of solutions, such as order grouping, route optimisation, and night deliveries, could be implemented more or less immediately. Others, such as the use of droids, robots, and autonomous ground vehicles (AGVs) are realistic, but likely years away from large-scale deployment. Night deliveries are often seen as problematic due to noise concerns, but the advent of electric vehicles should offset much of this.

The Bureau of Infrastructure, Transport and Economics predicts that by 2030, 30 per cent of vehicles on Australia’s roads could be autonomous vehicles. They estimate this would increase existing freeway capacity by 25 per cent.

Planning for an older population

Australia’s population isn’t just growing; it’s ageing. This has further implications for the infrastructure needed. The Intergenerational Report predicts that the number of Australians aged 65 and older will double over the next 40 years.

One major impact of the ageing of the population is on demand for healthcare infrastructure. Hospitals, aged care facilities, and other supported living facilities will be in much higher demand as our population ages.

An ageing population is also likely to mean an increase in the number of people with mobility constraints, which infrastructure planners will need to take into account. Accessibility of public transport will be an increasing concern. In rural areas, as older people become less able to drive, there will be a need for more access to public transport options.

The Productivity Commission’s report “An Ageing Australia” found that workforce participation tends to fall as people age. An older Australia could face lower workforce participation rates which would potentially have impacts on infrastructure needs (such as peak hour transport) but
this might be offset by increased migration and further increases in female participation in the workforce.

The Productivity Commission also found that an ageing population will lead to budget pressures that limit the ability for governments to finance infrastructure investment. According to the Commission, from 2011–12 to 2059–60 health expenditure as a proportion of GDP is projected to increase from 4.1 per cent to 7.0 per cent for the federal government, and from 2.4 per cent to 3.8 per cent for state and territory governments. The likely resulting limitations on infrastructure investment in those future years make it all the more critical that today’s projects take account of future population needs.

Managing climate risk

Australia’s National Climate Change Adaptation Research Facility (NCCARF) at Griffith University has looked at potential impacts on Australian infrastructure from climate change. It emphasises the importance of co-ordinated policies from various levels of government to help guide infrastructure providers.

The NCCARF states that, “the nation’s infrastructure serves communities, industries and businesses across the vast and geographically diverse continent of Australia. Infrastructure is often long-lived, which poses a particular set of challenges — infrastructure planning must take account of changes in climate projected for fifty or more years in the future, bearing in mind that uncertainties in climate change projections grow over time.”

Looking at utilities, the NCRAAF notes some possible impacts.

“Both drought and flooding threaten water supply security: droughts limit water availability, floods can directly damage infrastructure such as purification plants, or increase turbidity to the point where the cost and time required to purify becomes prohibitive. Storms, dust storms, fire and heatwaves can damage or impair the function of electricity generation and transmission as well as telecommunications infrastructure. High service demand (e.g. electricity during heatwaves, telecommunications during extremes) can lead to electricity supply interruption (planned as rolling blackouts, or unplanned)”.

The European Union has said that all types of infrastructure (transport, power grids, water supply, sewage, and buildings) are all crucial for the functioning of the economy and society now and in the future. One policy focus for the European Union is to assess infrastructure for resilience to current risks and future climate changes.
Transport infrastructure is one area highlighted by the EU. It states that “climate change threatens to compromise transport services that are indispensable for Europe’s economy and society”.

A report by the European Environment Agency (EEA) on Adaptation of transport to climate change in Europe outlines the challenges for the transport sector which include:

- Rising temperatures and extended heat-wave periods increasing the problems of rail buckling, pavement deterioration and thermal comfort for passengers in vehicles.
- Weather extremes generating floods or landslides leading to delays, interruptions and detouring needs.
- Sea-level rise threatening harbours and other transport infrastructure and services in coastal areas.
- Air transport challenged by changing wind patterns, flooding of airport infrastructure and other weather events.

Climate risk to projects is an increasing focus of Australian investors and regulators, too.

The Queensland Investment Corporation, a major infrastructure investor, has noted infrastructure operators and owners have unique responsibilities as stewards of essential economic and social assets. The well-being of communities and economies significantly depends
on efficient, reliable infrastructure and as a result, planning for and adapting to climate change is prudent. Increasing numbers of natural disasters are likely to have impacts on the lifespans of infrastructure assets. Ageing infrastructure that is not designed for such extremes and higher density urban environments are especially vulnerable to increasing natural stresses.

“The rise in the number of severe climate events suggests that developing frameworks to understand climate change risk and building resilience now, rather than decades into the future, is a prudent course of action for infrastructure investors,” QIC noted.

Regulators are stepping in, too. Given the long-term nature of infrastructure projects, financiers and other participants will need to be more aware of the potential consequences of climate change. The Australian Prudential Regulation Authority (APRA) has begun pressing financial companies on their awareness of climate change risks, and is encouraging them to run "stress tests" on climate risk scenarios. APRA executive board member Geoff Summerhayes said in a speech late last year that APRA was also working with other regulators on the matter, pointing out that risks include the potential exposure of banks’ and insurers’ balance sheets to real estate impacted by climate change.

In comments that will give any executive or investor pause for thought when coming from a regulator, Summerhayes said:

The general point is that the transition now in train could potentially lead to significant repricing of carbon-intensive resources and activities and reallocation of capital. This process will be highly sensitive to changes in regulation, technology, the physical environment and behaviour by investors and institutions – and interrelated perceptions and sentiment about all of the above. Inevitably, even under a sanguine view of how smoothly this transition happens, there will be systemic impacts and implications that have to be carefully monitored.

From a regulatory perspective, one key to getting a better handle on potential system-wide exposures is better information on risk and strategy at the firm level. We are keenly aware of potential systemic implications. But in simple terms, a comprehensive understanding that will help to identify and avert potential vulnerabilities is not possible unless entities and regulators are systematically monitoring, disclosing and talking about these risks.
Major institutional investors are also upping the pressure on companies over climate change preparedness. More than 200 institutional global investors accounting for more than US$26 trillion in funds under management - including AustralianSuper, AMP Capital, Colonial First State and Cbus - have launched the Climate Action 100+ campaign, which will push the world’s 100 biggest emitting companies to curb emissions and to boost disclosure around climate change risks.

The campaign aims to make directors accountable for managing climate risk, with investors suggesting they would consider votes against director re-elections to make their point - as well as with the increasingly-used tool of shareholder resolutions.
Smarter, more connected cities

A smart city – a concept and planning framework increasingly at the heart of discussion among infrastructure planners -- is, broadly speaking, one that is “connected” – offering seamless technology with fast internet and ubiquitous mobile access, and using data to drive better decision-making across services. Smart cities are also often referred to as those that have strong environmental credentials and offer easily accessible public transport. Cities such as Kansas City in the USA and Copenhagen in Europe have been touted as smart cities.

The International Telecommunication Union defines a smart city as “an innovative city that uses ICTs [information and communication technologies] and other means to improve quality of life, efficiency of urban operation and services and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects.”

According to the United Nations Economic and Social Council, smart infrastructure provides the foundation for all of the key themes related to a smart city, including smart people, smart mobility, smart economy, smart living, smart governance and smart environment. The core characteristic that underlies most of these components is that they are connected and that they generate data, which may be used intelligently to ensure the optimal use of resources and improve performance.

The United Nations report describes smart mobility as approaches that reduce congestion and foster faster, greener and cheaper transportation options. Most smart mobility systems use data collected from a variety of sources about mobility patterns in order to help optimise traffic conditions in a holistic manner. Smart mobility systems include mass transit systems, bicycle sharing, ride sharing, vehicle sharing and, more recently, on-demand transportation.

Futurologist Ian Pearson compiled a report with Hewden, a construction equipment rental company, looking at likely trends in the construction industry over the next 30 years. With advances in fields like robotics and artificial intelligence, city buildings are bound to use much smarter technology.

The report suggests buildings will be run by artificial intelligence and voice connectivity that allows, for example, occupants to use voice commands to control things such as building temperature. Other suggestions from the report include the likely arrival of “super tall” buildings that will act as self-contained mini-cities. With high land costs, these can be converted
to house low and medium income workers. They will have a wide variety of uses in-built, with floors dedicated to exercise, residential space, and office work. 3D printing and robot construction workers could allow for much more rapid construction processes.

With such an abundance of ideas on what smarter cities might look like, it’s worth looking at a working example: South Korea’s Songdo.

Source: Andy Scales

Songdo in South Korea is a purpose-built smart city. It was set up from scratch on reclaimed land near the Incheon international airport around 60 km from Seoul. The project was part of former President Lee Myung-bak’s effort to promote green and low-carbon growth as an avenue for future development after 60 years of reliance on export-oriented manufacturing.

Estimated to cost between US$35 and $40 billion, the city is the largest-ever private real estate development. The development is being undertaken by US company Gale International in partnership with Incheon Metropolitan Council and Korean company Posco E&C.

Songdo aims not to be a hub for Korea, but a hub for all of Asia. Songdo is envisioned as an aerotropolis. The island is positioned for easy access to Incheon International Airport via a seven-mile-long suspension bridge. South Korea is betting that for hyper-mobile global
corporations, connectedness to other business hubs overseas will be a lot more important than the local area.

The city is only nominally Korean. The lingua franca of Songdo is English. The school is projected to be 70% non-Korean. Even the city plan adopts elements of foreign cities, with its website describing the city as follows:

*Songdo IBD boasts the wide boulevards of Paris, a 100-acre Central Park reminiscent of New York City, a system of pocket parks similar to those in Savannah, a modern canal system inspired by Venice and convention centre architecture redolent of the famed Sydney Opera House.*

*Source: Business Insider*
Computers have been built into the houses, streets, and offices as part of a wide area network. In addition, Songdo IBD uses a pneumatic waste disposal system. This means no garbage cans on street corners, and no garbage trucks. Instead, garbage is thrown into pipes that suck the garbage underground, disposing of waste, and recycling what can be recycled. Part of this waste is also converted into energy to help heat the district.

It’s also a fully wired city. The developers teamed up with Cisco to provide TelePresence in every home, office, school and hospital in the city.

When residents of the International Business District (IBD) in Songdo, South Korea go to work, pick up their kids from school, or shop for groceries, driving is optional, because the city is designed to do away with cars. The area prioritises mass transit, like buses, subways, and bikes, instead of road traffic, according to Gale International’s chairman Stan Gale.

The city features a mixed-use urban planning, meaning its retail, office space, parks, medical facilities, and schools are all close to housing. Most non-residential buildings are walking distance from everything else.

Around 40% of the land area is devoted to green space, which the developer believes will also encourage residents to walk. When completed by 2020, the district will span 100 million square feet.

The city has the highest concentration of LEED (Leadership in Energy and Environmental Design) projects in the world. However, residents point out that the city still gets its electricity from Korea’s coal-fired generators and suffers from pollution blown in from Northern China.

According to one press report the city has attracted less than half the intended population. The report describes it as “Sterile and soul-less”. The city is said to look very different from other Korean cities - there are no poor people, no street vendors and no old people. At present, around 70,000 people work in Songdo, still far below the government’s original aim of 300,000.

Some residents have complained that the IBD and the larger Songdo City are too secluded from Seoul, the country’s economic, political, and cultural hub. It takes over an hour to reach the capital.

So, while the intentions behind “smart cities” might be good ones, there is still a steep learning curve to the adaption in practice.
Health infrastructure is also vital to a well-functioning economy and population. The UNESCO infrastructure report has raised this issue, noting that the health and well-being of urban residents are of particular concern with regard to the sustainability of urban areas and their supporting ecosystems. They point out that smart cities can develop the capacity to use technology such as big data to develop predictions or identify hotspots of population health (such as epidemics or health impacts during extreme weather events).

Smart healthcare management converts health-related data into clinical and business insights, which include digital health records, home health services and remote diagnoses, treatment and patient monitoring systems. It also facilitates the provision of health care using intelligent and networked technologies that help monitor the health conditions of citizens. It is enabling a shift in focus to prevention instead of cures, with a broader view of overall care, healthy living and wellness management.
Vitally, the success of these systems will require effective collaboration between governments and private industry to support medical innovation and progress.

Importantly, the United Nations notes that smart health-care systems have a great potential in ageing societies in developed countries, and may lessen inequality in health care between high and low-income groups. Examples of smart health approaches include crowdsourcing to collect data on epidemics and predict epidemic outbreaks and take the necessary precautions, remotely collecting patient health vitals and data for diagnostic purposes, and establishing automated alerts for patients with regard to medications and health check-ups.

Transit-Oriented Development

Transit-Oriented Development is a municipal development strategy that aims to develop compact, walkable, mixed-use communities around public transportation nodes such as rail stations and major bus lines. The concept has become increasingly popular as municipalities struggle to reduce traffic congestion and pollution, and encourage more efficient land use patterns. People living in communities centred around viable transportation options have better access to centres of employment and are less reliant on driving. As a result, people walk more which has both personal health and environmental benefits. Transit-oriented development concentrates economic development in specific corridors, thereby reducing sprawl and increasing the efficiency of public service delivery.

Residential and commercial building near current or proposed infrastructure makes sound planning sense. The Hong Kong MTR (metro system) has long been one of the city’s main property developers, building commercial and residential properties above railway stations.

The NSW government had considered similar plans for the proposed light rail/freeway to go under the existing Paramatta Road to the Sydney city centre. This was part of the proposed 30-year “Parramatta Road Corridor Urban Transformation Strategy”. Details of the eventual plan are still vague at this early stage, with the state government having considered several alternatives including both commercial and residential development adjacent to or even in the air space over the planned transformed arterial road.
Walkability premiums

Australian property company Stockland says property values rise faster in areas where people walk more and drive less, and the country's largest developer is focusing on 'walkability' as it moves back into the apartment market. Stockland CEO Mark Steinert said that “walkable” developments in the company’s portfolio earn a premium “because the desirability and ease of access and being central to the broader community is driving very high foot traffic, very high relative sales per square metre, which creates sustainable rent in those centres.”

The company is tapping into research by George Washington University professor of urban real estate Christopher Leinberger, who found “an average 150 per cent value premium in New York for 'walkable' real estate, compared with the lower-density 'driveable suburban' alternative.”

Professor Leibeger was also a creator of the Walk Score app that rates urban areas by the number of consumer destinations such as schools and shops within walking distance of dwellings, and rates them on a scale between 0 (car dependent) and 100 (most walkable). One US study found a rise of between $US700 ($884) and $3000 in land value for every one-point increase in walk score of an area.
A report commissioned by US group “CEOs for Cities” also looked at the “walk score” and its impact on residential real estate prices. The report found that “more than just a pleasant amenity, the walkability of cities translates directly into increases in home values.”

Homes located in more walkable neighbourhoods—those with a mix of common daily shopping and social destinations within a short distance—command a price premium over otherwise similar homes in less walkable areas. Houses with the above average levels of walkability command a premium of about $4,000 to $34,000 over houses with just average levels of walkability in the typical metropolitan areas studied.

This theme is also highlighted by Commonwealth Bank’s Global Head of Real Estate, Managing Director, Graeme Ross, who notes that there is more of a desire now for work, play and rest to be all co-located. Ross noted that the younger generation in particular appreciates the ability to live close to work and be able to dine out and attend entertainment venues all within close proximity. This changes infrastructure needs, in particular around public transport.

One example of this sort of development is property company Mirvac’s Australian Technology Park at Redfern. This development is located adjacent to Sydney’s Redfern station and also the University of Sydney. The revitalisation of the old Eveliegh railway workshops will help transform the southern end of the Sydney CBD. It will introduce new employment opportunities on the southern edge of the CBD. It is close to public transport and two universities (University of Sydney and UTS). There has also been significant residential development in this part of Sydney in recent years, helping to build a new “walkable” employment and residential hub. Commonwealth Bank has signed on as an anchor tenant for the development helping to give the project added impetus.

Smart Buildings

A smart building integrates the different physical systems present in an intelligent way to ensure that all the systems act together in an optimised and efficient manner. Smart building management systems can improve building energy efficiency, reduce waste and ensure an optimum usage of water, with operational effectiveness and occupant satisfaction. A report by Honeywell in conjunction with EY estimated that implementing smart building solutions could save as much as 30 per cent of water usage and 40 per cent of energy usage and reduce overall building maintenance costs by 10 to 30 per cent.
Developer Mirvac has said that “employees were starting to want their work environment to feel more like home and that they weren’t just coming to another office space”. Mirvac is the developer of 200 George Street in Sydney, which has been awarded a “6 green stars” rating, making it one of Australia’s most sustainable buildings.

One of the country’s first buildings lit entirely by LEDs, tenants features will include automatic blinds which adjust throughout the day, and a triple-gazed façade design ensuring there’s plenty of natural light coming in. The developer is also experimenting with the use of plants to see how it will impact air quality within the building.

Phillip Ross, CEO of workplace consultancy Ungroup, once explained at a Mirvac event that the trend in commercial office says is all about providing “flexibility to smaller companies that don’t necessarily want to have fixed term leases. They just want rent space, desks or spots.”

He adds: “[The offices] are bit like a Qantas lounge. If you’re registered and you’ve got a membership then you go in and you work where you want to work”.

“It’s fully wi-fi connected and usually open plan, and you can access all your files from the cloud, get a coffee, print stuff and rent meeting rooms – they’re pretty mobile.”

He said this way of working is not only saving employers money on fit out costs but also caters for a new generation of workers who demand more flexibility in the way they work.

Despite the touted benefits of smart buildings, in a recent report published by Schneider Electric, over 80% of commercial real estate leaders recognised the value of smart building technology, yet only half were willing to invest in it.

In smart buildings, energy savings are tied to energy information systems, which are used to store, analyse and display building energy data. The Lawrence Berkeley National Laboratory did a study examining 28 buildings and nine facility portfolios containing 260 million square feet of space.

Reported energy savings were as high as 35 percent, with median savings of 17 percent for individual buildings and 8 percent for portfolios, or $56,000 annually per individual building and $1.9 million annually per portfolio.

Costs varied considerably based on system size and complexity. The median five-year software-procurement cost for the facility portfolios was $150,000. This suggests that incorporating smart technology in buildings could pay for itself in around 3 years as well as helping companies to achieve social and environmental goals.
The Lawrence Berkeley study also recommended that smart windows that lighten or darken depending on sunlight intensity, as they can help reduce the HVAC (heating, ventilation and air conditioning) and lighting loads and reduce glare. The study described savings of 19-26% on cooling and 48-67% on lighting if smart windows are implemented.

Benefits of smart buildings can include matching occupancy patterns to energy use: A smart building will run leaner when there are fewer people inside. They can also allow proactive maintenance of equipment. Analysis algorithms will detect problems in performance before they cause expensive outages, maintaining optimum efficiency along the way. Older buildings can also be adapted to take advantage of these benefits by adding sensors and internet connected monitoring.

**Data connectivity: The NBN and 5G**

Communications and broadband infrastructure is key in the digital age. The NBN Company (NBNCo) was established in 2009 to design, build and operate Australia’s new high-speed, wholesale local access broadband network. Underpinned by a purpose to connect Australia and bridge the digital divide. NBNCo is wholly owned by the Commonwealth of Australia as a Government Business Enterprise.

NBNCo’s key objective is to ensure all Australians have access to fast broadband as soon as possible, at affordable prices, and at least cost. To achieve this objective, NBNCo has been structured as a wholesale-only, open-access broadband network. It provides services on its local access network on equivalent terms to all Retail Service Providers (RSPs), to provision for end-user needs. This is intended to level the playing field in Australian telecommunications, creating real and vibrant competition within the industry and providing choice for consumers. The National Broadband Network aims to foster productivity and provide a platform for innovation in order to deliver economic and social benefits for all Australians.

NBN is using hybrid technologies. Some Australian households will get fibre to the node (FTTN), a few will have fibre to the premises (FTTP), while those with current cable (HFC) connections will still use that for NBN access. Remote customers will have access via the satellite “Sky Muster” system.

Although there have been problems and controversies with the roll-out, the network construction and delivery is nonetheless progressing. In early March 2017, the NBN roll out has 6.3 million premises across Australia “ready to connect” and 3.6 million are already activated.
Another technology getting lots of attention is the next generation mobile network known as 5G. 5G will enable the roll out of the internet of things (IOT) allowing much faster speeds. The speed of 5G will allow virtual and augmented reality, instant response times for automated cars, massive new video streaming capacity and help the growth of IOT using sensors to connect billions of devices rather than people.

Telstra has said it plans to launch a commercial 5G service in Australia in 2019. It is estimated that the 5G network will allow speeds of around 3 GBPS in theory but in practice is more likely to offer download speeds of 100 mbps, which is similar to the current highest speeds being offered to NBN customers. However, mobile users are likely to see much slower speeds in practice as network usage grows.

Telstra CEO Andy Penn has been quoted as saying that he does not expect 5G to take over from the NBN. While it will allow much more to be done on mobile devices, he points out that out the average fixed broadband user downloads about 150 gigabits of data a month whereas the average mobile user downloads about three gigabits. To match the capacity of the NBN would require an enormous increase in mobile network capacity.
Conclusion

Infrastructure is often seen as an issue for governments but it is also an issue that business leaders must take into account. Smart buildings and sustainable infrastructure can be investments that save costs into the future for businesses. Efficient infrastructure helps the economy to run smoothly and enables businesses to get product to market, provide essential services such as water and power to run the business, and allows workers to get to their workplace.

Roads, ports and airports are obviously important but so is a healthy and educated workforce. It is important that the “soft” infrastructure is also in place to provide the workforce needed. Policy certainty around these issues and also developing issues such as climate change are important for business to be able to plan and invest in appropriate infrastructure.

Senior executives should also be considering their own business infrastructure and whether it is as efficient as it could be. Are they operating out of “smart buildings”, potentially reducing power bills? Are they taking advantage of trends in technology to provide the most efficient operating model? Are they using smart transport solutions? Have they taken advantage of the broadband infrastructure available to boost data analytics? Have they considered the likely demographics and lifestyle expectations of their future workforce?

Smart buildings as well as saving costs are also becoming more important to attract and retain staff. Natural light, connectivity and efficient facilities make staff feel more comfortable and can boost productivity.

Infrastructure is the mechanism that allows our economy to function and it should be a key focus for business leaders and not just left to governments. Business can play a vital role not just in participating in the design and delivery of great infrastructure that lays the foundation for a nation’s economic future, but by encouraging governments to continually update and improve it.
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