

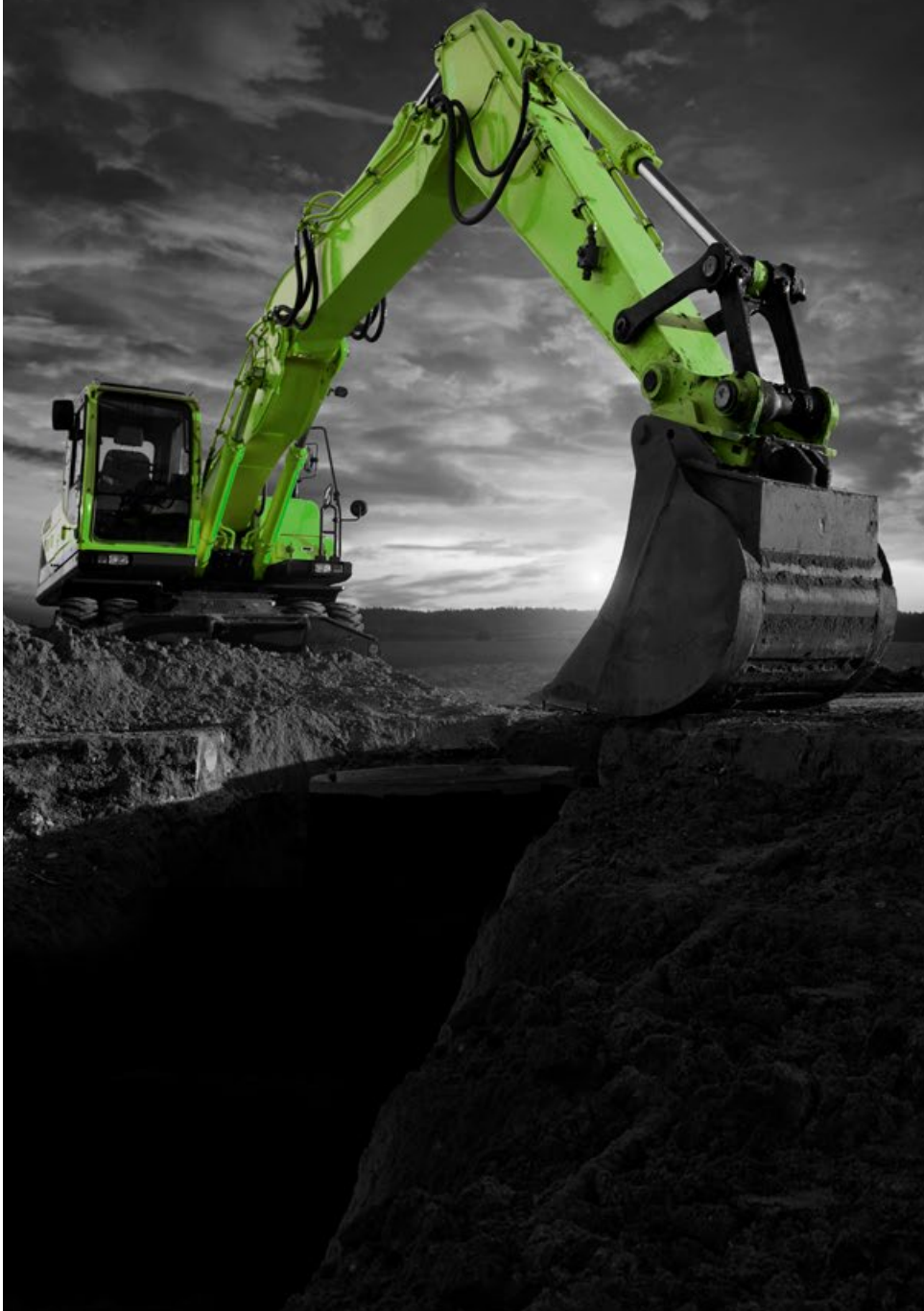
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FOR INSTITUTIONAL, PROFESSIONAL AND WHOLESALE INVESTORS ONLY



MARTIN CURRIE

Infrastructure - the time is now



LONG-TERM INVESTMENT INSTITUTE

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EXECUTIVE SUMMARY

Today, there is an undisputed infrastructure investment gap right around the world – as evidenced by the American Society of Civil Engineers (ASCE) regular reporting¹ on the state of US infrastructure which has averaged grade D (meaning Poor, At Risk²) since 1998.

In developing countries, however, the ability to deliver these types of projects is even more pronounced: severely curtailed by a combination of financing shortfalls, and a lack of relevant skills. For most sub-Saharan and central Asian countries, there has been a dearth of any infrastructure building since their independence. At the same time, western donors have been steadily retreating from the financing of ‘hard’ infrastructure such as roads and bridges, in favour of ‘soft’ infrastructure, such as the promotion of governance, education, healthcare and water treatment. Partly, this is due to an escalating concern of the potential environmental, social and governance (ESG) liability risks.

This paper is a comprehensive overview of the state of play, aiming to help investors parse through what can be a relatively opaque area for the public markets.

¹The ASCE issues a report on US infrastructure every four years. The latest available is 2016's 'Failure to Act' report <https://www.asce.org/failuretoact/>
The 2017 Report Card awards a D+ grade <https://www.infrastructurereportcard.org/>
²What makes a grade?
ASCE <https://www.infrastructurereportcard.org/making-the-grade/what-makes-a-grade/>

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WHY NOW?

The hit to the global economy from COVID-19 has been unprecedented with historic increases in unemployment, falling industrial production and weakened confidence. In response, governments around the world have focused initially on providing income support. However, going forward, we expect infrastructure spend will be increasingly utilised as a policy tool for further stimulus.

In our view, this is supported by three key observations:

- Higher infrastructure spend has helped economies recover from previous crises
- Given rising urbanisation and aging infrastructure, infrastructure spend is essential not just for the short-term economic boost, but also for lasting productivity benefits
- Rising private sector involvement in funding infrastructure will be likely given stretched government finances

Rationale: Higher infrastructure spend has helped economies recover

Infrastructure investment not only provides a significant boost to employment and the broader economy but also improves productive capacity. Historically, we have seen several infrastructure-led stimulus packages after periods of considerable economic weakness. Two notable examples are the Great Depression (1929) and the Global Financial Crisis (2008).

- After the devastating effect of the Great Depression, the New Deal (amounting to US\$653 billion in 2009 dollars)³ was implemented in the US between 1933 and 1939, by which 8.5 million people were employed to build useful works such as government buildings, public housing, airports, hospitals, schools, roads, bridges and dams among many other programmes to revive the economy.
- In response to the 2008 Global Financial Crisis (GFC), the United States passed the Recovery Act, a US\$831 billion stimulus package, 14% of which was spent on infrastructure including improving roads, replacing bridges, constructing high-speed rail, expanding broadband as well as boosting funding to renewable energy.⁴ It is said that the US economy bounced faster than Europe partly due to this larger package.⁵

Given the significant contraction in global economies through the COVID-19 pandemic, we believe that investing in infrastructure makes sense, especially as the long-term drivers of infrastructure investment remain compelling.

Infrastructure investment not only provides a significant boost to employment and the broader economy but also improves productive capacity.

³Source: Federal Reserve Bank of St. Louis, "Which Was Bigger: The 2009 Recovery Act or FDR's New Deal?" On the Economy (blog), 30 May 2017, <https://www.stlouisfed.org/on-the-economy/2017/may/which-bigger-2009-recovery-act-fdr-new-deal>

⁴Source: Council of Economic Advisers, "The economic impact of the American Recovery and Reinvestment Act five years later", Final Report to Congress (2014): iv - v, https://obamawhitehouse.archives.gov/sites/default/files/docs/cea_arra_report.pdf

⁵Michael S. Burke, "The future is now: Infrastructure's role in economic recovery," AECOM The Future of Infrastructure, accessed 11 August 2020, <https://infrastructure.aecom.com/2020/the-future-is-now-infrastructures-role-in-economic-recovery>

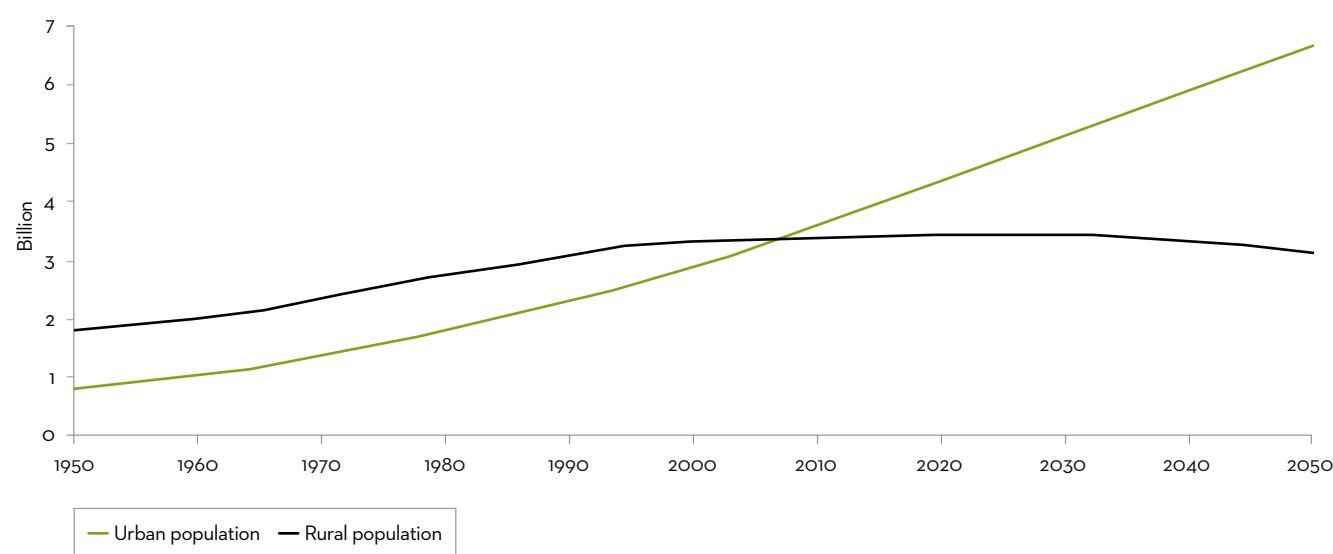
Infrastructure spend supported by population growth

Infrastructure is a tangible building block of an economy, the construction of which can stimulate not only job growth and the broader economy but also provide productivity benefits.

Capital spend on infrastructure such as roads and bridges are especially labour intensive and use a substantial amount of materials, which will in turn help businesses, as well as improve private mobility, ultimately benefiting economic productivity and the wider economy. This initial injection into the economy therefore causes a proportionately bigger final increase in national income levels via the multiplier effect.

The demand for quality infrastructure continues to be driven by population growth and urbanisation. Urbanisation remains a global megatrend with city-based populations continuing to grow. The drivers for this trend are varied and revolve around the range of benefits that cities provide, namely better job prospects, education and healthcare. Importantly, this trend is long-term and enduring, having been evident for well over the last century.

Number of people living in urban and rural areas



Source: United Nations, Department of Economic and Social Affairs, Population Division (2018); World Urbanization Prospects: The 2018 Revision, Online Edition.

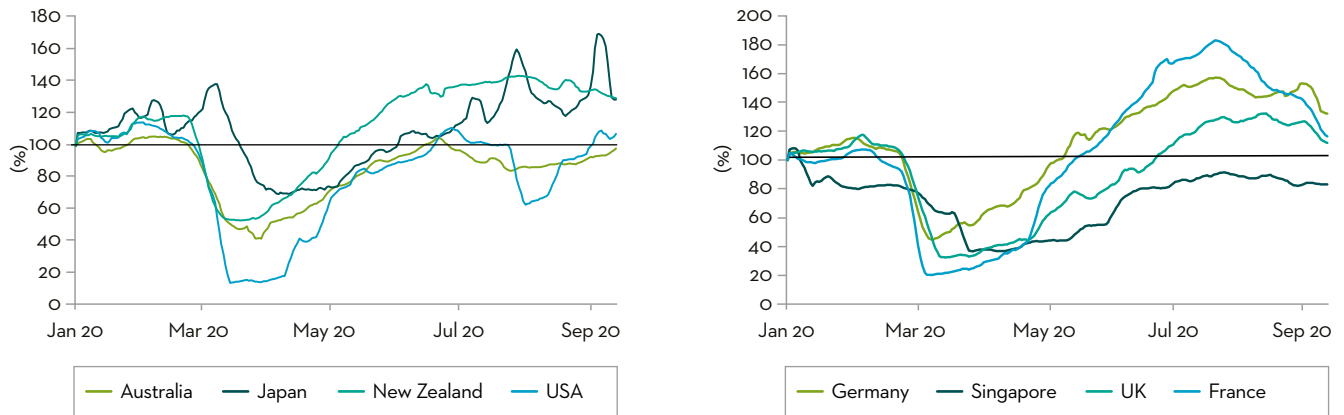
Importantly, this trend is expected to continue into the future, with the UN forecasting urban populations to grow by an extra 2.5 billion people by 2050. This implies an urban population growth rate of 1.4% p.a. from 2020-2050.⁶, approximately twice that of the overall population growth. This will require ongoing investment in all manner of infrastructure, from toll roads and airports to rail, power and telecommunications.

⁶Source: United Nations, Department of Economic and Social Affairs, Population Division (2018); World Urbanization Prospects: The 2018 Revision, Online Edition.

Travel infrastructure

While COVID-19 is clearly impacting the international travel, aviation and public transport sectors, we expect private travel by cars, motorbikes and bikes to rebound rapidly in both the short and long term given fewer issues around social distancing. Indeed, we have already seen evidence of this in countries around the world with traffic getting close to pre-COVID-19 levels and in some cases exceeding it. The charts below show a relative volume of directions requests for each country compared to a baseline volume on 13 January 2020 of 100. This will ultimately lead to further road congestion thus providing more impetus to spend on necessary infrastructure.

Mobility trends (driving): Change in routing requests since 13 January 2020

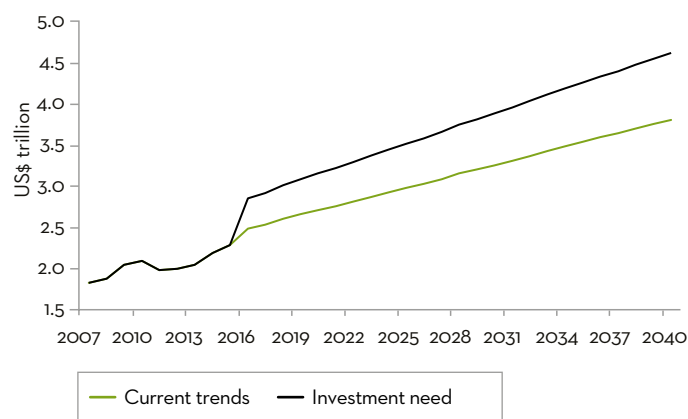


Source: Apple Inc., Mobility Trends Reports; data as of 30 September 2020.

Historical underinvestment in infrastructure

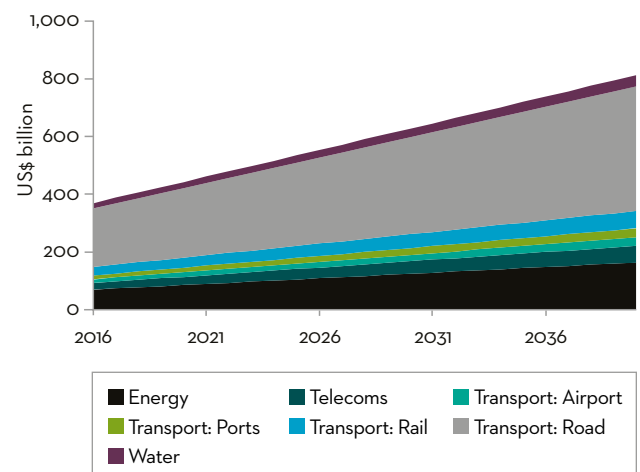
The Global Infrastructure Hub, created by the G20 to help implement the constituent countries' infrastructure agendas, has projected that the world is facing a US\$15 trillion gap between the current infrastructure investment trend and the investment needed to provide adequate global infrastructure by 2040⁷. The gap is getting wider with road transportation and energy being two of the largest sectors for incremental investment needs.

Global infrastructure investment 2007 - 2040 (US\$ trillion)



Source: Global Infrastructure Hub; data as of June 2018.

Investment gaps by sector (US\$ billion)



⁷Source: "Infrastructure Outlook," Global Infrastructure Hub; data as of June 2018, <https://outlook.gihub.org/>.

'Current trend' in infrastructure investment is forecast using sector-specific econometric models based on drivers such as GDP, population density and industry mix. 'Infrastructure need' is estimated by applying a new methodology based on infrastructure performance estimated as the difference between the infrastructure a country has and what it would be expected to have. From this, how much additional investment would be needed is estimated to align provision with a country's 'best performing' peers, adjusted for the characteristics of that country and its infrastructure quality.

As well as the previously mentioned urbanisation trends putting more strain on infrastructure, infrastructure around the world is aging, requiring spend to upgrade.

In the United States for example, the overall infrastructure is considered ‘poor, at risk’ with a score of D+, according to the American Society of Civil Engineers’ Report Card⁸. Almost four in 10 of 614,387 bridges in the U.S. are 50 years or older and about 9% of them were structurally deficient in 2016⁹. For dams, the average age of the US’s more than 90,000 dams is 56 years, and approximately US\$45 billion is required to repair aging dams in critical conditions.¹⁰ In California, the average age of its jurisdictional dams is even higher at 70 years, many of which were designed before the modern era of earthquake engineering.¹¹ It’s a similar story for water pipes and distribution assets with an old network at an average age of over 40 years (rising to 100 years in certain towns and counties).¹²

In Canada, we see another example of aging infrastructure. Nearly 40% of roads/bridges and 30% of water infrastructure are in fair, poor or very poor conditions and the majority of these infrastructure assets are more than 20 years old according to the 2019 Canadian Infrastructure Report Card.¹³

Aging infrastructure clearly has safety implications as well as the potential to lead to lost competitiveness. A case in point is the deadly collapse of the 51-year-old Morandi Bridge in Genoa (Italy) that killed 43 people in 2018 due to aging infrastructure and insufficient maintenance.¹⁴ This event prompted many other countries in Europe such as France, Germany and Norway to question the safety of their aging infrastructure, maintenance schedule, as well as the government tracking databases.¹⁵ As such, more expenditure will be necessary upgrading and investing in key infrastructure not only to support the economy but also to maintain high levels of safety.

As well as the previously mentioned urbanisation trends putting more strain on infrastructure, infrastructure around the world is aging, requiring spend to upgrade.

⁸Every four years, the American Society of Civil Engineers for America’s Infrastructure assigns letter grades to assess the physical condition and performance of American infrastructure. The grading scale includes A (Exceptional, fit for the future), B (Good, adequate for now), C (Mediocre, requires attention), D (Poor, at risk), F (Failing/critical, unfit for purpose) and based on key criteria which include capacity, condition, funding, future need, operation and maintenance, public safety, resilience and innovation.

⁹Source: The American Society of Civil Engineers, America’s Infrastructure Grade – Bridges, 2017 Infrastructure Report Card, <https://www.infrastructurereportcard.org/cat-item/bridges/>

¹⁰Source: The American Society of Civil Engineers, America’s Infrastructure Grade – Dams, 2017 Infrastructure Report Card, <https://www.infrastructurereportcard.org/cat-item/dams/>

¹¹Source: California Department of Water Resources, “Division of safety of dams inspection and re-evaluation protocols,” p 3, 28 September 2018, https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/All-Programs/Division-of-Safety-of-Dams/Files/Publications/DSOD-Inspection-and-Reevaluation-Protocols_a_y19.pdf

¹²Hiroko Tabuchi, “\$300 Billion War Beneath the Street: Fighting to Replace America’s Water Pipes”, The New York Times, 10 November 2017, <https://www.nytimes.com/2017/11/10/climate/water-pipes-plastic-lead.html>

¹³Source: The Association of Consulting Engineering Companies Canada et al., Canadian Infrastructure Report Card 2019, <http://canadianinfrastructure.ca/downloads/canadian-infrastructure-report-card-2019.pdf>

¹⁴Monique El-Faizy, “Genoa bridge collapse sounds the alarm on aging infrastructure in Europe,” France 24, 17 August 2018, <https://www.france24.com/en/20180817-genoa-bridge-collapse-sounds-alarm-aging-infrastructure-europe>

¹⁵Source: Richard Pérez-Peña, “After Italy collapse, Europe asks: How safe are our bridges?” The New York Times, 21 August 2018, <https://www.nytimes.com/2018/08/21/world/europe/genoa-bridge-collapse.html>

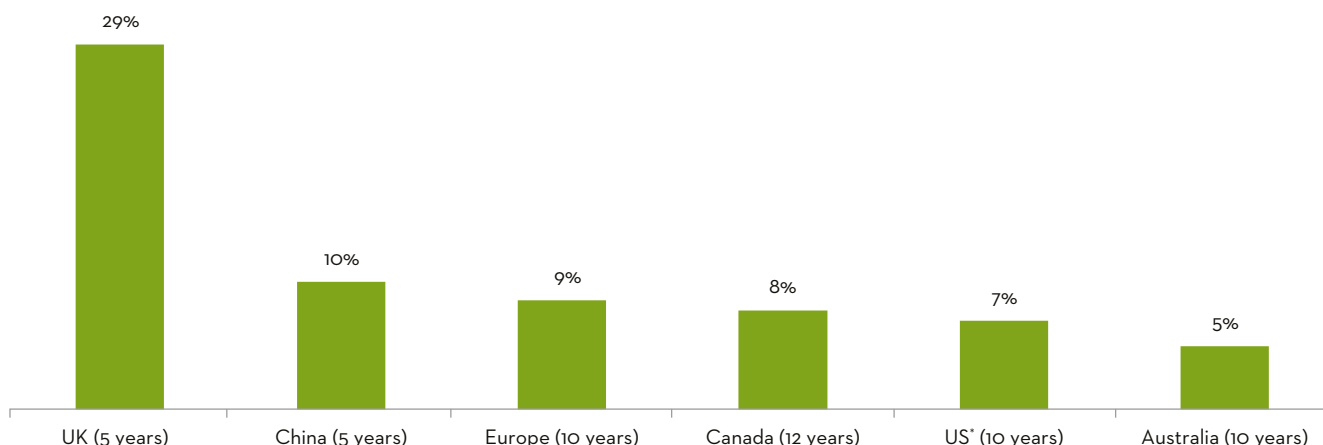
Governments are starting to spend

As we move in to the second phase of government support for economies post COVID-19, we expect further infrastructure packages to be announced.

Already, we have seen some notable progress in some leading economies with large-scale plans recently announced in various countries, including Canada and the UK (see Appendix). The overwhelming theme of these packages is to revitalise the economy in the wake of COVID-19 and to fund transportation infrastructure, energy and digitisation.

As an example, on 5 August 2020, Canada's Infrastructure and Communities Minister Catherine McKenna proposed changes to the existing C\$33.5 billion 'Investing in Canada Infrastructure Program' to allow faster processing for public transit, green infrastructure and high-speed internet infrastructure, as well as including a new stream (up to C\$3.3bn) on more pandemic-resilient infrastructure projects such as schools, hospitals, and new parks.¹⁶

Major infrastructure plans by time frame and country (as % of current GDP)



*On the assumption of a second term in office for President Trump.

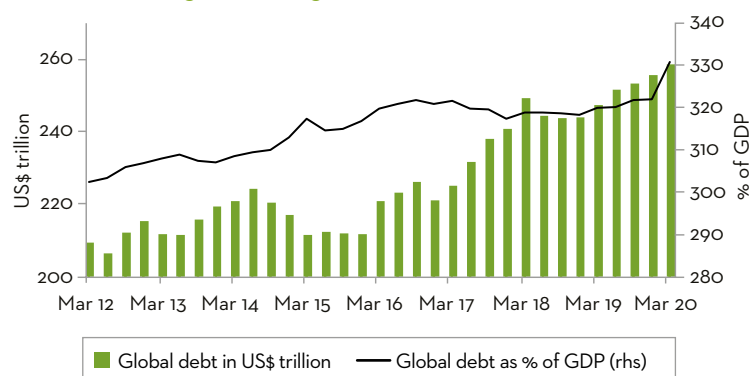
Source: Martin Currie Australia, FactSet. Refer to the Appendix.

THE FINANCING CHALLENGE

With deep economic challenges ahead, large government debt levels (chart) and limited monetary policy levers, funding such infrastructure development is a key question.

Interest rates have been trending downward in many countries for many years. With modest growth and interest rates already at very low levels, the effectiveness of further monetary stimulus using interest rates is limited.

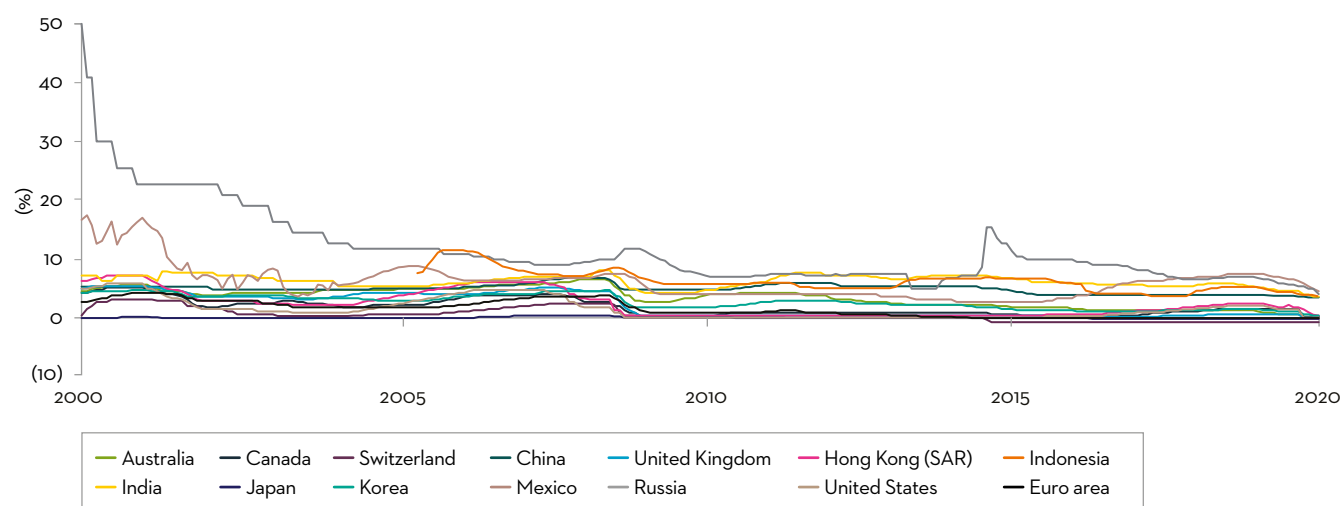
Global debt, weighted average (% GDP)



Source: IMF, BIS, IIF; data as of 31 March 2020

¹⁶Source: Infrastructure Canada, "Infrastructure program expands to support COVID-19 community resilience", News release, 5 August 2020, <https://www.canada.ca/en/office-infrastructure/news/2020/08/infrastructure-program-expands-to-support-covid-19-community-resilience.html>

A race to the bottom - central bank policy rates in major economies (%)



Source: "Central bank policy rates," *Bank for International Settlements*; data as of 15 July 2020.

Given high government debt levels, we expect that governments will move to hybrid ownership models (e.g. Private Public Partnerships) with private capital funding developments over long concession lives but which ultimately revert to the government. This will provide many opportunities for the private sector. We are seeing examples of this already with leading private toll road groups such as Transurban putting forward major projects in Australia and North America.

We see energy transition as being sizeable investment opportunity for the private sector also. As utilities invest in new renewable generation capacity, more grid connection spend will be required to facilitate this growing capacity and we see many opportunities around the world where we invest. Electricity network companies like Spark Infrastructure (Australia) and National Grid (UK) are two companies that will benefit from the increased grid connections necessary for incremental renewable power build.

Asset recycling and privatisation are also likely to be used by some governments to help fund the next round of infrastructure spend. For example, Australia's NSW State Government indicated that it may sell its remaining 49% stake in the WestConnex toll road network and use the money to extend its A\$97 billion infrastructure programme¹⁷, building more schools and hospitals as well as road and rail networks. Asset recycling not only facilitates infrastructure spending but also offers the private sector new investment opportunities.

As an alternative funding source and given stretched financial conditions, countries and central banks may also look to 'print money' to invest in sizeable infrastructure projects. Given the considerable shock to aggregate demand, some commentators are now calling for this actively.¹⁸ The benefits of further infrastructure investment have been touched on during this article with infrastructure representing something tangible, providing permanent productivity benefits as compared to temporary consumption bumps or yield curve support. While recent quantitative easing (QE) has been more limited to yield curve support, even in emerging markets¹⁹, such QE policies to fund infrastructure investment are now being discussed in both developed and emerging markets (for example, India²⁰). While money printing to build infrastructure has seen few examples recently, it is not without historic precedent, and may yet lead to a significant pick up in the pace of infrastructure spend in the coming years.

¹⁷Source: Jenny Wiggins, "NSW looking to sell its remaining WestConnex stake," *Australian Financial Review*, 6 March 2020, <https://www.afr.com/companies/infrastructure/nsw-looking-to-sell-its-remaining-westconnex-stake-20200305-p547b7>

¹⁸Source: Percy Allan, "Central banks must print money for nation rebuilding", *Australian Financial Review*, 15 April 2020, <https://www.afr.com/policy/economy/central-banks-must-print-money-for-nation-rebuilding-20200415-p54jz9>

¹⁹Source: Adrian Wail Akhla, "Indonesia raises \$1.5b from government bonds to fund fiscal deficit," *The Jakarta Post*, 29 July 2020, <https://www.thejakartapost.com/news/2020/07/29/indonesia-raises-1-5b-from-government-bonds-to-fund-fiscal-deficit.html>

²⁰Source: ET Bureau, "How printing money can save the economy of a nation", *The Economic Times*, 1 May 2020, <https://economictimes.indiatimes.com/news/economy/finance/how-printing-money-can-save-the-economy-of-a-nation/articleshow/75483789.cms?from=mdr>

TRACK RECORD OF LARGE INFRASTRUCTURE PROJECTS IN RECENT HISTORY

A significant amount of the large-scale infrastructure development in recent history has come from Asia. We have seen considerable investment across a range of countries over the last 70 years starting with Japan in the 1950s, Korea in the 1960s, Thailand from the 1990s and more recently China.

A common theme across Asia has been investment in infrastructure as a source of growth as well as a recognition that infrastructure is a key source of long-term competitiveness - important in a region of predominantly net exporters.

South Korea

From the 1960s, South Korea has invested heavily in infrastructure and according to the Asian Development Bank is a key reason for its ongoing rapid growth and competitiveness. It is interesting to note that Korea has continued to invest heavily in infrastructure even in more recent history (from 1990s onwards) with funding models that have evolved to more private sector involvement, given higher government debt levels. Since 1980, South Korea has developed all forms of transport infrastructure, ranging from expressways linking its cities, industrial zones, and seaports to railways which have complemented the growth of highway transport.²¹

An example of large-scale infrastructure projects in action has been the building and ongoing development of Incheon International Airport, developed over four phases from November 1992 to 2025. Despite the large cost and the scale of these projects, these have been developed on time, at high quality and in-line with budget. It should also be noted that this airport has won the Airport Service Quality (ASQ) Award from the Airport Council International and been ranked as the best airport worldwide every year from 2005 to 2016, surpassing even high-quality airports such as Singapore's Changi Airport and Hong Kong International Airport.²²

Japan

Japan from the 1950s onward has continued to spend on infrastructure and to this day has some of the most impressive infrastructure in the region. The Shinkansen (bullet train) has become one of Japan's most innovative infrastructure projects, whose iconic technology has been successfully exported to Taiwan, China, India and the UK, with a connection planned between Singapore and Malaysia by 2026.²³ Regional development in countries like Vietnam has also been a big focus for Japan's infrastructure know-how. Japan has provided infrastructure development aid to Vietnam with significant projects throughout the country, ranging from bridges, expressways, urban railways to ports and a brand-new airport terminal using modern design and technology. The cable-stayed Nhat Tan Bridge (Vietnam - Japan Friendship Bridge) connecting Hanoi city to Noi Bai International Airport, is the largest bridge in Southeast Asia.²⁴ The 3.75km bridge not only serves as a major artery that improves logistical efficiency and eases traffic congestion but has also become a symbol of the capital Hanoi.

While Japan continues to spend on infrastructure and already has impressive infrastructure overall, the country is also an example of where we have seen marginal projects being developed leading to large government debt, marginal productivity benefits and so-called 'bridges to nowhere'.



Nhat Tan Bridge, Hanoi, Vietnam

²¹Source: Asian Development Bank, 2014, "A comparative infrastructure development assessment of the Republic of Korea and The Kingdom of Thailand," p 4-5. <https://www.adb.org/sites/default/files/publication/100117/comparative-infrastructure-development-kor-tha.pdf>

²²The Airport Council International, the only global trade representative of the world's airports, conducts a global survey every year on approximately 350,000 airport users. The Best Airport Worldwide category was discontinued in 2016. Currently Incheon International Airport is in the Top 4 according to the UK-based international air transport rating agency Skytrax.

²³Source: Laura McCamy, "8 Japanese infrastructure projects that could reshape the world," Business Insider, 7 May 2019, <https://www.businessinsider.com.au/japan-infrastructure-projects-2019-5?r=US&IR=T>

²⁴Source: Nippon Engineering Consultants Co., Ltd, <https://www.ne-con.co.jp/ne-con/pub/english/field/bridge/nhattanbridge/>

Among Japan's unnecessary public works - a marginal bridge, airport and dam

The Hamada Marine Bridge links the city of Hamada to a small, sparsely populated island already connected by a shorter bridge. It is dubbed “hakomono” (the Japanese equivalent of white elephant) by Hamada residents²⁵.



Hamada Marine Bridge, Shimane-prefecture

The 10-year-old airport in Ibaraki, 80 km north of Tokyo reputedly cost US\$220 million to build as a hub for low-cost carriers and handles a few flights a day²⁶.



Ibaraki Airport, Ibaraki-prefecture

The construction of the nearly US\$5 billion Yamba Dam in northwest Japan was deemed controversial. Its planning started in 1967 and the project was halted in 2009 due to the government's review of public work projects before being resumed in 2015²⁷ and finally completed in 2020²⁸.



Yamba Dam
 Qurren / CC BY-SA, <https://creativecommons.org/licenses/by-sa/4.0>

These cases highlight that the quality of infrastructure projects remains important and that not all infrastructure spend is necessarily positive from a return or competitiveness standpoint.

²⁵Source: Martin Fackler, “Japan’s Big-Works Stimulus Is Lesson,” The New York Times, 5 February 2009, <https://www.nytimes.com/2009/02/06/world/asia/06japan.html#:~:text=In%20Hamada%2C%20residents%20say%20the,traffic%20on%20a%20recent%20morning>.

²⁶Source: Roland Buerk, “Japan opens 98th national airport in Ibaraki,” BBC, 11 March 2010, <http://news.bbc.co.uk/2/hi/asia-pacific/8561375.stm>

²⁷Source: Japan Today, “Construction of controversial Yamba dam resumes,” 23 January 2015, <https://japantoday.com/category/national/construction-of-controversial-yamba-dam-resumes>

²⁸Source: Tomasz Janowski & Kaori Kaneko, “Analysis: Japan’s mission impossible: to spend \$100 billion in 15 months,” Reuters, 22 February 2013, <https://www.reuters.com/article/us-japan-construction/analysis-japans-mission-impossible-to-spend-100-billion-in-15-months-idUSBRE91K1BM20130221>

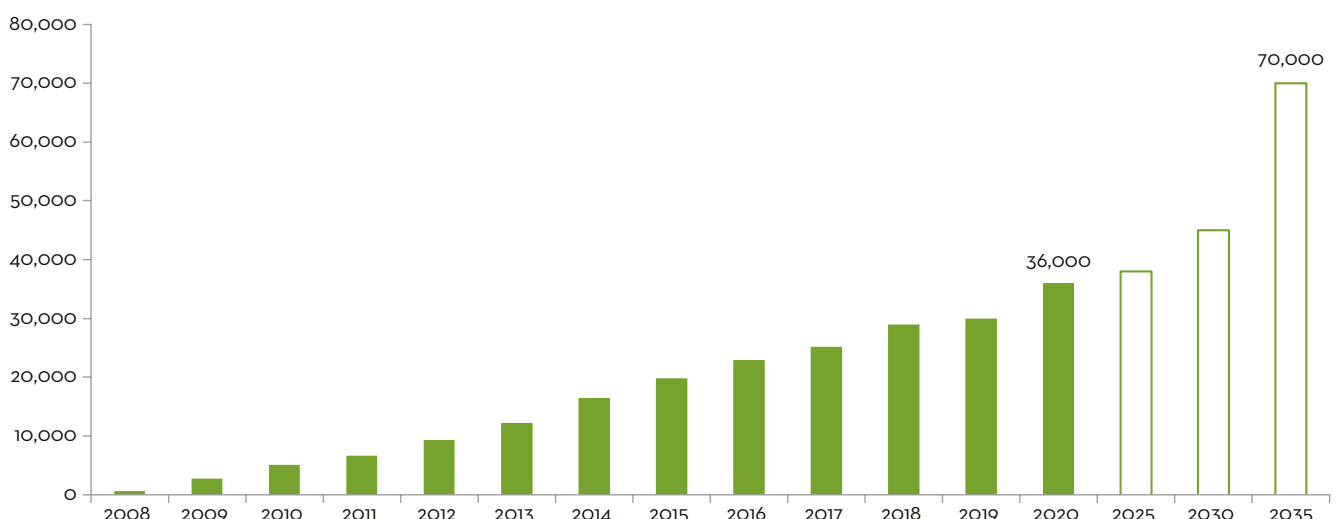
China

China is a special case. Unlike other countries, Beijing has consistently viewed infrastructure in terms of serving geopolitical aims beyond purely economic ones. Successive leadership groups have prioritised infrastructure projects with economic rationales, in transport, logistics, agriculture, energy, urbanisation and telecommunication. A strategic focus for this series of projects was the Greater Bay Area concept, linking together the cities of the Pearl River Delta, to enable the region to drive economic growth. This first wave of projects was followed by what might be termed as ‘dual purpose’ projects. For instance, the Belt and Road Initiative and more recently, clearly defence-oriented projects such as the South China Sea islands, which have been militarised and sit astride one of the world’s most important seaborne trade routes.

China’s economic infrastructure

Like Korea and Japan, China has also spent considerable amounts on infrastructure in recent history boosting its economy and providing rapid catch up to the rest of the world in terms of infrastructure quality. Although some might say it has overly relied on infrastructure to fuel the country’s growth, there is no doubt that its development has been rapid and impressive with an extensive infrastructure network built across highways and rail. As can be seen below, over the past 12 years, China has built 36,000 km of dedicated high-speed railway - more than the rest of the world combined, and enough track to almost travel around the world.²⁹ Going forward, it has an ambitious plan to double the length by 2035.

Length of China’s high-speed rail network (km), 2008 - 2035



Source: Asian Development Bank, South China Morning Post & International Railway Journal.

²⁹The Earth’s circumference is approximately 40,000 kilometres.



2008 vs 2017, & planned HSR corridors

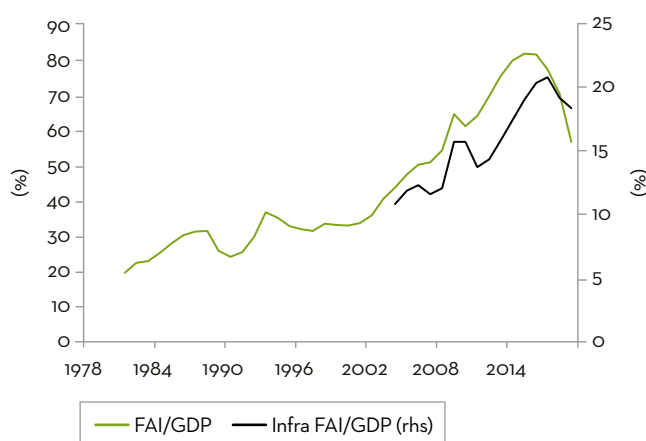


Source: Martha Lawrence, Richard Bullock & Ziming Liu, "China's High-Speed Rail Development," *World Bank Group*, 2019, <http://documents1.worldbank.org/curated/en/933411559841476316/pdf/Chinas-High-Speed-Rail-Development.pdf>

Investment in infrastructure remains high in China with fixed asset investment (FAI) close to 19% of GDP on average over the last five years.³⁰

However, like Japan previously, it could well be that China is now coming to the limits of what it can spend from a debt perspective. Marginal projects are therefore not likely to be as productive as earlier, 'easy-win' projects. A look at the current top-10 infrastructure projects in 2020 highlights this point, with high-speed rail developments in Mongolia and the west of the country - unlikely to be the most economic projects given lower population density and incomes.³¹ The Belt and Road Initiative project is one way China is looking to utilise its vast infrastructure experience and capacity as the country seeks to expand its infrastructure network westwards and along key trade routes.

FAI and Infra FAI as % of GDP



Source: Xiangrong Yu, "China Economics Flash - Activity Recovery Hits Milestone", Citi, October 2020.

Although China's track record on development is harder to ascertain in terms of cost and timing, we have seen several large infrastructure projects not always being completed on budget. One recent example would be Beijing's new Daxing Airport which has an annual carrying capacity of 72 million passengers a year and took five years to construct, reputedly costing US\$17 billion according to the airport³², notably more than its original US\$13.8 billion budget³³. Another major project which also saw a material increase in budget was the Hong Kong-Macao-Zhuhai Bridge which links Hong Kong and China. With an initial cost estimate of 70 billion yuan, this project is thought to have cost 120 billion yuan.³⁴ That such projects run over cost is not necessarily a surprise with many large-scale infrastructure projects globally ending up costing more than originally budgeted given their complexity and increases in inflation. A 2016 study shows that China infrastructure costs are 30.6% higher than estimated costs on average in real terms, which is in line with global trends; in addition, there is evidence of cost underestimation bias in the budgeting phase.³⁵ The study concludes that there is a trade-off between impressive speed and other important factors such as quality, safety, social equity and the environment. As such, while the delivery from a timing and scale perspective has been impressive, China's delivery of large infrastructure from a cost perspective is perhaps not that different from other countries around the world.

Although China's track record on development is harder to ascertain in terms of cost and timing, we have seen several large infrastructure projects not always being completed on budget.

³⁰Source: Xiangrong Yu, "China Economics Flash - Activity Recovery Hits Milestone", Citi, October 2020.

³¹Cissy Zhou, "China's top 10 infrastructure projects for 2020 and beyond will help boost its slowing economy," South China Morning Post, 28 January 2020, <https://www.scmp.com/economy/china-economy/article/3047305/chinas-top-10-infrastructure-projects-2020-and-beyond-will>

³²Source: Daxing Airport, <https://daxing-pkx-airport.com/>

³³Source: Adam Williams, "Zaha Hadid unveils plans for world's largest airport terminal," New Atlas, 6 February 2015, <http://www.construction-post.com/concept-design-released-for-worlds-largest-airport-terminal-in-beijing/>

³⁴Luis Liu, "Massive infrastructure project cost overruns should be viewed objectively," China Daily, 10 December 2018, http://www.chinadaily.com.cn/hkedition/2018-12/10/content_37378423.htm

³⁵Atif Ansar et al., "Does infrastructure investment lead to economic growth or economic fragility? Evidence from China," Oxford Review of Economic Policy 32, no. 3 (2016), p. 384-385, <https://arxiv.org/ftp/arxiv/papers/1609/1609.00415.pdf>

A Case in Point - China's Greater Bay Area (GBA)

The GBA has seen phenomenal growth over the last 40 years. Now boasting two of the country's largest megacities, it is a shining example of urbanisation and population growth in Asia. The GBA spans nine cities in the Guangdong Province, as well as Hong Kong and Macau. The GBA is already the most productive province in mainland China in terms of GDP per square kilometre and this looks set to continue, with further infrastructure developments on the horizon, ongoing strength in manufacturing, and continued population growth. The region also has room to grow with 700 square kilometres of new development land still available³⁶.



CBRE Research, 2018, The Guangdong-Hong Kong-Macau Greater Bay Area.

The design was conceived as a mechanism to promote an economic powerhouse in the region. The three main cities are each centres of excellence: Shenzhen (GDP of US\$350 billion³⁷) in technology; Guangzhou (GDP: US\$340 billion³⁸) in shipping and logistics; and Hong Kong (GDP of US\$366 billion³⁹) in finance. Macau, for good measure, is the entertainment centre of the region. This is probably the most successful large-scale infrastructure project undertaken by Zhongnanhai (the central Headquarters of the Chinese Communist Party and the State Council of China).

³⁶Source: CBRE Research, 2018, The Guangdong-Hong Kong-Macau Greater Bay Area <https://www.cbre.com/research-and-reports/Greater-China-Major-Report-The-GuangdongHong-KongMacau-Greater-Bay-Area-The-Rise-of-Chinas-Pioneer>

³⁷Source: Statista & National Bureau of Statistics of China <https://www.statista.com/statistics/278939/chinese-cities-with-the-highest-gdp/>

³⁸Source: Statista & National Bureau of Statistics of China <https://www.statista.com/statistics/278939/chinese-cities-with-the-highest-gdp/>

³⁹Source: Statista report Hong Kong, using an exchange rate of HK\$7.75/USD on September 3rd 2020.

Belt and Road Initiative - Dual purpose

The Belt and Road Initiative (BRI) was launched in 2013 with the evocation of the romanticism of recreating the Silk Road of Marco Polo, extending Chinese soft power outside China. After a few false starts, which involved poorly thought out contracts and unrealistic revenue projections, the BRI took off. The vision of a land route to Europe has been expanded, it reaches 126 countries⁴⁰ and serves multiple purposes.

From an economic perspective, this is a Silk Route on steroids: the network of roads, railways, logistics hubs, ports, airports and telecommunications infrastructure constitute tangible links with China which will be hard to unwind. Countries that are now connected via the BRI increase their external trade and effectively fall into China's sphere of economic influence.

From a soft power perspective, the recipient countries have also benefited. Even if the road building did not in the end yield the hoped-for number of jobs for locals, there was the welcome boost to economic growth provided by this shiny new infrastructure, the first since independence for some, certainly the first in 50 years for others. Faced with the choice of accepting the first chance of infrastructure or continuing as before, governments have tended to accept.

From a geopolitical and strategic perspective, this could be a masterstroke. China is a net oil importer and given the country's positioning at the heart of global supply chains, is highly dependent on safe sea corridors for its energy and food security, as well as for its exports. So, there is a category of infrastructure on the BRI that is clearly dual purpose, as it can also be quickly turned to military use.

The best example of how these threads are interlinked is Pakistan (see *overleaf*).

⁴⁰Source: Xinhua 2019-09-14 http://www.xinhuanet.com/english/2019-09/14/c_138391095.htm



A Case in Point - China-Pakistan Economic Corridor (CPEC)⁴¹

Geography matters in geopolitics as much as in infrastructure. China's key potential vulnerability is its status as the world's largest energy importer, exacerbated by the long and windy sea lanes trade must follow to reach foreign markets, or to return to the Chinese coastline. The map below shows the extensive network of ports where China (or Chinese companies) hold at least a significant equity stake. The triangles denote maritime 'choke points' where a single submarine or a couple of destroyers could effectively blockade shipping. The Strait of Hormuz is barely 21 miles wide and is the only exit from the Persian Gulf, allowing 21 million barrels of oil per day⁴² to go to international markets in 2018. That volume is equivalent to 21% of global production.

Gwadar port in Pakistan's southwest is strategically situated 390 nautical miles from the Strait of Hormuz and is now a potential destination of oil bound for China, via pipelines laid across the country, although the capacity is likely to be limited and the cost of pumping oil up and over the Khunjerab Pass, at an altitude of 4,693 metres and in temperatures of -37°C in winter is likely to be prohibitive. Of higher value geopolitically speaking is the agreement with Djibouti, to host the first overseas military base,⁴³ of the Peoples' Liberation Army (PLA's), which is strategically placed to cover the all-important sea lanes.

As an illustration of the importance of this location, Djibouti is 1,525 nautical miles from Gwadar, or two days sailing by modern destroyer.

Elsewhere, the Strait of Malacca, between Indonesia, Malaysia and Singapore enabled 16 million barrels per day in 2016. At its narrowest point in the Philips channel, it is only 1.7 miles wide. Piracy is also still endemic in the Strait of Malacca, according to the International Chamber of Commerce's (ICC) Piracy Reporting Centre.⁴⁴

Chinese-owned global ports



Source: Martin Currie.

⁴¹CPEC official site, Government of Pakistan <http://cpec.gov.pk/index#>

⁴²US Energy Information Administration (EIA), 'The Strait of Hormuz' June 20th 2019 <https://www.eia.gov/todayinenergy/detail.php?id=39932#:~:text=the%20Arabian%20Sea.,The%20Strait%20of%20Hormuz%20is%20the%20world's%20most%20important%20oil,of%20global%20petroleum%20liquids%20consumption.>

⁴³Source: The Jamestown Foundation, China Brief Volume: 17 Issue: 17 <https://jamestown.org/program/chinas-overseas-military-base-djibouti-features-motivations-policy-implications/>

⁴⁴ICC Piracy Reporting Centre IMB Piracy & Armed Robbery Map 2020 <https://www.icc-ccs.org/piracy-reporting-centre/live-piracy-map>

A Case in Point - China-Pakistan Economic Corridor (CPEC) continued

In many ways, Pakistan was a natural choice for Beijing as the first country to work with on a comprehensive infrastructure buildout. Pakistan and China have had a long friendship and of course share a dislike of India. For Pakistan, chronic security concerns, a dearth of infrastructure and a deterioration in relations with the US since the end of the Cold War meant a warm welcome for China.

The CPEC commitment covers energy, transport & logistics, health, education and water supply. So far, 5,320 MW of generating capacity (31% of target) and 2,548 km of highways (36% of target) have been delivered at a cost of US\$10.8 billion. There are a myriad of projects including 4,122 km of railways and a series of industrial zones on the plans which, if delivered, will transform the country by 2030.

But one of the more interesting subplots of CPEC is an attempt to increase the use of the renminbi (RMB) as an international currency. This is a push from Islamabad, not Beijing - it stems from IMF constraints, dwindling US dollar reserves and persistent current account deficits. China has recently doubled its RMB Currency Swap Agreement with Pakistan to 40 billion yuan. It has been reported that this arrangement has been replicated for 19 other countries⁴⁵ on the BRI. It is not clear at this point how successful this effort might be, as most private businesses prefer dollars or euros and there is a limit to the amount of goods that countries like Pakistan can buy from China.

Special economic zones under CPEC

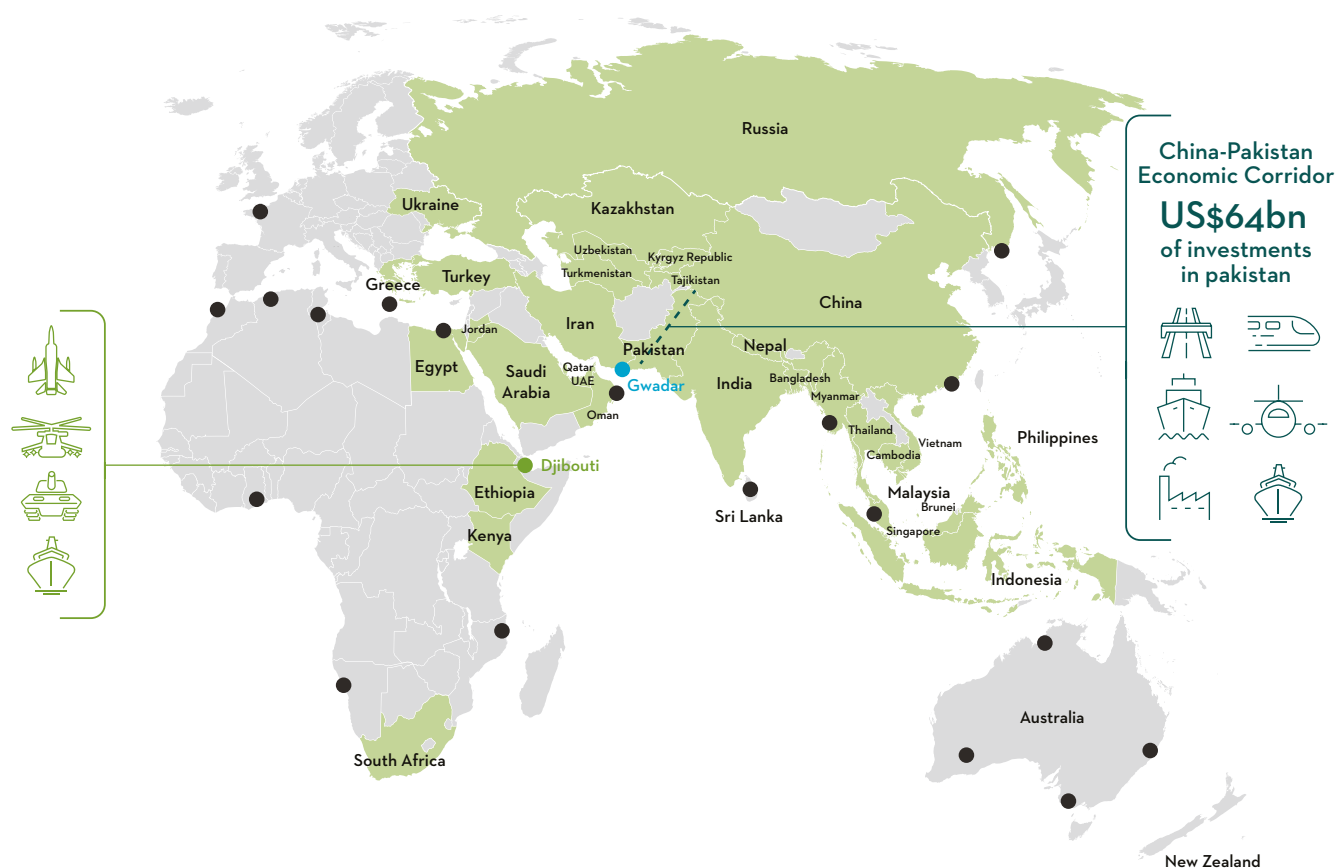


Source: CPEC Factbook 2019 - Government of Pakistan Ministry of Planning Development & Reform p11. <http://cpec.gov.pk/brain/public/uploads/documents/Fact%20Book%202020.pdf>

⁴⁵Source: Xinhua 2019-09-14 http://www.xinhuanet.com/english/2019-09/14/c_138391095.htm

A Case in Point - China-Pakistan Economic Corridor (CPEC) *continued*

68 nations, US\$2-3 trillion of investment



Source: Martin Currie.

BRI has critics

No commentary on the Belt and Road Initiative would be complete without examining the criticisms in the West. These tend to centre around two contentions: that this is a masterplan for Chinese domination and military expansion and that the projects are essentially based on predatory ‘debt trap’ diplomacy, tying countries in with huge debt burdens.

It is undeniable that China has been working assiduously to expand its global trade footprint around the world – one of the reasons for its success has been its integration in global supply chains. By delivering transport and logistics infrastructure, Beijing can effectively ‘lock in’ foreign markets by virtue of short, reliable shipping links and the soft power provided by being the first to do so in over 75 years. Collateral advantages for the host country accrue via access to cheap (compared to Western costs), relatively high-specification railways, highways, ports and airports as well as information and communications technology, which would be prohibitively expensive for

most developing countries. There is no doubt that China’s ‘non-judgemental’ attitude to governance is attractive for many leaders, especially when it comes to the deployment of its sophisticated surveillance technology. That is certainly something the West actively dislikes but cannot do much about.

Turning to the military dimension, the answer is probably obvious in the defence white paper published in July 2019 by the State Council Information Office, entitled *China’s National Defence in the New Era*,⁴⁶ an unusually clear and comprehensive response to the US equivalents of 2017 and 2018, which explicitly identified China as the US’s principal strategic competitor. It highlights the need to modernise the PLA and to update the country’s early warning capability in the South China Seas as well as building overseas bases to project blue water capabilities and protect vital shipping routes. In that context, it is logical to see the buildout in Djibouti, on the Gulf of Aden.

⁴⁶Source: CSIS report China’s New 2019 Defense White Paper, July 24th, 2019 <https://www.csis.org/analysis/chinas-new-2019-defense-white-paper>

The genesis of the BRI was typically haphazard, in the sense that state-owned enterprises (SOEs) rushed to be seen to be delivering on the vision in 2013, without any experience of working overseas, or many of the requisite project financing skills. There were numerous examples of poorly executed contracts which backfired, before a series of reviews and a more coordinated approach was created. The Sri Lankan port of Hambantota is often cited as evidence of predatory lending, since it was financed by the Chinese EXIM Bank in several rounds between 2007 and 2016; the story goes that the repayments were unaffordable and the port ended up being leased to China for 99 years. According to data from the Ministry of Finance of Sri Lanka, this explanation appears unlikely, as Chinese debt represented only 10%⁴⁷ of the country's total debt in 2017; 39% was composed of bond issuance. What seems to have triggered the lease of the port was a combination of overambitious assumptions, falling external trade, minimal reserves and fiscal constraints which meant that as the maturity of the bonds approached, the country had to find some foreign currency to meet the bond payments.

There is undoubtedly still poor execution in lending practices. This seems at least partly a function of China being China: state-owned companies disregard country risk, lending to already extended governments due to a prioritisation of the top down 'BRI vision'. The apparent lack of central coordination of the wide variety of projects involved make it difficult to identify evidence of predatory practices.

If there is one clear criticism that ought to be levelled at most of the BRI projects, it is the lack of transparency around financing and the potential ESG liabilities that may be mounting up. Observers may note that hectoring from the sidelines is of limited use when what these host countries really need is clear commitment to direct investment, which is not forthcoming from the West. So, when the White House demands that countries block Huawei technology, BRI countries will probably not comply.

Ultimately, the BRI will continue to develop, cementing trade links and government-to-government ties with Beijing; trade in goods will inevitably be followed by information and telecommunications technology and China's *de facto* sphere of influence will continue to expand. If the escalation of the confrontation with the US continues, Beijing will be able to count on the majority of the 126 countries of the BRI as virtually captive markets for its exports and potentially their votes at the United Nations.

If there is one clear criticism that ought to be levelled at most of the BRI projects, it is the lack of transparency around financing and the potential ESG liabilities that may be mounting up.

The information provided should not be considered a recommendation to purchase or sell any particular security. It should not be assumed that any of the security transactions discussed here were or will prove to be profitable.

⁴⁷Source: Ministry of Finance of Sri Lanka - Annual Report 2017- 5.5.2 Outstanding Foreign Debt - Chart 5.12 (page 118)
<http://treasury.gov.lk/documents/10181/12870/2017.pdf/2bce4f3d-ebde-4409-b2b5-c8a0801b3edc>

THREE INFRASTRUCTURE MODELS AROUND THE WORLD

In the US and in other parts of the developed world, we see large private sector involvement, not necessarily to the exclusion of government, with private sector involvement across a range of infrastructure-related sectors including hospitals (Ramsay Healthcare – UK), roads (Transurban – Australia), railways (MTR – HK) and telecommunications (Crown Castle – US). In Asia, we see more government-led infrastructure projects, particularly in countries such as China and Japan. Elsewhere around the world, there tends to be a hybrid model of both private and public ownership such as Brazil in Latin America.

While we have seen rapid development in Asia over the last 20 years, on the face of it, it is tempting to associate centrally planned economies as being an attractive model for infrastructure delivery. Although what has been delivered is impressive in terms of scale and size, the cost to deliver this infrastructure is not always so transparent, as is evident from a recent study on China:

“Despite the widespread admiration of China’s infrastructure development, there is scant bottom-up evidence from the field about the actual outcomes of specific investment projects. The macroeconomic account of infrastructure investments in China, for instance, omits the massive costs incurred in the building of megaprojects.”⁴⁸

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⁴⁸Atif Ansar et al., “Does infrastructure investment lead to economic growth or economic fragility? Evidence from China,” Oxford Review of Economic Policy 32, no. 3 (2016), p. 3, <https://arxiv.org/ftp/arxiv/papers/1609/1609.00415.pdf>

⁴⁹Department for Transport, “Planning Inspectorate Journal - Heathrow Terminal Five article,” Planning Inspectorate Journal, 2005, <https://web.archive.org/web/20071224055842/http://www.dft.gov.uk/foi/responses/2005/jan/terminalfive/planninginspectoratejournalh2291?page=2>

China is driving things from a centrally-planned economy and while its cost track record is not that dissimilar to other countries, it is also pioneering the use of infrastructure as a tool for expanding and locking-in trade routes as part of the BRI – as well as for its use as a geopolitical instrument.

Western countries have had their own issues satisfactorily delivering high-quality infrastructure over long periods. This has been due to a range of reasons including more prolonged planning times, relatively short election cycles (given the scale/length of infrastructure projects) and governance models that can be critical on spending with vested interests sometimes not supportive (not in my backyard or ‘NIMBY’ sometimes proving problematic). High debt levels in many Western countries have also led to more caution on large infrastructure projects. Terminal 5 at Heathrow provides an illustrative example of how long, large infrastructure projects can take the project taking 20 years from concept to delivery with the terminal finally opening in 2008 after submitting approval plans in 1993.⁴⁹

It is unlikely there is any perfect infrastructure development model and various models have positives and negatives around speed of delivery, governance and stakeholder engagement.



IS INCREASED INFRASTRUCTURE SPEND GOING TO WORK THIS TIME?

Overall, increased infrastructure spend is likely in the short term given the shock to aggregate demand caused by COVID-19, as well as increasing necessity of that spend – namely due to aging infrastructure as well as growing populations. But will it be enough to stimulate economic activity, given the dire impacts to global growth? We think it depends on:

1. The size of the spend
2. The quality of the spend
3. The time to develop

Should the fiscal support be too small then the impact on economies will be negligible. If projects which are to be developed are marginal (i.e. as has often been the case in Japan) then such projects will provide nothing more than a short-term fiscal sugar hit, with higher debt ultimately ending as a drag on the economy. Lastly, should delays be extensive in rolling out new infrastructure spend, then it will not have the desired effect of supporting economic growth in the face of weak aggregate demand. We are currently seeing examples of this in the US with delays for bi-partisan fiscal stimulus dragging on.⁵⁰

As such, while we are positive on increasing infrastructure spend, we believe it will not be uniform across all countries and will ultimately depend on the aforementioned factors on each countries' infrastructure opportunity set, their ability to finance said infrastructure-spend as well as on the political appetite.

The three models of infrastructure will all flourish.

CONCLUSION

In the developed world, infrastructure has taken a back seat to alternative approaches to stimulus, but we expect this will not be the case going forward as economies reopen and people return to work.

Given rates are already close to zero in many countries, governments will increasingly look to focus on infrastructure to stimulate economies given the lasting impact of this spend and the boost in productivity this spend provides. Ongoing population growth and the age of infrastructure around the world provides a compelling rationale for increased spending. Infrastructure spend has saved us before and will no doubt be used again.

It has long been considered that Western countries prefer to invest in 'soft' rather than 'hard' (bridges, road, rail and power) infrastructure. Going forward, it may be that this differentiation will only be seen in low-income countries, because legislation in Europe particularly has moved so quickly to remove 'blind spots' in terms of potential ESG liabilities. The likelihood is, however, that in these developing countries, their preference will continue to be for 'soft' infrastructure, such as the promotion of governance, education, healthcare and water treatment.

Opportunities will be present for private companies to invest across the infrastructure spectrum given alternative funding sources will be needed (for example, public-private partnership and asset recycling) as government finances remain stretched and private sector delivery remains a great model for delivering large-scale infrastructure projects.

The three models of infrastructure will all flourish. In the developed world, low borrowing costs and genuine shortfalls in safety and quality of existing infrastructure should make this an easy vote winner. In the developing countries, China's offer of the BRI has already been accepted. The only issues that could potentially derail this development are a sudden and commensurate generosity of finance from the US, evidence of poor-quality execution in the BRI, or a particularly shocking political misstep by Beijing. All seem unlikely at this point, thus underlining that should the US-China decoupling continue, there are many countries already committed to the Chinese sphere of influence.

⁵⁰Anil Panchal, "US stimulus delayed as Republican talks fall into disarray," *Financial Times*, 23 July 2020, <https://www.ft.com/content/3af3eeae-b3ea-4e0d-aadb-01a1069a687a>

APPENDIX

Major infrastructure plans recently announced:

Country/Region	Last updated	Infrastructure plans
United States	18 June 2020	<p>The Trump Administration plans to fund US\$906 million through the Infrastructure for Rebuilding America (INFRA) discretionary grant programme to improve major highways, bridges, ports and railroads across 20 states.⁵¹</p> <p>Looking ahead, it remains uncertain which major infrastructure plan will come through given the upcoming November election: the Trump Administration's US\$1.5 trillion in 'brown' infrastructure over the next decade, or Joe Biden's US\$2 trillion in 'green' infrastructure and energy over four years.</p>
Canada	5 August 2020	<p>Through the Investing in Canada plan, the Government of Canada is investing more than C\$180 billion over 12 years (from 2016) in public transit projects, green infrastructure, social infrastructure, trade and transportation routes, and Canada's rural and northern communities.</p> <p>On 5 August, Canada's Infrastructure and Communities Minister Catherine McKenna proposed changes to the existing C\$33.5 billion (US\$24.5 billion) Investing in Canada Infrastructure Program to allow faster processing for public transit, green infrastructure and high-speed Internet infrastructure, as well as to include a new stream (up to C\$3.3 billion) on more pandemic-resilient infrastructure projects such as schools, hospitals, and new parks.⁵²</p>
Europe	21 July 2020	<p>In March 2020, the European Commission (EC) approved an investment package worth more than €1.4 billion for 14 large infrastructure projects in Croatia, the Czech Republic, Hungary, Poland, Portugal, Romania and Spain. The projects include a number of rail and transit projects, as well as environment, health and energy schemes.⁵³</p> <p>On 21 July 2017, the EC concluded the Recovery effort and Multiannual Financial Framework (MFF) under Next Generation EU for Europe to kick-start the European economy post COVID-19. Part of the MFF includes the €28,396 million 'Connecting Europe Facility' for the period 2021-2027, which will be distributed across transport infrastructure, energy and digitisation.⁵⁴</p> <p>Additionally, among the EC's priorities for 2019-24 is the Green Deal, which provides an action plan to achieve climate neutrality by 2050 and it is said that at least €1 trillion is needed to cover the cost over the next decade from the EU budget and national governments.⁵⁵</p>

⁵¹Source: United States Department of Transportation, "U.S. Secretary of Transportation Elaine L. Chao Announces \$906 Million Investment to Revitalize America's Infrastructure," last updated 18 June 2020, <https://www.transportation.gov/buildamerica/financing/infra-grants/infrastructure-rebuilding-america>

⁵²Source: Infrastructure Canada, "Infrastructure program expands to support COVID-19 community resilience", News release, 5 August 2020, <https://www.canada.ca/en/office-infrastructure/news/2020/08/infrastructure-program-expands-to-support-covid-19-community-resilience.html>

⁵³Source: David Burroughs, "EU approves €1.4bn for infrastructure projects," International Railway Journal, 24 March 2020, <https://www.railjournal.com/infrastructure/eu-approves-e1-4bn-for-infrastructure-projects/>

⁵⁴Source: European Commission, "Special meeting of the European Council (17, 18, 19, 20 and 21 July 2020) - Conclusion," 21 July 2020, <https://www.consilium.europa.eu/media/45109/210720-euco-final-conclusions-en.pdf>

⁵⁵Source: Fiona Harvey and Jennifer Rankin, "What is the European Green Deal and will it really cost €1tn?" The Guardian, 9 March 2020, <https://www.theguardian.com/world/2020/mar/09/what-is-the-european-green-deal-and-will-it-really-cost-1tn>

APPENDIX

Major infrastructure plans recently announced:

Country/Region	Last updated	Infrastructure plans
UK	30 June 2020	A 'New Deal': Spring Budget 2020 set out that the public sector will invest £640 billion over five years, bringing forward £5 billion of capital investment projects, supporting jobs and the economic recovery. ⁵⁶
Australia	15 June 2020	The Australian Government is committed to delivering its A\$100 billion, 10-year infrastructure pipeline. This long-term commitment to build the transport infrastructure Australians need to meet the challenges of a fast-growing population, while improving safety and productivity, will support jobs and the economy to help stem the economic impact of COVID-19. ⁵⁷
China	22 May 2020	In the May government work report, China pledged to accelerate the construction of 'new infrastructure' to offset the COVID-19 economic impact, totalling 10 trillion to 17.5 trillion yuan until 2025. The projects range from 5G networks, data centres to artificial intelligence and electric vehicle charging stations. ⁵⁸

⁵⁶Source: Prime Minister's Office, "PM: A New Deal for Britain," Press Release, 30 June 2020, <https://www.gov.uk/government/news/pm-a-new-deal-for-britain>

⁵⁷Source: Australian Government, "Infrastructure investment response to COVID-19", Department of Infrastructure, Transport, Regional Development and Communications, 15 June 2020, https://investment.infrastructure.gov.au/infrastructure_investment/infrastructure_investment_response_covid-19/

⁵⁸Source: Caroline Meinhardt, "China bets on 'new infrastructure' to pull the economy out of post-Covid doldrums," Mercator Institute for China Studies, 4 June 2020, <https://merics.org/en/analysis/china-bets-new-infrastructure-pull-economy-out-post-covid-doldrums>

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