



Emerging analysis

# China's investment in digital infrastructure along the Belt and Road

Olena Borodyna

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## Key messages

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Digital infrastructure is revolutionising industries, services, and the very nature of how we work and communicate. However, improving internet access and unlocking opportunities for the nearly 4 billion people lacking internet globally will be costly. Providing universal access in Africa alone will cost around \$100 billion. Chinese companies offer opportunities to close infrastructure gaps and access cutting-edge technology, but they are not without risk.

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Domestically, digitalisation is crucial to the next stage of China's development. The 14<sup>th</sup> Five-Year Plan sets out a comprehensive approach to mainstreaming digital technologies at individual household and community levels, across economic sectors, and through the delivery of government, health, and education services. China is also gearing up for the next stage of technology competition with the United States with plans to invest in nascent 6G technologies.

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Despite COVID-related disruptions, China continued overseas investment in digital infrastructure. While security concerns drive the exclusion of Chinese companies from critical infrastructure networks in wealthier countries, many developing economies appear reluctant to follow suit. This does not necessarily indicate an absence of security concerns on the part of those countries. Rather, it may reflect their higher risk-tolerance whereby opportunities outweigh security risks.

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With China and Chinese companies at the heart of the digital revolution, both domestically and globally, understanding how Chinese investments can align with country needs and development priorities will be crucial for developing economies to maximise opportunities offered by these investments. As such, a greater understanding of China's development plans for the 4th Industrial Revolution is needed, as well as an assessment of risks and opportunities arising from related 'disruptions'.

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The original report is part of ODI's Economic Pulse series, which collects and analyses information on Chinese economic activity relevant to developing countries. The series identifies emerging policy signals as well as trade and investment trends fundamental to the socio-economic development planning of low- and middle-income countries. The series was set against the backdrop of the COVID-19 pandemic and the on-going recovery.

## About the authors

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# Display items

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Figure 1 Internet service users and penetration rate

Figure 2 Certified patent applications

# Acronyms

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ASEAN	Association of Southeast Asian Nations
BRI	Belt and Road Initiative
FYP	Five-Year Plan
ITU	International Telecommunication Union
ICT	information and communications technology
IP	intellectual property

# 1 Introduction

***Pulse 3: recover, reform and restructure***, covers economic and policy developments through March 2021, with data for the full year of 2020 available, as well as some early indicators for January to March. It takes a forward-looking approach to assess the short- and long-term outlook for China and its appetite for outward investment and trade given how events are unfolding. Given its coverage, macroeconomic and project-level data will start to reflect a full year's worth of change and a new and low steady base from which to begin. While policy priorities may have shifted along the way, the near- to long-term outlook is guided by the need to reform and restructure the economy to adapt to the post-pandemic geopolitical and economic landscape. It is important that developing economies understand these changes in China's economy as these shifts inform how China engages, invests and finances activity in other countries.

**Digital economy is critical to China's post-pandemic recovery, featuring prominently in the country's bilateral and regional engagements.** The country's interest in cooperation with developing countries on emerging technologies dates to the late 1990s when Huawei set-up operations in Cambodia. Since the adoption of the Sustainable Development Goals in 2015, China has promoted the 'Digital Silk Road' as part of its development approach. Meanwhile, the country's Global Data Security Initiative, proposed in 2021, speaks to China's ambitions to shape the future of global data governance. However, the country's ambitions have prompted concerns about China's growing influence in the sectors driving the 4th Industrial Revolution, particularly in the context of geopolitical hostility between the United States and its allies, and China.

**Unlocking the opportunities of the 4th Industrial Revolution will be costly but critical for countries looking to capitalise on new technologies to accelerate their development.** This emerging analysis, originally published as a special focus section in [Economic Pulse 3: recover, reform, restructure](#), spotlights China's investment in digital infrastructure along the Belt and Road. It briefly outlines the opportunities and costs of digitalisation for developing countries, before looking at China's domestic digital policy and its overseas investment in digital infrastructure. Finally, the analysis explores the potential risks of Chinese investment in digital infrastructure and how different countries have responded to these risks.

## 2 Unlocking opportunities of digitalisation globally

**Access to digital infrastructure is increasingly a necessity in economic development, and with many developing countries still struggling to provide universal access, China's digital Belt and Road Initiative (BRI) is proving attractive notwithstanding some emerging risks.**<sup>1</sup> Despite the growing importance of the digital economy, over 4 billion people, mostly in developing countries, have no internet access (Strusani and Hounghonon, 2020). By 2035 5G-enabled connectivity will help create \$3.6 trillion of economic output and 22.3 million jobs, adding \$13.2 trillion in economic value (World Economic Forum, 2020). In agriculture, digital transformation offers opportunities to improve marketing, logistics and quality control of goods, helping farmers reach new export markets.

Digitalisation also offers opportunities to improve health services through transforming administrative reporting systems, telemedicine, electronic medical records and patient portals. Other opportunities exist in building smart cities and e-governance, among many others. Digital services such as FinTech have also lowered the costs of connecting women and low-income groups to the formal financial system.

**Yet improving digital infrastructure access will be costly. In Africa alone, providing universal internet access will cost around \$100 billion, with around 80% of that investment going towards laying and maintaining broadband networks and 20% towards skills improvement (ITU and UNESCO, 2019).** With Chinese companies involved in various aspects of digital infrastructure – from introducing broadband networks to integrating blockchain in agriculture supply chains to building smart cities – opportunities exist for partner countries to close infrastructure gaps and access cutting-edge technologies. Understanding how Chinese activities can align with national development priorities and country needs, as well as assessing any associated risks, will be crucial to maximising these opportunities.

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<sup>1</sup> We use a broad definition of 'digital infrastructure' to include network equipment, cables, 5G, data and research centres, large e-commerce, mobile payment deals and smart-city projects.



# 3 China's domestic and overseas policy and investment in digital infrastructure

## 3.1 China's 14<sup>th</sup> Five-Year Plan: setting a vision for a digitally enabled economy and society

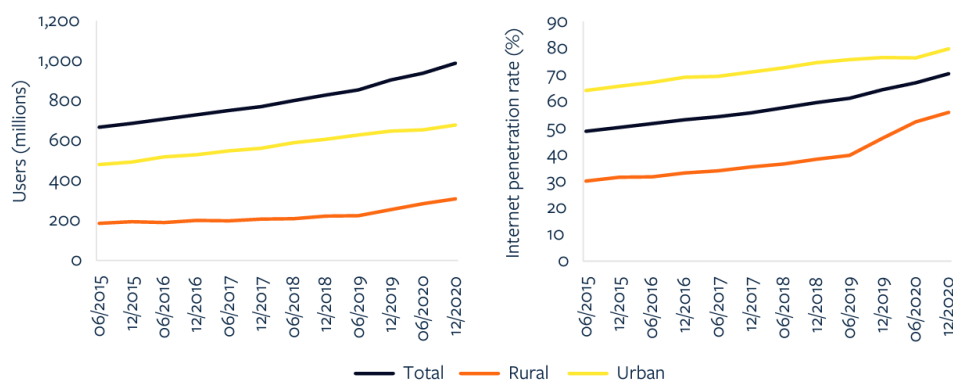
**China has prioritised innovation-driven development and digital infrastructure construction for several years.** The importance of building digital infrastructure was recognised as early as 2006 with the release of the National Informatisation Development Strategy 2006–2020<sup>2</sup> by the General Office of the Central Committee of the Communist Party of China and the State Council. For 2015–2020, the 13th FYP set targets for expanding household broadband coverage from 40% to 70% (National Development and Reform Commission, 2016). Recent data shows that internet services have become more accessible, and China was set to reach the targets set in the 13th FYP (Figure 1). Beyond internet access, China also published a host of industrial and sectoral policies to fulfil the 13th FYP. The 'Made in China 2025' industrial policy aimed to address gaps in the country's innovation capacity and upgrade the manufacturing sector so that the country can consolidate its major manufacturing country status and establish technology and industrial sectors (Government of China, 2015).<sup>3</sup> A jump in certified patent applications in 2020 speaks to the push for greater innovation (Figure 2).

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<sup>2</sup> The strategy recognised information technology (IT) as a force for development with impacts on the global division of industrial labour that will 'trigger profound changes in today's world, shaping a new pattern of political, economic, social, cultural and military development' (Government of China, 2006). The strategy set targets for the integration of IT across sectors and areas, from e-governance to the service sector.

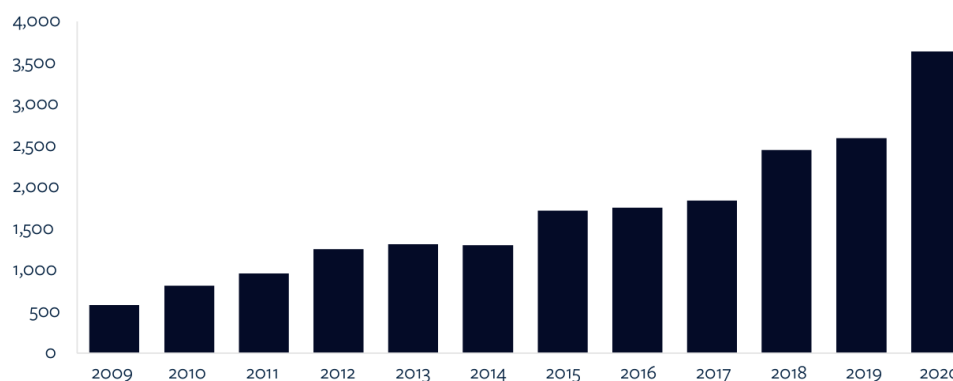
<sup>3</sup> For a list of relevant sectoral plans, see [www.uscc.gov/sites/default/files/Research/The%2013th%20FiveYear%20Plan\\_Final\\_2.14.17\\_Updated%20\(002\).pdf](http://www.uscc.gov/sites/default/files/Research/The%2013th%20FiveYear%20Plan_Final_2.14.17_Updated%20(002).pdf).

**Figure 1: Internet service users and penetration rate**



Source: China Internet Network Information Center, Half-Yearly Statistics, CEIC

**Figure 2: Certified patent applications**



Source: National Bureau of Statistics of China, CEIC

**Digitalisation is a prominent theme in the 14<sup>th</sup> FYP. The Plan sets out a multisectoral and comprehensive approach to mainstreaming digital technologies at individual household and community levels in the delivery of government, health and education services and across economic sectors.** Cloud computing, big data, industrial internet, blockchain, AI and virtual and augmented reality are identified as key industries of the digital economy. In the energy sector, digital technologies will be used to identify opportunities to improve energy efficiency, regulate energy demand, and upgrade coal mines and oil and gas fields. In agriculture, technology will be applied to improve performance across crop growth stages. At the community level, digital technologies will help with introducing smart early-warning systems, emergency rescue and elderly care. To support digitalisation, China will upgrade the existing network and increase 5G user penetration rates to 56%. The sharing and platform economy will be promoted, and companies will be encouraged to open up e-commerce and data sharing (Xinhua, 2021).

**The 14<sup>th</sup> FYP reiterates that China will sustain efforts ‘to promote the construction of a community with a shared future in cyberspace’ which entails advancing the formulation of international rules and standards for data security, digital currency and taxes, under the United Nations framework.** China will seek to establish ‘a multilateral, democratic, and transparent global Internet governance system’ and a ‘fairer and reasonable network infrastructure and resource governance mechanism’. Continued lobbying of developing countries for support for the recently proposed Global Initiative on Data Security, and activism at the International Telecommunication Union (ITU) and other relevant international bodies, will likely be central to these efforts. This will create further unease among countries already concerned about China’s attempts to shape global data governance and its implications for privacy and human rights. China will also continue providing developing countries with technology, equipment and services ‘so that all countries can share the dividends of the digital age’.

**While many countries, including China, are now focusing on upgrading their networks to 5G, China will invest in a ‘forward-looking layout of 6G network technology reserves’.** In November 2019 China announced that it would invest in 6G research and development (Guo, 2019), though rising geopolitical tensions will likely add urgency to developing next-generation technologies. In May 2020, ZTE and China Unicom signed a strategic partnership to collaborate on 6G innovation and standards (ZTE Corporation, 2020). Industry experts anticipate stronger competition for 6G technology, with Japan, European countries, South Korea and the United States countries all starting research into 6G (Zhao, Moritz, and Seal 2020). This geopolitical competition is likely to spill over to developing countries as leading technology companies compete to launch the next generation of technologies.

### **3.2 Chinese overseas investment in digital infrastructure**

**Despite economic challenges associated with the COVID-19 pandemic, the Chinese government has continued to prioritise cooperation on digital infrastructure in its bilateral and regional engagements, and Chinese companies have cooperated on digital infrastructure projects in partner countries (Tanjungco et al., 2020; 2021).** Mapping the scale of China’s involvement in digital infrastructure is, however, challenging. As shown in [Economic Pulse 2](#), between January and November 2020 Chinese companies announced 17 new digital projects in 13 countries and one cross-

border regional initiative for a total value of around \$1.4 million (see Tanjangco et al., 2021).<sup>4</sup>

Both SOEs like CRBC and private companies such as Huawei are playing a role in digital projects overseas. These are geographically diverse and in countries with different income levels. A new project announcement by Huawei in France indicates that security concerns about Huawei raised by the US in relation to the company are not necessarily shared by other developed countries, and that a common security policy towards Chinese investment in digital infrastructure is unlikely. Projects have also been announced in Thailand, where Huawei will build a third data centre to develop a regional hub for digital technology and jointly build a first optical transport network, to serve multinationals and government agencies, with CAT Telecom Public Company. Chinese companies have reportedly exported smart city technologies to over 100 countries in 398 instances (Atha et al., 2020).

**As noted in Economic Pulse 2, it will be important to monitor the impact of the Regional Comprehensive Economic Partnership, a free trade agreement signed between China and ASEAN in November 2020 that contains provisions for e-commerce, to see whether policy announcements will translate into investments. If so, Huawei will likely lead investment and cooperation in research and development (the company established a presence in the region in the late 1990s). In Cambodia, China's key strategic ally in ASEAN, the company is leading the introduction of 5G and won the bid for construction of a Malaysia–Cambodia– Thailand undersea cable system, worth around \$70 million (Xinhua 2015; 2019). As of 2016, Huawei communication networks covered around 70% of Cambodian consumers and around 1,000 people were being trained in information and communication technologies (ICT) (Xinhua, 2016). Huawei is also negotiating the introduction of 5G with Malaysia and the Philippines. Other areas of cooperation between China and ASEAN include big data and smart cities.**

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<sup>4</sup> The total value of projects is a lower-bound estimate as some did not report monetary values. Most projects were also flagged as research and development endeavours rather than actual infrastructure investments, with the latter often costing more.

## 4 Balancing the risks of opportunities

**Growing concerns about technology dependence are prompting some wealthier developed countries to reassess engagement with China in digital infrastructure construction, but poorer developing countries appear reluctant to follow suit.**

In 2019 the US Department of Commerce's Bureau of Industry and Security added Huawei to the Entity List that, for all intents and purposes, barred the company from the country's communications networks. In an effort to limit Huawei's use of US technologies, the Bureau also restricted exports of US technologies to the company (U.S. Department of Commerce, 2020).<sup>5</sup> The company was also banned from bidding on government contracts and/or building 5G networks in other developed countries including Australia, Japan, New Zealand and the UK. Developing countries, however, are resisting the push to exclude the company from their networks. In response to US pressure, the Malaysian government has stated that its security standards will be applied in selecting 5G partners and has not explicitly ruled out using Huawei or other Chinese companies (Sipalan and Das, 2020). Despite criticism of Huawei, as well as pressure and offers of alternative financing for 5G from the US, Brazil did not exclude Huawei from its 5G auctions (Reuters, 2021; Boadle and Shalal, 2020). Early indications suggest that the Biden administration will maintain the prohibition on sales to Huawei and other Chinese companies, but it is still unclear whether it will take any steps, such as offering financial incentives to its allies, to discourage the uptake of Chinese digital infrastructure.

Despite having no formal ban on Huawei, India will reportedly move to phase out Huawei equipment from its 5G networks following the escalation of border clashes with China (Kazmin and Findlay, 2020). Kyrgyzstan scrapped plans for two smart cities that were to be built by Huawei. Although technical disagreements were cited, it is unclear if security concerns played a role in the decision. Huawei, along with Nokia and Ericsson, are among the companies contracted to build 5G networks, equipment globally with Samsung and Qualcomm also looking to gain greater market share (Reuters, 2020). In terms of revenue share of the telecoms market, Huawei leads with 28% while ZTE had an 8% share (Pongrantz, 2020). In 2020, the two Chinese

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<sup>5</sup> Huawei, Hangzhou Hikvision Digital Technology and China Mobile Communications Group were among those sanctioned by OFAC on account of alleged links to the Chinese military (US Department of the Treasury, 2020).

companies also reportedly accounted for 50–60% of wireless equipment sales in Africa and the Middle East (Woo, 2020). It remains to be seen whether more countries will exclude Chinese companies from their 5G networks.

**China’s growing participation in international regulatory and standard-setting bodies such as ITU, which oversees the development of standards and regulations for ICT, is a source of growing concern on similar grounds.** ITU Secretary Zhao Houlin has made favourable comments regarding the BRI and defended Huawei against US allegations regarding security concerns. Chinese companies are well-represented at ITU, with Huawei, Alibaba and ZTE all members.<sup>6</sup> Huawei put forward 2,000 standard proposals to ITU study groups, which may become official standards to be accepted across Africa, the Middle East and Asia, where countries often lack the capacity to set their own standards. Concerns about the proposed standards have been raised on human rights, consumer protection and data privacy grounds (Gross, Murgia, and Yang 2019).

While many governments would like to introduce tighter internet regulations, a proposal for a new internet intellectual property (IP), put forward by Huawei, China Mobile, China Unicom and China’s Ministry of Industry and Information Technology, caused significant concern on the grounds that it would potentially radically alter the nature of the internet, placing greater control in the hands of national governments, including ones that may limit civil liberties (Gross and Murgia, 2020). Huawei, along with ZTE and China Unicom, are also represented at the ITU Telecommunication Development Sector, which provides technical assistance on the development of ICT to developing countries. Chinese companies, both private and state-owned, are thus well positioned to deliver and shape ICT standards in the future.

**It is unclear to what extent concerns about security and data privacy are shared by developing countries, and if so whether this will deter them from cooperating with China, particularly in the absence of competitive alternatives.** Even prior to introducing the 5G network, Huawei had expanded its market share in developing countries thanks to loans to governments and telecommunications companies from China’s Development Bank, Exim Bank and the Bank of China for upgrading telecoms networks (Hart and Link, 2020). In terms of 5G, competitors such as Samsung are reportedly unable to match Huawei in some of the more price-sensitive markets, likely including many developing countries (White, 2020). Nevertheless, Nokia and Ericsson are entering the 5G market in Africa, with Ericsson selected as a 5G network modernisation provider in South Africa and Nokia in Togo, the latter set to be the first 5G network in West Africa (Ericsson, 2019; Nokia, 2020)

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<sup>6</sup> For a full list of ITU sector members, see [www.itu.int/online/mm/scripts/gensel11](http://www.itu.int/online/mm/scripts/gensel11).

## 5 Conclusion

**Digital infrastructure is revolutionising industries, services, and the very nature of how we work and communicate.** However, improving internet access and unlocking opportunities for nearly 4 billion people lacking internet globally will be costly. Providing universal access in Africa alone will cost around \$100 billion. Chinese companies offer opportunities to close infrastructure gaps and access cutting-edge technology, but they are not without risk.

**Domestically, digitalisation is crucial to the next stage of China's development.** The 14<sup>th</sup> Five-Year Plan sets out a multisectoral and comprehensive approach to mainstreaming digital technologies at individual household and community levels, and in the delivery of government, health, and education services and across economic sectors. Amid heightened geopolitical tensions, China is also gearing up for the next stage of technology competition with the United States with plans to invest in nascent 6G technologies.

**Despite COVID-related disruptions, China continued overseas investment in digital infrastructure.** While security concerns are driving the exclusion of Chinese companies from critical infrastructure networks in wealthier countries, many developing economies appear reluctant to follow suit. This does not necessarily indicate an absence of security concerns on the part of those countries. Rather, it may reflect their higher risk tolerance whereby opportunities outweigh security risks particularly in the absence of competitive alternatives. It remains to be seen whether more countries will exclude Chinese companies from their 5G networks.

**With China and Chinese companies at the heart of the digital revolution, both domestically and globally, understanding how Chinese investments can align with national development priorities and country needs, and assessing any associated risks, will be crucial to maximising opportunities offered by these investments for developing economies.** This requires a holistic view of China's digital ambitions that can pinpoint where innovation can cause disruption and what this means for other countries. As such, there is a need for a greater understanding of the landscape of China's development plans for the 4<sup>th</sup> Industrial Revolution and an assessment of risks and opportunities arising from 'disruptions' linked with China's digital innovation and investment.



# References

- Atha, K., Callaghan, J., Chen, J. et al. (2020) *China's smart cities development*. Research report. US–China Economic and Security Review Commission. ([www.uscc.gov/sites/default/files/2020-04/China\\_Smart\\_Cities\\_Development.pdf](http://www.uscc.gov/sites/default/files/2020-04/China_Smart_Cities_Development.pdf) ).
- Boadle, A., and Shalal, A. (2020) 'U.S. Offers Brazil Telecoms Financing to Buy 5G Equipment from Huawei Rivals', 20 October 2020. ([www.reuters.com/article/us-usa-brazil-trade/u-s-offers-brazil-telecoms-financing-to-buy-5g-equipment-from-huawei-rivals-idUSKBN2751TA](http://www.reuters.com/article/us-usa-brazil-trade/u-s-offers-brazil-telecoms-financing-to-buy-5g-equipment-from-huawei-rivals-idUSKBN2751TA)).
- Ericsson (2019) 'Press release: MTN South Africa selects Ericsson for commercial 5G core and radio'. Ericsson, 14 November ([www.ericsson.com/en/press-releases/2019/11/mtn-south-africa-selects-ericsson-for-commercial-5g-core-and-radio](http://www.ericsson.com/en/press-releases/2019/11/mtn-south-africa-selects-ericsson-for-commercial-5g-core-and-radio)).
- Government of China (2006) '中共中央办公厅 国务院办公厅 关于印发《2006—2020年 国家 信息化发展战略》的通知'. Government of China ([www.gov.cn/gongbao/content/2006/content\\_315999.htm](http://www.gov.cn/gongbao/content/2006/content_315999.htm)).
- Government of China (2015) '国务院关于印发《中国制造2025》的通知'. Government of China ([www.gov.cn/zhengce/content/2015-05/19/content\\_9784.htm](http://www.gov.cn/zhengce/content/2015-05/19/content_9784.htm)).
- Gross, A. and Murgia, M. (2020) 'China and Huawei propose reinvention of the internet'. Financial Times, 27 March ([www.ft.com/content/c78be2cf-a1a1-40b1-8ab7-904d7095e0f2](http://www.ft.com/content/c78be2cf-a1a1-40b1-8ab7-904d7095e0f2)).
- Gross, A., Murgia, M. and Yang, Y. (2019) 'Chinese tech groups shaping UN facial recognition standards'. Financial Times, 1 December ([www.ft.com/content/c3555a3c-0d3e-11ea-b2d6-9bf4d1957a67](http://www.ft.com/content/c3555a3c-0d3e-11ea-b2d6-9bf4d1957a67)).
- Guo, M. (2019) 'China launches research and development of 6G technology'. China Global Television Network, 6 November (<https://news.cgtn.com/news/2019-11-06/China-launches-research-and-development-of-6G-technology-Lpdw0kAYec/index.html> ).
- Hart, M. and Link, J. (2020) *There is a solution to the Huawei challenge*. Center for American Progress, 14 October ([www.americanprogress.org/issues/security/reports/2020/10/14/491476/solution-huawei-challenge/](http://www.americanprogress.org/issues/security/reports/2020/10/14/491476/solution-huawei-challenge/) ).



- ITU UNESCO – International Telecommunication Union and United Nations Educational, Scientific and Cultural Organization (2019) *Connecting Africa through broadband: a strategy for doubling connectivity by 2021 and reaching universal access by 2030*. ITU and UNESCO: Broadband Commission for Sustainable Development ([www.broadbandcommission.org/Documents/working-groups/DigitalMoonshotforAfrica\\_Report.pdf](http://www.broadbandcommission.org/Documents/working-groups/DigitalMoonshotforAfrica_Report.pdf) ).
- Kazmin, A. and Findlay, S. (2020) 'India moves to cut Huawei gear from telecoms network'. Financial Times, 24 August ([www.ft.com/content/55642551-f6e8-4f9d-b5ba-a12d2fc26ef9](http://www.ft.com/content/55642551-f6e8-4f9d-b5ba-a12d2fc26ef9)).
- National Development and Reform Commission (2016) *13th Five Year Plan for economic and social development of the People's Republic of China, 2016–2020*. Beijing: National Development and Reform Commission ([https://en.ndrc.gov.cn/newsrelease\\_8232/201612/P020191101481868235378.pdf](https://en.ndrc.gov.cn/newsrelease_8232/201612/P020191101481868235378.pdf)).
- Nokia (2020) 'Press release: Nokia and Togocom deploy first 5G network in West Africa'. Nokia, 30 November ([www.nokia.com/about-us/news/releases/2020/11/30/nokia-and-togocom-deploy-first-5g-network-in-west-africa/](http://www.nokia.com/about-us/news/releases/2020/11/30/nokia-and-togocom-deploy-first-5g-network-in-west-africa/) ).
- Pongrantz, S. (2020) 'The telecom equipment market 2019'. Dell'Oro Group, 2 March ([www.delloro.com/the-telecom-equipment-market-2019/](http://www.delloro.com/the-telecom-equipment-market-2019/) ).
- Reuters (2020) 'Factbox: Deals by major suppliers in the race for 5G'. Reuters, 17 June ([www.reuters.com/article/us-telecoms-5g-orders-factbox-idUSKBN23O2G4](http://www.reuters.com/article/us-telecoms-5g-orders-factbox-idUSKBN23O2G4)).
- Reuters (2021) 'Brazil regulator approves 5G spectrum auction rules, no Huawei ban'. Reuters, 26 February ([www.reuters.com/article/brazil-telecoms-idUSL1N2KV39X](http://www.reuters.com/article/brazil-telecoms-idUSL1N2KV39X)).
- Sipalan, J. and Das, K.N. (2020) 'Malaysia to choose 5G partners based on own security standards'. Reuters, 17 February ([www.reuters.com/article/us-telecoms-5g-malaysia-huawei/malaysia-to-choose-5g-partners-based-on-own-security-standards-idINKBN20B0TV](http://www.reuters.com/article/us-telecoms-5g-malaysia-huawei/malaysia-to-choose-5g-partners-based-on-own-security-standards-idINKBN20B0TV) ).
- Strusani, D. and Hounghonon, G.V. (2020) 'Accelerating digital connectivity through infrastructure sharing'. Note 79. Washington DC: International Finance Corporation ([www.ifc.org/wps/wcm/connect/2d3c4eff-12a8-4b0b-b55d-9113a950ed33/EMCompass-Note-79-Digital-Infrastructure-Sharing.pdf?MOD=AJPERES&CVID=n2dwWtn](http://www.ifc.org/wps/wcm/connect/2d3c4eff-12a8-4b0b-b55d-9113a950ed33/EMCompass-Note-79-Digital-Infrastructure-Sharing.pdf?MOD=AJPERES&CVID=n2dwWtn)).
- Tanjangco, B., Cao, Y., Nadin, R. et al. (2020) *Pulse 1: Covid-19 and economic crisis – China's recovery and international response. Research report*. London: ODI (<https://odi.org/en/publications/economic-pulse-1-covid-19-and-economic-crisis-chinas-recovery-and-international-response/> ).

- Tanjangco, B., Cao, Y., Nadin, R. et al. (2021) *Pulse 2: China navigates its Covid-19 recovery – outward investment appetite and implications for developing countries*. Research report. London: ODI (<https://odi.org/en/publications/economic-pulse-2-china-navigates-its-covid-19-recovery-outward-investment-appetite-and-implications-for-developing-countries/>).
- US Department of Commerce (2020) 'Commerce addresses Huawei's efforts to undermine entity list, restricts products designed and produced with US technologies'. US Department of Commerce ([www.commerce.gov/news/press-releases/2020/05/commerce-addresses-huaweis-efforts-undermine-entity-list-restricts](http://www.commerce.gov/news/press-releases/2020/05/commerce-addresses-huaweis-efforts-undermine-entity-list-restricts)).
- White, E. (2020) 'Samsung mounts 5G offensive as countries review Huawei networks'. Financial Times, 4 October ([www.ft.com/content/4ef1d31f-ebfe-475e-97fb-3c7993b11202](http://www.ft.com/content/4ef1d31f-ebfe-475e-97fb-3c7993b11202)).
- Woo, S. (2020) 'US to offer loans to lure developing countries away from Chinese telecom gear'. Wall Street Journal, 18 October ([www.wsj.com/articles/u-s-to-offer-loans-to-lure-developing-countries-away-from-chinese-telecom-gear-11603036800](http://www.wsj.com/articles/u-s-to-offer-loans-to-lure-developing-countries-away-from-chinese-telecom-gear-11603036800)).
- World Economic Forum (2020) *The impact of 5G: creating new value across industries and society*. Geneva: World Economic Forum.
- Xinhua (2015) 'Huawei wins bid to build Malaysia-Cambodia-Thailand undersea cable'. China Daily, 26 May ([www.chinadaily.com.cn/business/tech/2015-05/26/content\\_20818774.htm](http://www.chinadaily.com.cn/business/tech/2015-05/26/content_20818774.htm)).
- Xinhua (2016) 'China's Huawei helps Cambodia enhance ICT development'. China Daily, 13 December ([www.chinadaily.com.cn/business/2016-12/13/content\\_27651685.htm](http://www.chinadaily.com.cn/business/2016-12/13/content_27651685.htm)).
- Xinhua (2019) 'China's Huawei to build 5G network in Cambodia: Cambodian senior official'. Xinhua, 25 April ([www.xinhuanet.com/english/2019-04/25/c\\_138009211.htm](http://www.xinhuanet.com/english/2019-04/25/c_138009211.htm)).
- Xinhua (2021) '中华人民共和国国民经济和社会发展第十四个五年规划和2035年远景目标纲要'. Xinhua, 13 March ([www.gov.cn/xinwen/2021-03/13/content\\_5592681.htm](http://www.gov.cn/xinwen/2021-03/13/content_5592681.htm)).
- Zhao, S., Moritz, S. and Seal, T. (2020) 'Forget 5G, the US and China are already fighting for 6G dominance'. Bloomberg, 8 February ([www.bloomberg.com/news/features/2021-02-08/forget-5g-the-u-s-and-china-are-already-fighting-for-6g-dominance](http://www.bloomberg.com/news/features/2021-02-08/forget-5g-the-u-s-and-china-are-already-fighting-for-6g-dominance)).
- ZTE Corporation (2020) 'ZTE and China Unicom sign a strategic cooperation agreement on 6G'. Press release, 20 May ([www.zte.com.cn/global/about/news/20200520e1.html](http://www.zte.com.cn/global/about/news/20200520e1.html)).