South Asia Scan

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Executive Summary

In 2019, India found itself caught between the United States (US) and China on Huawei's access to the Indian 5G mobile technology market. India wanted to maintain a workable relationship with China, which then was both a critical economic partner and a strategic threat. Chinese companies have been investing in India's growing digital economy. Simultaneously, India has a burgeoning defence and strategic partnership with the US which, among other things, was quickly emerging as India's largest defence supplier. The US served as a bulwark for India against growing Chinese influence in Asia and the world.

In 2019, US President Donald Trump's administration sought to restrict Huawei's access to global markets, pressuring partners and allies to ban the company from their domestic markets. India was a key target, given the size of its digital market. In 2019, India wanted to keep all channels open and maintain both these relationships (with China and the US). Thus, India looked to downplay the issue of Huawei's entry into its 5G network deployment. At the time, Indian Foreign Secretary, S Jaishankar, called the issue a "telecom issue" and not a "geopolitical" one. Two years later, Huawei was banned in India. The Galwan Valley crisis in June 2020 forced a rethink on the issue. What emerged was a new direction in India's approach to technology cooperation with other countries and specifically with Chinese companies in the Indian technology sector. After the Galwan Valley incident, India adopted a more security focused approach. China is now largely seen as a geopolitical threat with engagement being tempered. Meanwhile, India has embraced the US' position in the technology competition, working with it and its allies to limit and roll back Chinese influence in the Indo-Pacific.

This South Asia Scan analyses the trajectory through which India has arrived at its current position. It analyses the debates and discourses within India's strategic community surrounding Huawei's involvement in India's 5G network deployment. The Indian domestic debate on Huawei can be seen as a microcosm of the larger debate surrounding China's relationship with India. It groups the debate into three broad schools of thought – the Globalisation School, the Self-Reliance School and the National Security School. It then highlights the change

in the policy direction of the Indian government following the Galwan Valley clashes in June 2020. Finally, it studies the impact of this new policy direction on issues of foreign policy, economic engagement, national security and domestic technology development. Ultimately, it concludes with some thoughts for the future.

Introduction

In July 2019, soon after Trump blacklisted Chinese telecommunication giants, Huawei and ZTE, the Chinese foreign ministry released a statement asking New Delhi not to tiptoe the American line. As the Chinese foreign ministry statement stated, "On the issue of Chinese enterprises participating in the construction of India's 5G, we hope the Indian side makes an independent and objective decision, and provides a fair, just and non-discriminatory commercial environment for Chinese enterprises' investments and operations, to realise a mutual benefit."[1] Privately, the Chinese foreign minister warned India's Ambassador to Beijing, Vikram Misri, of "reverse sanctions" on Indian companies if New Delhi blocked Huawei's participation in India's 5G network trials. Washington, too, employed diplomatic pressure on New Delhi. In October 2019, US Senator Ted Cruz argued against Huawei on the pretext of growing Indo-US strategic partnerships during his visit to New Delhi. As Cruz argued, "[the] US has made it clear that it would be severely constrained in sharing intelligence with any nation that installs Huawei equipment; that undermines US national security and that of any country that installs it."[2]

Under the urge to follow its traditional policy of non-alignment, the need to pursue technological autonomy and, most importantly, an inclination to mend relations with Beijing, as underlined by the Wuhan summit meeting between India's Prime Minister Narendra Modi and Chinese President Xi Jinping, New Delhi ignored American entreaties. During the second summit meeting between Modi and Xi in December 2019, India reiterated its unbiased approach toward Huawei. The Indian government's Department of Telecommunications (DoT) invited all stakeholders and major equipment vendors, including Huawei, to discuss the 5G roadmap and the pending network trials. As India's Minister of Telecommunications Ravi Shankar Prasad stated,

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1 Sanjeev Miglani and Neha Dasgupta, "China warns India of "reverse sanctions" if Huawei is blocked-sources", *Yahoo News*, 6 August 2019, https://news.yahoo.com/exclusive-china-warns-india-reverse-141005256.html?fr=sycsrp_catchall.

2 Suhasini Haidar, "China is the most significant geopolitical threat: U.S. Senator Ted Cruz", *The Hindu*, 13 October 2019, https://www.thehindu.com/news/national/china-is-the-most-significant-geopolitical-threat-us-senator-ted-cruz/article29668129.ece.

the government had taken an "in principle decision to give 5G spectrum for trials", and the "5G trials will be done with all vendors and operators".[3]

However, India's desire for technological autonomy and its quest to walk a tightrope between China and the US crashed at the altar of the Sino-Indian territorial dispute. As India allowed Huawei to participate in the 5G network trials, beginning in April 2020, the People's Liberation Army (PLA) was busy planning and executing a series of advancements across the Sino-Indian frontier, particularly in the northern region of Ladakh. By May 2020, as the Indian forces finally gauged the level of the PLA's forward deployments in the contested border region, the two armies engaged in several intense stand-offs. The ensuing crisis resulted in the deadliest confrontation between the two Himalayan neighbours in almost four decades. In June 2020, in the Galwan Valley, soldiers of the Indian Army and the PLA clashed, resulting in several casualties on both sides. The summer of 2020 rendered the entire Himalayan border active, with both sides' heavy deployments of troops and firepower along the frontier.

One of the biggest casualties of the crisis is Huawei's future in India. Though India's Minister of State for Electronics and Information Technology Sanjay Dhotre informed the parliament that no proposal existed to exclude Chinese companies from India's 5G rollout in September 2020, by December 2020, the Indian government issued a National Security Directive for the Telecommunication Sector, requiring telecommunication service providers (TSPs) to procure telecommunication equipment from "trusted sources", practically restricting Chinese firms from operating in India. In May 2021, the government invited all telecommunication companies, except Huawei and ZTE, to participate in India's 5G network trials.

Evidently, India's response to China's grey zone tactics in the Himalayas is not restricted to conventional military deterrence. Using a playbook from the Chinese strategy, India has deployed its

[3] "India allows Huawei to participate in 5G trials", *The Economic Times*, 31 December 2019, https://economictimes.indiatimes.com/industry/telecom/telecom-news/govt-will-give-5g-spectrum-for-trials-to-all-players-prasad/articleshow/73033442.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

asymmetric economic relationship with China to punish Beijing. Given the vastness of the Indian market and the growth potential, a ban on Chinese firms signals economic coercion. India took the first step when it banned several Chinese applications from operating in India, citing security concerns. However, Huawei's subsequent exclusion from India's 5G trials appears to be motivated by a strategic logic. First, it signifies a greater trend towards economically decoupling from China to reduce India's vulnerability, given its economic, especially trade, dependence on China. Second, it underlines India's growing convergence on certain technology issues with the US. This convergence is increasingly becoming multi-focal: from geopolitical to economic and increasingly technological. Lastly, India is using the Galwan Valley crisis to develop and mainstream homegrown technological solutions. However, India's effort to shore up its 5G capability is an example of economic statecraft rather than simply a pursuit of industrial policy, as it aims to use the international politics of 5G technology competition between China and the West to develop technology alliances and indigenous solutions.

This Scan will cover and present India's 5G debates and their consequences vis-à-vis India's emerging foreign, economic and national security policies as well as its domestic technological capability. The first section investigates the nature of 5G technology, India's telecommunication sector and the role of Huawei in India's digital landscape. The second section unpacks domestic debates over the causes and consequences of Huawei's participation in India's 5G network. Before the Galwan Valley crisis, as this section shows, the positions on Huawei's participation were wide-ranging. The third section covers how China's actions along the Himalayas forced New Delhi to recalibrate its policies. It will discuss the implications of India's decision to virtually block Huawei from India's 5G infrastructure after the Galwan Valley crisis and how this move impacts India's foreign and economic policies, and technology development. India's 5G actions reflect how it employs economic statecraft with the help of its private sector and uses the opportunities provided by the Sino-US technological competition to further its 5G ambitions.

The Multifaceted Nature of 5G

5G technology is the latest iteration of mobile communication technologies. The most pressing issue is the crowding of the 4G network spectrum, resulting in lower mobile broadband speeds. The economic potential embedded in the adoption of 5G technology is immense – for India and globally. As per one estimate, adopting 5G technology could generate nearly US$12 trillion (S$15.99 trillion) in revenue across industries by 2035.[4] It is estimated that 5G adoption in India will add US$1 trillion (S$1.3 trillion) to the economy by 2035.[5] 5G technology should improve 4G services by increasing the capacity to support a larger number of connected devices and execute several industrial applications and advanced technologies.

Apart from being solely a mobile communication technology, 5G is seen as an enabler to allow digital services to impact several industries. It will enable faster data transfer rates and increase the number of devices connected. 5G mobile technology, when coupled with other emerging technologies like the internet of things (IoT), cloud services and artificial intelligence (AI), will allow businesses to improve services and increase efficiencies. This includes sectors like healthcare, industrial manufacturing and financial services, not just telecommunication.[6] Given this outlook, 5G has come to be seen as part of the critical infrastructure of a nation's economy. It is widely believed that 5G technology will underpin economic growth in the years to come.

Mobile communications commenced in the early 1980s. The first generation of mobile technologies consisted of cellular phones based on basic analogue networks and supported only voice services. The second generation adopted digital networks that offered better

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4 Jill C. Gallagher and Michael E. DeVine, "Fifth-Generation (5G) Telecommunications Technologies: Issues for Congress", *Congressional Research Service*, 30 January 2019, 8, https://crsreports.congress.gov/product/pdf/R/R45485.

5 "Making India 5G Ready", *Report of the 5G High Level Forum*, Department of Telecommunication, Government of India, 23 August 2018, 48, https://dot.gov.in/sites/default/files/5G%20Steering%20Committee%20report%20v%2026_0.pdf?download=1.

6 "The global economic impact of 5G. Powering your tomorrow", PWC Report, https://www.pwc.com/gx/en/industries/technology/publications/economic-impact-5g.html.

quality in terms of communications and supported both voice and texting services. The third generation offered broadband access alongside voice and texting, allowing users to access email and video streaming services. Finally, the fourth generation increased broadband capacity, supporting more online activities, including live streaming and online gaming. However, the current frequency spectrum on which 4G technology is based (for example, 6 GHz and below), is getting strained and overcrowded, reducing speed and capacity. The 5th generation technologies address and overcome these problems.[7]

5G is a shorthand for a host of innovative technologies that promise to increase the capacity of current network infrastructure and improve the quality of services delivered. Why is 5G revolutionary? First, 5G represents the transformation of telecommunications architecture (as underlined in 2G, 3G and 4G versions) from "static networks and switches" to very "responsive, high-powered computers and networks managed by software".[8] The physically separated layers of the internet – content, applications, logical and physical – can now operate in remarkably close proximity. 5G, thus, provides the modus operandi for connecting "billions of devices" and transferring "data at much faster and more reliable rates".[9] These technological innovations exist on the network's hardware and software side. On the hardware, 5G technology offers a mix of different frequency spectrums – low (less than 1 GHz), medium (1-6 GHz) and high (above 6 GHz) frequency spectrums – to meet different scenarios relating to coverage, connectivity, and latency. Given the different frequency spectrums, a new telecommunications network architecture with a new antenna design and a network of cells to provide adequate coverage is required.[10]

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7 "5G—Enabling the future economy", Department of Infrastructure, Transport, Regional Development and Communications, Australian Government, October 2017, https://www.infrastructure.gov.au/sites/default/files/5g-enabling-the-future-economy.pdf.

8 Stacie Hoffman, Samantha Bradshaw and Emily Taylor, "Networks and Geopolitics: How great power rivalries infected 5G", Oxford Information Labs, 2020, 7.

9 Ibid.

10 Amy Nordrum, Kristen Clark and IEEE Spectrum Staff, "Everything You Need to Know About 5G", IEEE, 27 January 2017, https://spectrum.ieee.org/video/telecom/wireless/everything-you-need-to-know-about-5g; and David Talbot, "5G Wireless Is Coming, and It's Going to Blow You Away", *MIT Technology Review*, 27 July 2016, https://www.technologyreview.com/2016/07/27/108042/5g-wireless-is-coming-and-its-going-to-blow-you-away/.

5G's support for all critical infrastructure renders it crucial not only for social and economic development but also for national security, commercial dependencies, and the global governance of technology. For one, given the virtualisation of the network supported by software rather than physical nodes, 5G will underline a shift where service providers can and will integrate the hardware, software, network management and services under one "vertically integrated business model".[11] 5G is, therefore, highly susceptible to technological monopolies which can integrate across technological domains. This feature also renders a great first-mover advantage to firms and companies which can set the standards and provide early solutions to capture entire markets.[12] The first-mover advantage is further reinforced by the patents and intellectual property rights that will help generate constant revenue and domination, irrespective of the widespread sharing of technological specifications. 5G's susceptibility to techno-economic monopolies and the ubiquitous power of service providers also leave the network open to control, manipulation and surveillance. If in the hands of authoritarian governments, such control creates avenues for domestic abuse of the internet within the state; in international politics, it engenders avenues for economic and technological coercion. Commercial liabilities notwithstanding, 5G poses unique challenges to national security.

The vulnerability of the 5G network rises out of its technological characteristics. 5G networks are highly dependent on software and high-capacity computers and will have a far greater number of devices connected to the network. These characteristics drastically increase the avenues of attack on the 5G network.[13] Furthermore, the need for specialised service providers to maintain the network gives

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[11] Stacie Hoffman, Samantha Bradshaw and Emily Taylor, "Networks and Geopolitics: How great power rivalries infected 5G", op. cit., p. 10.

[12] Ibid, p. 11.

[13] For a broader discussion on security risks of 5G technology, see James Sullivan and Rebecca Lucas, "5G Cyber Security: A Risk-Management Approach", Occasional Papers, RUSI, February 2020, https://static.rusi.org/20200602_5g_cyber_security_final_web_copy.pdf. Some scholars have also pointed to the possibility of separating core and edge networks in 5G telecommunication infrastructure and keeping Chinese companies out of the core networks as a means to mitigate security risks posed by Huawei. Others contend that the nature of 5G technology is to remove the distinction between the core and edge altogether and; hence, excluding Huawei from the core network is not possible. For a discussion on this aspect, see Simeon Gilding, "5G choices: a pivotal moment in world affairs", *The Strategist*, 29 January 2020, https://www.aspistrategist.org.au/5g-choices-a-pivotal-moment-in-world-affairs/.

them unimpeded access to data, information, services, and systems. Therefore, trust in the service provider is central to security in 5G networks.[14] Traditional mitigation techniques such as the "testing and monitoring" of network equipment are not highly effective in the case of 5G since they require extensive checks on highly voluminous codes to detect backdoors and vulnerabilities.

[14] Rajiv Shah, "Ensuring a trusted 5G ecosystem of vendors and technology", *ASPI Policy Brief Report No. 30/2020*, Australian Strategic Policy Institute, 17 September 2020, https://www.aspi.org.au/report/ensuring-trusted-5g-ecosystem-vendors-and-technology.

The Telecommunication Sector in India

India's first mobile telephone call was made in July 1995 between Jyoti Basu, Chief Minister of West Bengal, and Communications Minister Sukh Ram. Since then, the Indian mobile market has grown exponentially. The sector began gradually, and up until the 1990s, telecommunication services in India were provided mainly by the DoT. India skipped the first generation of mobile telephony based on analogue communications and delved straight into 2G digit transmission technology.[15] In the early 1990s, tele-density in India stood at a meagre 0.8, compared to the global average of 10, and tariff rates stood at ₹16.80 (S$0.29), ₹30.00 (S$90.52) and ₹75.00 (S$1.31) for local, subscriber trunk dialling (STD) and international subscriber dialling (ISD) calls respectively.[16] The National Telecom Policies (NTP) of 1994 and 1999 gave a major push for the sector's liberalisation, easing many barriers for private TSPs to enter the telecommunication sector. The 1994 NTP called for private investment to expand the existing telecommunication infrastructure. The country was divided into various 'telecommunication circles' where licences were granted to private telecommunication operators. However, in the policy's implementation, the government ensured a duopoly where a private TSP had to compete with the state entity. This led to a situation wherein the DoT created rules and guidelines that favoured the state-owned TSP. Further, the TSPs took the Indian government to court over irregularities in the existing rules governing the sector.

To remedy this situation and generate market-based competition, the government brought out the 1999 NTP. The policy ended the earlier duopolistic regime and paved the way for the entry of private players into basic telecommunications. It also mandated connections between service providers. The 1999 NTP also restructured the DoT, and a subsidiary arm called the Department of Telecom Services (DTS) was set up to ensure a separation of the policymaking functions of

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[15] Tushar Burman, "Revisiting the history of the cell phone", *The Hindu*, 17 April 2018, https://www.thehindu.com/sci-tech/technology/revisiting-the-history-of-the-cellphone/article23560685.ece.

[16] R. U. S. Prasad, "The Impact of Policy and Regulatory Decisions on Telecom Growth in India", *Working Paper No. 361*, Stanford University (July 2008): 4.

the DoT from its service delivery role. The DTS was later corporatised to form Bharat Sanchar Nigam Limited (BSNL). Although the move partly precluded the 1999 NTP, the establishment of an independent regulator in 1997, the Telecom Regulatory Authority of India (TRAI), and a dispute resolution mechanism, Telecom Disputes Settlement and Appellate Tribunal, in 2000 went a long way to establishing a regulatory framework that enhanced market competition.[17]

With more competition, telecommunication services became accessible and affordable. For instance, by 2007, call rates were down to ₹1.0 (S$0.017), ₹2.4 (S$0.042) and ₹6.40 (S$0.11) for local, STD and ISD calls respectively. In addition, tele-density increased to almost 24.[18] Between 2002 and 2007, the share of wireless devices increased from 15 per cent to 85 per cent.[19] In 2010, India was set to launch mobile communication services based on 3G technology. Several private TSPs believed that mobile data services through 3G technology would herald a new phase in telecommunications. The annual report of Bharti Airtel in 2011-12 stated that "with the advent of 3G in India, the telecommunication market is all set to witness a new wave of mobile applications ushering the growth of data services."[20] Similarly, Idea Cellular, in its annual report of 2010-11, argued that "with [the] launch of 3G services and the improvement in 3G ecosystems in terms of devices, applications and contents,…(Idea Cellular) is all set to exploit the untapped wireless broadband data market and other emerging verticals of revenue like Mobile banking, M-commerce, M-health, M-education, etc."[21] The commercial 3G rollout in India began in 2010 with the auctioning of the 3G spectrum. Nine different TSPs participated, and the government was able to generate nearly US$15 billion (S$21.35 billion) from the bidding

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[17] This paragraph is a summation from overviews provided by the following: R.U.S. Prasad, "The Impact of Policy and Regulatory Decisions on Telecom Growth in India", Ibid, "India Attempts to Give a Jump-start to Its Derailed Telecommunications Liberalization Process," 15 October 2020, https://arxiv.org/pdf/cs/0109062.pdf. ; "Licensing Framework for Telecom: A Historical Overview," Telecom, Centre for Internet and Society, 15 October 2020, https://cis-india.org/telecom/resources/licensing-framework-for-telecom.

[18] Prasad, "The Impact of Policy and Regulatory Decisions on Telecom Growth in India", op. cit., p. 22.

[19] Ibid, p. 4.

[20] "Bharti Airtel Limited Annual Report 2010-11", Bharti Airtel, p. 24, http://www.moneycontrol.com/bse_annualreports/5324540311.pdf.

[21] "Idea Cellular Annual Report 2010-2011", Idea Cellular, p. 5, https://www.vodafoneidea.com/content/dam/vodafone-microsite/docs/pdf/investor-/results/annual-reports/FY%202010-11.pdf. Also accessed through https://assignmentpoint.com/annual-report-2010-2011-of-idea-cellular-limited-aditya-birla-group/.

process.[22] At the end of the financial year 2010-11, 698.37 million (86.05 per cent) were Global System for Mobile Communications (GSM) [2G] subscribers, and 113.22 million (13.95 per cent) were Code-Division Multiple Access (3G) subscribers.[23] By December 2011, 48.2 per cent of total wireless subscribers had access to data services.[24] By 2012, 88 per cent of the market belonged to private TSPs.[25] Several private entities were competing in India's telecommunication market, chief among which were Bharti Airtel, Reliance Communication, Vodafone, Tata, Idea Cellular and Aircel.

However, the 3G data boom did not take off for several reasons. Firstly, the base spectrum price in auctions was 70 per cent greater than the world average for the same type of spectrum.[26] Deploying a 3G network, therefore, required an extremely high investment. However, stiff market competition and price wars between service providers in the sector meant that service providers could not charge consumers high prices for data and voice services. If they did, they ran the risk of losing market share to competitors. As a result, companies limited the investment and deployment of 3G networks to areas where a significant return on investment was guaranteed. These areas resided in a few pockets of major cities, limiting both coverage and capacity.

Secondly, consumers were reluctant to adopt 3G due to its low speed. There is no difference between the speeds of a 2G network on a General Packet Radio Service, enhanced data rates for GSM evolution technology or 3G technology. While data consumption had grown rapidly, primarily led by 3G services, its contribution to the overall revenue of the operators was minuscule compared with voice. The average data usage per GSM subscriber had grown from 50.70 megabytes in December 2013 to 79.73 megabytes in December

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[22] "India's 3G mobile auction raises $15bn", *BBC*, 19 May 2010, https://www.bbc.com/news/10127649.

[23] "TRAI Annual Report 2010-2011," Telecom Regulatory Authority of India, https://www.trai.gov.in/sites/default/files/ar_10_11.pdf.

[24] "Telecom Sector in India: A Decadal Profile", Department of Telecommunication, p. 17, https://trai.gov.in/sites/default/files/NCAER--Report08june12.pdf.

[25] "National Telecom Policy 2012", Department of Telecommunication, p. 1, https://www.meity.gov.in/writereaddata/files/National%20Telecom%20Policy%20(2012)%20(480%20KB).pdf.

[26] Manu Kaushik, "Distress Call", *Business Today*, 5 July 2015, https://www.businesstoday.in/magazine/trends/factors-that-are-contributing-to-death-of-3g-in-india/story/220551.html.

2014, a jump of 57 per cent.[27] However, data usage contributed only 17.1 per cent to the average revenues of the telecommunication companies in December 2014.[28]

The growth in 3G networks was further hampered by the rise and deployment of 4G networks in India. Bharti Airtel was the first to launch 4G services in India in 2012.[29] 4G services offered better internet connectivity at higher speeds, as compared to 3G. Indian consumers moved to 4G services before revenue streams from 3G services could fully materialise. However, the entrance of Reliance Jio severely disrupted the market in 2016. Reliance Jio offered free voice calls and extremely low prices for data and text messages. Reliance Jio pioneered the Voice over Long Term Evolution (LTE) technology to provide high-quality voice calls and data services. In 2015, India crossed one billion wireless subscribers.[30] However, the growth in data consumption was remarkable. From 2014 to 2018, the number of wireless data subscribers doubled from 280 million to 580 million; the total number of wireless subscribers grew by 20 per cent between 2014 and 2018. By contrast, the total number of data subscribers grew by almost 50 per cent.[31] The growth in data subscribers can be attributed to data pricing in India. In 2018, one gigabyte of mobile data costs US$0.26 (S$0.37) in India, while the price was close to US$12.37 (S$17.60) in the US and US$6.66 (S$9.48) in the United Kingdom (UK).[32]

Despite the phenomenal growth of consumer base and revenues, India's telecommunication sector, to use the words of Professor Bhaskar Ramamurthi, was caught in a "maze of deficiencies".[33] These deficiencies largely accrued from four interconnected factors.

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[27] Manu Kaushik, "Distress Call", op. cit.

[28] Ibid.

[29] "First 4G data service launched in India", *BBC*, 10 April 2012, https://www.bbc.com/news/world-asia-india-17662393.

[30] "India mobile subscribers rise to more than 1 billion", *Reuters*, 30 December 2015, https://in.reuters.com/article/india-telecoms-idINKBN0UD1A220151230.

[31] "Wireless Data Services in India: An Analytical Report", Telecom Regulatory Authority of India, https://trai.gov.in/sites/default/files/Wireless_Data_Service_Report_21082019_0.pdf.

[32] Sindhu Hariharan, "India's mobile data is cheapest globally", *The Times of India*, 7 May 2019, http://timesofindia.indiatimes.com/articleshow/68294413.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

[33] "India's 5Gi standard: Manufacturing Ecosystem and Impact," *YouTube*, Streamed live on 15 August 2021, https://www.youtube.com/watch?v=PQes76ULZZs.

First, India's telecommunication sector was heavily dependent on foreign supply chains. Between 2009 and 2015, the value of electronics hardware production in India rose from US$21.1 billion (S$30.03 billion) to US$30.6 billion (S$43.55 billion), a rise of merely 30 per cent over 10 years.[34] However, the production value of telecommunication and broadcasting equipment between 2007 and 2015 rose by merely a billion dollars – from US$2.1 billion (S$2.99 billion) to US$3.1 billion (S$4.41 billion).[35] The gap between the import and export of telecommunication equipment was huge: India exported only US$285 million (S$405.61 million) of telecommunication products, compared to US$3.303 billion (S$4.7 billion) of imports, resulting in a trade deficit of almost US$3 billion (S$4.27 billion). Almost two-thirds of these imports were procured from China; in 2015, India imported US$2.12 billion (S$3.02 billion) of telecommunication equipment from China. The situation has improved drastically in terms of exports, which have risen almost by 15 times, to US$4.13 billion (S$5.88 billion) in 2021. However, in the same period, the imports of telecommunication equipment tripled in size to US$9.3 billion (S$13.24 billion).[36] India's dependence on China has reduced in absolute terms but remains substantial. In 2021, India imported US$4.5 billion (S$6.4 billion) worth of telecommunication equipment from China.[37] Second, as the statistics above indicate, India's telecommunication sector was and remains a net negative foreign exchange player in India's trade matrix, putting an enormous burden on precious foreign exchange reserves. Third, India's telecommunication sector was hardly involved in value addition, both in terms of intellectual property patents as well as setting global standards for telecommunication equipment. Until 2014-15, India was visibly absent from the global standard-setting bodies such as the 3rd Generation Partnership Project (3GPP) which resulted in hardly any India-specific standards for 2G, 3G or 4G networks.

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[34] "Value of electronics hardware production in India from financial year 2009 to 2020", *Statista*, https://www.statista.com/statistics/757032/electronics-hardware-production-value-india/.

[35] "Production value of communication and broadcasting equipment across India from FY 2007 to FY 2015", *Statista*, https://www.statista.com/statistics/757032/electronics-hardware-production-value-india/.

[36] Ministry of Commerce and industry,https://dashboard.commerce.gov.in/commercedashboard.aspx.

[37] Ibid.

India's share of IoT patents was also minuscule. Between 2009 and 2019, 70 per cent of IoT patents filed in India came from multinational companies, compared to 2.1 per cent by Indian start-ups, 4.6 per cent by indigenous companies and 4.8 per cent by Indian universities. Network providers hardly invested in manufacturing or research and development (R&D). The uniqueness of India's market forced TSPs to make huge investments but were unable to set prices for data and voice services in a financially sustainable range. This constraint severely undercuts the profitability of TSPs and puts them under intense financial strain.

Before Reliance Jio entered into the Indian telecommunication sector, the sector had a poor economic outlook. The overall debt of the sector was estimated to be around US$33 billion (S$46.97 billion). The debt of Bharti Airtel, Vodafone and Idea Cellular – the three leading TSPs in India – was estimated to be at US$9 billion (S$12.81 billion), US$5 billion (S$7.12 billion) and US$2 billion (S$2.85 billion) respectively in December 2013. Reliance Jio's entry into the market and resulting competition exacerbated the situation. By March 2019, the debts of Vodafone-Idea Cellular and Bharti Airtel were ₹14 billion (S$244.7 million) and ₹15 billion (S$262.1 million) respectively.[38] In October 2019, the Supreme Court ordered the telecommunication sector to pay an additional US$13 billion (S$18.5 billion) in penalties and arrears to the government by early 2020.[39] Price wars between network providers have also been extremely debilitating. For instance, Bharti Airtel had to invest nearly US$230 million (S$327.4 million) to US$500 million (S$711.71 million) to upgrade its 4G network to compete with Reliance Jio in 2016.[40] The financial health had been affected mainly due to intense price wars to increase market share. However, in 2016, Bharti Airtel was forced to drop its 4G data rates by nearly 80 per cent to compete with Reliance

[38] Mihir Sharma, "India Hangs Up on the Future", *Bloomberg*, 30 October 2019, https://www.bloomberg.com/opinion/articles/2019-10-30/vodafone-bharti-airtel-penalties-threaten-india-telecom-sector.

[39] Mihir Sharma, "India Hangs Up on the Future", op. cit.

[40] "Nokia bags $230 million 4G network deal from Airtel in 9 circles", *The Financial Express*, 7 October 2016, https://www.financialexpress.com/industry/nokia-airtel-to-expand-4g-deployment-in-india/421539/ ; and Danish Khan, "Nokia bags 4G deployment deal worth $500 million from Bharti Airtel", *ET Telecom*, 17 October 2016, https://telecom.economictimes.indiatimes.com/news/nokia-bags-4g-deployment-deal-worth-500-million-from-bharti-airtel/54896573.

Jio.[41] Vodafone and Idea Cellular followed suit.[42] Network providers notwithstanding, the Indian information technology (IT) industry also remained interested in systems integration and software and services support rather than cutting-edge R&D. Lastly, such extreme dependence and low productivity were accentuated by the security vulnerabilities accompanying the 5G network technologies.

The crucial role of 5G in the evolving global technological and economic landscape, its promise and perils, coupled with India's deficient telecommunication sector, posed a major challenge in front of India's decision-makers. It is under these circumstances that Huawei emerged as a major contender in India's 5G future. Huawei's equipment was cheap; blocking Huawei out of the Indian market also entailed higher network deployment costs for India's telecommunication service providers. The next section provides a brief overview of Huawei's operations in India.

[41] "Airtel cuts 4G price by up to 80% to check R Jio effect", *The Hindu Business Line*, 29 August 2016, https://www.thehindubusinessline.com/info-tech/airtel-cuts-4g-price-by-up-to-80-to-check-r-jio-effect/article9045573.ece.

[42] "Vodafone-Idea vs Reliance Jio vs Airtel: Fresh price wars soon – This news will sweeten your mood", *The Financial Express*, 2 July 2018, https://www.financialexpress.com/industry/vodafone-idea-vs-reliance-jio-vs-airtel-fresh-price-wars-soon-this-news-will-sweeten-your-mood/1228376/.

Huawei in India

Huawei's growth since the 1990s is remarkable. From an annual revenue of 146.91 billion yuan (S$100.04 billion) in 2012, the Chinese electronic giant has expanded its revenue share to almost 900 billion yuan (S$180.06 billion) in 2020. Though much of its revenue is generated within China, the Asia-Pacific region's contribution to Huawei's growth has been substantial. Between 2012 and 2019, Huawei's revenue in the Asia-Pacific region grew from 31.2 billion yuan (S$6.24 billion) to 81.2 billion yuan (S$16.25 billion). Its carrier network business doubled in the same period and its consumer business, primarily led by tablets and smartphones, expanded tenfold. From merely four patents in 1999, Huawei's R&D efforts allowed it to accumulate almost 6,000 patents (both in force and pending) by 2018. Its R&D investments in semiconductors alone increased by five times – from US$4.9 billion (S$6.89 billion) in 2013 to US$24.93 billion (S$35.51 billion) in 2019.

In the 1990s, Huawei expanded overseas. Its first overseas R&D centre in Bangalore was launched in 1999. After setting up its R&D centre, Huawei planned to invest another US$60 million (S$85.46 million) to set up a manufacturing facility in India but this proposal was delayed due to scrutiny by Indian security agencies.[43] While Huawei's engagement was limited in the 2000s, in 2010, it announced a US$2 billion (S$2.85 billion) investment in India spread over five years.[44] In the early 2010s, Huawei's market share was almost 65 per cent, offering services to 250 million people, directly or indirectly. India was emerging as a major market for Huawei and as a test case for future expansion worldwide. "We believe that if we can survive in India, we can survive in any other country. All other countries are just a piece of cake", argued Daniel Jiang, Vice President, Enterprise Business Unit, at Huawei.[45] In 2011, Huawei expanded its business

[43] John Rebeiro, "Huawei to expand R&D in India," *Networked*, 31 August 2006, https://www.networkworld.com/article/2306507/huawei-to-expand-r-d-in-india.html.

[44] "Huawei to invest $2 bn in 5 years, set up India plant," *Hindustan Times*, 14 December 2010, https://www.hindustantimes.com/business/huawei-to-invest-2-bn-in-5-years-set-up-india-plant/story-slVoPfJFjLRVGA9UWYVt4L.html.

[45] "Huawei Enterprise Vision for India," *News*, Huawei, 26 May 2012, https://e.huawei.com/en/news/ru/2012/hw_116874.

operations in India with the launch of its enterprise business unit. This new unit provided information and communication technology (ICT) solutions for sectors such as transport, energy, telecommunication, finance and others.[46] Huawei concurrently looked to expand services into smart metering technology, tele-medicine, e-learning and virtual teller machines.

After Modi's trips to China in 2014 and 2015, Huawei inked deals with Reliance Communications for US$157 million (S$223.62 million) and Bharti Airtel inked deals with China Development Bank for US$2.5 billion (S$3.56 billion) and Huawei to provide network equipment.[47] In 2015, Huawei invested a further US$170 million (S$242.14 million) in its Bangalore facility, turning it into its largest R&D facility outside of China.[48] Like other Chinese firms, Huawei also expressed support for Modi's 'Make in India' initiative.[49] In 2016, Huawei began manufacturing smartphones in its Chennai plant, linking the plant with the 'Make in India' initiative.[50] It also announced major expansion plans for its retail market, including 200 service centres and 350 distributors for Huawei's consumer products. Huawei's primary telecommunication-related investments are with domestic firms like Bharti Airtel, Vodafone, Reliance Jio, Tata and Telenor India. In 2012, Bharti Airtel awarded Huawei India a contract to plan, design, supply and deploy LTE networks to offer 4G services in Karnataka.[51] According to one estimate, at the peak of its operations, Huawei

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46 Kalyan Prabat, "Huawei debuts enterprise business solutions; launches telepresence," *The Economic Times*, 10 December 2012, https://economictimes.indiatimes.com/tech/software/huawei-debuts-enterprise-business-solutions-launches-telepresence/articleshow/11058797.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

47 "After Narendra Modi-Xi Jinping meet, India, China ink 12 pacts; $20 bn investment vowed over 5 years", *Financial Express*, 19 September 2014, https://www.financialexpress.com/archive/after-narendra-modi-xi-jinping-meet-india-china-ink-12-pacts-20-bn-investment-vowed-over-5-yrs/1290463/. ; "Airtel secures USD 2.5 billion Chinese financing commitments", *The Indian Express*, 17 May 2015, https://indianexpress.com/article/business/companies/airtel-secures-usd-2-5-billon-chinese-financing-deals/.

48 "Huawei announces state-of-the-art Research & Development (R&D) campus in Bangalore", *Press Release, Huawei*, 10 February 2015, https://www.huawei.com/en/news/2015/02/hw_414011.

49 Go Yamada, "Chinese companies keen to 'Make in India'", *Nikkei Asia Review*, 18 March 2015, https://asia.nikkei.com/Economy/Chinese-companies-keen-to-Make-in-India. https://www.huawei.com/en/news/2016/9/Huawei-Smartphone-Manufacturing-India.

50 "Huawei Starts Smartphone Manufacturing in India", *Press Release, Huawei*, 23 September 2016, https://www.huawei.com/en/news/2016/9/Huawei-Smartphone-Manufacturing-India#:~:text=%5BNew%20Delhi%2C%20India%2C%20September,%2C%20Flex%20India%2C%20in%20October.

51 "Huawei to deploy Airtel's 4G network in Karnataka", *Deccan Herald*, 2 May 2012, https://www.deccanherald.com/content/246468/huawei-deploy-airtels-4g-network.html.

supported one-third of Bharti Airtel's network and constituted 40 per cent of Vodafone-Idea Cellular's network.[52]

Bharti Airtel and Huawei also jointly deployed massive multiple-input/multiple-out (MIMO) technology in Bengaluru as the first step toward 5G in September 2017[53] and successfully tested India's first 5G trial in Manesar in February 2018.[54] Huawei's promise for India's 5G future was compelling: "MIMO technology achieves four times the capacity with the same spectrum. This way, the telecommunication operators can build 5G-ready transport networks without extra spectrum investment. Huawei's enhanced MIMO solution can reduce the antenna installation distance criteria, simplify MIMO deployment and reduce TCO [total cost of ownership]."[55] Huawei's investments in the Indian market engendered a hope that irrespective of Western sanctions, India will continue to involve it in its 5G infrastructure. As company spokesman Hua Chunying stated in June 2019, "On the issue of Chinese enterprises participating in the construction of India's 5G, we hope the Indian side makes an independent and objective decision, and provides a fair, just and non-discriminatory commercial environment for Chinese enterprises' investment and operations, to realise mutual benefit."[56] In fact, in 2019, Huawei was well-positioned to not only participate but also succeed in the Indian market.

Huawei's growth in the Indian telecommunication sector was, however, punctuated by security concerns plaguing China-based telecommunication firms, particularly with concerns around its links with the Chinese government. Globally, Huawei was viewed less as a multinational corporation and more as an extension of the Chinese

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[52] Palki Sharma, "Chinese apps have been banned in India; Is Huawei next?", *Wion*, 1 June 2020, https://www.wionews.com/india-news/chinese-apps-have-been-banned-in-india-is-huawei-next-309732.

[53] "Huawei partners Airtel to deploy Massive Mimo in Bangalore", *ET Telecom*, 26 September 2017, https://telecom.economictimes.indiatimes.com/news/huawei-partners-airtel-to-deploy-massive-mimo-in-bangalore/60846967.

[54] Danish Khan, "Airtel, Huawei conduct India's first 5G network test trial", *ET Telecom*, 23 February 2018, https://telecom.economictimes.indiatimes.com/news/airtel-huawei-conduct-indias-first-5g-network-test-trial/63043433.

[55] "4 Times capacity, Reaching 13KM, India Bharti and Huawei complete 5G microwave enhanced MIMO joint innovation", *News, Huawei*, 29 September 2019, https://www.huawei.com/en/news/2019/9/india-bharti-huawei-5g-microwave-mimo-joint-innovation.

[56] Sanjeev Miglani and Neha Dasgupta, "China warns India of "reverse sanctions" if Huawei is blocked-sources", 6 August 2019, https://news.yahoo.com/exclusive-china-warns-india-reverse-141005256.html?fr=sycsrp_catchall.

Communist Party (CCP). Huawei has allegedly received financial support from the Chinese government since its inception in 1987 in the form of "financing, tax breaks and cheap resources".[57] These subsidies are reportedly of the magnitude of US$75 billion (S$106.83 billion).[58] The relationship between Huawei and the CCP today continues to remain opaque. Apart from securing financial subsidies, senior members of Huawei are reported to have close personal links to the CCP, with some of them previously being PLA and CCP members. Several party representatives serve in private companies and domestic laws require strict compliance with state directives. This domestic structure allows the CCP to exert control over private sector enterprises, including Huawei. These actions raise fears that Huawei could exploit its economic reach toward political ends at the behest of the CCP.

Security concerns have also dogged Huawei's expanding role in India. The threat from Chinese telecommunication equipment manufacturers has been a constant source of concern for India's intelligence agencies. Fears in the Indian security establishment revolve around embedded spyware or malware in telecommunication equipment. Such malware could bypass existing network security measures and provide remote access to a party with malicious intent. In 2010, Indian intelligence agencies also issued warnings to BSNL to ban Huawei (and ZTE) from its tender process while deploying telecommunication equipment in India.[59] Media reports suggested that the Research and Analysis Wing (RAW) had issued warnings to the Indian government, stating Huawei could be a part of China's intelligence network.[60] RAW also issued warnings about Huawei's growing footprint in India's neighbourhood, especially Nepal and the Maldives.[61] In 2014, allegations emerged that Huawei had hacked the

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57 Chuin Wei Yup, "State Support Helped Fuel Huawei's Global Rise", *Wall Street Journal*, 25 December 2019, https://www.wsj.com/articles/state-support-helped-fuel-huaweis-global-rise-11577280736.

58 Ibid.

59 Manoj Gairola, "Intelligence Cloud Over Huawei", *Hindustan Times*, 24 April 2009, https://www.hindustantimes.com/business/intelligence-cloud-over-huawei/story-ySicx6SD6XnVnWU2Tbg4QI.html.

60 Bharti Jain, "Huawei part of Chinese spy network, says R&AW", *The Economic Times*, 7 May 2010, https://economictimes.indiatimes.com/news/politics-and-nation/huawei-part-of-chinese-spy-network-says-raw/articleshow/5900798.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

61 Joji Thomas Philip, "Intelligence Agencies fear China is trying to encircle India via tech deal in neighbouring nations", *The Economic Times*, 23 January 2013, https://m.economictimes.com/news/company/corporate-trends/intelligence-agencies-fear-china-is-trying-to-encircle-india-via-tech-deals-with-neighbouring-nations/articleshow/18139596.cms.

networks of BSNL, which forced the Indian government to establish an inter-ministerial panel to investigate the issue.[62]

Given the nature of 5G, the health of India's telecommunication sector and the promise and perils of Huawei, the role of Huawei in India's 5G had some major implications. Not without reason, therefore, it has engendered a healthy and intense debate within India's strategic community over the path forward on India's 5G conundrum. The next section underlines some major issues involving 5G technology in India.

[62] "India investigates report of Huawei hacking state carrier network", *Reuters*, 6 February 2014, https://www.reuters.com/article/us-india-huawei-hacking/india-investigates-report-of-huawei-hacking-state-carrier-network-idUSBREA150QK20140206.

5G Debate Playing Out in India's Strategic Community

Before the Galwan Valley crisis, the future of Huawei in India's 5G infrastructure remained an open question. Economically, Huawei's equipment was cheaper than its competitors. A 2019 Huawei-funded Oxford study estimated that by 2035, the loss to the Indian economy if Huawei was left out of the 5G competition could be around US$15.5 billion (S$22.08 billion).[63] Furthermore, the delay in implementing 5G infrastructure may result in a cumulative cost increase of US$500 million (S$712.18 million) over the next decade.[64] Since the early 1990s, economic interdependence has guided India's strategy to manage China's rise as well as the tricky issue of the border problem between the two neighbours. This assumption allowed the two countries to embark on a very fruitful economic relationship. The value of total trade between India and China stood at nearly US$125 billion (S$178.04 billion) in 2021.[65]

Huawei's participation in India's 5G infrastructure was essential to keep the Sino-Indian economic relationship thriving. It also ensured that India could pursue its technological non-alignment and maintain an independent stance on the growing technological competition between the West and China. India's balancing act in 5G technology was symptomatic of its balancing act vis-à-vis other avenues of cooperation with the West, as was the case with the Quadrilateral Security Dialogue (Quad). Yet, there were several downsides to Huawei's involvement. Given its cost-effectiveness and cost-efficiency, Huawei's sizeable presence in the Indian 5G market would have not only resulted in greater economic dependence but created long-term commercial liabilities. It could also provide China leverage for economic coercion in future. Huawei's 5G success would have also provided huge momentum to China's digital connectivity projects under the Belt and Road Initiative (BRI). If the BRI successfully expands across Asia, it will render China greater influence in India's

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63 "Restricting Competition In 5g Network Equipment: An Economic Impact", *Oxford Economics*, December 2019, 29, https://resources.oxfordeconomics.com/hubfs/Huawei_5G_2019_report_V10.pdf.

64 Ibid, p. 29.

65 Ananth Krishnan, "India-China trade crossed $125 bn in 2021", *The Hindu*, 15 January 2022, https://www.thehindu.com/business/india-china-trade-crossed-125-bn-in-2021/article38275450.ece.

neighbourhood and beyond. The intensifying Sino-US technology competition would have also complicated India's military and diplomatic relations with the US. Moreover, Huawei could provide the Chinese state with the capability to cripple India's critical infrastructure through backdoors and cyber-attacks.

These questions gained greater significance as the rivalry between the US and China intensified under Trump and with India's growing competition with China. The strategic flux in contemporary international politics has engendered an extensive debate within the Indian strategic community over the future of Indian foreign policy and its strategic choices.[66] Technology is an emerging fault-line in contemporary great power rivalry and its implications for India have captured the attention of India's strategic community. For instance, former Indian Foreign Secretary Shyam Saran insists that "the new Cold War will be centred on mastery of technology as the currency of power".[67] Others have pointed out that such fault-lines and differences over technology exist between the US and its allies, especially over policies governing data transfer and storage.[68]

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[66] The 'strategic community', as referred to in this article, extends beyond just experts on Indian foreign policy. Apart from the traditional policy analysts, academics, journalists, diplomats and military officials who speak on India's foreign and security policy, the strategic community also includes influencers from the industry and technical experts such as engineers. This is because the rollout of 5G will have important implications for both the economy and industry and, given the esoteric nature of the technology, technical expertise is required to evaluate the security risks inherent in deploying the network. Several academics from the engineering field have been associated with the 5G policy in India and have been advising the government on its security implications. Such categorisation of opinions on foreign policy issues helps to identify the undercurrents of policy discussion in India. The Indian strategic community has had a tradition of vigorous debate over New Delhi's foreign policy choices. In fact, several Indian scholars have categorised the opinions expressed by the strategic community to understand how different domestic constituencies position themselves on global concerns. Scholars have used such categorisation to explain the diversity in India's strategic thought process on issues, including on from India's strategic culture; concerns over global hegemony; foreign policy strategies; New Delhi's stand on nuclear weapons; and even its position on balancing behaviour in the Indo-Pacific. See Kanti Bajpai, "India and the World: The Grand Strategy Debate", in Niraja Jayal and Pratap Bhanu Mehta, eds., *The Oxford Companion to Politics in India* (New Delhi: Oxford University Press, 2010), pp. 521-541; Kanti Bajpai and Varun Sahni, "Hegemony and Strategic Choice", in Chandra Chari, ed., *War, Peace and Hegemony in a Globalized World: The Changing Balance of Power in the Twenty-First Century* (Oxford: Routledge, 2008), pp. 93-108; Deepa Ollapally and Rajesh Rajagopalan, "The Pragmatic Challenge to Indian Foreign Policy", *The Washington Quarterly 34*, no .2 (2011): pp. 145-162; Henry R. Nau and Richard Fontaine, "India as a Global Power: Contending Worldviews from India", Sigur Centre for Asian Studies, March 2012, https://www.risingpowersinitiative.org/publication/rpi-policy-report-india-as-a-global-power-contending-worldviews-from-india-by-henry-nau-and-richard-fontaine/; and Yogesh Joshi, "Between Concern and Opportunity: U.S. Pivot to Asia and Foreign Policy Debate in India", *Journal of Asian Security and International Affairs 2*, no. 3 (2015): pp. 314-337.

[67] Shyam Saran, "Technology will drive the new Cold War", *Business Standard*, 9 July 2019, https://www.business-standard.com/article/opinion/technology-will-drive-the-new-cold-war-119061200020_1.html.

[68] Dhruva Jaishankar, "From the iPhone to Huawei: The new geopolitics of technology", Brookings Institution, 31 July 2019, https://www.brookings.edu/blog/order-from-chaos/2019/07/31/from-the-iphone-to-huawei-the-new-geopolitics-of-technology/.

However, the focal point of this competition for technological superiority and 5G technology has been Huawei.

Over 5G, India's strategic community appeared divided into three schools of thought, each with its distinct line of arguments, leading to a different policy prescription. For the purposes of this Scan, they are referred to as the 'Self-Reliance School', the 'Globalisation School' and the 'National Security School'. The differences between these three schools can be understood in terms of the following primary questions: What is the overriding consideration with respect to the 5G rollout in India? What is the status of India's domestic industry in delivering 5G technology? How does India manage the security challenges that arise while launching 5G networks in India?

Before delving into the differences between these three schools, it is important to note that similarities exist across this divide. First, all three schools accept China as a geopolitical challenge. They also share security anxieties around Huawei's involvement in the 5G rollout in India. However, each school of thought placed this challenge differently in the global context, leading to a divergence in positions. Secondly, no school is directly opposed to international engagement on 5G through multilateral organisations. While the 'Globalisation School' tends to be more vocal about the need for international engagement in bodies like the United Nations-sponsored International Telecommunications Union, the other two schools did not explicitly oppose such engagement. For instance, the Observer Research Foundation's Gautam Chikermane argues that India should ban Huawei in India's 5G rollout, saying, "the standards are currently being dominated and influenced by American and Chinese firms. Voices of 'the 5G have-nots' must be heard and served. Along with indigenisation, India must tailor the global 5G standards to fit its requirements."[69] Aruna Sundararajan, former Secretary of the DoT, also argues for a global and harmonised approach to setting industry standards for the rollout of 5G.[70] The 'Self-Reliance School'

[69] Gautam Chikermane, "5G Infrastructure, Huawei's Techno-Economic Advantages and India's National Security Concerns: An Analysis", *ORF Occasional Paper No. 226*, (December 2019): 33.

[70] Aruna Sundararajan, "5G and Data Security", Panel Discussion, Global Technology Summit 2019, Carnegie India, Bengaluru, 6 December 2019.

has not directly advocated for international engagement and global standards; however, it does not explicitly oppose it either.

The 'Self-Reliance School'

The proponents of 'self-reliance' perceive the world to be one of self-help. For them, threats to the network can emerge from anywhere and not necessarily from China. This is the main challenge with 5G adoption. This assertion emanates from an interpretation of the equipment itself and the actors involved. For instance, scientists such as Professor V Kamakoti have insisted that network threats are both multifaceted and multidirectional, due to the diversity of vendors and supply chains. Vulnerabilities that exist can be exploited by third parties, which can cause harm not only to the economy but also to national security.[71] Others like General D S Hooda, referring to the US National Security Agency's prism programme to demonstrate how US companies were also complicit in supporting the National Security Agency's intrusions, points out that while China has been India's main threat, the US has also been equally complicit in intrusions into India's networks.[72]

Advocates of the 'self-reliance' approach believe that capability exists in India to develop indigenous 5G technology. Their chief criticism is that while technical capability exists within India, market and government policies do not support or allow indigenous capabilities to flourish. General Hooda, for example, highlights that the Indian Army's Northern Command used the Bharat Operating System Solutions (BOSS), an operating software for computer desktops, which was developed indigenously.[73] He adds that the programme to expand the use of the BOSS operating software in the Indian Army was eventually scuttled. At the time, both the government and military preferred foreign vendors while opting for desktop operating systems. Local telecommunication manufacturing associations have

[71] V. Kamakoti, "5G Technology from an Indian Perspective", Presentation, Indian Council of World Affairs, Chennai, 10 July 2019.
[72] D. S. Hooda, "At Digital War", *The Indian Express*, 25 October 2018, https://indianexpress.com/article/opinion/columns/cyber-warfare-indian-military-defence-cyber-attack-at-digital-war-5416998/.
[73] Ibid.

also highlighted the need to develop indigenous capability stressing the availability of both talent and capability, locally.

Therefore, proponents of 'self-reliance' argue that the only way to secure India's 5G networks is to indigenise the entire 5G ecosystem as vulnerabilities rise from different quarters. What they ask is for a new industrial policy that supports the development of an Indian telecommunication ecosystem through financial incentives, technology transfers and keeping foreign vendors, especially Huawei, out of the Indian market. For example, Arogyaswami Paulraj, Stanford engineering professor and head of India's high-level forum on 5G, has highlighted the extensive Indian talent driving innovation in foreign multinational corporations while Indian companies tend to be just "tech shops".[74] He further claims that India needs to follow an approach similar to China where technology transfer was a critical part of any business transaction between the state and foreign technology firms.

Given the uncertainty of a return on investment, venture capital investment in Indian technology firms has been low. This has stalled innovation in domestic firms and start-ups. As Paulraj argues, "One thing missing in India is venture capital. In this high-risk business, 80 per cent of companies fail, whether it is in China or the US. Technology companies fail because the market is so competitive. One out of 10 companies succeed and makes a whole lot of money; that is how the venture capital sustains. Making venture capital money available has not happened and the government has failed with its policies."[75] Similarly, others like Kamakoti recommend the improvement of indigenisation through financial incentives such as reducing license fees for companies that integrate indigenous technologies into their networks and nudging private players to adopt India-sourced equipment.[76]

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[74] Raghu Krishnan, "India should emulate China in tech transfer, IP: 5G Forum head Arogyaswami Paulraj", *ET Telecom*, 8 November 2019, https://telecom.economictimes.indiatimes.com/news/india-should-emulate-china-in-tech-transfer-ip-5g-forum-head-arogyaswami-paulraj/71964808.

[75] Ibid.

[76] V. Kamakoti, "5G Technology from an Indian Perspective", presentation, Indian Council of World Affairs, Chennai, 10 July 2019.

Several of India's domestic telecommunication equipment manufacturers also hold similar outlooks and recommendations outlined by the scholars mentioned above. Indian telecommunication equipment manufacturers expressed these arguments in their responses to a consultation paper on 'Promoting Local Telecom Equipment Manufacturing', floated by the DoT in 2017.[77] Several domestic telecommunication manufacturers and industry associations wrote to the department, requesting preferential market access and India-specific testing and certification standards to allow their businesses to grow. They claim that security within the telecommunication sector can only be achieved through incorporating domestic telecommunication equipment into telecommunications networks.

The Telecom System Design and Manufacturing Association has requested that telecommunication equipment manufacturing be declared a vital strategic and economic imperative segment.[78] The Association has further outlined that "while domestic Industry faces serious disabilities, there are serious security vulnerabilities or threats the country faces because of the core telecommunication infrastructure products. The same government must consider 'self-reliance' as a vital strategic and economic imperative and define critical infrastructure segments under the telecommunication sector as a strategic/core segment".[79] Furthermore, domestic telecommunication manufacturers and industry associations have also called for 'India-specific' standards for testing and certification. The Telecom Equipment and Services Export Promotion Council, an industry association of domestic telecommunication equipment manufacturers, identifies that computer malware is a clear and present challenge. "The only solution" to counter the security risks of malware in foreign products "is to promote Indian designed, developed and manufactured telecommunication infrastructure at a

[77] "Consultation Paper on Promoting Local Telecom Equipment Manufacturing", Consultation Paper 12/2017, Telecom Regulatory Authority of India, 18 September 2017, https://www.trai.gov.in/sites/default/files/CP_on_Manufacturing_18_09_17.pdf.

[78] "TSDM Response to TRAI Consultation Paper on Promoting Local Telecom Equipment Manufacturing", Telecom System Design and Manufacturing Association, 27 November 2017, 5, https://trai.gov.in/sites/default/files/TSDM_CP_PLTEM.pdf.

[79] Ibid.

very large scale and to make India developed encryption technology mandatory across all networks."[80]

In sum, the 'Self-Reliance School' identifies the threat to India's 5G network as multidirectional and believes that an indigenous solution to India's 5G future is feasible; it calls for the indigenous development of technology, with greater participation from both state and private enterprises. The 'Self-Reliance School' particularly resists the Chinese invasion into India's 5G digital space, given the acute security concerns and actual conflict of interests with Beijing. However, its push for indigenous development has implications for such an enterprise's economic efficiency and would also raise questions over India's growing technological and strategic partnership with Western countries, especially the US.

The 'Globalisation School'

In the 'Globalisation School', scholars tend to agree with those in the 'Self-Reliance School' that equipment from other vendors is just as vulnerable as that of Huawei. The insecurity around digital equipment is not restricted to Huawei but is a problem inherent to equipment of all companies, given the nature of the technology. Scholars here prioritise not only national security but the consequences of India's 5G debate on its social, economic and technological development. When it comes to national priorities, they argue that any policy decisions, like the inclusion or exclusion of certain companies, on India's 5G rollout must consider the policy's impact on the population and the economy while safeguarding national security interests. For example, Manoj Joshi has argued that India should deploy 5G technology in a manner that is most beneficial to Indian citizens and helps overcome socio-economic issues.[81] Similarly, Manoj Kewalramani and Anirudh Kanisetti have stated, "in addition, it (Huawei) is keen to expand investments in India, announcing an additional US$100 million [S$133.32 million] in October last year.

[80] "TEPC Response On Trai Consultation Paper On Domestic Manufacturing", Telecom Equipment and Services Export Promotion Council, 13, https://trai.gov.in/sites/default/files/TEPC_CP_PLTEM_0.pdf.

[81] Manoj Joshi, "5G Infrastructure, Huawei's Techno-Economic Advantages, and India's National Security Concerns", Panel Discussion, Observer Research Foundation, New Delhi, 9 April 2020.

This would support Indian telecommunication operators already struggling with massive capital expenditure burdens", adding that a level playing field and market competition benefits Indian consumers.[82]

Unlike the 'self-reliance' advocates, the 'Globalisation School' doubts India's capability to indigenise the entire 5G infrastructure. As former DoT Secretary Aruna Sundararajan states, "I don't think India has the luxury of saying that we will develop our own technologies completely on our own…(because) supply chains are scattered widely and dispersed across geographies."[83] These concerns are amplified because of India's past failures in indigenising critical technologies in the defence and civilian sectors. For example, Manoj Joshi highlights India's dismal track record in the indigenisation of the 'Kaveri' jet engine, leading to exorbitant delays in the 'Tejas' fighter programme.[84]

Unlike domestic telecommunication manufacturers, several industry associations and network providers have criticised policies promoting preferential market access to Indian telecommunication equipment manufacturers. The DoT's consultation paper on 'Promoting Local Telecom Equipment Manufacturing' requested stakeholder feedback on how to improve preferential market access policies that promote domestic telecommunication equipment manufacturing. The industry associations asserted that globally, no country can achieve 100 per cent localisation of telecommunication manufacturing. Industry associations and stakeholders, like network service providers, are also sceptical of the ability of domestic telecommunication equipment manufacturers to produce equipment for the Indian market which is on standards comparable to their global counterparts. Hence, the 'Globalisation School' believes that preferential market access may hurt Indian consumers. Preferential market access will limit the growth of the Indian telecommunication market, induce economic inefficiency, reduce competition and eventually harm Indian

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[82] Manoj Kewalramani and Anirudh Kanisetti, "5G, Huawei & Geopolitics: An Indian Roadmap", Takshashila Discussion Document, The Takshashila Institution, 19 June 2019, https://www.researchgate.net/publication/334164576_5G_Huawei_Geopolitics_An_Indian_Roadmap.

[83] Aruna Sundararajan, "5G and Data Security", panel discussion, Global Technology Summit 2019, Carnegie India, Bengaluru, 6 December 2019.

[84] Manoj Joshi, "5G Infrastructure, Huawei's Techno-Economic Advantages, and India's National Security Concerns", Panel Discussion, Observer Research Foundation, New Delhi, 9 April 2020.

consumers. Responding to the consultation paper on 'Promoting Local Telecom Equipment Manufacturing', the US-India Business Council stated, "government policies should also encourage market competition to maximise investment and minimise the cost to end users" and "the discriminatory measure (referring to the preferential market access policy), therefore, harms consumers because it protects domestic vendors from foreign competition, thereby letting local sellers raise prices to local consumers".[85] Bharti Airtel took a similar position, "it is important to promote the domestic manufacturing sector but not at the cost of making telecommunication service provisioning dependent on domestic manufacturing which could impact the competitiveness of the Indian telecommunication sector",[86] Broadband India Forum pointed out that there is no guarantee that domestically produced systems are more secure than foreign ones.[87]

Therefore, the 'Globalisation School' believes that Huawei's entry into the Indian market will be beneficial to India, both economically and in managing its relationship with China, by fostering economic interdependence. First, Huawei's technical and market competitiveness, due to its superior technology, which is available at lower prices, would reduce the costs of 5G infrastructure. Sunil Bharti Mittal, the Chief Executive Officer of Bharti Enterprises, claims that Huawei's technology is superior to its Western counterparts.[88] Beyond economic efficiency, there are also strategic reasons to keep Huawei involved in the Indian 5G space. If India is dependent upon China for critical supplies, Beijing is equally dependent on the Indian market to remain competitive. The size of the Indian telecommunication market offers telecommunication companies the potential to generate large revenues and growth. Being excluded would impose significant costs. Such asymmetric interdependence can be used as an instrument of geopolitical influence. By keeping

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85 USIBC Response to Consultation Paper on Promoting Local Telecom Equipment Manufacturing", US-India Business Council, 10 November 2017, 3, https://trai.gov.in/sites/default/files/USIBC_CP_PLTEM.pdf. USIBC Response to Consultation Paper on Promoting Local Telecom Equipment Manufacturing," 3.

86 "Response to Consultation Paper on Promoting Local Telecom Equipment Manufacturing", Bharti Airtel, 27 November 2017, p. 1, https://trai.gov.in/sites/default/files/Bharti_Airtel_CP_PLTEM.pdf.

87 "BIF Response To Trai Cp On Promoting Local Telecom Equipment Manufacturing", Broadband India Forum, p. 15, https://trai.gov.in/sites/default/files/Broadband_India_Forum_CP_PLTEM.pdf.

88 Dhirendra Tripathi, "Sunil Mittal bats for Huawei equipment, calls it superior to rivals", *Mint*, 3 October 2019, https://www.livemint.com/industry/telecom/sunil-mittal-bats-for-huawei-equipment-calls-it-significantly-superior-to-rivals-11570114707883.html.

Huawei engaged, India could use its large market size as a hedge against Chinese coercion. Globalisation scholars believe that the fear of losing out on the second-largest digital market in the world could deter China's aggressive behaviour on the frontier. In other words, Huawei would provide India leverage that New Delhi could use to influence Chinese behaviour during crisis periods but also signal its resolve in standing up to China's bullying tactics in future. As Kewalramani and Kanisetti argue, "the higher the stakes of Chinese enterprises in the Indian market, the greater the potential political leverage for India. Investments by Chinese firms in India can lead to developing constituencies that can act as stabilisers in the bilateral relationship and even potentially influence policy in Beijing."[89]

However, the 'Globalisation School' proponents are not ignorant of the security challenges confronting 5G infrastructure and its vulnerability. Even the 'globalisation' proponents agree that Huawei equipment must be kept out of the core and critical networks of India's telecommunications infrastructure but allowed to participate in non-critical elements of the infrastructure.[90] Further, Chinese equipment and Huawei must be thoroughly scrutinised before being deployed.[91] Second, India should leverage areas in which it has certain strengths, such as a large resource pool of IT professionals. This pool can be tapped to develop standards, certification, testing, and safeguards against intrusions into the networks. While India continues the indigenous R&D on 5G, in the interim, the government can support the development of technological solutions – barriers and firewalls against external interventions in the network – to secure the network from threats accruing out of imported 5G equipment. This sentiment was expressed by T V Ramachandran, President of the Broadband Forum of India, "with the established Indian IT prowess – one of the best in the world and probably well ahead of Chinese capabilities – it is inconceivable that our engineers cannot devise the necessary tests and safeguards."[92] The Cellular Operators Association

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89 Manoj Kewalramani and Anirudh Kanisetti, "5G, Huawei & Geopolitics: An Indian Roadmap", op. cit., p. 9.

90 Manoj Joshi, "5G Infrastructure, Huawei's Techno-Economic Advantages, and India's National Security Concerns", Panel Discussion, Observer Research Foundation, New Delhi, 9 April 2020.

91 Manoj Kewalramani and Anirudh Kanisetti, "5G, Huawei & Geopolitics: An Indian Roadmap", op. cit., pp. 11-12.

92 T. V. Ramachandran, "The great Huawei conundrum – Why India can't afford to fall behind in 5G technology on speculative fears", *Financial Express*, 13 June 2019, https://www.financialexpress.com/opinion/the-great-huawei-conundrum-why-india-cant-afford-to-fall-behind-in-5g-technology-on-speculative-fears/1605820/.

of India has also recommended that India develop "indigenous technical capacity to handle these threats", as opposed to the promotion of local telecommunication equipment manufacturing.[93]

Scholars of the 'Globalisation School' argue that the priority should be to build resilience in India's telecommunication networks by preventing single vendor lock-in. Thus, the Indian government must ensure that a technological monopoly does not develop and that a single firm does not ultimately dominate the entire domestic telecommunication ecosystem. In this regard, the government should provide targetted support to develop telecommunication network resilience by embedding sufficient indigenous capabilities while promoting a multi-vendor approach to deploying 5G networks. They also hope security in telecommunication networks can be achieved through certification and testing in line with a harmonised global approach.[94] Several industry associations have also supported the promotion of testing and certification standards in accordance with global procedures. The US-India Strategic Partnership Forum states that "Indian standards, certification and testing mechanisms are harmonised with global standards and best practices. Otherwise, standard setting in siloes will hamper the growth of Indian telecommunication manufacturing".[95]

Proponents of the 'Globalisation School' believe that Huawei's market competitiveness can be beneficial to the Indian economy, and that that should be the overriding consideration. Further, while India does not have the capabilities to deploy its own fully indigenous network, policy interventions can help India build on existing strengths to mitigate security concerns that emanate from Huawei.

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93 "COAI Submission on TRAI Consultation Paper on Promoting Local Telecom Equipment Manufacturing," Cellular Operators Association of India, 27 November 2017, p. 10, https://trai.gov.in/sites/default/files/COAI_CP_PLTEM.pdf.

94 Aruna Sundararajan, "5G and Data Security", Panel Discussion, Global Technology Summit 2019, Carnegie India, Bengaluru, 6 December 2019.

95 "US ISPF Response to TRAI Consultation Paper on Promoting Local Telecom Equipment Manufacturing", US-India Strategic Partnership Forum, 27 November 2017, p. 4, https://trai.gov.in/sites/default/files/USISPF_CP_PLTEM.pdf.

The 'National Security School'

In the 'National Security School', the overriding consideration is India's geopolitical and strategic context and the ensuing interests. Scholars of the 'National Security School' consider even private Chinese multinational corporations such as Huawei as an outright extension of the CCP. They suspect that private Chinese companies, like Huawei, are either willingly complicit or are forced to comply with the directives of Chinese state authorities. In this regard, Huawei's involvement will allow China to gain undue leverage over India's communications infrastructure and make India vulnerable to Chinese coercion. As Lieutenant General Prakash Menon writes, "China is, after all, India's adversary and its biggest strategic challenge. Given this situation, handing over critical communications infrastructure to companies closely connected with the Chinese party-state does not make any strategic sense."[96] Similarly, Nitin Pai of the Takshashila Institution underlines the need for caution, "regardless of the technical merits of equipment produced by Chinese and other foreign manufacturers, the two are very different from a political and strategic perspective."[97] He goes on to argue that any decision to allow Chinese firms to deploy their equipment in telecommunication networks must consider the future trajectory of India-China relations. Some scholars point to China's recently enacted National Security Laws in 2017, which compels its citizens to aid the Chinese government, as evidence that Huawei can be forced to provide the Chinese government access to its network if required.[98] The issue is not whether Huawei is currently servicing the Chinese national intelligence agencies but the uncertainty of its future behaviour.

Scholars in the 'National Security School' are divided over India's capability to indigenously provide solutions for its 5G dilemma. Therefore, opinions differ on whether India should seek foreign collaborations or develop 5G systems in-house. For instance, Pai

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96 Lt Gen (Dr) Prakash Menon And Pranay Kotasthane, "Dealing with Huawei: Think strategy, not just security", *The Telegraph*, 21 January 2020, https://www.telegraphindia.com/opinion/5g-infrastructure-in-india-holistic-assessment-of-security-economic-strategic-concerns-needed/cid/1738436.

97 Nitin Pai, "As China Fights For Huawei, Should India Be Wary of Its 5G Entry?", *The Quint*, 24 January 2019, https://www.thequint.com/voices/opinion/china-fights-huawei-should-india-be-wary-of-its-entry-in-5g.

98 Gautam Chikermane, "5G Infrastructure, Huawei's Techno-Economic Advantages and India's National Security Concerns: An Analysis", ORF Occasional Paper No. 226, (December 2019): 12-16.

recommends that "the Centre must reverse the disturbing trend of top government officials snubbing foreign investors and promoting ideas like import substitution that failed India in the past".[99] On the other hand, Gautam Chikermane points to the success of institutions like the Indian Space Research Organisation and recommends that "the government must rethink its commercial enterprises and, using a mix of capital investments and professional freedom, create several ISRO-like organisations", adding that a government entity can pilot 5G in India.[100]

However, if the scholars of the 'National Security School' differ from their counterparts in the 'Globalisation School' in their fervent opposition to Huawei's involvement in India's 5G space, it also differs from those in the 'Self-Reliance School' over exclusively relying on indigenous solutions. Unlike the 'Globalisation School', the 'National Security School' clearly states that India should ban Chinese companies, especially Huawei, from participating in the 5G rollout in India. However, it enthusiastically promotes partnering with like-minded countries like the US and Japan to deploy 5G infrastructure in India. The Principle Scientific Advisor to the Indian government, K Vijay Raghavan, has suggested that India should head for 5G trials with all companies except Chinese companies.[101] Similarly, Lieutenant General Prakash Katoch recommends that "those (companies) participating in the (India's 5G) trials should also not be allowed to partner with Chinese companies. Instead, partnering companies in countries like South Korea, Japan and Vietnam should be preferred, where required."[102] Banning Huawei also serves a larger strategy: it can help contain China's rise and build a coalition to resist China. This approach again involves looking at Huawei strategically and partnering with other 'like-minded countries' to stop China's impending technological hegemony.

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99 Nitin Pai, "We should offer to safeguard the world's telecom networks", *Mint*, 2 February 2020, https:/www.livemint.com/opinion/columns/we-should-offer-to-safeguard-the-world-s-telecom-networks-11580662870570.html.

100 Chikermane, "5G Infrastructure, Huawei's Techno-Economic Advantages and India's National Security Concerns: An Analysis", pp. 32-33.

101 Pankaj Doval, "5G panel head wants Chinese vendors excluded from trials," *The Times of India*, 2 July 2019, http://timesofindia.indiatimes.com/articleshow/70032601.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

102 Lt Gen Prakash Katoch, "India's 5G Network," *Indian Defence Review*, 9 June 2019, http://www.indiandefencereview.com/news/indias-5g-network/.

Therefore, those in the 'National Security School' look at the issue of the 5G rollout in India through a geopolitical lens. They argue that Huawei should be kept out of India's 5G rollout, and that India should partner with like-minded countries to deploy its 5G infrastructure.

Table 1: Summary of Schools of Thought within the Strategic Community on 5G and Huawei

School of Thought	World View	Priorities and Threat Dynamics	Extant Capabilities	Policy Prescriptions
Self-Reliance	Self-help system; mercantilist approach to technological development	National security and technological independence; threats are multidirectional	Domestic R&D can provide solutions	Indigenous development
Globalisation	Economic and technological interdependence; markets should decide on the technological direction	Economic and market efficiency; threats, though present, can be addressed.	Extant capabilities non-existent or minimal, no short or medium-term solutions available internall	Allow markets to decide India's 5G future
National Security	Self-help systems but security partnerships critical to technological solutions	National security; Chinese threat is paramount over all other sources of technological insecurity	Sceptical over indigenous solutions; technological alliances with like-minded countries a way out.	Technological cooperation with strategic allies to find solutions to India's 5G dilemma

Source: Authors' own synopsis based on the above analysis.

These debates highlight the range of ideas in India's strategic community regarding how India should deal with the 5G question and the motivations, considerations and implications of that choice on India's security, economic outlook and technological development. The 'Self Reliance school' argues that India's 5G network must be shielded from all external threats, especially China, given Huawei. 5G technology from foreign vendors like Huawei could exacerbate

existing cyber and related security threats that must be met by upgrading domestic 5G capacities through an indigenous 5G network. The 'globalisation' advocates hold that external threats from 5G technology and, specifically, Huawei can be mitigated and that market forces and consumer attitudes should guide India's 5G development and rollout. These proponents believe India cannot build a domestic 5G network and will have to cooperate and innovate with external partners like Huawei. Moreover, innovation, they claim, can potentially neutralise existing security concerns through effectively constructing a safe network. The 'national security' proponents balance these polarising views by pushing for a strategy that emphasises technological cooperation with like-minded partners like the US, not rivals like China, to fulfil India's technological and development objectives. New Delhi appears to approach the 5G question through a national security lens tempered by competing self-reliance and globalisation currents.

We now highlight emerging trends and fault-lines in India's 5G policy with respect to its foreign policy requirements and national security challenges, its approach to economic interdependence and the global governance of the 5G technology, and its efforts to build indigenous technologies to fill the gaps in its 5G ecosystem.

India-China Competition in the Shadow of Sino-US Rivalry

One of the hallmarks of Indian foreign policy has been a desire to preserve its strategic autonomy. During the Cold War, it translated this into the policy of non-alignment where India refused to be a part of any of the great power alliances. Non-alignment allowed India to garner economic and military support from both or either of the great powers, as and when it suited India's national interests. Non-alignment, therefore, was India's strategy of navigating a deeply polarised bipolar world order and maintaining its foreign policy autonomy.

Even when the context changed with the end of the Cold War, Indian decision-makers remained wedded to non-alignment broadly. India's economic and military rise also contributed to a desire for a multipolar world where India could emerge as a great power. However, the emerging bipolarity between China and the US has, once again, shaken the foundations of India's foreign policy. Unlike the Cold War, where India could easily navigate the conflict and confrontation between the great powers, the rise of China has posed fundamental questions for Indian decision-makers. India today confronts a great power in its immediate vicinity; it also has some serious conflicts of interest with China, including the world's largest territorial dispute along the Himalayan frontier. Moreover, during the Cold War, the superpowers were happy to leave South Asia as India's sphere of influence. China's inroads into the region, however, challenges India's primacy in South Asia. As India confronts new power realities, it is also realising that proclaiming non-alignment, coveting strategic autonomy, and wishfully desiring multipolarity does not come cheap. 5G debate strikes at the heart of some of India's most vexing foreign policy dilemmas.[103]

In many respects, Modi has moved India closer to the West, especially the US and its allies. The Modi-led Bharatiya Janata Party government

[103] Sumit Ganguly and Manjeet S. Pardesi, "Explaining Sixty Years of India's Foreign Policy", *India Review* 8, no.1 (2009): 4-19.

has instituted policies that have looked to limit the Chinese role in India's digital market. These policies were appreciated by the Trump administration officials. The US launched the Clean Network Initiative based on six areas where Chinese technology would be banned to protect US citizens' data. This included 5G network technologies and other means through which data can be collected, such as mobile applications, undersea cables and cloud services.[104] India has moved closer to the US position with its recent ban on 224 Chinese applications, including the popular TikTok and WeChat, citing national security concerns.[105] The Trump administration worked to have some of these apps banned or at least heavily regulated in the US. US Secretary of State Mike Pompeo lauded India for undertaking its application ban saying that the move would help India maintain its security and sovereignty.[106] Furthermore, India's Reliance Jio has been declared a "clean telco" (among other companies around the world) by Pompeo for not having any Chinese equipment throughout its network.[107] A move to restrict Huawei's participation in India's 5G rollout will further align India and the US. However, this does not mean that India and the US are in complete agreement over technological issues. Significant divergences still exist regarding issues such as data localisation.[108]

Apart from the US, India engages with several countries to develop technology. India has signed agreements on 5G cooperation with Japan,[109] Israel and the US.[110] India and Japan have deepened technology cooperation, including 5G technology, with the signing of

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104 "The Clean Network", The Clean Network, US Department of State, https://2017-2021.state.gov/the-clean-network/index.html.

105 "IT Ministry has blocked 224 apps in interest of national security: Dhotre", *Business Standard*, 16 September 2020, https://www.business-standard.com/article/technology/it-ministry-has-blocked-224-apps-in-interest-of-national-security-dhotre-120091601398_1.html.

106 Sriram Lakshman, "U.S. Secretary of State Mike Pompeo welcomes India's Chinese app ban", *The Hindu*, 2 July 2020, https://www.thehindu.com/news/international/us-secretary-of-state-mike-pompeo-welcomes-indias-chinese-app-ban/article31968077.ece.

107 Ishita Guha, "US secretary of state Pompeo calls Jio clean telco for rejecting Huawei", *Mint*, 25 June 2020, https://www.livemint.com/news/india/us-secretary-of-state-pompeo-calls-jio-clean-telco-for-rejecting-huawei-11593024741357.html.

108 Karthik Nachiappan, "Technology and China-India Relations", *China-India Brief #150*, Lee Kuan Yew School of Public Policy, 27 November 2019 – 11 December 2019, https://lkyspp.nus.edu.sg/cag/publications/details/china-india-brief-150.

109 Dipanjan Roy Chaudhury, "India, Japan finalise pact for cooperation in 5G, AI, critical information infrastructure", *Economic Times*, 7 October 2020,https://economictimes.indiatimes.com/news/defence/india-japan-finalise-pact-for-cooperation-in-5g-ai-critical-information-infrastructure/articleshow/78534833.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

110 "India, Israel and US cooperating on digital leadership and innovation", *Financial Express*, 8 September 2020, https://www.financialexpress.com/industry/technology/india-us-israel-collaborating-in-5g-tech-official/2077544/.

a memorandum of understanding to increase cooperation in ICT.[111] Furthermore, Japan-based NEC Corporation is looking to partner with Indian telecommunication operators to deploy OpenRAN technology for their 5G networks. NEC Corporation has also set up an OpenRAN laboratory in India to explore the possibility.[112] At the same time, India is working with France to secure 5G networks. The Indo-French Roadmap on Cybersecurity and Digital Technology, released on 22 August 2019, stated that "France and India intend to work together on the risks associated with the deployment of 5G technology and the technical solutions adopted to deal with them."[113] The Quad member states have established a working group on critical and emerging technologies to develop standards for telecommunication equipment, among other technologies.

Two of India's leading TSPs– Bharti Airtel and Reliance Jio– have partnered with foreign vendors to prepare for rollout. Amidst the border standoff, Indian telecommunication operators have been attempting to limit the amount of Chinese equipment in their respective networks. Media reports indicate that Bharti Airtel will move for 5G trials with Ericsson and Nokia and exclude Huawei and ZTE.[114] The company has also partnered with the US, Japanese and Taiwanese firms to deploy OpenRAN technology for some of its 5G trials.[115] Reliance Jio maintains a partnership with Samsung and, more recently, Qualcomm to deploy 5G networks in India. Reliance Jio has also developed partnerships with Facebook and Google, deepening a larger technology cooperation between the US and India.[116] After

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111 S. Ronendra Singh and Amiti Sen, "India, Japan sign MoU to enhance cooperation in ICT, including 5G tech", *The Hindu Businessline*, 15 January 2021, https://www.thehindubusinessline.com/info-tech/india-japan-sign-mou-to-enhance-cooperation-in-ict-including-5g-tech/article33582217.ece.

112 Danish Khan, "Japan's NEC in talks with Indian telcos for 5G-based OpenRAN deployment", *ET Telecom*, 19 February 2021, https://telecom.economictimes.indiatimes.com/news/japans-nec-in-talks-with-indian-telcos-for-5g-based-openran-deployment/81112335.

113 "Indo-French Roadmap on Cybersecurity and Digital Technology", Ministry of External Affairs, Government of India, 22 August 2019, https://mea.gov.in/bilateral-documents.htm?dtl/31757/IndoFrench+Roadmap+on+Cybersecurity+and+Digital+Technology+August+22+2019.

114 Danish Khan, "Airtel to solve DoT's Chinese gear vendor dilemma for 5G field trials: Here's how", *ET Telecom*, 19 August 2020, https://telecom.economictimes.indiatimes.com/news/airtel-preparing-to-submit-fresh-5g-trial-applications-with-nokia-ericsson/77618188.

115 Danish Khan, "After Vodafone Idea, Airtel preparing to conduct OpenRAN 5G trials with Mavenir; seeks DoT nod", *ET Telecom*, 12 March 2021, https://telecom.economictimes.indiatimes.com/news/after-vodafone-idea-airtel-looks-to-conduct-openran-based-5g-trials-submits-application/81468048.

116 Viki Auslander, "Why western tech giants are storming India's emerging digital market", *CTECH*, 26 July 2020, https://www.reuters.com/article/us-huawei-india-exclusive/exclusive-china-warns-india-of-reverse-sanctions-if-huawei-is-blocked-sources-idUSKCN1UW1FF https://www.calcalistech.com/ctech/articles/0,7340,L-3841270,00.html.

expressing a desire to develop an indigenous 5G equipment stack, it remains to be seen what percentage of Reliance Jio's network will be produced domestically or indigenously.

Despite these moves, the Indian government has not banned Huawei from the Indian market. In September 2020, the minister of state for electronics and information technology informed the parliament that there was no proposal to exclude Chinese companies from India's 5G rollout.[117] In December 2020, the DoT constituted working groups to evaluate the implications of 5G technology for eight specific sectors. Huawei representatives have been included in working groups on healthcare and financial-technology sector working groups.[118] In March 2021, Indian TSP, Bharti Airtel, awarded a contract to Huawei to expand its national long-distance network.[119]

The various alignments and patterns in which India is rolling out 5G technology indicate that the Modi administration is aligning with the approach of the 'National Security School'. It has deepened its engagement with Western partners while severely limiting the role that Huawei will likely play in India's 5G rollout. However, it must be stressed that while the 'National Security School' appears to be the dominant approach, there appear to be strong undercurrents of the 'Globalisation School' as well. This is evidenced by the fact that the Indian government is still vacillating on whether to allow Huawei to take part in India's 5G rollout.

The proponents of the 'National Security School' approach offer a practical option that allows India to balance contradictions within that of the other two schools of thought. In the case of the 'Globalisation School' proponents, their hope that deep economic and technological links will temper China's aggressive behaviour has not borne fruit. India increasingly sees China as a strategic competitor vying for

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117 Surajeet Das Gupta, "No Plan To Exclude Huawei, ZTE From 5G Infra Contracts: Junior IT Minister", *The Wire*, 18 September 2020, https://thewire.in/government/no-plan-to-exclude-huawei-zte-from-5g-infra-contracts-junior-it-minister.

118 Ishita Guha, "Huawei part of DoT groups to prep India's 5G roadmap", *Mint*, 2 December 2020, https://www.livemint.com/industry/telecom/huawei-part-of-dot-groups-to-prep-india-s-5g-roadmap-11606881807725.html.

119 Danish Khan, "Huawei bags Rs 300 crore network contract from Bharti Airtel", *ET Telecom*, 6 March 2021, https://telecom.economictimes.indiatimes.com/news/huawei-bags-rs-300-crore-network-contract-from-bharti-airtel/81353839.

influence in South Asia. Furthermore, increasing reliance on China can leave India vulnerable to economic coercion thereby impacting its autonomy. While the advocates of the 'Self-Reliance School' approach offer the best route to strategic autonomy, it may end up costing India as it will delay the 5G rollout in the country. The approach itself may not be sustainable as the equipment produced within India may not be economical or competitive. The 'National Security School' approach allows India to deepen partnerships with Western nations while attempting to roll out 5G technology as soon as possible. In addition, it allows India to develop a hedge against China.

However, closer relations with the West does not signify that India has completely discarded its quest for strategic autonomy. There are, however, different interpretations of how India defines and chooses to pursue strategic autonomy under Narendra Modi. Harsh Pant notes that under Modi, India has sought to deepen multiple partnerships, each of which gives India some room to hedge against its other partnerships. It also looks to focus more on issue-based coalitions and pronounce its policy alignment accordingly.[120] However, C Raja Mohan contends that, in the aftermath of India's border tensions with China and the COVID-19 global pandemic, which hit global supply chains, India has redefined strategic autonomy to mean autonomy from Chinese economic influence and the preservation of India's territorial integrity. He adds that this redefinition of strategic autonomy will lead India to seek deeper relationships with the US, Europe, Japan and Australia.[121]

The Modi government's desire to keep Huawei out of India is aimed at preserving India's strategic autonomy vis-à-vis China. However, to maintain a significant degree of autonomy, India engages with several countries, not just the US. In the Indo-Pacific, India has been working with France, Japan and Australia apart from the US. Similarly, on 5G, India is diversifying its relationships to include countries like Israel, France and Japan, while deepening its relationship with the US. This

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120 Harsh Pant, "A quiet but decisive shift in India's foreign policy", *Mint*, 29 January 2020, https://www.livemint.com/opinion/columns/opinion-a-quiet-but-decisive-shift-in-india-s-foreign-policy-1548695556487.html.

121 C. Raja Mohan, "Today, India's strategic autonomy is about coping with Beijing's challenge to its territorial integrity, sovereignty", *Indian Express*, 25 August 2020, https://indianexpress.com/article/opinion/columns/reinventing-india-strategic-autonomy-china-us-6568347/.

comports with India's desire to form issue-based coalitions rather than develop an overarching alliance-based model with Western powers.

However, enhancing relationships with Western powers will deepen an already existing security dilemma between India and China. India has been deepening its overall defence relationship with the US and engaging anti-China coalitions such as the Quad. If India bans Huawei, China will likely see India as aiding the US in arresting China's rise. It will deepen Chinese perceptions that the move is a larger part of India's attempts to join the US in 'containing' China, intensifying competition in other areas like maritime competition in the Indian Ocean.

This threatens to hold the overall bilateral relationship hostage to the border dispute. During his first term, Modi sought dual-track diplomacy with China. He was keen to attract investment from China and use economic engagement to India's benefit all the while adopting a more assertive posture on the border.[122] This was a continuation of a policy instituted in the late 1980s during the Rajeev Gandhi and Deng Xiaoping summit meeting where the leaders decided that the India-China relationship should not be held hostage to the situation or status of the India-China border dispute.[123] However, under the current trajectory, it appears that the India-China relationship will likely be entwined with the border dispute.

[122] Harsh V. Pant and Yogesh Joshi, *The US Pivot and Indian Foreign Policy: Asia's Evolving Balance of Power* (Palgrave Macmillan, 2016), 74-76; and C. Raja Mohan, *Modi's World: Expanding India's Sphere of Influence* (New Delhi: Harper Collins, 2015), 28.

[123] David M. Malone and Rohan Mukherjee, "India and China: Conflict and Cooperation", *Survival 52*, no.1 (2010): 143.

Addressing National Security Concerns Emanating from 5G

While 5G technology holds immense potential to benefit large sections of the population, it can exacerbate existing security threats. To understand 5G technology's national security implications, it needs to be seen in the context of broader changes in the cyber landscape. These changes are brought about by concepts like IoT and the Fourth Industrial Revolution. Such concepts look to extend the reach of the internet connecting millions of devices through it. Given its lower latency and higher bandwidth and coverage capacity, 5G technology can enable the growth of the internet. However, cyber threats also proliferate. As the number of devices connected to the internet increases, so will the points through which hackers can penetrate a particular computer network.

Once inside a computer network, hackers can choose to carry out either espionage or sabotage. A notable example of cyber-attacks carried out for sabotage purposes has been the American and Israeli attacks on Iran's nuclear facilities through the Stuxnet worm.[124] The advent of network-centric warfare has also seen militaries come to depend on more off-the-shelf commercial technologies.[125] The increasing use of network-centric warfare concepts, where military forces are integrated into a single network already expose the military to various cyber threats.

Apart from the risks of sabotage, most Chinese cyber-attacks are undertaken for espionage. The aim is to gain access to sensitive data on proprietary technologies to increase China's industrial competitiveness.[126] It is estimated that Chinese intrusions have resulted in data theft on nearly two dozen defence projects.[127]

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[124] For examples, see Joseph S. Nye Jr., "Deterrence and Dissuasion in Cyberspace", *International Security 41*, no. 3 (Winter 2016/2017): 48; and Joseph S. Nye Jr., "Cyber Power", Paper, Belfer Center for Science and International Affairs, Harvard Kennedy School, May 2010.

[125] Steve Polak and Brendan Jordan, "Off-the-Shelf Solutions for the Battlefield", *Army Technology*, 13 May 2008, https://www.army-technology.com/features/feature1918/.

[126] Adam Segal, "China's Pursuit of Cyberpower", *Asia Policy 15*, no. 2 (April 2020): 60-66.; Jon R. Lindsay, "The Impact of China on Cybersecurity: Fiction and Friction," *International Security 39*, no. 3 (Winter 2014/15): pp. 7-47.

[127] Ibid, pp. 62.

Furthermore, there have been cases of the Chinese government installing backdoors on devices for surveillance and espionage. In an alleged case, data was stolen from computer systems at the African Union headquarters and routed back to servers in China. Huawei reportedly supplied the computer equipment. Thus far, Huawei has denied allegations of being complicit in the data theft.[128] However, this is one of several allegations of espionage via backdoors against Huawei and China. At the very least, it is known that Huawei's equipment has major security vulnerabilities.[129]

The incorporation of IoT and 5G technology can magnify these threats. The US military has already been experimenting with 5G technology and its applications in the fields of logistics, virtual reality and joint operations. As the US attempts to incorporate commercial concepts like IoT into its military doctrines and weapon systems, it may rely on commercially available 5G infrastructure.[130] The presence of Chinese backdoors in these networks can create serious vulnerabilities. Chinese backdoors can be used to compromise these networks, deny military communications and sabotage weapon systems. A US Department of Defense report on the security implications of 5G technology notes that "The 5G ecosystem will especially run the risk of including security vulnerabilities if China becomes the global leader supplying 5G infrastructure…for even if the US limits sales of Chinese products into the US, DoD will still have to operate on foreign networks overseas that will likely be built with a Chinese supply chain."[131]

In India, Chinese cyber-attacks have targetted both civilian and military institutions. India ranked third in terms of the highest number of cyber threats detected and second in terms of recipients

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128 Ashley Dutta and Jonathon Marek, "A Concise Guide to Huawei's Cybersecurity Risks and the Global", The National Bureau of Asian Research, 3 October 2019, https://www.nbr.org/publication/a-concise-guide-to-huaweis-cybersecurity-risks-and-the-global-responses/.

129 "Annual Report 2019", Huawei Cyber Security Official Oversight Board, March 2019, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/79027 0/HCSEC_OversightBoard Report-2019.pdf.

130 Denise E. Zheng William A. Carter, "Leveraging the Internet of Things for a More Efficient and Effective Military", Centre for Strategic and International Studies, September 2015.

131 Milo Medin and Gilman Louie, "The 5G Ecosystem: Risks & Opportunities For Dod", Defence Innovation Board, April 2019, 23-27, https://apps.dtic.mil/sti/pdfs/AD1074509.pdf.

of coordinated cyber-attacks in 2017.[132] A report to the National Security Council Secretariat in 2018 estimated that 35 per cent of all cyber intrusions into India originated from China.[133] During the height of the 2020 India-China border standoff, Chinese cyber intrusions into India dramatically increased. One report estimated there were an estimated 40,000 attacks in a span of four to five days.[134] Data theft from India's sensitive national security organisations like the Defence Research and Development Organisation or the Indian Space Research Organisation is a serious concern. Any Chinese cyber incursions are likely to obtain information on Indian defence systems to develop countermeasures against them or circumvent their effectiveness on the battlefield. These factors and vulnerabilities may significantly impact the balance of power in the India-China dyad.

Chinese hackers have also targetted civilian government institutions such as critical infrastructure and the banking sector. Reportedly, Chinese hackers also gained access to Mumbai's power grid and disabled it for several hours. An investigation into the incident by the Maharashtra state government is still being conducted; however, a US-based cybersecurity firm confirmed that Chinese hackers conducted the intrusion.[135] The assumption in policy circles is that the inclusion of Huawei will severely magnify these threats. Analysts and policymakers suspect that Chinese telecommunication equipment may have pre-installed backdoors that will allow Chinese hackers easy access to networks. A report by the Parliamentary Standing Committee on Information Technology highlighted several shortfalls in India's cyber security architecture and specific threats from imported electronics and IT products.[136]

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132 "India ranks 3rd among nations facing most cyber threats: Symantec", *The Economic Times*, 4 April 2018, https://economictimes.indiatimes.com/tech/internet/india-ranks-3rd-among-nations-facing-most-cyber-threats-symantec/articleshow/63616106.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

133 Mahender Singh Manral, "35% of cyber attacks on Indian sites from China: official report", *Indian Express*, 23 August 2018, https://indianexpress.com/article/india/35-of-cyber-attacks-on-indian-sites-from-china-official-report/.

134 "Rise In Cyber Attacks From China, Over 40,000 Cases In 5 Days: Official", *NDTV*, 23 June 2020, https://www.ndtv.com/india-news/rise-in-cyber-attacks-from-china-over-40-000-cases-in-5-days-official-2251111.

135 "Did Chinese Hackers Cause Mumbai's Power Failure in October?", *The Wire*, 1 March 2021, https://thewire.in/world/india-china-hackers-border-tension-power-grid-malware-recorded-future.

136 "Cyber Crime, Cyber Security and Right To Privacy", 52nd Report, Lok Sabha Standing Committee On Information Technology, 12 February 2014, https://eparlib.nic.in/bitstream/123456789/64330/1/15_Information_Technology_52.pdf.

The increasing reach of China's cyber capabilities could allow the Chinese military to disrupt Indian military operations through cyber-attacks. Since the Chinese military adopted its strategic military guideline of 'Active Defence' in 1993, it has placed a premium on achieving information dominance over a particular battlespace. The Chinese military has incorporated significant cyber capabilities to attack and disable an adversary's networks to achieve this dominance. However, there are no known instances of the Chinese military carrying out such operations.

Like the US military, India is working to incorporate network-centric warfare capabilities into its military.[137] This will involve the induction of various commercial 'off-the-shelf' technologies into military systems. Increasing software and IT equipment use in the Indian Armed Forces will undoubtedly increase cyber security risks. Furthermore, contingencies may arise where the Indian military may have to rely on civilian infrastructure. The inclusion of Chinese equipment in this infrastructure may create new vulnerabilities.

However, in the case of the Indian military, the threats appear to be to a lesser extent. The Indian military has traditionally used indigenous equipment while deploying communication networks. In 2016, India launched its Integrated Defence Communication Network which was built entirely by HCL.[138] To improve communications near border regions, the Indian Army is implementing the Army Static Switched Communication Network Phase IV Network. This project is also being conducted by domestic companies with nearly 80 per cent indigenous equipment. This trend is likely to continue, especially after India's recent push for indigenisation of defence equipment and may mitigate some cyber security concerns.[139] Despite this drive to indigenise, the Indian military has flagged issues regarding Huawei's participation in India's 5G network. Officials have warned

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137 Yogesh Joshi and Harsh V. Pant, "India and the changing nature of war: gradual incrementalism?", in *Handbook of Indian Defence Policy: Themes, structures and doctrines*, ed. Harsh V. Pant (New York: Routledge, 2016), 79-94.

138 "HCL Info implements India's first integrated defence communication network", *Hindu Business Line*, 30 June 2016, https://www.thehindubusinessline.com/news/national/hcl-info-implements-indias-first-integrated-defence-communication-network/article8792134.ece.

139 "Army Static Switched Communication Network (ASCON) Phase IV of the Indian Army to be established by M/s ITI", *Press Information Bureau*, 1 October 2020, https://pib.gov.in/PressReleasePage.aspx?PRID=1660685.

that India's entire command and communication structure could be compromised through pre-installed backdoors on Chinese telecommunication equipment.[140]

Given the risks associated with the compromise of military communications, the Indian government has worked to limit any foreign equipment in military communication networks. Domestic firms play a key role in developing these networks. Thus, in the defence sector, it appears that the views of the 'Self-Reliance School' resonate with the government. In fact, unlike contradictions that exist in the case of foreign policy approaches, all three schools are unanimous on the need to secure military communications through domestic means. While the 'Self-Reliance School' is the most vocal, the other two schools of thought appear to be aware of the risks.

[140] Snehesh Alex Philips, "'Concerned' Army red-flags possibility of China's Huawei 5G services entering India", *The Print*, 15 January 2020, https://theprint.in/defence/concerned-army-red-flags-possibility-of-chinas-huawei-5g-services-entering-india/349879/.

Impact on Economic Interdependence between India and China and Global Governance

The logic of economic interdependence has guided US-China relations in the post-Cold War era. This logic stipulates that the close economic linkages between the two leading global powers will foster an environment that will minimise conflict and maintain stability. A wider aspiration of this policy approach was that increasing economic liberalisation of China's domestic market would lead to a political liberalisation of Chinese society, setting the stage for a transition to democracy. Thus, under successive post-Cold War administrations, the US has increased investments and trade with China to broaden and deepen economic ties.

Making a case for stability, Joseph Nye has argued that going to war and disrupting deep economic links would entail costs both the US and China would not be willing to incur. He added that this entanglement of economies deters conflict.[141] Similarly, former Australian Prime Minister Kevin Rudd explains that "a fully 'decoupled world' would be a deeply destabilising place, undermining the global economic growth assumptions of the last 40 years, heralding the return of an iron curtain between East and West and the beginning of a new conventional and nuclear arms race with all its attendant strategic instability and risk."[142] Furthermore, business communities have long been seen as stabilisers in the US-China relationship. Being both significant domestic constituents as well as the communities with the most to lose in a conflict, they have long advocated for restraint on both sides of the Pacific.[143]

However, in recent years and since the Trump administration the logic of economic independence has come under criticism. There have been increasing calls to rethink this policy. Pompeo openly questioned the logic of interdependence and stressed the

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141 Joseph S. Nye Jr., "Power and Interdependence with China", *The Washington Quarterly 43*, no.1 (2020), 7-21.
142 Kevin Rudd, "To Decouple or Not to Decouple?", Robert F. Ellsworth Memorial Lecture, University of California-San Diego, 4 November 2019, https://asiasociety.org/policy-institute/decouple-or-not-decouple.
143 Evan S. Medeiros, "The Changing Fundamentals of US-China Relations", *The Washington Quarterly*, 42, no.3 (2019), 93-119.

unequal terms of the US-China relationship, which, in his estimate, greatly favoured China.[144] Former US Vice President Michael Pence stated that the logic underpinning the Trump administration's trade war with China was to "continue to negotiate in good faith with China to bring about long-overdue structural reforms in our economic relationship".[145] Meanwhile, scholars have pointed out the asymmetric nature of the US-China relationship and called for both foreign and domestic policy course corrections.[146] This view has been upheld by US President Joe Biden's administration. Thus, in his Interim Strategic Guidance in 2021, Biden wrote, "We will confront unfair and illegal trade practices, cyber theft, and coercive economic practices that hurt American workers, undercut our advanced and emerging technologies, and seek to erode our strategic advantage and national competitiveness."[147] To this end, both the Trump and Biden administrations have attempted to pursue a limited rollback of economic interdependence, specifically looking to enhance their leadership in the research, development, deployment and governance of emerging technologies.

One aspect of the ongoing technology rivalry is centred around preventing Chinese telecommunication companies from dominating the global telecommunication market. The Trump administration doubled down on these efforts but saw limited success. Both US treaty allies, Australia and Japan, have banned Huawei from their 5G rollouts. The UK, which until recently had withstood US pressure to ban Huawei, passed an order mandating the phase-out of Huawei equipment from its networks by 2027.[148] The US has also pressured India to ban Huawei from its networks.[149]

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144 Michael R. Pompeo, "2019 Herman Kahn Award Remarks: US Secretary of State Mike Pompeo on the China Challenge", The Hudson Institute, New York, 30 October 2019, https://s3.amazonaws.com/media.hudson.org/Transcript_Secretary%20Mike%20Pompeo%20Hudson%20Award%20Remarks.pdf.

145 Michael Pence, "Remarks by Vice President Pence at the Frederic V. Malek Memorial Lecture", Washington, DC, 24 October 2019, https://trumpwhitehouse.archives.gov/briefings-statements/remarks-vice-president-pence-frederic-v-malek-memorial-lecture/.

146 Aaron L. Friedberg and Charles W. Boustany Jr., "Partial Disengagement: A New US Strategy for Economic Competition with China", *The Washington Quarterly 43*, no.1 (2020), pp. 23-40.

147 Joseph R Biden, "Interim National Security Strategic Guidance: Renewing America's Advantages", White House, US Government, March 2021, https://www.whitehouse.gov/wp-content/uploads/2021/03/NSC-1v2.pdf.

148 Tim Bowler, "Huawei: Why is it being banned from the UK's 5G network?", *BBC News*, 14 July 2020, https://www.bbc.com/news/newsbeat-47041341.

149 Dipanjan Roy Chaudhury, "India, US to discuss Huawei's role in 5G trials", *Economic Times*, 26 June 2019, https://economictimes.indiatimes.com/tech/internet/india-us-to-discuss-huaweis-role-in-5g-trials/articleshow/69951779.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

Another prong of the US' approach to competing with China is to restrict its access to critical technologies needed for manufacturing telecommunication equipment. In May 2020, Trump extended a 2019 Executive Order, placing Huawei and other Chinese firms on the Entity List.[150] This move prohibits US firms with sensitive IT to transact with Huawei without first obtaining a Department of Commerce licence. The above move, however, is not only aimed at arresting the growth of China's telecommunication giants but also preventing China from gaining advantages in other sectors. In October 2019, the US commerce department added 28 companies and government organs to the entity list, including leaders in China's AI sector such as SenseTime, Megvii, Yitu and iFlytek.[151]

The Chinese government has reacted to these measures by focusing on building indigenous capabilities in many of these "core" technologies. "Core" technologies mainly include semiconductor devices and related technologies like integrated circuits and capacitors. It has funnelled huge funds into developing these technologies under the 'Made in China 2025' initiative.[152] However, China remains dependent on imports for such technologies. It imported nearly US$300 billion (S$399.85 billion) worth of semiconductors in 2018.[153] Now, the Chinese government intends to remove all foreign hardware and software equipment from its government institutions in three years.[154] China has, thus far, been leading the world in terms of R&D in the next generation of technologies, both in terms of input and output. Beijing has invested significant amounts of money into developing technologies related to 5G and AI. In 5G particularly, China also provided US$400 billion (S$533.14 billion) in 5G investments, coordinated with companies

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150 Roslyn Layton, "Trump Just Extended The Huawei Ban. Is The Policy Working?", *Forbes*, 15 May 2020, https://www.forbes.com/sites/roslynlayton/2020/05/15/trump-just-extended-the-huawei-ban-is-the-policy-working/#344a44293492.

151 Adam Segal, "Year in Review 2019: The U.S.-China Tech Cold War Deepens and Expands", Council on Foreign Relations, 18 December 2019, https://www.cfr.org/blog/year-review-2019-us-china-tech-cold-war-deepens-and-expands.

152 Adam Segal, "Seizing Core Technologies: China Responds to U.S. Technology Competition", *China Leadership Monitor*, 1 June 2019 https://www.prcleader.org/segal.

153 Segal, "Seizing Core Technologies: China Responds to U.S. Technology Competition", op. cit.

154 Segal, "Year in Review 2019: The U.S.-China Tech Cold War Deepens and Expands", op. cit.

manufacturing 5G technology, and worked with Chinese providers to deploy 5G infrastructure.[155]

Huawei invested US$600 million (S$799.71 billion) into 5G technology research between 2009 and 2013 and US$1.4 billion (S$1.87 billion) into 5G product development up to 2018.[156] In terms of output, Huawei also leads the world in the number of patents filed in 5G technology, with almost 13,000 patents filed globally. By February 2020, Huawei led the world in the number of 5G contracts secured, with most being in Europe.[157]

This positions Huawei and, by extension, China to dominate the international 5G standard-setting process.[158] Dominating the international standard-setting process has important advantages. It allows Chinese firms to set standards that favour them and makes their equipment less interoperable with other suppliers. This could lock out other players and even create Chinese monopolies outside of China.[159] Chinese companies have already begun developing an end-to-end stack of 5G compatible technologies from core networks to 5G capable smartphones. This may lead to a situation where two sets of standards develop, decoupling the Chinese-led and Western-led 5G markets even further. The eventual outcome would entail a fragmented internet due to incompatible hardware and restricted data flows.

Recognising the risk China poses to the global governance architecture, the Biden administration has sought to reform it. Kurt Campbell, the coordinator for the Indo-Pacific at the National Security Council, has acknowledged the need to form niche and issue-based

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155 Dan Littmann et al, "5G: The chance to lead for a decade", Deloitte, 2018, https://www2.deloitte.com/content/dam/Deloitte/us/Documents/technology-media-telecommunications/us-tmt-5g-deployment-imperative.pdf.

156 "5G, Gear Up", *Spotlight*, Huawei, 11 October 2020, https://carrier.huawei.com/en/spotlight/5g#:~:text=Leading%20R%26D%20Investment,billion%20into%205G%20product%20development.

157 Ma Si, "Huawei secures most 5G contracts around world", *China Daily*, 22 February 2020, http://global.chinadaily.com.cn/a/202002/22/WS5e50491ea3101282172796b9.html.

158 For an overview, see Daniel Russell and Blake Berger, "Stacking The Deck: China's Influence In International Technology Standards Setting", Asia Society Policy Institute, 2021, https://asiasociety.org/sites/default/files/2021-11/ASPI_StacktheDeckreport_final.pdf.

159 James I. Schoff and Asei Ito, "Competing With China on Technology and Innovation", Carnegie Endowment for International Peace, 10 October 2019, https://carnegieendowment.org/2019/10/10/competing-with-china-on-technology-and-innovation-pub-80010.

coalitions that can help develop and maintain a new order. Campbell argued that the Indo-Pacific coalitions could be formed around issues such as "supply chains, standards, investment regimes, and trade agreements".[160] More recently, US Secretary of State Anthony Blinken acknowledged a need to reform some parts of the rules-based order in Asia.[161] To this end, 5G governance (among other technology issues) has emerged as the Quad's focus area. Specifically, on 5G technology, the Quad has made a strong push for "OpenRAN deployment and adoption".[162] Thus, the Quad has stepped up engagement to develop solutions that run counter to China's agenda. The recently launched Indo-Pacific Economic Framework (IPEF) is another potential forum for developing rules that govern technology deployment.

Banning Huawei in India gels with calls to rebalance the India-China economic relationship due to the immense trade deficit, which still favours China. The Modi administration has already banned various Chinese applications, citing national security concerns.[163] However, these applications may be low-hanging fruit as China is deeply embedded in India's technology market. Its market share ranges from dominance in India's mobile handset markets to venture capital investments in Indian start-ups. Chinese companies – Xiaomi, Vivo, Oppo and Transsion – hold the first, third, fourth and fifth positions respectively.[164] They successfully ousted several Indian companies like Micromax and Lava to dominate the Indian market. By the first quarter of 2019, Chinese handset manufacturers controlled 66 per cent of the market. The Indian market has also seen the Indian start-up ecosystem receive significant venture capital investment from

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160 Kurt M. Campbell and Rush Doshi, "How America Can Shore Up Asian Order", *Foreign Affairs*, 12 January 2021, https://www.foreignaffairs.com/articles/united-states/2021-01-12/how-america-can-shore-asian-order.

161 Antony Blinken, "The Administration's Approach to the People's Republic of China", George Washington University, Washington, D.C., 26 May 2022, https://www.state.gov/the-administrations-approach-to-the-peoples-republic-of-china/.

162 "Fact Sheet: Quad Leaders' Summit", Statements and Releases, The White House, 24 September 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/09/24/fact-sheet-quad-leaders-summit/.

163 "IT Ministry has blocked 224 apps in interest of national security: Dhotre", *Business Standard*, 16 September 2020, https://www.business-standard.com/article/technology/it-ministry-has-blocked-224-apps-in-interest-of-national-security-dhotre-120091601398_1.html.

164 Prasid Banerjee, "How Chinese mobile phones took over the Indian market", *Mint*, 2 November 2018, https://www.livemint.com/Technology/KsUB8dkslIxzBqcUCFfySJ/How-Chinese-mobile-phones-took-over-the-Indian-market.html.

China. In the final quarter of 2019-2020, deals involving Chinese investors totalled a record US$1.4 billion (S$2 billion).[165] Alibaba has invested in payments group Paytm and food-delivery service Zomato, while fellow Chinese internet giant Tencent has backed car-hailing application Ola and BYJU'S, an education start-up.[166]

However, it does appear that the Modi administration is following through on efforts to limit Chinese investments. Offices of two Chinese smartphone makers, Xiaomi and Vivo, were raided by India's enforcement directorate on allegations of tax evasion. The enforcement directorate seized up to US$730 million (S$972.98 billion) from Xiaomi based on these allegations.[167] Previously, the Indian government changed its foreign direct investment policy to prevent "opportunistic takeovers" of Indian firms by Chinese entities.[168]

While the side-lining of Huawei in India's 5G rollout could dent India-China economic links, it is unlikely that a major decoupling will occur. The main challenge for India is that China is not dependent on India for the import of any critical materials like rare earth minerals or semiconductors. Therefore, it becomes difficult for India to gain coercive leverage by imposing trade restrictions alone. However, the exclusion of Huawei from India's 5G rollout will have an impact on the larger geo-economic competition being played between the US and China and globalisation. India has the world's second-largest mobile subscriber base. Preventing Huawei from gaining a first-mover advantage in India will impact its revenue and its global competitiveness vis-à-vis its western counterparts. Finally, India has been an active participant in the Quad mechanism and joined the US-led IPEF. It has been aligning with the West's global governance reform agenda, engaged in developing standards, rules and norms for technology governance.

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165 Benjamin Parkin, "China provides record funding for Indian tech start-ups", *Financial Times*, 17 February 2020, https://www.ft.com/content/4899354a-4f13-11ea-95a0-43d18ec715f5.

166 Ibid.

167 Sayan Chakroborty, "Indian raids on Chinese phone makers: 5 things to know", *Nikkei Asia Review*, July 8, 2022, https://asia.nikkei.com/Politics/International-relations/Indian-raids-on-Chinese-phone-makers-5-things-to-know.

168 Prabha Raghavan, "Explained: Why India tightened FDI rules, and why it's China that's upset", *The Indian Express*, 23 April 2020, https://indianexpress.com/article/explained/why-india-tightened-fdi-rules-and-why-its-china-thats-upset-6374693/.

Ultimately, the view that has emerged is that economic engagement needs to be tempered by a national security lens. India has pivoted to increase economic links with the West at China's cost. Thus, the 'Globalisation' school's view that greater economic engagement will lead to stability has, for the most part, been side-lined. India's economic links, especially with regard to emerging technology sectors, are being driven by a desire to engage 'like-minded' partners. This view is held both in India and the West, setting up a mutual convergence of interests. As noted in the previous sections, India has deepened its engagement with its Western partners on technology issues. This includes trade in technology products, investment in initiatives to develop and foster and deploy new technologies as well as developing a new framework to govern technology use. This form of economic engagement is likely to continue and the 'National Security' school's views will mostly dominate thinking for the foreseeable future.

Technological Innovation and Development

The ICT sector contributes nearly 6.5 per cent to India's gross domestic product.[169] However, India imports nearly all its telecommunication hardware equipment. In 2017-2018, India imported US$21.8 billion (S$31.15 billion) worth of telecommunication equipment while exporting US$1.2 billion (S$1.71 billion). In terms of R&D, out of approximately 23,500 total patents identified, only 18 patent applications were filed by Indian entities between 2000 and 2015.[170]

As highlighted above, there is a significant constituency which believes that the indigenisation of telecommunication networks with locally produced gear will ensure the security of telecommunication networks. This view appears to have begun to permeate the Indian government. A recent paper released by TRAI on recommendations on promoting local telecommunication equipment manufacturing clearly recognises the fact that indigenisation can promote the security of networks. In its paper, TRAI notes, "with the Fourth Industrial Revolution already unfolding, the telecommunication networks and devices would become the backbone for the industrial and knowledge economy of the country. Having self-reliance in such critical areas of the economy is not only necessary from an economic point of view but also necessary from the national security perspective."[171] TRAI also recommends that "India should aim to achieve the objective of 'net zero imports of telecommunication equipment' by 2022".[172]

The National Digital Communication Policy of 2018 also identifies the "usage of indigenous communication products and services" as a means of ensuring data protection and security of digital communications.[173] Senior officials within the Indian government

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169 "Consultation Paper on Promoting Local Telecom Equipment Manufacturing", Publications, Telecom Regulatory Authority of India, 18 September 2017, 4, https://trai.gov.in/sites/default/files/CP_on_Manufacturing_18_09_17.pdf.

170 Consultation Paper on Promoting Local Telecom Equipment Manufacturing", p. 11.

171 "Recommendations on Promoting Local Telecom Equipment Manufacturing", Press Release, Telecom Regulatory Authority of India, 3 August 2018, p. 19, https://www.trai.gov.in/sites/default/files/Recommendations_LTEM_03082018_0.pdf.

172 Ibid, p. 22.

173 "National Digital Communications Policy 2018", Department of Telecom, p. 18, 13 October 2020, https://dot.gov.in/sites/default/files/EnglishPolicy-NDCP.pdf.

have put forward a plan to support indigenous production in 5G to enhance 5G network security.[174] The Indian government has also been supporting the development of a fully indigenous end-to-end 5G test bed in the Indian Institute of Technology, Madras, which is expected to be fully operational by 2021. The test bed aims to build domestic competencies in 5G technology and is a collaboration between academic institutes and domestic start-ups.[175]

The Indian government thus far has allocated a sum of ₹2,240 million (S$44.3 million) over a three-year period in 2018 to develop this test bed. As noted previously, the Telecom Standards Development Society, India (TSDSI), has received approval to implement India-specific standards for 5G technology.

The TSDSI has pushed for the adoption of low-mobility large-cell technology standards to cater to connectivity in India's rural areas. This standard advocate for 5G deployment in the more efficient 3.4 GHz band and pegs the inter-site distance at 12 kilometres rather than opting for the global 3GPP standard, which opts for the 700 MHz band and pegs inter-site distance at six kilometres.[176] Global players contend that creating such standards will not harmonise the Indian market with the global market, fragment global supply chains and could drive up costs in India. However, such India-specific standards could give domestic manufacturing and indigenisation a boost.[177] In 2020, the International Telecommunication Union (ITU) approved TSDSI's India-specific standards recommendations. The TSDSI noted that this was "the first ever Mobile Radio Interface Technology contribution from India to become part of ITU-R's [International

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174 Shubhajit Roy, "5G technology: NSAB member, Chinese diplomat cross swords over Huawei", *Indian Express*, 11 July 2019, https://indianexpress.com/article/business/5g-technology-nsab-member-chinese-diplomat-cross-swords-over-huawei/.; "Accelerating domestic output of telecom gear in strategic interest: Trai", *Business Standard*, 16 August 2020, https://www.business-standard.com/article/economy-policy/accelerating-domestic-production-of-telecom-gear-in-strategic-interest-120081600217_1.html.

175 "India's 5G Testbed to be fully operational by 2021: Project coordinator", *ET Telecom*, 10 October 2018, https://telecom.economictimes.indiatimes.com/news/indias-5g-testbed-to-be-fully-operational-by-2021-project-coordinator/66137722.

176 Kalyan Parbat, "Telcos to move DoT to stop adoption of India-specific 5G standards, say costs will jump by 40%", *The Economic Times*, 15 September 2020, https://economictimes.indiatimes.com/industry/telecom/telecom-news/telcos-to-move-dot-to-stop-adoption-of-india-specific-5g-standards-say-costs-will-jump-by-40/articleshow/78126170.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

177 Bhaskar Ramamurthi, "Bridging the 5G digital divide: How indigenously developed technology can reach remote Indian villages", *The Times of India*, 23 July 2020, https://timesofindia.indiatimes.com/blogs/toi-edit-page/bridging-the-5g-digital-divide-how-indigenously-developed-technology-can-reach-remote-indian-villages/.

Telecommunication Union's Radiocommunication] IMT [International Mobile Telecommunication] recommendation".[178] While these measures will certainly help advance the indigenisation of 5G technology, a major stumbling block is the lack of adequate funding. India's US$31 million (S$44.3 million) pales in comparison to the US$400 billion (S$571.6 million) the Chinese government has invested in 5G development. In India, a mere 1.8 per cent of total turnover is spent by telecommunication equipment manufacturers on R&D, as opposed to the 6-13 per cent spent by international players.[179]

Recently, the Chairman of Reliance Industries, Mukesh Ambani, announced that his company would develop and deploy a "complete end-to-end 5G solution" in India.[180] Ambani suggested that the network would be deployed with fully indigenous technologies. While this could be an important step in developing indigenous 5G capability, Reliance Jio's announcement must be considered in context. Currently, Reliance Jio holds no major patents on 5G technology and has filed a total of 134 patents since it began operations in 2016.[181] This starkly contrasts with the 2,000 plus patents filed by Huawei in 5G technology. Reliance Jio also continues to partner with foreign entities such as Samsung, Qualcomm and Google on 5G technology. Furthermore, reports suggest that Reliance Jio is planning on acquiring technology from Indian start-ups on 5G technology.[182] For the time being, it is likely that Reliance Jio is focussed on the deployment of 5G services in a non-standalone capacity and looks to leverage its existing 4G networks to deliver

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178 "TSDSI's 5G Radio Interface Technology "5Gi" approved by SG5 of ITU-R as part of upcoming ITU-R Recommendation M.[IMT-2020.SPECS]", News, Telecom Standards Development Society, India, 2 December 2020, https://tsdsi.in/tsdsis-5g-radio-interface-technology-5gi-approved-by-sg5-of-itu-r-as-part-of-upcoming-itu-r-recommendation-m-imt-2020-specs/.

179 "Recommendations on Promoting Local Telecom Equipment Manufacturing", op. cit., p28.

180 Aashish Aryan and Pranav Mukul, "What does the solution mean to Reliance, and its users?", *The Indian Express*, 22 July 2020, https://indianexpress.com/article/explained/jio-5g-what-does-the-solution-mean-to-reliance-and-its-users-6509088/.

181 Devina Sengupta, "Stiff competition awaits Reliance Jio as it takes 'made-in-India' 5G tech to the world", *The Economic Times*, 28 July 2020, https://economictimes.indiatimes.com/industry/telecom/telecom-news/stiff-contest-awaits-jio-as-it-takes-its-5g-tech-to-the-world/articleshow/77206868.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

182 Muntazir Abbas, "Reliance Jio seeks to buy homegrown startups, companies developing 5G solutions", *ET Telecom*, 28 August 2020, https://tech.economictimes.indiatimes.com/news/startups/reliance-jio-seeks-to-buy-homegrown-startups-companies-developing-5g-solutions/77795699; and Samarth Bansal, "Inside Reliance Jio's game plan for 5G", *Mint*, 8 September 2020, https://www.livemint.com/industry/telecom/inside-reliance-jio-s-game-plan-for-5g-11599489457041.html.

5G services.[183] However, this will limit the number of use cases for which 5G technology can be leveraged. Furthermore, Reliance Jio's approach does not foster R&D development as it is merely acquiring existing technology rather than developing its own.

Across all schools of thought, support exists to leverage domestic capabilities. The divergence is mainly between the 'Globalisation School', which calls for developing and leveraging India's comparative advantage, against the indigenisation school that recommends India develops indigenous capabilities.

As noted above, TRAI has recommended that it is necessary to step up domestic production of telecommunication equipment, given the increasing role digital technology plays in society and the security threats posed by imported equipment. Domestic production can take two forms – either domestic manufacturing, where products are locally manufactured or assembled, but technology ownership is outside India or where technology is sourced from domestic entities and value addition to the supply chain is high. While successfully creating a manufacturing base can be accomplished, creating a value addition is difficult and requires concerted investment in R&D capability.

This fact is borne out in mobile handset manufacturing in India. In 2020, India became a net exporter of mobile handsets; however, the true value addition in India is only 12 per cent. In India, companies mainly focus on assembly and low-level production. High-value parts are still imported.[184] The Indian government has stated its desire to increase the percentage of indigenous technology content in telecommunication equipment deployed and manufactured in India. This goal will prove to be a challenge. The sector is dominated by external players, and as India looks to deploy 5G technology,

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[183] V. Sridhar, "Reliance's 5G claim: A reality check", *Frontline*, 14 August 2020, https://frontline.thehindu.com/the-nation/reliances-5g-claim-reality-check/article32169716.ece; and Samarth Bansal , "Inside Reliance Jio's game plan for 5G", *Mint*, 8 September 2020, https://www.livemint.com/industry/telecom/inside-reliance-jio-s-game-plan-for-5g-11599489457041.html.

[184] Sunil Mani, "Developing India's Mobile Phone Manufacturing Industry", *Economic and Political Weekly 55*, No. 19 (9 May 2020); and Nikhil Rampal, "India is a mobile phone exporter now, but can it mute the Dragon ring tone?", *India Today*, 10 June 2020, https://www.indiatoday.in/diu/story/india-is-a-mobile-phone-exporter-now-but-can-it-mute-the-dragon-ring-tone-1687706-2020-06-10#:~:text=So%20far%2C%20India's%20mobile%20phone,export%20of%2036%20million%20units.

domestic firms may not receive sufficient market share to develop financially worthwhile technologies. While banning Huawei gives the domestic industry room by eliminating competition, it is unlikely the Indian government can delay the 5G rollout till domestic capabilities improve. In this regard, while production may be shifted within India, the intellectual property remains in the hands of partner countries.

Conclusion

This Scan has covered internal discussions and motivations around 5G technology in India. Since 2019, domestic 5G discussions have been shaped by a complex amalgam of security, economic and political considerations. The decision confronting the Indian government of whether to include Chinese telecommunication giant Huawei in India's 5G trials and landscape has collided with considerations beyond the technical and technological. Though Huawei's history and imprint in India and its linkages with domestic Indian technology firms ostensibly necessitate its presence in India's 5G network, the 2020 clashes between Chinese and Indian troops across the border, US intentions to limit Huawei's access to global markets and technologies and intentions to develop indigenous 5G capabilities, given US-China economic tensions, and supply chain constraints unleashed by the COVID-19 pandemic have complicated India's Huawei decision. This choice will have immense implications for India's foreign policy, economic orientation and future and domestic technological ecosystem.

We sketched three broad fault-lines or ideas that have crystallised around India's 5G choice in India's strategic community – the 'National Security School', consisting of scholars who view the international system to be anarchic and that India must make decisions, including those concerning technologies, rationally, given China's growing threat to India. They push for the Indian government to dispense with Huawei and related Chinese solutions and partner with like-minded countries to advance technological agendas. They are also, at best, sceptical, of indigenous solutions to India's 5G predicament. The 'Self-Reliance School' emphasises self-sufficiency and autonomy or that India should rely on domestic homegrown solutions to its 5G problem, not rely on rivals like China or partners like the US. 'Self-reliance' advocates pushing technological independence. Finally, 'globalisation' advocates preach economic and technological interdependence and for markets and market forces, not the state or politics, to determine technological innovation and direction. Like the 'national security' proponents, they are sceptical over India's capacity to self-innovate and work itself out of this technological predicament. Instead, they push for firms, regardless of national origins, to work with other firms across borders

to advance technological innovation. All these views have salience in New Delhi as the government mulls how to use and leverage 5G technology without undermining national security and the quest for technological autonomy.

The impetus to constrain and check China's technological presence in India grew after the Galwan Valley crisis in mid-2020. This shift represents an about-turn from 2019 when the Indian government allowed Huawei to participate in the country's 5G trials. Soon after, discussions occurred between several Indian ministries over how to deal with a multi-faceted Chinese technology threat that ranged across hardware, software and cyber dimensions. These discussions extended to the multilateral realm where Indian officials worked within the Quad and other frameworks to protect domestic technological ecosystems from China. Concurrently, the pandemic introduced new pressures to invest and develop 5G capacities at home, given rising tensions between China and the US that have triggered global efforts to rebalance domestic and international economic engagement. Whether or not these new partnerships pan out and whether India can successfully develop 5G capacity at home, it is beyond doubt that technological issues and considerations have entered the Indian strategic realm where they tangle with a complex set of concerns and priorities, economic and geopolitical. If anything, this situation appears to be the new normal when understanding and explaining India's geo-economic behaviour.

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