Technological Sovereignty of Great Powers: A Case Study of China

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Abstract

The traditional focus on geopolitics is shifting toward a geoeconomic paradigm, where emerging technologies are increasingly viewed as central to the dynamics of great power politics. States are pursuing technological sovereignty as a policy choice to achieve self-reliance and sovereign control over critical technologies, aiming to maximise their autonomy and influence in a competitive international landscape. This paper examines China's approach to technological sovereignty by analysing key government initiatives, like 'Science & Technology in China: A Roadmap to 2050', 'Digital Silk Road', and 'Made in China 2025' and the role of Chinese big tech corporations. Due consideration has also been accorded to the multifaceted impacts of China's technological sovereignty on global power politics, with special focus on the intensifying Sino-US tech war. Lastly, it evaluates the rapid transitions that may unfold on a global scale as a result of these developments.

Keywords: Technological Sovereignty, Fourth Industrial Revolution, Great Power Politics, Sino-US Tech War, Global Politics.

Introduction

The global power struggle is increasingly characterised by a shift away from the traditional pre-eminence of geopolitical and military modes of influence, moving toward economic and technological domains. Core technologies have emerged as a pivotal source of power, prompting states to compete for self-sufficiency and dominance in these areas. This pursuit of technological sovereignty entails achieving self-reliance within the technological sphere, enabling states to assert autonomy and reduce dependencies on other nations. Such dependencies can erode state sovereignty, motivating countries to develop and follow an indigenously crafted roadmap to shape their economic and technological futures. Advent of the Fourth Industrial Revolution (4IR) has amplified the critical intersection of power and technology. Emerging technologies such as Artificial Intelligence (AI), cloud computing, the Internet of Things (IoT), and robotics have become central to this landscape, further reflecting the strategic importance of technological innovation and independence. This dynamic underscores the evolving nature of global influence in an era increasingly driven by technological advancement, as well as reinforces the enduring notion that the quest for power remains constant, while the modes of acquiring and wielding it continue to adapt and transform.

In the contemporary era, global power dynamics are increasingly shaped by the Sino-US rivalry, which has become the defining feature of international relations. Given the critical and strategic significance of technology in this landscape, this competition is aptly termed the Sino-US tech war. At its core, this struggle is about dominance in cutting-edge technological domains, including AI, quantum computing, semiconductor development, and telecommunications, which are expected to define the global

balance of power in the coming decades.[1] The US has resorted to a multipronged approach to thwart China's adoption and commercialisation of emerging technologies while the latter is undertaking initiatives like 'Science and Technology Roadmap 2050', 'Made in China 2025' and 'Digital Silk Road' to make greater leaps in the race for technological supremacy. Against this backdrop, China is materialising the notion of technological sovereignty to maximise its autonomy and influence at a global scale.

This evolving trend toward technological sovereignty is analysed in this paper through the theoretical framework of geoeconomics. This paradigm suggests that the traditional focus on military and geopolitical strategies is increasingly being supplanted by non-military and economic modes of power among states. In this era of geoeconomics, competition and conflict are often waged through non-military instruments, with technology emerging as the most potent tool in this arsenal.[2] The Sino-US rivalry exemplifies this shift, where technology has become the dominant non-military means in the broader struggle for global influence. From AI and semiconductor supremacy to control over data and digital infrastructure, technology is central to the strategies employed by both states in their pursuit of power. In this context, geoeconomic statecraft offers novel perspectives for understanding international relations and security dynamics, challenging the dominance of traditional theoretical frameworks such as realism and liberalism.

By looking at the economic and technological dimensions of power, geoeconomics provides a more nuanced lens through which to analyse the interplay of states in an increasingly interconnected

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[1] Anu Bradford, "The Battle for Technological Supremacy: The US–China Tech War," in *Digital Empires: The Global Battle to Regulate Technology*, ed. Anu Bradford (London: Oxford University Press, 2023).

[2] Robert D. Blackwill and Jennifer M. Harris, *War by Other Means: Geoeconomics and Statecraft* (Harvard University Press, 2017).

and technology-driven world. This approach highlights how economic interdependence and technological innovation are reshaping the global order, necessitating a rethinking of conventional strategies and theories in the fields of international relations and security studies.

This paper begins with the elucidation of technological sovereignty and geoeconomics theory and goes on to briefly evaluate the role of technology in great power politics across all epochs of industrial revolutions. After discussing China's ascension as a great power, the paper casts a comprehensive analytical glance on Chinese technological sovereignty with a special focus 'Science & Technology in China: A Roadmap to 2050', 'Digital Silk Road', and 'Made in China 2025', alongwith Chinese tech corporations. Subsequently, the paper covers the impacts of China's technological sovereignty on great power politics with a special focus on the contours of Sino-US technological rivalry. The last section anticipates the future scenario of China's technological sovereignty and ensuing global power dynamics.

Technological Sovereignty Defined

The Westphalian system marks a pivotal epoch in the conceptual evolution of sovereignty. Traditionally, this term has been associated with the state, highlighting its autonomy in international engagements and advocating for non-intervention by other states. However, technological advancements have introduced the need to integrate technology into the broader framework of sovereignty. 'Technological sovereignty' can be defined as a state's capacity to exercise autonomy in developing and providing critical technologies while minimising structural dependencies on other nations. It reflects a growing recognition of technology's strategic role in shaping the independence and resilience of states in the

modern era,[3] enabling them to shape and influence their economic and political standing on an international scale.[4] Viewed through a dual lens, it serves both as a geoeconomic approach and a deliberate policy choice adopted by states to maximise their autonomy and extend their influence.

Theory of Geoeconomics

The economic dimensions of statecraft are increasingly gaining prominence in both the study and practice of international relations. Edward Luttwak, in his seminal article 'From Geopolitics to Geoeconomics', laid the foundation for the theory of geoeconomics.[5] This theory posits that economic tools and strategies are being employed in ways traditionally associated with military and geopolitical instruments, signaling a shift in how states exert influence and pursue their national interests.

Geoeconomics also highlights the use of economic statecraft, such as trade policies, investment flows, and technological dominance, as a means of achieving strategic objectives. By framing economic interactions as arenas of competition rather than purely cooperative engagements, Luttwak's work provides a framework to

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[3]   Tiana Ramahandry et al., *Key Enabling Technologies for Europe's Technological Sovereignty* (Brussels: European Parliamentary Research Service, December 2021), 1, https://www.europarl.europa.eu/RegData/etudes/STUD/2021/697184/EPRS_STU(2021)697184_EN.pdf; Jakob Edler et al., *Technology Sovereignty: From Demand to Concept* (Karlsruhe: Fraunhofer Institute for Systems and Innovation Research, July 2020), 2, https://www.econstor.eu/bitstream/10419/233462/1/policy-brief-02-2020.pdf.

[4]   Francesco Crespi et al., "European Technological Sovereignty: An Emerging Framework for Policy Strategy," *Intereconomics* 56, no. 6 (2021): 6, https://doi.org/10.1007/s10272-021-1013-6.

[5]   Edward N. Luttwak, "From Geopolitics to Geo-Economics: Logic of Conflict, Grammar of Commerce," *National Interest*, no. 20 (1990).

understand how economic power can be wielded in the service of political and strategic goals. This approach has become particularly relevant in the context of global power rivalries, where economic competition increasingly supplants traditional military confrontations.[6] Besides the attainment of security interests through economic means, states strive for an economic edge over adversaries in the quest for dominance of international markets.[7]

Innovative technologies play a central role in geoeconomics as they underpin strategic industries, creating asymmetrical dependencies among states.[8] Hence, the choice of this theoretical framework stems from its interdisciplinary nature, offering a holistic perspective on technological sovereignty by integrating elements of economic statecraft, geopolitics, and global power dynamics. Unlike the mono-causal approaches of dominant theories such as realism, liberalism, and Marxism, geoeconomics provides a more nuanced and comprehensive lens.[9] Therefore, analysing evolution of great power politics through this framework presents a distinctive approach.

Great Power Politics and Industrial Revolutions

The technological advancements and economic means across historical epochs have noticeably influenced and substantially shaped the geopolitical tussles and territorial outreach of great powers. Centred in Britain in the mid-18th Century, the First Industrial Revolution mechanised production through steam-power technology and heralded the industrial economy. Britain resorted to

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[6]   Glenn Diesen, *Great Power Politics in the Fourth Industrial Revolution: The Geoeconomics of Technological Sovereignty* (London: Bloomsbury Publishing, 2022), 44-45.

[7]   Luttwak, "From Geopolitics to Geo-Economics," 21.

[8]   Diesen, *Great Power Politics in the Fourth Industrial Revolution*, 8.

[9]   Gyula Csurgai, "The Increasing Importance of Geoeconomics in Power Rivalries in the Twenty-First Century," *Geopolitics* 23, no. 1 (2018): 2, https://doi.org/10.1080/14650045.2017.1359547.

state intervention and employed protectionist policies to protect its nascent industrial base in those times.[10] Britain's dominance in international markets was driven more by its productive manufacturing base than by the strength of the Royal Navy, enabling it to outcompete colonial powers such as France and Spain. At the heart of this manufacturing base was steam power technology, which played a crucial role in Britain's rise to global leadership.[11] Contrary to the liberal view of free trade as a mechanism for mutual benefit, it often serves as a geoeconomic strategy employed by dominant powers to maintain their comparative advantage within the international political economy. This perspective highlights the strategic, rather than purely cooperative, nature of free trade in global power dynamics.

The Second Industrial Revolution, helmed primarily by the United States (US) and Germany in the mid-19th Century, was symbolised by groundbreaking inventions such as electricity, telegraph and combustion engine. The telegraph, a pivotal telecommunications technology, was effectively used by France and Britain as a geopolitical tool to expand colonial influence[12] and maintain the Mediterranean balance of power. It also played a strategic role in World War I, where both Allied and Central powers used it for wartime communication. In 1914, Britain severed Germany's global cable network by cutting its five Atlantic telegraph cables, prompting Germany to retaliate through U-boat raids targeting Allied cables.[13] Observing these developments, the US recognised

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[10]   William J. Ashworth, *The Industrial Revolution: The State, Knowledge and Global Trade* (London: Bloomsbury Publishing, 2017).

[11]   John R. Ward, "The Industrial Revolution and British Imperialism, 1750-1850," in *The Rise and Fall of Modern Empires, Volume III,* ed. Sarah Stockwell (Routledge, 2017), 60.

[12]   Daniel R. Headrick, *The Invisible Weapon: Telecommunications and International Politics, 1851-1945* (Oxford: Oxford University Press, 1991), 15.

[13]   Jonathan Reed Winkler, "Information Warfare in World War I," *The Journal of Military History* 73, no. 3 (2009): 849.

its vulnerability to similar attacks and began constructing its own cable network, a move that contributed to its emergence as a global power.[14] World War II, in many ways, represented a continuation of World War I, but with more advanced technologies.[15]

The Third Industrial Revolution, also known as the Digital Revolution, transformed industries with innovations like microprocessors, semiconductors, and the Internet. During this period, the US provided government support to its multinational corporations to boost innovation and sustain global market dominance. This approach contradicted the *laissez-faire*, market-oriented principles of the Washington Consensus that the US promoted internationally.[16]

As Cold War-era geopolitics receded, geoeconomics gained prominence, with the US adopting an antagonistic economic stance even toward traditional allies. A notable example occurred in 1987 when Japan's semiconductor market share surged to 75%, while the US share dropped to 20%. Accusing Japan of unfair trade practices, the US responded by imposing 100% tariffs on Japanese imports.[17] The increasing penetration of Japanese and American firms in European markets was viewed as 'technological colonization' as they only produced merely low-skilled jobs and diminished Europe's capability to develop spin-offs.[18] Further

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[14]   Jonathan R. Winkler, *Nexus: Strategic Communications and American Security in World War I* (Cambridge: Harvard University Press, 2008), 12.

[15]   Headrick, *The Invisible Weapon*.

[16]   Fred Block, "Swimming against the Current: The Rise of a Hidden Developmental State in the United States," *Politics & Society* 36, no. 2 (2008): 181–182.

[17]   Douglas A. Irwin, "The US-Japan Semiconductor Trade Conflict," in *The Political Economy of Trade Protection*, ed. Anne O. Krueger (Chicago: University of Chicago Press, 1996), 5–14.

[18]   Dietmar Keller, "Should Europe Provide Selective Assistance for Key Industries?" *Intereconomics* 27, no. 3 (1992): 112.

advancements in the Third Industrial Revolution paved way for the next epoch in the industrial evolution of the world.

Great Power Politics and Fourth Industrial Revolution

The term Fourth Industrial Revolution (4IR), coined by Klaus Schwab, represents a distinct evolution from the Third Industrial Revolution in terms of its velocity, scope, and systemic impact.[19] It is increasingly defined by emerging technologies such as AI, IoT, nanotechnology, robotics, 3D printing, biotechnology, and blockchain. This era has intensified the geoeconomic strategies of great powers, as they compete for technological leadership to reduce dependencies, dominate markets, and ultimately secure global influence.[20] UNCTAD's 'Technology and Innovation Report 2023' estimates that the market size of Industry 4.0 technologies will reach USD 9.5 trillion by 2030, including AI (USD 1582 billion), IoT (USD 4422 billion), nanotechnology (USD 34 billion), robotics (USD 150 billion), 3-D printing (USD 51 billion), biotechnology (USD 36 billion) and blockchain (USD 88 billion).[21]

The transformative impact of 4IR has not only reshaped industries but also heightened concerns about digital security and sovereignty. A decade after the Snowden Revelations, these disclosures continue to underscore the importance of protecting

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[19] Klaus Schwab, "The Fourth Industrial Revolution: What It Means and How to Respond," *World Economic Forum*, January 14, 2016, https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/.

[20] Rush Doshi, "The United States, China, and the Contest for the Fourth Industrial Revolution," *Brookings*, July 31, 2020, https://www.brookings.edu/articles/the-united-states-china-and-the-contest-for-the-fourth-industrial-revolution/.

[21] UNCTAD, *Technology and Innovation Report 2023*, report (New York: UN Conference on Trade and Development, 2023), https://unctad.org/system/files/official-document/tir2023_en.pdf.

states from digital espionage and securing domestic control over critical infrastructure and digital ecosystem.

This growing awareness has extended beyond academic discourse into policy-making circles, reinforcing the connection between technological sovereignty, economic independence, and strategic autonomy. In 2019, Ursula von der Leyen, President of the European Commission, stated, 'We must have mastery and ownership of key technologies in Europe.'[22] Similarly, Thierry Breton, the EU's Internal Market Commissioner, has stressed that Europe's digital and green transitions are contingent upon achieving technological sovereignty, urging action to close digital gaps.'[23]

Emerging technologies have thus become a critical dimension of geopolitics, with immense potential to reinforce states' economic and strategic influence. Russian President Vladimir Putin highlighted the geopolitical stakes of technology by declaring that leadership in AI could determine global dominance.[24] He advocated for Russia's technological sovereignty, calling it essential for the country's security, defence, and socioeconomic stability. In line with this vision, Russia has implemented its 'sovereign internet', granting it greater control over its digital space. Against this backdrop, the rise of China demands close examination. Its technological advancements and strategic ambitions are central to understanding the shifting dynamics of global power in the 21st Century.

China's Rise to Global Power Status

China's historical trajectory demonstrates the interplay between economic strength and global influence, a core tenet of the

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22   Crespi et al., "European Technological Sovereignty," 6.
23   Ibid., 6.
24   President of Russia, "Meeting on the Development of Artificial Intelligence Technologies," May 30, 2019, http://en.kremlin.ru/events/president/news/60630.

geoeconomic framework. Once a leading civilisation, China's progress peaked during the Qing Dynasty but declined sharply during the 'Century of Humiliation' (1840–1949), initiated by the Opium Wars and European colonial interventions.

In the 1970s, Deng Xiaoping's market-oriented reforms shifted China away from socialist central planning, integrating the nation into global value chains and attracting international investments and technology. These structural changes propelled China's economy to grow at an average rate of over 9%, as per the World Bank, lifting approximately 800 million people out of poverty[25] - a transformation that has drawn global attention to the 'Chinese model' as an alternative to the Washington Consensus.

With a GDP of USD 18.53 trillion, China is the world's second-largest economy, following the US. Sustained economic growth has strengthened China's financial and technological capabilities, enabling military modernisation, making it the third-largest military power after the US and Russia.[26] As illustrated in Figure 1, China's exponential economic growth from 1993 to 2023 underscores the geoeconomic principle that enduring economic strength forms the foundation of military modernisation and global power. This analytical perspective frames China's rise as a quintessential example of economic leverage shaping international power dynamics.

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[25]   World Bank, "The World Bank in China," April 2024, https://www.worldbank.org/en/country/china/overview.
[26]   Global Firepower, "2024 Military Strength Ranking," May 11, 2024, https://www.globalfirepower.com/countries-listing.php.

Figure 1: Biggest Economies Over Time (1993-2023)
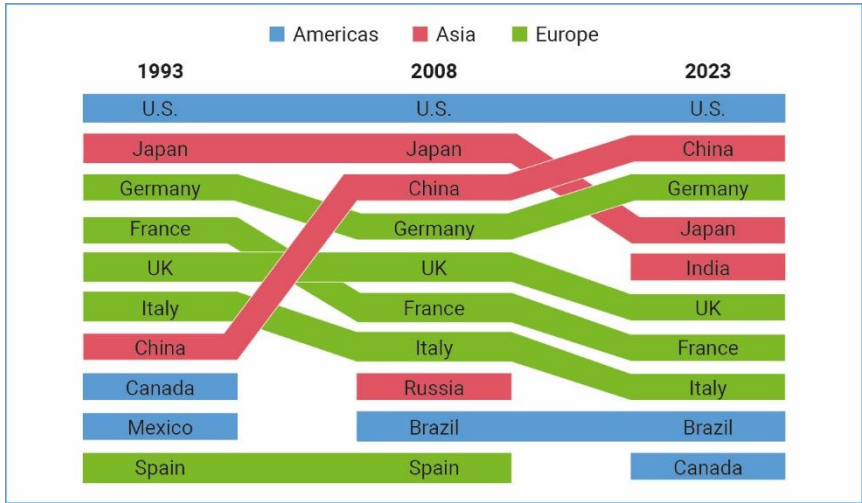
Source: Katharina Buchholz, "Continental Shift: The Biggest Economies Over Time," Statista, February 21, 2024, https://www.statista.com/chart/31788/the-biggest-economies-over-time-nominal.

Technological adoption has been a cornerstone of China's rise and its sustained ascent to global power status. Following a period of economic stagnation and limited technological progress in the decades after independence, China leveraged Deng Xiaoping's reforms to integrate with the global economy and implement strategic initiatives aimed at advancing its technological capabilities. Key measures included joint Research and Development (R&D) programmes with foreign countries, sending students abroad to acquire cutting-edge knowledge, and mobilising diaspora networks in the 1980s. These efforts were further supported by the creation of Overseas Chinese Scholar (OCS) programmes in the 1990s and the establishment of National Technology Transfer Centres in the early 2000s. These well-directed steps laid the foundation for China's technological transformation, which has become a critical driver of its economic

and geopolitical ascent.[27] In addition, the Chinese innovation and start-up ecosystem was steered through state-funded and state-supported initiatives. China has surpassed Japan and European countries in R&D expenditure, now ranking second globally, behind only the United States. Figure 2 illustrates the GDP expenditure on R&D by selected economies from 2000 to 2022, with values displayed in USD million, adjusted for inflation. Unlike many Western countries, China focuses heavily on directed R&D, aligning innovation efforts closely with the commercial needs of its industries. This approach enhances the productivity of R&D investments, driving both innovation and wealth generation.[28]

Figure 2: GDP Expenditure on R&D (2000-22)
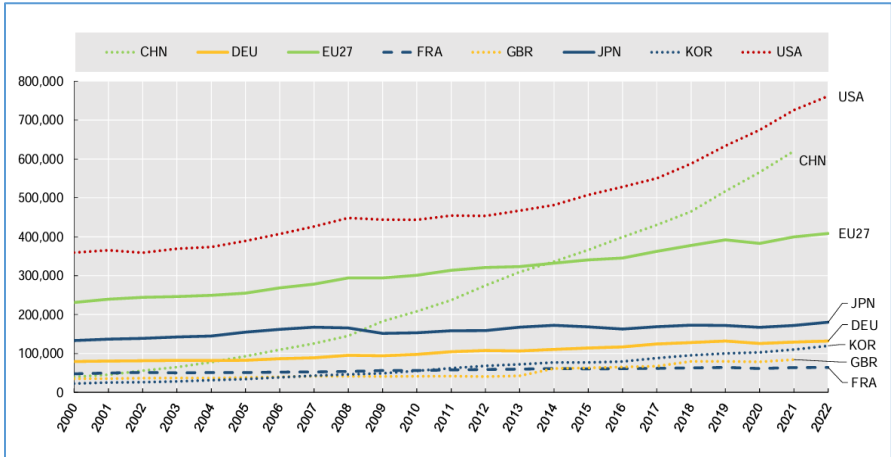
Source: OECD, *OECD Main Science and Technology Indicators*, report (Organisation for Economic Co-operation and Development, March 2024), https://www.oecd.org/sti/msti2024march.pdf.

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[27] William C. Hannas and Didi K. Tatlow, *China's Quest for Foreign Technology: Beyond Espionage* (Routledge, 2020), 5.

[28] Jospeh P. Lane, *The ABC'S of Science, Technology & Innovation (STI) Policy: Spelling Out Problems, Consequences and Viable Solutions* (Springer, 2023), 191.

Impetus behind China's Technological Sovereignty

In the strategically important context of 4IR, great power politics is being increasingly shaped by the contest for technological supremacy. The US wary of China's growing technological capabilities, has implemented a series of punitive measures reminiscent of its earlier actions against Japan. This technological contest gained momentum with Donald Trump's trade war in 2018 and escalated with measures such as the crackdown on Huawei in 2019, the continuation of trade restrictions under Joe Biden in 2021, US restrictions on China's chip industry in 2022, expansion of the Entity List in 2023, and the threats to ban TikTok in 2024.[29] Against this backdrop of a competitive and uncertain international landscape, China's leadership has increasingly recognised that technological sovereignty is crucial for securing its economic growth and maintaining its strategic autonomy.

Hence, technological sovereignty underscores China's pursuit of indigenous high-tech capabilities and global leadership in advanced manufacturing. President Xi Jinping has long championed this agenda, advocating for cyber sovereignty and warning against cyber hegemony as early as 2015.[30] In 2018, he highlighted the transformative potential of emerging technologies for global development, urging China to seize opportunities for leapfrog progress.[31] By 2023, Xi reinforced the need for self-reliance and strength in science and technology to augment China's competitiveness in military and economic domains against the

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[29]   "US-China Relations in the Biden-Era: A Timeline," *China Briefing*, May 14, 2024, https://www.china-briefing.com/news/us-china-relations-in-the-biden-era-a-timeline/.

[30]   "China Internet: Xi Jinping Calls for 'Cyber Sovereignty,'" *BBC News*, December 16, 2015, https://www.bbc.com/news/world-asia-china-35109453.

[31]   Xi Jinping, "Xi Jinping: Follow the Trend of the Times and Achieve Common Development," *Communist Party of China*, July 25, 2018, http://cpc.people.cn/n1/2018/0726/c64094-30170246.html.

West.[32] Thus, the Chinese leadership has openly stated its goals for technological sovereignty because the means of pursuing a zero-sum game amongst great powers are increasingly being defined by technologies.

The next section evaluates the initiatives China has undertaken to advance its technological sovereignty such as 'Science & Technology in China: A Roadmap to 2050', the 'Digital Silk Road', and 'Made in China 2025', alongside the role of leading Chinese big tech firms, including Baidu, Alibaba, Tencent, and Huawei. These companies are at the forefront of major global technological breakthroughs, acting as pivotal agents in driving innovation and solidifying China's position in the competitive landscape of 4IR.

Science & Technology in China: A Roadmap to 2050

China's push toward high-tech indigenisation has been guided by a strategic vision outlined in the 'Science & Technology in China: A Roadmap to 2050',[33] a comprehensive report developed by the Chinese Academy of Sciences, a state-backed science and technology think tank. The report marked a paradigm shift by underscoring directed R&D to align scientific innovation with industry commercialisation goals. It acknowledged the transformative role of technology in past industrial revolutions and underscored the urgency for China to move away from traditional growth models toward innovative and sustainable production methods.[34] Anticipating 4IR, the report declared that 'the world is at

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[32]   Meaghan Tobin, Christian Shepherd, and Lily Kuo, "China's Xi Promises to Build 'Great Wall of Steel' in Rivalry with West," *Washington Post*, March 13, 2023, https://www.washingtonpost.com/world/2023/03/13/xi-jinping-china-tech-self-reliance/.

[33]   *Science & Technology in China: A Roadmap to 2050*, report (Chinese Academy of Sciences, 2010), https://bdp.cas.cn/zlqbygg/202307/t20230705_4924999.html.

[34]   Ibid., 7.

the eve of a new S&T Revolution,' urging the government to prioritise 'transition from imitation to innovation.'[35] The report is reflective of China's official embrace of the innovation-driven economy which lies at the core of technological sovereignty.

The 2050 Roadmap calls for building eight basic and strategic systems for socioeconomic development including a green system of advanced materials and intelligent manufacturing as well as a system of ubiquitous information networking.[36] Under the ambit of these systems, the Roadmap lays out 22 S&T initiatives that it deems of strategic importance to China's modernisation. These are characterised by initiatives pertaining to international competitiveness, national security, sustainability and cutting-edge research.[37] The 2050 Roadmap envisions these modernisations tailored with Chinese characteristics, aligning with the nation's political structure and cultural values.

Digital Silk Road

Announced in 2015, China's 'Digital Silk Road' (DSR) is an integral part of its overall Belt and Road Initiative (BRI). Through DSR, China aims to enhance its digital infrastructure, build partnerships and offer assistance to countries in the areas of telecommunication networks, cloud computing, AI, surveillance technology, e-commerce and smart cities.[38] In contemporary times, power dynamics and geopolitical tug of war have extended to the digital domain where telecommunication networks and the Internet have become vulnerable to security risks. DSR should, hence, be viewed within the broader context of its pursuit of technological sovereignty and greater autonomy over its digital ecosystem. It represents a strategic initiative aimed at strengthening China's

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[35]   Ibid., 116.
[36]   Ibid., 42.
[37]   Ibid., 92.
[38]   Council on Foreign Relations, "Assessing China's Digital Silk Road Initiative," https://www.cfr.org/china-digital-silk-road.

technological independence and enhancing its global influence specifically through digital infrastructure development.[39] Agreements have been signed with approximately 40 countries – (USD 79 billion[40]) – which are one-fourth of the total BRI signatories.[41] Thus, China is in a position to push alternative technology standards and digital practices to recipient countries that could enhance Chinese influence over global economic and technological policy. Additionally, Chinese companies have completed over a dozen undersea fibre cable projects in Southeast Asia while 20 more are currently in operation.[42] These fibre networks are critical for global data transmission and internet connectivity. Through these initiatives, China is not only expanding its digital infrastructure footprint but also promoting its internet governance model, training recipient countries to implement regulatory frameworks aligned with its vision of state-controlled internet management.[43]

One of the most ambitious projects under the DSR is 'Pakistan & East Africa Connecting Europe' (PEACE). It aims to establish Chinese dominance in fibre optic cables connecting the Middle East, Africa and Europe.[44] Huawei Marine is at the forefront of

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[39] Anirudh Suri, *The Great Tech Game: Shaping Geopolitics and the Destiny of Nations* (Harper Collins, 2022), 216.

[40] Sanoop S. Koshy, *Rise of China in the New World Order: An Analysis on Digital Silk Road* (Surabaya: Airlangga University Press, 2023), 332.

[41] Sameer Patil and Gupta Prithvi, "The Digital Silk Road in the Indo-Pacific: Mapping China's Vision for Global Tech Expansion," *Observer Research Foundation*, January 2024, https://www.orfonline.org/public/uploads/posts/pdf/20240103105252.pdf.

[42] Ibid., 333.

[43] Council on Foreign Relations, "Assessing China's Digital Silk Road Initiative."

[44] Thomas Blaubach, "Connecting Beijing's Global Infrastructure: The PEACE Cable in the Middle East and North Africa," *Middle East Institute*, March 7, 2022,

Chinese headways in this regard. The PEACE project may enable China to dominate the future digital economy by offering greater connectivity. There is a persisting global digital divide considering that only 35% of people in developing countries are connected to the internet, in contrast to over 80% of people online in developed countries.[45] Due to this, DSR is likely to appeal to developing countries by enhancing internet penetration and contributing to bridging the global digital divide. The geoeconomic influence gained through the DSR has the potential to translate into geopolitical advantages for China, particularly in regions like Africa and the Middle East, where digital infrastructure gaps remain pronounced.

Made in China 2025

China has devised a multi-pronged policy to secure technological sovereignty with the goal of attaining technological self-sufficiency culminating in global technological leadership. Announced in 2015, 'Made in China 2025' aims to catapult the country to a 'manufacturing superpower' through indigenous innovation and self-sufficiency in industry 4.0 technologies.[46] The plan could be viewed as a comprehensive roadmap to shore up its financial, technical and human resources to climb up the global value chains and reduce dependencies on other countries. In essence, its

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https://www.mei.edu/publications/connecting-beijings-global-infrastructure-peace-cable-middle-east-and-north-africa.

[45] Douglas Broom, "These are the Places in the World Where Internet Access is still an Issue – and Why," *World Economic Forum*, September 5, 2023, https://www.weforum.org/agenda/2023/09/broadband-no-luxury-basic-necessity/.

[46] Jost Wübbeke et al., *Made in China 2025*, report (Mercator Institute for China Studies, December 2016), https://kritisches-netzwerk.de/sites/default/files/merics_-_made_in_china_2025_-_the_making_of_a_high-tech_superpower_and_consequences_for_industrial_countries_-_76_seiten_1.pdf.

ambitious goals are planned to be achieved in three phases. The first phase (till 2025) envisages indigenisation and upgradation of key industries with a focus on smart manufacturing technologies. The second phase (till 2035) focuses on innovative breakthroughs at the global level and the uptake in the ownership of intellectual property. In the last phase (till 2049), China hopes to achieve leadership in global high-tech manufacturing in ten core industries (Figure 3). Thus, the government has been subsidising these tech industries under this vision.[47]

The geoeconomic strategy underpinning 'Made in China 2025' should be analysed within the context of an increasingly competitive international environment, where states are deploying similar policies to secure an edge in the technological race of 4IR. For instance, the US has introduced the National Strategic Plan for Advanced Manufacturing, Germany has adopted its Industry 4.0 policy, and Japan has implemented the New Robot Policy.[48]

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[47] Kenji Kawase, "Made in China 2025 Plan Thrives with Subsidies for Tech and EV Makers," *Financial Times*, August 1, 2022, https://www.ft.com/content/f7df0f64-25b5-4526-82fa-ca1b554b541b.

[48] Ma Huimin et al., "Strategic Plan of 'Made in China 2025' and Its Implementation," in *Analyzing the Impacts of Industry 4.0 in Modern Business Environments*, ed. Richard Brunet-Thornton and Felipe Martinez (IGI Global, 2018), 1−23.

Figure 3: Made in China 2025
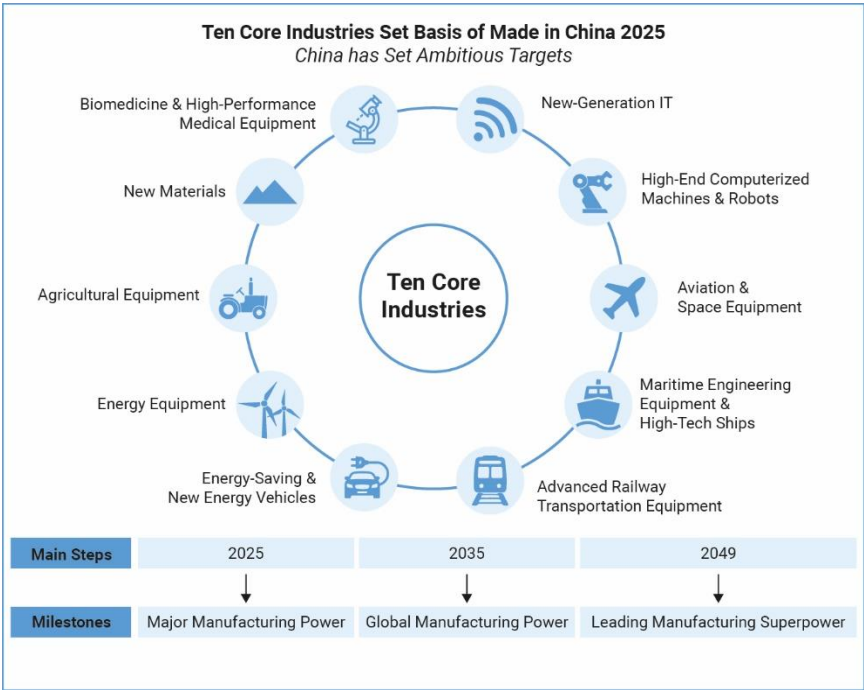
Source: Max J. Zenglein and Anna Holzmann, *Evolving Made in China 2025*, report (Mercator Institute for China Studies, July 2019), https://www.merics.org/sites/default/files/2020-04/MPOC%20Made%20%20in%20China%202025.pdf.

China's success in achieving technological sovereignty and global leadership will depend on the effective implementation of the strategies and plans discussed earlier and its ability to overcome challenges posed by foreign powers seeking to counter its rise. This highlights the intricate relationship between geoeconomics, technological innovation, and global power dynamics in shaping the future of international competition.

Big Tech Firms

The big tech firms are a geoeconomic instrument for states to maintain their technological sovereignty and magnify their international prestige and power. Chinese big tech firms are at the forefront of major technological breakthroughs on a global scale. Some of the leading Chinese tech giants are Baidu, Alibaba, Tencent and Huawei which rivalled by their American counterparts i.e. Google, Amazon, Facebook and Apple, respectively. The dominance of domestic tech companies over the local market resonates with the notion of technological sovereignty, given that foreign corporations are left with lesser ground to extract resources and influence the market.

Baidu is a search engine which is dominating with a 55% share in the Chinese market, having reduced Google's share drastically to a mere 1.5%.[49] Alibaba leads the e-commerce market in the country with a 58% share, while Amazon is trailing behind with 0.7%.[50] These tech giants have started making inroads into foreign markets which showcase their burgeoning influence. Out of the five most downloaded apps in the US, four trace their origin to Chinese companies. Moreover, a 35% share of Alibaba's revenue in 2023 came from international operations,[51] whereas Tencent recorded a 14% surge in its revenue from the international gaming sector.[52] Additionally, Huawei is collaborating with governments and

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[49] Lai L. Thomala, "Market Share of Leading Search Engines in China from May 2019 to May 2024," *Statista*, May 10, 2024, https://www.statista.com/statistics/253340/market-share-of-search-engines-in-china-pageviews/.

[50] Jeff Beckman, "Insightful Alibaba Statistics: Impact, Revenue, and Trends for 2023," *Tech Report*, January 28, 2024, https://techreport.com/statistics/alibaba-statistics/.

[51] Ibid.

[52] "Tencent Announces 2023 Third Quarter Results," *Yahoo Finance*, November 15, 2023, https://finance.yahoo.com/news/tencent-announces-2023-third-quarter-100500759.html.

corporations globally to extend operations in the areas of 5G, AI and mobile operating systems.

Chinese big tech companies – mainly Huawei, ZTE and Alibaba – are the prominent beneficiaries of 'Digital Silk Road' projects in Southeast Asia, and these firms also receive policy support from Beijing to expand their businesses.[53] Moreover, under the ambit of 'Made in China 2025', the Chinese government is augmenting the innovation capability of tech firms through generous subsidies and tax cuts.[54] At the centre of the Sino-US tech war, Huawei received 7.3 billion yuan in government subsidies in 2023, exemplifying state support for big tech firms in the global struggle for technological dominance.[55] While these policy initiatives and corporate efforts align with China's overarching goal of achieving technological sovereignty, they also carry multifaceted economic, geopolitical, implications for global power dynamics.

Impact on Great Power Politics

Emerging technologies have become one of the dominant sources of power in the era of Industry 4.0, with the potential to influence the nature as well as trajectory of great power politics. China is advancing rapidly through its policies and corporate initiatives to

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[53] Wang Zheng, "China's Digital Silk Road (DSR) in Southeast Asia: Progress and Challenges," (ISEAS – Yusof Ishak Institute, January 5, 2024), https://www.iseas.edu.sg/articles-commentaries/iseas-perspective/2024-1-chinas-digital-silk-road-dsr-in-southeast-asia-progress-and-challenges-by-wang-zheng/.

[54] Farrukh Nawaz, Khalil Abu Saleem and Umar Kayani, "The Made in China 2025 Strategy: Perceptions and Reservations of China's State Capitalist Economic Model," *Corporate & Business Strategy Review* 5, no. 1 (2024), https://doi.org/10.22495/cbsrv5i1siart16.

[55] Che Pan, "China Pumps up State Subsidies as Chip War with US Intensifies," *South China Morning Post*, August 16, 2024, https://www.scmp.com/tech/tech-war/article/3274599/tech-war-china-pumps-state-subsidies-chip-industry-counter-us-sanctions.

secure technological sovereignty and achieve supremacy in the high-tech industry. Being a preponderant power in the post-WWII period, the US has started regarding China's meteoric rise as a threat to its hegemony. This is primarily the reason why contemporary US-China relations have morphed into what is being termed as the 'tech war.'[56] In his first address as President, Joe Biden referred to China as the 'most serious competitor,'[57] reflecting escalating tensions. Approximately 42% of the American population now perceives China as an 'enemy', underscoring the growing antagonism in public and political discourse.[58]

Citing national security concerns, the US is hampering many Chinese tech sectors through restrictions, export controls and sanctions. For instance, China's technological sovereignty through 'Made in China 2025' extends to indigenisation of semiconductors which are essential for innovative developments and global leadership in AI, automation, and electric vehicles. In response, the US is sanctioning China to thwart its endeavours for self-reliance in the semiconductor industry and has, in turn, earmarked approximately USD 52.7 billion to revitalise its R&D and indigenous manufacturing in semiconductors.[59] Thus, tech war is an emerging dimension of great power politics which has traditionally been

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[56]   Bradford, "The Battle for Technological Supremacy."
[57]   Owen Churchill, "Biden Calls China 'Most Serious Competitor' to the US, in First Foreign Policy Speech," *South China Morning Post*, February 5, 2021, https://www.scmp.com/news/china/diplomacy/article/3120618/first-foreign-policy-address-president-biden-calls-china-most.
[58]   "More Americans Consider China an Enemy, Pew Research Says," *Bloomberg*, May 1, 2024, https://www.bloomberg.com/news/articles/2024-05-01/more-americans-consider-china-an-enemy-pew-research-says.
[59]   Citi Group, "The U.S.-China Chip War: Who Dares to Win?," January 2, 2024, https://www.citigroup.com/global/insights/the-u-s-china-chip-war-who-dares-to-win.

dominated by geopolitical tussles, military confrontations, and proxy wars.

Nationalism and alliance politics were defining features of the years leading up to the world wars. The advent of the digital era initially fostered optimism that the openness and connectivity of digital platforms might mitigate great powers' inclination toward zero-sum competition. However, the push for technological sovereignty and the emergence of the US-China tech war have instead given rise to a new form of nationalism: techno-nationalism.[60]

States like China and Russia are increasingly turning inward to consolidate control over core technologies, digital ecosystems, and data flows. China's 'Great Firewall' exemplifies a techno-nationalist strategy, enabling regulatory control and censorship that limits the presence of American social media firms within its borders. This approach not only enhances state control but also provides a competitive advantage to indigenous platforms, strengthening their global positioning. This strategy is part of a broader tech war that now extends to big tech firms. In 2023, the Chinese government demonstrated its commitment to this effort by granting 7.3 billion yuan in subsidies to Huawei, underscoring state-backed support for domestic technology companies in their competition with Western tech platforms.[61]

The normalisation and subsequent escalation of techno-nationalism could partially undermine the post-WWII global governance system, particularly in addressing technological issues. To remain effective, the traditional governance framework must evolve by incorporating technological considerations into

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[60]   Bradford, "The Battle for Technological Supremacy."
[61]   Che Pan, "China Pumps up State Subsidies as Chip War with US Intensifies," *South China Morning Post*, August 16, 2024, https://www.scmp.com/tech/tech-war/article/3274599/tech-war-china-pumps-state-subsidies-chip-industry-counter-us-sanctions.

international law, ensuring it is equipped to manage the complexities of a rapidly advancing digital and technological landscape.

Traditionally, alliances have been formed based on geopolitical and military considerations, but in the current era, technology has emerged as a critical determinant of alliance formation. For instance, China and Russia have initiated discussions on cooperation between Huawei's HarmonyOS and Russia's AuraOS, signaling the potential for a techno-alliance aimed at reducing reliance on the US.[62] China's DSR further underscores its strategy to deepen technological influence, particularly in Africa and Southeast Asia, raising the likelihood of these regions becoming strategically dependent on Beijing and DSR evolving into a geopolitical and techno-alliance framework. Countries like Cambodia, Malaysia, Thailand, and Nepal are increasingly adopting regulatory and censorship frameworks that align more closely with Beijing's approach.[63] Through the DSR, China could further expand its techno-alliances, potentially reshaping the balance of power in the Asia-Pacific region.

Simultaneously, the Biden administration has proposed an alliance of techno-democracies, termed T-12, to counter China's technological ascendancy.[64] Similarly, the Quad security bloc is

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[62] "China-Russia Joint Communique Urges Cooperation on Huawei's Harmony OS for First Time," *Global Times*, December 1, 2021, https://www.globaltimes.cn/page/202112/1240360.shtml.

[63] Lin Yang, "China's Digital Silk Road Exports Internet Technology, Controls," *Voice of America*, May 28, 2024, https://www.voanews.com/a/china-s-digital-silk-road-exports-internet-technology-controls/7626266.html.

[64] David Ignatius, "Biden's Ambitious Plan to Push Back against Techno-Autocracies," *Washington Post*, February 11, 2021, https://www.washingtonpost.com/opinions/bidens-ambitious-plan-to-push-back-against-techno-autocracies/2021/02/11/2f2a358e-6cb6-11eb-9ead-673168d5b874_story.html.

incorporating technological objectives, such as isolating China from critical supply chains for microchips and semiconductors, thereby blending traditional security strategies with technology-driven goals.[65]

Future Scenario

An analytical assessment of the future trajectory of China's technological sovereignty and its impact on great power politics is essential.

While a comprehensive evaluation of 'Made in China 2025' will only begin post-2025, current indicators suggest that China still faces challenges. For instance, a 2023 study reveals that the US dominates the AI sector, hosting 60% of top AI companies and employing 57% of the world's leading AI talent, compared to China's 12% share of AI talent.[66] However, China is making notable strides - its contribution to the production of top AI researchers increased from 29% in 2019 to 47% in 2022, signaling rapid progress.

Despite this, the US continues to attract a larger share of AI venture capital, and its restrictions on China have dampened investment flows into the Chinese AI sector. Another challenge for China is the trend of supply chain reshoring and repatriation by Western companies. Technological advancements have made local manufacturing increasingly cost-effective, reducing the incentive to offshore production. Moreover, geopolitical considerations, particularly efforts by Western nations to decouple from China, have further fueled this shift. These developments pose hurdles for China's technological sovereignty and could impede its progress in the coming years.

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[65]   Suri, *The Great Tech Game*, 285.
[66]   Macro Polo, "The Global AI Talent Tracker 2.0," https://macropolo.org/digital-projects/the-global-ai-talent-tracker/.

The US-China tech war is expected to persist, but a complete decoupling of technologies remains unlikely, as the full 'balkanization' of the digital economy would not serve the interests of either nation. The deeply interconnected nature of emerging technologies and the global digital economy may also act as a deterrent against escalating the rivalry into a full-blown conflict. While the US is actively pursuing techno-alliances to counter China, such as the proposed T-12, China could respond by leveraging its influence within Chinese-led blocs like BRICS and the Shanghai Cooperation Organization (SCO). These platforms provide China with opportunities to deepen technological cooperation with member states, further advancing its technological sovereignty and broadening its sphere of influence in the global digital economy.

The US may also struggle to form a rigid Cold War-style coalition against China, largely because European Union (EU) countries have generally maintained cooperative and cordial relations with Beijing. Xi Jinping's recent visit to France exemplifies this growing mutual trust and commitment to collaboration. French President Emmanuel Macron has put emphasis on the importance of the EU avoiding entanglement in the US-China rivalry, advocating for an independent stance that prioritises Europe's strategic interests.[67]

While a US-China rapprochement remains unlikely given the zero-sum and conflict-driven tendencies inherent in the current international system, reducing the intensity of the rivalry may be achievable. Identifying areas of mutual interest, such as climate change, global health, or sustainable development, could provide a pathway for cooperation, offering an opportunity to contribute to global peace and stability.

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[67] Tara Varma, "Xi's Visit Exposes Fault Lines in European Unity," *Brookings*, Accessed May 13, 2024, https://www.brookings.edu/articles/xis-visit-exposes-fault-lines-in-european-unity/.

Conclusion

China's remarkable rise has positioned it in an era where innovative technologies hold political, economic, and strategic significance. The leadership has proactively embraced Industry 4.0, pursuing technological self-reliance and challenging Western dominance in the technological domain. Through initiatives like 'Roadmap 2050', 'Made in China 2025', and the 'Digital Silk Road', alongside the global reach of its big tech firms, China is steadily advancing toward technological sovereignty. 'Made in China 2025' outlines a path from developing innovative competencies to achieving technological leadership by 2049, while the 'Digital Silk Road' expands China's influence globally by fostering partnerships in the digital economy and telecommunications. Together, these efforts aim to secure China's position as a leader in 4IR.

Having been a preponderant global power in the post-WWII period, the US deems China's rise as a threat to its entrenched power across different sectors. However, it is the technological growth of China that the US is more apprehensive of, considering that innovative technologies have become instrumental sources of power. The ensuing Sino-US tech war has solidified as a defining feature of international relations, with the geoeconomic modality of a zero-sum game taking precedence over the military bloc politics of the Cold War era. This shift has fueled a global trend toward techno-nationalism, where states increasingly assert control over their technological landscapes and innovation capabilities. The ongoing reshoring and repatriation of global supply chains further reflect this paradigm, as nations prioritise technological sovereignty and strategic autonomy.

While US-China competition for technological supremacy is likely to persist and even intensify, complete decoupling is improbable, as it would disrupt both nations and destabilise global supply chains. China is expected to continue advancing and employing political, socioeconomic, and diplomatic strategies to achieve its ultimate

goal of global technological leadership. If technologies remain competitive and strategically deployed in inter-state relations, the concept of technological sovereignty could solidify as a global policy norm. In coming years, the complexities of geoeconomic competition and technological orientation of global power dynamics will become increasingly apparent.

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