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Claremont McKenna College

Connection and Competition: Navigating the U.S.-China Race to 5G

submitted to
Professor Jennifer Taw

by
Hannah Reilly

for
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Table of Contents

Introduction	2
Chapter I: Literature Review	4
Chapter II: What is 5G?	12
Chapter III: Background	24
Chapter IV: Strategies	33
Chapter V: Case Study	44
Conclusion	55
Appendix	56
Bibliography	63

Introduction

By improving the speed and reliability of the transfer of data, 5G technology has the potential to produce a fourth technological revolution over the next few decades. Its infrastructure will enable advanced technology that will generate massive economic growth and bolster military power. 5G technology will also create new vulnerabilities that introduce new security concerns. The nation with the most control over its 5G networks and the networks of other countries will gain the ability to protect itself from the cyberattacks or espionage of countries with malicious intent. A fierce competition has erupted between countries vying for the economic and security advantages that 5G supremacy offers.

The so-called “race to 5G” is at the center of a larger confrontation between the United States and China. Beijing has embraced 5G as a national priority and directs resources and funding to the deployment of Chinese technology worldwide. By cultivating new relationships, China creates a dependence on its equipment, funding, and economic partnership. This strategy provides Beijing with a competitive advantage on 5G deployment in some regions, namely in Africa. The United States, on the other hand, leverages its economic and intelligence-sharing partnerships to pressure its allies into banning or restricting Chinese technology and, in doing so, attempts to minimize China’s global control over 5G.

This paper explores the race to 5G and China and the United States’ differing strategies to gain a comparative advantage over the development and deployment of 5G technology. Chapter 1 uses existing literature to examine the relationship between technology and national power, exploring the great power competition between the United States and China. Chapter 2 provides an overview of 5G, focusing on the economic and security implications of the emerging technology. Chapter 3 offers background on the long history of technological races that

culminate in today's competition between the United States and China, adding context on the political and economic factors that shape today's environment of technological competition. Chapter 4 examines both China and the United States' 5G strategies to maximize their control over the deployment of 5G. Through a case study of Germany, Chapter 5 examines the political, security, and economic trade-offs that countries caught in the middle of the great power competition between the United States and China consider when shaping their 5G policies..

The competition between the United States and China will have significant implications for all members of the international community. The country with the greatest control over global 5G networks will earn significant economic and security advantages in global politics. As the race to 5G further intensifies in the coming years, the outcome has the potential to shape international relations for decades to come.

Chapter I: Literature Review

Although great power competition manifests in all sectors, competition over technology perhaps has the most significant impact on national power. Technological competition between states striving for regional or global hegemony is endemic because it underpins economic, security, and political advantages. As a result, the link between technology and national power creates a race to technological development to reap the security and economic benefits. In recent years, great power competition between the United States and China has defined their relationship and reflected the intertwined nature of technology and geopolitics. Most recently, the competition for advanced telecommunications systems represents a larger effort to bolster economic power, military power, national image, and, therefore, national power.

As understood by American and Chinese leaders, technological innovation can act as a catalyst to national power. This is consistent with Schumpeter's findings of positive correlations between technological innovation, a country's scientific and technical power, and its economic power. Schumpeter argued that innovation alters the previously existing equilibrium and leads to economic development. According to him, development carries society forward. Innovation, after proving profitable, attracts investors and entrepreneurs in "swarm-like clusters."¹ Technological development in one sector, therefore, can stimulate innovations in other sectors and progressively bolster a country's economic performance.

An economy's ability to stand out from its competitors is oftentimes determined by its ability to innovate. In a recent report, the Council on Foreign Relations concluded that the impact of innovation on economic development, and subsequently, national power, is reflected in the

¹ Farrokh Langroodi, "Schumpeter's Theory of Economic Development: A Study of the Creative Destruction and Entrepreneurship Effects on the Economic Growth," *Journal of Insurance and Financial Management* 4:3, August 2021, 70.

United States' strategy. The U.S. invests in research and development, incentivizing the discovery of strategies that change the understanding of scientific concepts. By incentivizing research and development, as well as training STEM talent domestically, the U.S. attracts the world's best students, academics, and other talented individuals. In doing so, the United States links new markets around the world to domestic innovation by creating alliances and trade relationships.² World powers, therefore, use technological innovation to strengthen their economies, which provides them with tangible advantages to be leveraged for more productive relationships on the international stage. Through these relationships, countries with strong technology sectors have a greater influence over international affairs which, therefore, bolsters their relative national power.

In addition to advancements in economic power, innovation can contribute to building military power. Joseph Nye recognized the existence of a long-standing debate between whether economic or military power is more fundamental for success in international politics. He wrote that, following the Cold War, many scholars argued that economic power became the key to success in world politics, expecting countries such as Japan and Germany to quickly become world leaders. He acknowledged that strong economies can finance the military resources necessary for hard power while leveraging their soft power to attract others to follow its example. Nye cautioned, however, that the role of military power should not be underestimated because "markets and economic power rest upon political frameworks, which in turn depend not only upon norms, institutions, and relationships but also upon the management of coercive power."³ According to him, a modern state exercises its monopoly on the legitimate use of force

² Adam Segal, "Innovation and National Security: Keeping Our Edge," Council on Foreign Relations, September 2019, <https://www.cfr.org/report/keeping-our-edge/>.

³ Joseph Nye, "Has Economic Power Replaced Military Might?," *Belfer Center*, June 2011, <https://www.belfercenter.org/publication/has-economic-power-replaced-military-might>.

and that power allows markets to operate. Following Nye's logic, fortifying security forces through innovation contributes to building national power as remarkably as incentivizing innovation to bolster economic power.

Emerging technologies also introduce shifts in the capabilities of nations through their military applications. According to Georgetown researchers, major innovations allow for changes to the relative power of countries in three ways. For one, innovation introduces new elements of power.⁴ Consequential innovation affects how states generate power and can produce new factors to be considered when characterizing power.⁵ For instance, the invention of railroads increased the importance of a country's access to steel. In doing so, countries with access to steel gained power on the international stage.

Second, technological innovation alters the significance of existing elements of power. For instance, ballistic missiles changed how geographic barriers impacted the balance of power with neighboring countries. They decreased the effectiveness of large armies in the field as a form of protection from attack.⁶ As industrialization progressed, the role of engineers and scientists became more significant, while that of combatants decreased.

Finally, innovation changes states' goals, which can result in power changes. As innovation changes what states pursue, certain kinds of behaviors become either more costly or more valuable. Although states may keep the same long-term objectives, such as broadly rising in power or increasing economic prosperity, the intermediate goals used to achieve long-term objectives may evolve.⁷ This can lead to changes in national policies and actions. For instance,

⁴Matthew Daniels and Ben Chang, "National Power After AI," Center for Security and Emerging Technology, July 2021, https://cset.georgetown.edu/wp-content/uploads/CSET_Daniels_report_NATIONALPOWER_JULY2021_V2.pdf.

⁵Daniels, "National Power After AI"

⁶Daniels, "National Power After AI"

⁷Daniels, "National Power After AI"

before the sweeping changes introduced during the Industrial Revolution, agriculture was the principal means to earn a living. As a result, conquering lands to expand states' territories was the most important strategy to improve productivity. Following the Industrial Revolution, however, states could propel military and economic growth by leveraging new technology to increase productivity without the pressing need to conquer new territories. The technological development, therefore, permanently altered states' military objectives.

Military applications of technology also imply new means by which both state and non-state actors can inflict violence upon hostile parties. As such, technological innovation has also historically compounded the threat of war. Innovation can produce turmoil and possibly trigger instability. Completely preventing the disastrous consequences of war requires a concerted effort with the help of international institutions and necessitates agreements on a set of principles and crisis management systems. Those with the greatest ability to use technology to produce coercive violence often earn a greater voice over such agreements to shape the dynamics of international affairs.

In addition to military implications, innovation can also be a social signal of strength that factors into public opinion. A country's soft power, its ability to use its economy or culture to exert influence, is shaped by a variety of sources, including media, technology, brands, and popular culture.⁸ South Korea, for instance, develops and produces many technology products used around the world. As a result, the general public began to perceive the "reputation of the country as 'high technology' and 'advanced economy'." These influences on public opinion can contribute to a country's soft power and accompanying public perception as a strong and mighty nation.

⁸ Candace White, "Brands and National Image: An Exploration of Inverse Country-of-Origin Effect," *Place Brand Public Dipl* 8, June 2012.

Researchers have identified links between national power and communications systems, such as 5G, specifically. Control over communications systems allows countries the discretion to shape their public image. China, for instance, has worked to develop its communications technology since the beginning of the 21st Century.⁹ These concerted efforts allow China to use its technology to “disseminate national intentions and shape national images.”¹⁰ China and the United States both use communications technology to shape their national image, with slightly different strategies. China uses communication technology to control its image domestically, while the United States’ technological giants such as Apple, Microsoft, and Dell create an image of technological advancement globally. The companies’ reputations contribute to a broader recognition of the United States as a leader in the technology sector.

Additionally, investment in communications systems provides domestic economic benefits that can translate to benefits on the international stage. Analysis of economic recoveries among OECD countries revealed that investment in communications networks was crucial in almost all economic stimulus packages, which established a specific link between telecommunications investment and economic growth.¹¹ These infrastructure investments help countries decrease unemployment and facilitate long-term economic development, which bolster a country’s national power.

Communications processes facilitate the flow of information, allowing communications networks the single greatest role in international interactive processes.¹² The nation with the

⁹Zhu Hailong, “The Change and Construction of Chinese National Image in 1949-2019,” *Canadian Center of Science and Education* 12, October 2019, <https://files.eric.ed.gov/fulltext/EJ1232442.pdf>.

¹⁰Hailong, “The Change and Construction”

¹¹Darrell West, “Technology and Innovation Economy,” Brookings, October 2011, <https://www.brookings.edu/research/technology-and-the-innovation-economy/>.

¹²Kenneth Rogerson, “Information Interdependence: Keohane and Nye’s Complex Interdependence in the Information Age,” *Information, Communications & Society*, 2000, <https://www-tandfonline-com.ccl.idm.oclc.org/doi/abs/10.1080/13691180051033379>.

greatest control over international interactive processes, therefore, will achieve a position of great power on the world stage. Rogerson argues that communications networks have become a relevant security area for both national security and personal security. The proliferation of “access to international communications networks has made personal data much more difficult to keep hidden or secret.”¹³ In response, governments around the world have made communications networks a matter of national security and have maintained tight control over any developments.

A 2020 report from RAND proposed that a state’s ability to function is influenced by key sectors without which its economy could not grow. The report listed the communications sector as an area of critical infrastructure that enables economic activity and the functioning of society.¹⁴ Allowing other countries to manage the critical infrastructure of communications networks, such as 5G, essentially gives others some control over one nation’s communications, leaving it vulnerable to adverse influence. The RAND report draws the link between critical infrastructure, such as communications networks, and national security. A country with impenetrable and secure communications networks, therefore, earns a relative advantage in national power over its competitors.

Fundamental differences between authoritarian regimes and democratic governments influence their respective uses and goals for information systems. Authoritarian governments seek control of information domestically and use information internationally to misinform or disinform internationally. China, for instance, employs censorship and domestic propaganda to control the information space at home. By leveraging Chinese platforms like WeChat, it can flood the information space with pro-government narratives and influence domestic public

¹³Rogerson, “Information Interdependence,” 428

¹⁴Lucia Retter et al., “Relationships between the Economy and National Security: Analysis and Considerations for Economic Security Policy in the Netherlands,” RAND Corporation, 2020, https://www.rand.org/pubs/research_reports/RR4287.html.

opinion¹⁵ At the same time, it gains the ability to execute aggressive influence operations abroad to advance China's foreign policy interests. As China's confidence and power grow, "it is increasingly using influence and intimidation tactics, for example against media companies, civil society, and academia in Europe, the United States, Australia, and New Zealand, to suppress information contrary to the interests of the Chinese Communist Party."¹⁶ Democracies rely on citizens' ability to access trustworthy information and apply it to civic life. Given its power to increase accessibility to information, the technology ushered in by the Information Age was expected to strengthen democracies. Yet, vital information technologies have also been exploited to actively harm democracies, as evidenced by China's information warfare against its adversaries.¹⁷ Democracies, therefore, stand at a disadvantage due to their open information systems. Countries with secure and self-controlled information systems are better positioned to secure their domestic environments.

Great power competition and subsequent technological races have demonstrated the link between national power and technology. Acquiring the latest and most advanced technologies enables countries to bolster their economies, contributing to their economic power abroad, and attracting treaties with other countries that strengthen their alliances and relationships. At the same time, technological innovation allows for changes to the relative power of countries through military strength. By introducing new elements of power, altering the significance of existing elements of power, and changing states' goals, military power alters dynamics abroad and shifts countries' relative strength. Additionally, new technology can contribute to a country's "soft power" by bolstering its image as an advanced and modern nation. Communications

¹⁵Eric Rosenbach and Katherin Mansted, "Can Democracy Survive in the Information Age?," *Belfer Center for Science and International Affairs, Harvard Kennedy School*, October 2018, <https://www.belfercenter.org/publication/can-democracy-survive-information-age>.

¹⁶Rosenbach, "Can Democracy Survive in the Information Age?"

¹⁷Rosenbach, "Can Democracy Survive in the Information Age?"

systems, specifically, are some of the most predominant examples of technologies with economic, military, and public opinion consequences. Communications networks and their accompanying infrastructure guarantee shifts in relative economic power, military power, national image, and, therefore, national power.

Chapter II: What is 5G?

Fifth-generation wireless technology, known most commonly as 5G, will improve the speed and reliability of the transfer of data.¹⁸ 5G has the potential to transfer data 100 times faster than existing 4G technologies.¹⁹ Additionally, it reduces the latency, or the time it takes a packet of information to transfer between two points. While latency in 4G technologies is 50 milliseconds, 5G networks can theoretically reduce this to only 1 millisecond.²⁰ Additionally, 5G will introduce more bandwidth than 4G. Given that it uses the available spectrum more efficiently, 5G has a substantially higher capacity.²¹ The increased speeds, reduced latency, and improved broadband will support new forms of technology with the potential to revolutionize every industry.

The rollout of 5G, which has begun and will continue over the next few decades, will add value to all industries. The most ardent supporters of 5G predict a fourth technological revolution exceeding any prior period of rapid technological change.²² 5G will introduce innovation that will undoubtedly revolutionize a number of settings: “hospitals equipped with 5G devices that enable remote patient monitoring, and smart ambulances that communicate with doctors in real-time; digital wallets that connect phones, wearables, cars, and other devices to create

¹⁸ John Keller, “What 5G Means to the Military: 5G Wireless Communications Is Expected to Move Voice, Video, Text, and Image Data with Bandwidth as Fast as 300 GHz to Create Data on Demand for the Battlefield,” *Military & Aerospace Electronics* 31, 2020.

¹⁹ Dave Johnson, “4G vs. 5G: The Key Differences between the Cellular Network Generations,” *Business Insider*, December 2020, <https://www.businessinsider.com/4g-vs-5g#:~:text=The%20key%20difference%20between%204G,replacing%204G%20around%20the%20world.>

²⁰ Johnson, “4G vs. 5G”

²¹ Johnson, “4G vs. 5G”

²² Peter Mockel and Baloko Makala, “Artificial Intelligence and 5G Mobile Technology Can Drive Investment Opportunities in Emerging Markets,” *EM Compass*, December 2019, https://www.ifc.org/wps/wcm/connect/1f00b57b-3f6b-4be9-ad6a-af8ea87a0581/EMCompass_Note+76-AI+and+5G+in+Emerging+Markets_FIN+for+WEB.pdf?MOD=AJPERES&CVID=mYsdFhr.

seamless financial transactions; and 5G-enabled factories in which connections can be maintained among more sensors than ever before.”²³ Technological advancement in these industries illustrates the potential of 5G to produce an economic impact.

Experts predict that 5G technology will balloon global GDP and decrease unemployment in both the long-term and short term. In the United States, for instance, 5G deployment is expected to contribute between \$1.4 trillion and \$1.7 trillion to the national GDP.²⁴ Additionally, it will create 3.8 million - 4.6 million jobs.²⁵ While the risks of losing the 5G race have been “continually emphasized, the reality is that many countries will benefit widely from 5G technology.”²⁶ Some estimates predict that by 2035, 5G will enable 12 trillion dollars worth of goods and services globally.²⁷ Given the positive impact on the global economy, the benefits of 5G will be extensive and no one nation will be categorized as an exclusive winner or loser. In addition to being widespread, benefits will arrive gradually. First, 5G will contribute to economic growth through infrastructure deployment. As 5G grows to achieve widespread use, it will indirectly produce a larger wave of economic activity as it enables new uses, innovation, and technology.²⁸ In the long-term, 5G will produce socioeconomic benefits by increasing productivity and improving cost competitiveness. In response to the economic advantages that

²³ Wilson Chow, “The Global Economic Impact of 5G,” PricewaterhouseCoopers, <https://www.pwc.com/gx/en/tmt/5g/global-economic-impact-5g.pdf>.

²⁴ Enrique Melo et al., “5G Promises Massive Job and GDP Growth in the US,” Boston Consulting Group, February 2021, <https://www.bcg.com/en-us/publications/2021/5g-economic-impact-united-states>.

²⁵ Melo et al., “5G Promises Massive Job and GDP Growth in the US”

²⁶ Brian Hendricks and Allison Carlson, “5G Global Power Plays: Risks and Opportunities,” Foreign Policy, <https://foreignpolicy.com/wp-content/uploads/2020/07/FP-Nokia-5G-Global-Power-Plays-report.pdf>.

²⁷ *Why 5G Is a National Security Issue*, NBC News, 2018, <https://www.nbcnews.com/mach/video/why-5g-is-a-national-security-issue-1185076291808>.

²⁸ Enrique Melo et al., “5G Promises Massive Job and GDP Growth in the US”

supremacy in 5G offers, countries are naturally racing for a lead in the development and deployment of 5G and related technologies.

Predicted outcomes demonstrate how 5G could introduce a new era of innovation and economic growth similar to the upheaval sparked by the arrival of the internet. In order to maximize the technological development enabled by 5G, it must be accompanied by “complementary investments.”²⁹ These investments include new products and services that rely on 5G networks. According to a report by CSIS, “The need for complementary investments and business innovations put the race metaphor in context because what companies and countries do with 5G is more important than how quickly or how “much” 5G they have.”³⁰ Although accessing 5G networks is an important first step, the real “race” measures the innovation and revenue that 5G will stimulate.

Despite 5G’s overall promising prospects, the nature and magnitude of its economic impact depend on the industry and country. Healthcare, for instance, is expected to reap the greatest economic proceeds from the implementation of 5G. One model predicted that it would add half a trillion dollars to global GDP.³¹ These benefits likely will not be experienced equally among all healthcare systems. In a tax-funded, single-payer system, 5G could lower taxes or free up government funding and resources for other programs. In a system that relies on private insurance, on the other hand, the efficiencies introduced by 5G could allow consumers to reallocate spending to other sectors.³² Although the impacts of 5G vary, the economic growth

²⁹ James Lewis, “Can Telephones Race? 5G and the Evolution of Telecom,” Center for Strategic and International Studies, June 2020, https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/20615_Lewis_TelephoneRace_WhitePage_v2_FINAL.pdf.

³⁰ Lewis, “Can Telephones Race? 5G and the Evolution of Telecom”

³¹ Chow, “The Global Economic Impact of 5G”

³² Chow, “The Global Economic Impact of 5G”

produced by access to 5G remains certain, making the speedy implementation of the technology an attractive goal for countries with high economic ambitions.

In addition to economic incentives, security incentives have contributed to creating the 5G race. For one, 5G technology has the potential to transform how militaries function. 5G could “improve ISR [intelligence, surveillance, and reconnaissance] systems and signal processing, enable new command-and-control applications, and streamline logistics.”³³ With improved functions, militaries will become even more data-dependent, facilitating the connection of sensors and weapons while fueling algorithms to help commanders better understand, and therefore respond to, complex information environments. Additionally, the high speed and low latency enable new and improved autonomous weapons systems.³⁴ Coupling 5G with other developing technologies, such as AI and machine learning, means new applications can expand exponentially. The nation with the most advanced 5G systems thus gains additional time to develop technology that will bolster its military power.

5G, however, carries implications for national security beyond its potential to advance a country’s military. The day-to-day functioning of businesses, politics, the military, and other critical sectors will depend on 5G telecommunications. As a result, 5G has become accepted as critical infrastructure. It heightens the criticality of telecommunications because 5G unites automated factories, for example, with hospitals running remote surgeries, and systems coordinating the routes of driverless cars. Attacks on such systems jeopardize users’ lives, making vulnerabilities all the more dangerous.

As information technology systems grow increasingly complex, additional security concerns naturally arise. Today’s smartphone chips, for example, have over eight billion

³³ Keller, “What 5G Means to the Military

³⁴ Keller, “What 5G Means to the Military

transistors and their operating systems employ over 50 million lines of code.³⁵ These systems also include components produced by hardware and software manufacturers around the world. The systems' complexity creates numerous vulnerabilities to malicious attacks or data leaks through vulnerabilities known as 'backdoors' that can be exploited to gain control of a smartphone.³⁶ As systems become more complex, the opportunities for taking advantage of 'backdoors' subsequently increase. Without proper monitoring, these backdoors pose national security threats, especially since telecommunications systems are used to exchange sensitive information. As a complex and novel technology, 5G increases the susceptibility of telecommunications to malicious influence.

A recent Congressional Research Service Report emphasized the risk that 5G equipment could be easily manipulated to conduct cyberattacks or espionage. Although some experts point solely to unintentional vulnerabilities that would enable breaches of security, others note that vulnerabilities could be introduced with malicious intent.³⁷ American officials specifically express discomfort with the widespread use of Chinese equipment. China's National Intelligence Law states that "any organization and citizen shall, in accordance with the law, support, provide assistance, and cooperate in national intelligence work that they are aware of."³⁸ Some intelligence experts believe that this law implies that the Chinese government reserves the right to pressure Chinese companies into using their infrastructure abroad for espionage or cyberattacks.

³⁵ Daniel Gros, "We Must Tackle the Risks of 5G before National Security Is Compromised," *European CEO*, August 2019, <https://www.europeanceo.com/industry-outlook/we-must-tackle-the-risks-of-5g-before-national-security-is-compromised/>.

³⁶ Gros, "Why We Must Tackle the Risks of 5G before National Security Is Compromised"

³⁷ "National Security Implications of Fifth Generation (5G) Mobile Technologies" (Congressional Research Services, June 2021), <https://sgp.fas.org/crs/natsec/IF11251.pdf>.

³⁸ "National Security Implications of Fifth Generation (5G) Mobile Technologies"

Governments with malicious intent could conduct cyberattacks and espionage in a variety of ways. The primary risk is that a 5G provider or its national government could collect the traffic passing a system or disrupt the system altogether.³⁹ Experts use an analogy to illustrate the main concerns. They argue that “you don’t want an untrustworthy builder building your house and then keeping a copy of your key or the schematics of your house knowing exactly how to overcome your security features.”⁴⁰ Given that 5G will support critical technology on which citizens’ lives hinge, access to such systems from a foreign government presents a national security risk.

5G carries vital economic, security, and political implications for countries and, to reap the maximum benefits from 5G technology, fierce competition erupted. At the moment, the countries housing major telecommunications companies remain engaged in a contest for 5G deals among countries that lack telecommunications leaders. As a result, geopolitics plays a vital role in the deployment of 5G networks. At the same time, escalating geopolitical tensions place 5G at the center of a larger confrontation between the United States and China. The dominance of either China or the United States presents a threat to the hegemonic ambitions of the other in the long term. As the Chinese leader in telecommunications, “Huawei is a symptom of a larger problem, and 5G is a symptom of larger fears.”⁴¹ For the first time, the United States faces a formidable opponent with the resources, organization, and power to outperform the United States. Its might, coupled with its public intent to “displace” the United States as a world leader,

³⁹ Gros, “Why We Must Tackle the Risks of 5G before National Security Is Compromised”

⁴⁰ Melissa Griffith, *5G Technology and National Security: Vulnerabilities and Best Practices*, 2020, <https://5g.wilsoncenter.org/video/5g-technology-and-national-security-vulnerabilities-and-best-practices>.

⁴¹ Lewis, “Can Telephones Race? 5G and the Evolution of Telecom”

evokes fear among those with vested interests in the United States' supremacy.⁴² As technological superpowers, both view control of the forthcoming wave of advanced technologies as a matter of economic and national security.⁴³

To resolve political disagreements ensuing from 5G, many countries advocated for the establishment of international standards regulating the technology. The 3rd Generation Partnership Project (3GPP) joined together technical experts to collaborate on the development of standards for mobile networks based on “performance and interoperability criteria” established by the International Telecommunications Union.⁴⁴ Companies with the technology that becomes the industry standard for 5G will earn royalty payments from other corporate participants. These payments will be directed towards funding innovation projects and contribute to the future development of technology.⁴⁵ Companies participating in 3GPP must voluntarily consent to reasonable, fair, and non-discriminatory terms for standard essential patents (SEP). This agreement requires companies to make the intellectual property associated with the patents available to other companies.⁴⁶

Despite the 5G standards set by the international community, the use of foreign firms presents a threat to other countries' security environments. A Eurasia Group report compared 5G standards to a cookbook with numerous recipes. Any company that can take the “recipe” of 5G technology can make alterations beyond international standards. Companies can use the basic tech shared among the international community with the addition of malicious software or

⁴² Doshi Rush, “The Long Game: China’s Grand Strategy to Displace American Order,” *Brookings*, August 2, 2021, <https://www.brookings.edu/essay/the-long-game-chinas-grand-strategy-to-displace-american-order/>.

⁴³ Paul Triolo and Kevin Allison, “The Geopolitics of 5G,” Eurasia Group, November 2018, <https://www.eurasiagroup.net/live-post/the-geopolitics-of-5g>.

⁴⁴ Triolo and Allison, “The Geopolitics of 5G”

⁴⁵ Triolo and Allison, “The Geopolitics of 5G”

⁴⁶ Triolo and Allison, “The Geopolitics of 5G”

hardware features. No one company likely will monopolize 5G or the allocation of SEPs. The primary holders will be “European equipment makers Ericsson and Nokia; Chinese leaders Huawei and ZTE; Japanese and South Korean players such as Fujitsu, Panasonic, Samsung, and LG; and US firms such as Qualcomm, Interdigital, Intel, and Cisco.”⁴⁷ While 3GPP aims to ensure that no one country has a disproportionate influence, the goal of the United States is to minimize China’s influence and ensure that American allies gain and retain 5G leadership.

Beijing’s ambition has largely curtailed US efforts to diminish its progress. China made no effort to participate in the 3G and 4G standards-setting process. As a result, it had no say in international regulations and was left largely dependent on the 3G infrastructure and technology of foreign countries. In response, Beijing has ramped up its involvement in the 5G standards process.⁴⁸ By embracing 5G as a national priority, it justified extensive investment in its development and deployment. All Chinese long-term technology strategies, including Made in China 2025, heavily emphasize the importance of 5G technologies and connected sectors for long-term growth. These efforts indicate China’s growing influence, capabilities, and aspirations on the global stage.

China’s intensifying 5G investment reflects a larger strategy to gain a first-mover advantage in the race to 5G. Earning a lead would provide China with two advantages: First, it would signal to other 5G providers in large markets that it can deliver. Secondly, it earns domestic benefits. Rapid implementation of 5G allows it to capitalize on advanced technologies and its technology providers will have an edge when exporting 5G systems to Belt and Road countries. Doing so allows its researchers and scientists additional time to test and develop the advanced technology that 5G will enable. China’s integration of 5G in its long-term goals

⁴⁷ Triolo and Allison, “The Geopolitics of 5G”

⁴⁸ Triolo and Allison, “The Geopolitics of 5G”

provides it with a stronger 5G strategy and an advantage when competing with the U.S. and its other competitors.

In response to China's formidable achievements in regards to 5G, the United States and its allies have ramped up efforts to exclude Chinese telecommunications companies such as Huawei from their government and commercial 5G networks.⁴⁹ Many countries adopted clear stances in favor of the U.S. by committing to the restriction of Chinese technology. Last August, the Australian government restricted the use of Huawei for its 5G networks. This represented the first ban of its kind and the first victory of the American government in its efforts to ban Chinese technology from core components of 5G.⁵⁰ Since Australia's decision, other countries have followed suit. Several European countries, including the United Kingdom, Belgium, and the Netherlands followed Australia's example by enacting restrictions or complete bans of Huawei. Figure 1 shows what percent of the world's countries have formed partnerships with 5G providers of different countries or regions. China maintains a heavy lead in the race to secure 5G contracts. Although the restriction of Chinese suppliers from government and commercial networks is nothing new, 5G raises the stakes and, as a result, the U.S. intensified its efforts to bar Chinese companies from supplying and implementing its 5G networks and allies' 5G networks.⁵¹

⁴⁹ Triolo and Allison, "The Geopolitics of 5G"

⁵⁰ Triolo and Allison, "The Geopolitics of 5G"

⁵¹ Triolo and Allison, "The Geopolitics of 5G"

Country of Origin of 5G Providers and Percent of Countries Adopting Their Infrastructure

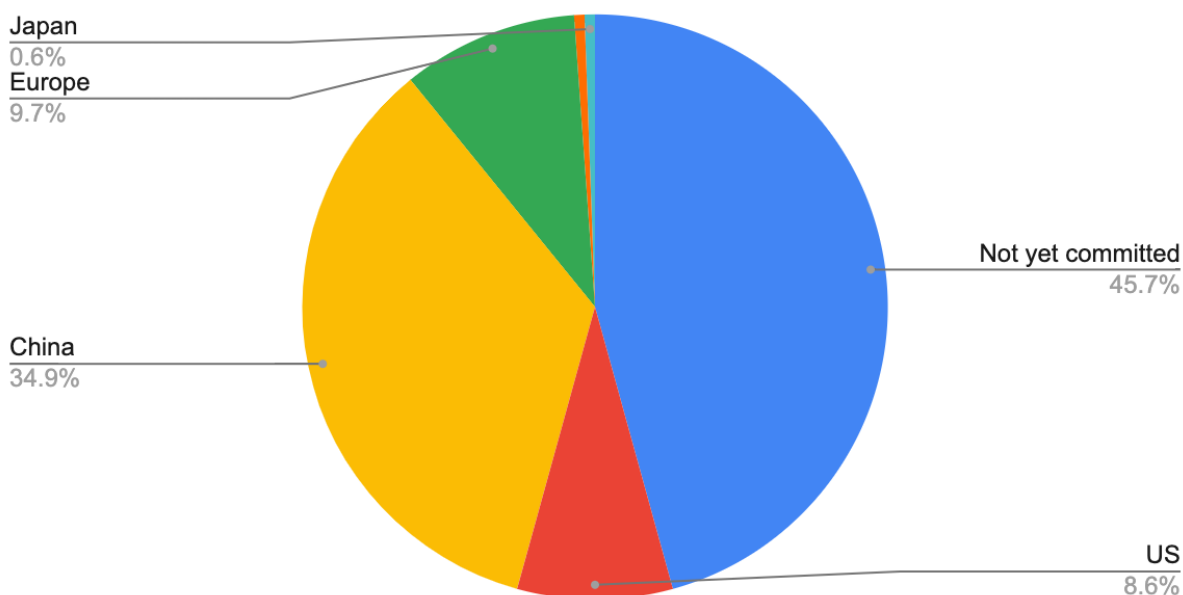


Figure 1

Regardless of progress in banning Huawei in Europe, the U.S. has not succeeded in convincing all of its allies to ban Chinese companies from their networks. NATO members Hungary, Iceland, and Turkey, for instance, struck deals with Huawei to develop their 5G networks. The primary reason for the U.S. government's failure in persuading allies to ban or restrict Huawei is that the U.S. lacks a comparable alternative. No American company has the technology, organization, or funding to rival Huawei. Instead, the U.S. is forced to support Nokia, Samsung, and Ericsson as Huawei's main competitors. Of those, the Swedish company Ericsson has emerged as its most formidable adversary. Ericsson provides equipment for the largest American mobile carriers, thus proving its reliability in the eyes of the U.S. government. The U.S. boosts trusted Huawei rivals by offering loans to wireless carriers operating in

developing countries to subsidize equipment from non-Chinese 5G suppliers.⁵² Its focus on bolstering any non-Chinese 5G company demonstrates that the United States' motivation is not merely economic. If the United States' only concern was profiting economically from 5G, any non-American 5G provider would compete with and threaten its economic goals. Rather than focus on growing its companies domestically to compete with Huawei, the United States supports its rivals. This demonstrates that it primarily aims to hamper China's growth rather than bolster its own as part of a larger competition between the two countries.

Given that the U.S. lacks a company such as Huawei with a major stake in 5G, it has less to gain from its deployment. William Barr, former US Attorney General, recommended that the U.S. government take a financial stake in Ericsson or Nokia. Doing so would "make [Ericsson or Nokia] a more formidable competitor and eliminate concerns over its staying power."⁵³ Investing in or otherwise supporting Huawei's competitors would give the United States more leverage in the 5G competition.

5G promises to become a cornerstone technology on which to hinge the development of future technologies, benefiting a country militarily and economically. Fierce competition has erupted between the United States and China to prevent the other from gaining a security or military advantage over the other in this domain. As a result, the United States has embarked on a campaign to minimize Huawei's global control over 5G, attempting to dissuade other countries from adopting China's systems. China's competition, on the other hand, has simply consisted of its providing a product at the best price, wooing countries with loans, affordable prices, and financial support in other sectors. Without a viable alternative to China's technology, however,

⁵² Stu Woo, "Ericsson Emerges as 5G Leader After U.S. Bruises Huawei," *The Wall Street Journal*, June 2020, <https://www.wsj.com/articles/ericsson-emerges-as-5g-leader-after-u-s-bruises-huawei-11591095601>.

⁵³ Woo, "Ericsson Emerges as 5G Leader After U.S. Bruises Huawei"

the United States' success has been limited and China continues to outperform any competitor in the high-stakes race to 5G.

Chapter III: Background

Technological leadership factors into geopolitical power. Technology links together multiple sectors and, as a result, “is blurring the lines between previously distinct domains, such as economy and security.”⁵⁴ The governments or companies that first develop and adopt technologies will achieve technological superiority, which breeds domestic political satisfaction, sends a message of strength to other countries, and offers military advantages and economic opportunities for sales and sharing. Nations that fall behind on technological development will have to rely on other countries for essential technologies, stripping them of their independence. As technology rises in importance for global power, the great power competition between the U.S. and China naturally incorporates technological competitions between the two countries.⁵⁵ A long history of technological races that culminates in the present competition between the two countries predates today’s technological environment.

Understanding differences between the American and Chinese political and economic systems provides valuable context for the ongoing technological competition. In China, the public sector plays a direct role in all facets of innovation, “from government agencies that define research objectives to government labs that conduct research and development, and its role in innovation is enhanced by the presence of state-run banks and state-owned enterprises.”⁵⁶ In the first half of the 1900s, political instability in China limited its ability to prioritize research and development (R&D) funding. After the establishment of the People’s Republic of China

⁵⁴ Kaan Sahin and Tyson Barker, “Europe’s Capacity to Act in the Global Tech Race,” DGAP, April 2021, https://dgap.org/sites/default/files/article_pdfs/210422_report-2021-6-en-tech.pdf.

⁵⁵ Sahin and Barker, “Europe’s Capacity to Act in the Global Tech Race”

⁵⁶ Aaron Melaas and Fang Zhang, “National Innovation Systems in the United States and China,” The Center for International Environment and Resource Policy, March 2016, https://sites.tufts.edu/cierp/files/2017/11/ECI_Innovation-Systems_WEB.pdf.

quelled widespread instability, the Chinese government followed a Soviet model of central planning that did nothing to promote science and technology in the country. The same pattern continued throughout the Cultural Revolution, which effectively eliminated a generation of scientists, academics, and other intellectuals.⁵⁷ Not until the centralization of political power in China under Deng Xiaopeng did market-oriented reforms begin to strengthen China's science and technology standings. Now China's single-party, highly centralized political system uses its political dominance to drive policy to meet its political goals.⁵⁸ Over the past few decades, an increase in R&D spending domestically, coupled with targeted public policy built a knowledge-based economy that strengthened its science and technology industries.

In addition to funding from the Chinese government, a small cluster of private firms make up most of the country's R&D funding. The industrial networks, economic system, and political system underpinning China's innovation produce an opaque R&D environment. In 2015, private sector spending in China reached \$211 billion, a total that represents three-quarters of research and development investment in the country.⁵⁹ Despite the appearance of the private sector adopting an expanded role for innovation in the country, "the prevalence of state-owned enterprises also reflects the crucial role of the government in linking technology producers and users in the presence of underdeveloped private capital markets, and because many of the major Chinese financial institutions are also state-owned, it is significantly easier for state-owned firms to obtain access to investment capital."⁶⁰ The Chinese government undoubtedly controls the private sector's innovation.

⁵⁷ Melaas and Zhang, "National Innovation Systems in the United States and China"

⁵⁸ Melaas and Zhang, "National Innovation Systems in the United States and China"

⁵⁹ Melaas and Zhang, "National Innovation Systems in the United States and China"

⁶⁰ Melaas and Zhang, "National Innovation Systems in the United States and China"

China relies on a system known as a socialist market economy to provide endurance to its economy while maintaining political control. Within its economic system, state-owned enterprises exist alongside market capitalism. The Chinese government manages the government by setting goals and strategies. It takes the same assertive approach to incentivize innovation to drive technological development. In 2006, for instance, the Chinese government began the National Indigenous Innovation Campaign, which included a mission to propel China to become the world's technology superpower in fewer than 15 years. Subsequent "five-year plans" composed by the Chinese government included goals for R&D and offered subsidies aimed at increasing the number of patent applications.⁶¹ Through its incentivization campaigns and the strict political control it maintains over the nation, China prompted impressive economic growth and innovation that endures today. China's state-dominated system is a strong contrast to the capitalism and federalism deeply entrenched in the United States.

The United States operates within a federal political system, which involves targeted, but limited, government support for innovation amidst reliance on the private sector and market forces for most innovative development.⁶² The sectors in which the United States federal government has historically taken a significant role in research and development spending are health and defense, with funding going to public universities and government research labs. In previous decades, U.S. investment in research and development helped it become the richest nation in the world and offered it military advantages over other great powers, such as the Soviet Union. During the Cold War, United States federal expenditures for research and development as a percentage of gross domestic product peaked.⁶³ The dissolution of the Soviet Union in 1991

⁶¹ "China's Economy," *Asialink Business*, n.d., <https://asialinkbusiness.com.au/china/getting-started-in-china/chinas-economy?doNothing=1>.

⁶² Melaas and Zhang, "National Innovation Systems in the United States and China"

⁶³ Segal, "Innovation and National Security: Keeping Our Edge"

created a sense of complacency in the United States. The fall of the Berlin Wall in 1989 and the asset bubble burst in Japan in 1991 neutralized two other major economic rivals. Without any formidable competitors to the United States in the early 1990s, technological advancement lessened in national priority, a trend reflected by the reduction in government expenditures for research and development.

A decline of United States government funding for innovation ushered in a new era known as the “American Way” of innovation that endures today. Federal spending for research and development, “which grew 60 percent in real terms from 1975 to 1987 and closely tracked the aggregate amount of industry spending during that time, has since declined by more than 20 percent in constant dollars.”⁶⁴ In 2019, federal funding for research and development totaled 0.6% of the United States’ GDP, the lowest in percentage in more than 60 years.⁶⁵ Since the U.S. government reduced its research and development spending, the free market has become the principal driver of innovation. Private companies have reflected this shift over the past 30 years. Whereas leading intellectuals used to be distributed relatively equally between the government and private sector, they are now heavily concentrated in private companies. Over time, start-ups led by independent entrepreneurs with no government involvement became the nation’s leaders in technological development.⁶⁶ Silicon Valley, the hub of innovation, serves as the quintessential example of the free market fostering innovation.

⁶⁴ “Measuring the Science and Engineering Enterprise: Priorities for the Division of Science Resources Studies,” National Center for Biotechnology Information, 2000, <https://www.ncbi.nlm.nih.gov/books/NBK208898/>.

⁶⁵ James Pethokoukis, “US Federal Research Spending Is at a 60-Year Low. Should We Be Concerned?,” American Enterprise Institute, May 2020, <https://www.aei.org/economics/us-federal-research-spending-is-at-a-60-year-low-should-we-be-concerned/>.

⁶⁶ “Tech-Politik: Historical Perspectives on Innovation, Technology, and Strategic Competition,” Center for Strategic and International Studies, December 2019, <https://www.csis.org/analysis/tech-politik-historical-perspectives-innovation-technology-and-strategic-competition>.

In light of the technological competition between the United States and China, the United States government's declining investment in technology over the past three decades comes at a troubling time. Although the United States benefits from a thriving private sector that drives innovation, private companies have no responsibility to consider national priorities and political needs. China, on the other hand, has greater control over its private sector and can steer its research and development to complement the country's political goals. Since 2000, China has steadily increased its research and development funding by 18% annually.⁶⁷ While China has been working to bolster its innovation, the failure of the American government to prioritize innovation while instead relying on the private sector will come at a steep cost. The United States risks losing its position as the technological leader on the international stage.

Although China and the U.S. are competitors, their dependence on each other creates an important dichotomy and undeniable tension. Each nation has developed different strengths and weaknesses as vital members of the global economy. China, on one hand, offers cheap manufacturing, a growing consumer economy, and an abundance of professionals in the science, technology, engineering, and mathematics fields.⁶⁸ The U.S. provides advanced technology, a well-developed and long-established consumer economy, and a highly advantageous position in global financial markets.⁶⁹ Both countries benefit from trade relations, investments, and collaboration with one another and have developed reliances that make each vulnerable to the others' foreign policy decisions.

⁶⁷ Segal, "Innovation and National Security: Keeping Our Edge"

⁶⁸ Jackson Barkstrom, *Modern China*, Palgrave Macmillan, 2020, https://link.springer.com/chapter/10.1007/978-3-030-39204-8_4.

⁶⁹ Barkstrom, *Modern China*

Chinese and American political goals certainly play into their complex dynamic. China avidly hopes to avoid the fate of the Soviet Union.⁷⁰ The USSR originally seemed to be an equal competitor to the U.S. Over time, however, it lost its momentum and its collapse only added to American hegemony abroad. Unlike the Soviet Union, China aims to prove itself as a viable competitor to the U.S. in the long term. Its economic success over the past few decades has added to its confidence and momentum. In order to continue this progress, China has identified technology as a requisite to power.⁷¹ If it can pass the United States in technological advancement, it would assert its ability to succeed independently of American support and further assert its position as a leader.

Today's competition between the U.S. and China over information technology is similar to other great power technological competition, whether it was over getting to space, developing nuclear weapons, or producing computer chips. Most notably, the U.S. and Soviet space race exemplifies the ability of innovation to act as a means to earn power. The two countries were entangled in a battle to prove their superiority as world powers. The Space Race was an extension of an ideological battle between the Soviet Union and the U.S. and space became the final frontier for each to prove their position as a singular superpower.⁷² According to most experts, the Soviet Union's launch of Sputnik and the concept of a satellite passing over the U.S. several times a day induced widespread fear in the United States.⁷³ Following the United States' successful moon landing, which marked a clear victory in the Cold War, Americans regained a

⁷⁰ James Lewis, "Technological Competition and China," Center for Strategic and International Studies, November 2018, <https://www-ciaonet-org.ccl.idm.oclc.org/record/68870>.

⁷¹ Lewis, "Technological Competition and China"

⁷² Maddie Davis, "The Space Race," The Miller Center, n.d., <https://millercenter.org/the-presidency/educational-resources/space-race>.

⁷³ Davis, "The Space Race"

sense of confidence that, with superior space and scientific military capabilities, they belonged to the dominant nation.

The most obvious consequence of the space race was the impact on space as first the most powerful countries in the world launched satellites and then, over time, private companies and low-income states joined the fray. Earth is now surrounded by satellites that facilitate communication, television, process data, and enable navigation, among other results. The space race also contributed to the production of specialized spacecraft that bolster military and scientific goals.⁷⁴ Additionally, there now exists a human presence in space on the International Space Station. Indirectly, the race to technological development in space led to “spinoff” technologies now used in everyday life. The global positioning system (GPS), for instance, was originally developed for the military to facilitate weapons targeting and more precise navigation. Its creation, however, drastically transformed almost every industry and allowed for the creation of ride-hailing services, workout tracking systems, package tracking, and safety features allowing relevant authorities access to one’s location in an emergency.⁷⁵ Without the incentive of the space race to prompt the original innovations, such technologies may have been developed much later, if at all.

Races to technological advancement produce ripple effects across all sectors and improvements in global connectivity introduced through the race to 5G will undoubtedly do the same. Global connectivity has transformed the climate for competition and introduced political and economic forces with no accompanying precedents for control. China’s accelerated pace towards becoming a global leader in technology directly challenges the mission of the American

⁷⁴ Aldo Spadoni, “How Technology From the Space Race Changed the World,” Now., April 2020, <https://now.northropgrumman.com/how-technology-from-the-space-race-changed-the-world/>.

⁷⁵ Spadoni, “How Technology From the Space Race Changed the World”

government to maintain its historically economic and technological dominance. In order to maintain this position, the U.S. has aggressively restricted and pressured China by, for instance, imposing export controls on Chinese semiconductors and levying firm restrictions on the deployment of Chinese telecommunications equipment in the United States.⁷⁶ Although taking firm action protects U.S. national security by hampering Chinese innovation and trade, jeopardizing relations threatens to damage American industries in the long run.

The race to 5G is one of the most scrutinized aspects of the technology race between the U.S. and China. Although it certainly fits the definition of a technological race, it differs from previous competitions because the focus is not on bolstering military strength or expanding territory. Instead, it plays into broader and fundamental disagreements between the U.S. and China on global rules and institutions, trade and economic systems, and standards. Although categorized as a technological race, it is a new battleground of its own.

The link between technological leadership and geopolitical power produces competition between great powers for technological supremacy. Due to their different economic and political systems, the United States and China's strategies to incentivize innovation differ dramatically. In the United States, technological superiority requires concerted, collaborative efforts between the private industry and the government. These endeavors leverage the domestic competition inherent to capitalist democratic societies in favorable ways. China, however, benefits from the efficiencies and directed development possible in communist autocracies, where the government and industry are essentially working together for the same leader. The ongoing technological competition is reminiscent of previous competitions between great powers, namely, the space

⁷⁶ Akinori Kahata, "Assessing the Impact of U.S.-China Technology Competition and Decoupling: Focusing on 5G," Center for Strategic and International Studies, December 2020, <https://www.csis.org/blogs/technology-policy-blog/assessing-impact-us-china-technology-competition-and-decoupling>.

race between the United States and the Soviet Union. The race to 5G will add a new dimension to the competition for political control.

Chapter IV: Strategies

The United States leverages numerous actors to curtail the rise of Huawei and control 5G policy domestically and internationally. Lack of proper funding, however, limits the effectiveness of key actors and forces the United States to leverage its existing relationships through public appeals to influence 5G decisions abroad. China, on the other hand, executes a dramatically different strategy to build relationships with governments and win 5G contracts abroad. It offered loans and supported Africa across its technology sector until it became a leader in the telecommunications industry years before the race to 5G reached its peak. In doing so, China created a dependence on Chinese-financed projects and built a reputation in Africa, making it the most logical option for the deployment of 5G on the continent. Whereas the United States government uses its long-standing economic and intelligence-sharing relationships to influence 5G policy, China cultivated new relationships and gradually created a dependence on its equipment and funding, providing it with a competitive advantage on 5G deployment in some regions.

The Federal Communications Commission (FCC) is a traditional player in telecommunications policy in the United States. The FCC regulates radio, satellite, cable, television, and wire communications in the United States and implements spectrum policy to advance the deployment of trusted 5G infrastructure. Its three-part plan, titled “The 5G FAST Plan” emphasizes streamlining infrastructure policy, modernizing network regulations, and delivering new spectrum to the market.⁷⁷ It has attempted to influence infrastructure policy to expedite the arrival of 5G in the U.S. by modifying the fees that cities were authorized to impose

⁷⁷ Doug Brake, “A U.S. National Strategy for 5G and Future Wireless Innovation,” Information Technology and Information Foundation, April 2020, <https://itif.org/publications/2020/04/27/us-national-strategy-5g-and-future-wireless-innovation>.

on 5G deployment. The agency limited cities from groundlessly requesting high rents for the right of way access and the pole access necessary to build 5G infrastructure. The move promoted low-cost deployment that benefits city services but nevertheless met legal opposition from local governments and an appeals court eventually voided the order.⁷⁸ In addition to attempting to lower the cost of 5G deployment, the FCC also backed a report on supply-chain security that would forbid the Universal Service Fund from subsidizing equipment or services from companies deemed national security threats. The commission continues to research and evaluate options to replace “untrustworthy” equipment that has already been deployed in rural America.⁷⁹ Despite efforts by the Federal Communications Commission to keep costs of 5G low and establish the security of new networks in the United States, it achieved only limited success and failed to accelerate the deployment of 5G.

The Trump administration also leveraged trade in an attempt to influence 5G policy abroad. In mid-2019, President Trump signed “the Executive Order on Securing the Information and Communications Technology and Services Supply Chain.”⁸⁰ The order restricted the “acquisition, importation, transfer, installation, dealing in, or use of [communications technology or services that pose an undue risk and were] designed, developed, manufactured, or supplied, by persons [subject to the jurisdiction of a foreign adversary].”⁸¹ By establishing import controls that restrict the importation of untrustworthy 5G equipment from competing countries, the United States eliminated Huawei’s business in the United States. The Trump administration coupled its import controls with strict export controls to maximize the impact. The U.S. Commerce Department’s Bureau of Industry and Security (BIS) included Huawei and other

⁷⁸ Brake, “A U.S. National Strategy for 5G and Future Wireless Innovation”

⁷⁹ Brake, “A U.S. National Strategy for 5G and Future Wireless Innovation”

⁸⁰ Brake, “A U.S. National Strategy for 5G and Future Wireless Innovation”

⁸¹ Brake, “A U.S. National Strategy for 5G and Future Wireless Innovation”

Chinese providers of 5G on its Entity List. Businesses, government and private organizations, individuals, and other entities make up the list, a designation that categorizes them as subject to specific requirements for export.⁸² BIS justified Huawei's inclusion on the list by arguing that it "is engaged in activities that are contrary to U.S. national security or foreign policy interests and its non-U.S. affiliates pose a significant involvement in activities contrary to the national security of the United States."⁸³ By limiting Huawei's import and export, the U.S. delivered a severe blow to the company's business operations both within and outside of the United States.

The export controls enacted during the Trump administration faced criticism from stakeholders. Most importantly, the policy damaged the semiconductor industry and created a harmful ripple effect. Chinese companies provide over 20 percent of the global demand for semiconductors. Limiting the involvement of Chinese companies in the United States impacted related industries. Given the ban's widespread impact, BIS faced implementation problems that delayed the full enforcement of the export controls. As a result, BIS is investigating its options to modify the scope of the export controls to more directly target technology related to 5G.⁸⁴ Although BIS successfully limited Huawei's business operations, its policies backfired and impaired vital U.S. industries.

American legislation also contributed to formulating 5G policy to a large extent. The National Defense Authorization Act, enacted by Congress in 2020, disallowed the government from using federal funding to buy equipment or services from specific telecommunications companies.⁸⁵ A few months later, Congress signed into law the Secure and Trusted

⁸² "Entity List," *Bureau of Industry and Security*, n.d., <https://www.bis.doc.gov/index.php/policy-guidance/lists-of-parties-of-concern/entity-list>.

⁸³ "Huawei Entity List Frequently Asked Questions (FAQs)," Bureau of Industry and Security, December 2020, <https://www.bis.doc.gov/index.php/documents/pdfs/2447-huawei-entity-listing-faqs/file>.

⁸⁴ Brake, "A U.S. National Strategy for 5G and Future Wireless Innovation"

⁸⁵ Brake, "A U.S. National Strategy for 5G and Future Wireless Innovation"

Communications Network Act, which forbade the use of federal money to buy equipment from companies that pose a significant national security threat. The same law created a reimbursement program to eliminate and replace gear already in use that was produced by any acts posing a risk to national security. Other articles of proposed legislation carry the potential to impact 5G policy. The Secure 5G and Beyond Act required the executive branch of the United States government to develop a more detailed strategy for 5G, including an implementation plan to “ensure the security of 5G wireless communications systems and infrastructure within the United States; assist mutual defense treaty allies, strategic partners, and other countries in maximizing the security of 5G systems and infrastructure; and protect the competitiveness of U.S. companies, the privacy of U.S. consumers, and the impartiality of standards-setting bodies.”⁸⁶ The laws and bills proposed and adopted by Congress demonstrate the accelerating efforts of American officials to secure the American telecommunications industry and those of its allies.

In terms of allocating funding to support its 5G goals, the U.S. government has largely failed. Congressional initiatives have approved specific programs to support the deployment of 5G, for instance, the State Department’s Multilateral Telecom Security Fund aimed to reinvest in network deployment and technology development through risk-based approaches to security built on partnerships advancing U.S. interests around the world.⁸⁷ Despite approving the program, Congress failed to pair it with the necessary appropriations, rendering the program useless.⁸⁸ China, on the other hand, made spending a priority in its 5G strategy. In some key

⁸⁶ Brake, “A U.S. National Strategy for 5G and Future Wireless Innovation”

⁸⁷ “National Telecommunications and Information Administration,” Pub. L. No. 200521–0144 (2020), <https://www.ntia.doc.gov/files/ntia/publications/comptia-06252020.pdf>.

⁸⁸ “Accelerating 5G in the United States,” Center for Strategic and International Studies, March 2021, https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/210301_Lewis_Accelerating_5G_0.pdf?kIP.hknBLh2uJBCEPMkxs5_wRNzFiMbdO.

technology sectors, China plans to outspend the United States by a 50 to 1 ratio.⁸⁹ China's ease at securing the necessary funding to excel in the race to 5G likely stems from its political system. Whereas Congress needs to justify its spending to an impatient and sometimes short-sighted public, Chinese officials do not face the same level of accountability to the public. The United States' failure to produce a comprehensive, well-funded, and targeted 5G plan forces American officials to resort to other means to compete with China.

The State Department has been effective in influencing 5G policy abroad. It succeeded in creating a dialogue to deter foreign governments from using untrustworthy equipment in their 5G infrastructure. The State Department's efforts reinforced the anti-Huawei progress established by the Trump administration's trade restrictions. Deputy Assistant Secretary of State for Cyber and International Communications Policy, Robert Strayer, has staunchly advocated for the implementation of the American government's 5G policy position under the Trump administration. In collaboration with other officials, he hosted meetings with leaders of foreign countries to persuade them to renounce Huawei equipment.⁹⁰ By increasing demand for 5G equipment of trustworthy suppliers, Strayer and other officials aim to preserve the security of intelligence sharing over communications networks.

Through poorly-veiled threats, U.S. officials implied that American allies would suffer consequences from using Huawei equipment. During an online press briefing, Strayer said that "it is the United States' position that putting Huawei or any other untrustworthy vendor in any part of the 5G telecommunications network is a risk... If other countries insert and allow untrusted vendors to build out and become the vendors for their 5G networks we will have to reassess the ability for us to share information and be connected with them in the ways that we

⁸⁹ "Accelerating 5G in the United States"

⁹⁰ Brake, "A U.S. National Strategy for 5G and Future Wireless Innovation"

are today... Exactly how that will be done will depend on the risk of the equipment that is put into the networks.”⁹¹ The United States has repeatedly made clear its perspective on the risk level presented by Huawei. Strayer implied, therefore, that U.S. allies choosing to contract Huawei for their 5G systems risk sacrificing vital intelligence sharing partnerships with the United States.

In addition to the efforts exerted by the State Department and the export controls introduced by the Trump administration, the United States openly criticizes networks dependent on Huawei to pressure countries into adopting Huawei bans. Huawei, however, has invested time and resources into becoming a leader in the information and communication technologies (ICT) sector, integrating itself in networks across the world and earning a strong foothold on which to hinge its 5G deployment strategy. Given Huawei’s position as an ICT leader, convincing countries to adopt a full Huawei ban proved challenging for the United States. Only a handful of countries, therefore, immediately followed the U.S. government’s example of implementing a complete ban of Huawei 5G in their communications networks. Other allies adopted partial restrictions on Huawei, at the insistence of the United States.⁹² The Netherlands, for instance, initially indicated its willingness to work with Huawei to build out its 5G network. President Trump loudly criticized the decision, citing security concerns that threatened to affect the strong relationship between the Netherlands and the U.S. As a compromise, the Netherlands banned Huawei from building the core of the Dutch 5G network, which holds most of the sensitive information. The United States viewed a partial ban as merely a partial success because

⁹¹ Zamira Rahim, “Huawei: US May Withhold Intelligence from UK If It Lets Chinese Firm Build 5G Network, Official Says,” *Independent*, April 2019, <https://www.independent.co.uk/news/uk/politics/huawei-5g-leak-cyber-security-network-intelligence-us-a8891226.html>.

⁹² Nicol Lee, “Navigating the U.S.-China 5G Competition,” Brookings Institution, April 2020, https://www.brookings.edu/wp-content/uploads/2020/04/FP_20200427_5g_competition_turner_lee_v2.pdf.

the U.S. does not “distinguish between core and non-core elements and instead [believes] that there [is] no safe level of involvement for Huawei.”⁹³ The Netherlands’ decision was influenced by the fact that Huawei maintained a strong presence in Dutch 3G and 4G networks. Given that it already invested money and time into Huawei networks, scrapping existing infrastructure was difficult. Although the U.S. failed to secure a complete ban of Huawei in the Netherlands due to the comprehensive existing infrastructure, it reduced the Netherlands’ involvement with Huawei as much as possible and thwarted the company’s momentum in Europe.

The Trump administration’s public appeals threaten to backfire without a coordinated effort by the government and Huawei competitors. Companies such as Ericsson, Nokia, and Samsung trail Huawei on matters of 5G infrastructure and collaboration with the U.S. government could boost their success and help the U.S. government achieve its goals.⁹⁴ The Secure and Trusted Communications Network Act, which called for the substitution of untrustworthy communications equipment with the equipment of trustworthy providers, allowed alternative providers the opportunity to secure 5G deals. Essentially, the act allocated \$1 billion to help with the removal and replacement of Huawei equipment.⁹⁵ Without a formidable competitor, however, the act risks “a loss of connectivity in rural America, including access to 911 and other public safety services.”⁹⁶ Rather than push telecommunications in the United States forward, the government’s efforts imperiled the existing domestic progress toward connectivity.

China’s strategy in the race to 5G differs dramatically from that of the United States. Its efforts to promote the accessibility of 5G and convince countries to adopt the technology of

⁹³ Rahim, “Huawei: US May Withhold Intelligence from UK If It Lets Chinese Firm Build 5G Network, Official Says,”

⁹⁴ West, “Technology and Innovation Economy”

⁹⁵ Maggie Miller, “Lawmakers Look for 5G Competitors to Huawei,” *The Hill*, March 2020,

<https://thehill.com/policy/cybersecurity/486014-lawmakers-look-for-5g-competitors-to-huawei>.

⁹⁶ Miller, “Lawmakers Look for 5G Competitors to Huawei,”

Chinese companies far surpass that of the United States. China added the Digital Silk Road (DSR) to its Belt and Road Initiative in 2015.⁹⁷ Through the DSR, China offers technology to countries participating in the Belt and Road Initiative for the ultimate goal of catalyzing global digitalization.⁹⁸ Since the beginning of the initiative, Huawei experienced an increase of 40% in its share of global telecommunications equipment.⁹⁹ These efforts have reaped the greatest results in Africa, where Huawei has become the predominant telecommunications company.

Through the BRI, China offers unbeatable prices on technology to participating countries. Meanwhile, the U.S. government has done little to address the cost concerns that drive many nations, especially developing countries, toward Chinese companies. Chinese companies maintain strong partnerships with state-affiliated banks and, as a result, Chinese companies can offer customers lower prices and earn an advantage over other competitors.¹⁰⁰ The Export-Import Bank of China provides African governments considerable loans under the stipulation that they use the money to deploy the technology of a Chinese company.¹⁰¹ Huawei's terms offer greater benefits and exceed the offerings of other commercial banks, "making Huawei cheaper to deploy at any price."¹⁰² On average Chinese technology is roughly 30-50% less expensive than its competitors, making it the most attractive option in Africa where the average revenue per user in

⁹⁷ David Sacks, "China's Huawei Is Winning the 5G Race. Here's What the United States Should Do To Respond," *Council on Foreign Relations*, March 2021, <https://www.cfr.org/blog/china-huawei-5g>.

⁹⁸ Richard Ghiasy and Rajeshwari Krishnamurthy, "China's Digital Silk Road and the Global Digital Order," *The Diplomat*, April 13, <https://thediplomat.com/2021/04/chinas-digital-silk-road-and-the-global-digital-order/>.

⁹⁹ Sacks, "China's Huawei Is Winning the 5G Race. Here's What the United States Should Do To Respond"

¹⁰⁰ Jie Xi, "Analysts: China Expanding Influence in Africa Via Telecom Network Deals," VOA, August 2021, https://www.voanews.com/a/economy-business_analysts-china-expanding-influence-africa-telecom-network-deals/6209516.html.

¹⁰¹ Xi, "Analysts: China Expanding Influence in Africa Via Telecom Network Deals"

¹⁰² Xi, "Analysts: China Expanding Influence in Africa Via Telecom Network Deals"

the telecommunications industry is the lowest in the world.¹⁰³ As a result, Huawei has emerged as the undeniable leader of telecommunications equipment on the continent.

Africa's technology sector reflects China's dominance in the industry. The African Union, with the support of the World Bank Group, aims to connect every individual, business, and government on the African continent within the next decade.¹⁰⁴ Through the Belt and Road Initiative, China has established trade relationships with African countries and supported them in expanding their mobile markets. In 2017, for instance, Africa reached 250 million smartphone connections. At its current rate, it expects to reach 440 million in the next four years.¹⁰⁵ The rapid expansion of Africa's mobile market hinged largely on the high-quality low-cost equipment provided by China. Within the past twenty years, Huawei constructed approximately 50% of Africa's 3G networks and 70% of its 4G networks.¹⁰⁶ In order to meet the requirements that connectivity demands, Africa needs to construct approximately 700 new data center facilities. China provided considerable funding to support these goals. The Export-Import Bank of China financed Senegal's national data center, which was built with Huawei equipment. Similarly, Cameroon recently unveiled its government data center funded by the Export-Import Bank of China, built by the Chinese-controlled China Shenyang International Economic and Technical Cooperation Corporation using Huawei equipment.¹⁰⁷ China's strong reputation and history as a leader in Africa telecommunications provides it with a competitive advantage in the race to 5G on the continent.

¹⁰³ Abubakar Idris, "The Race to Build Africa's 5G Networks Is Entangled in a U.S. Push to Cut Huawei's Dominance," *Rest of World*, August 2021, <https://restofworld.org/2021/the-race-to-build-africas-5g-networks-is-entangled-in-a-u-s-push-to-cut-huaweis-dominance/>.

¹⁰⁴ Xi, "Analysts: China Expanding Influence in Africa Via Telecom Network Deals"

¹⁰⁵ West, "Technology and Innovation Economy"

¹⁰⁶ Xi, "Analysts: China Expanding Influence in Africa Via Telecom Network Deals"

¹⁰⁷ Xi, "Analysts: China Expanding Influence in Africa Via Telecom Network Deals"

China's dominance in 5G in Africa reflects its efforts to foster relationships on the continent while the U.S. largely neglected it. Since Chinese companies cultivated a reputation in Africa's telecommunications industry, countries are more likely to continue working with companies familiar to them when transitioning to 5G, according to experts.¹⁰⁸ The United States, on the other hand, focused its efforts elsewhere, leaving it far behind China on 5G in Africa. According to the Atlantic Council, "Although the Trump administration's policies successfully curbed Chinese expansion in Western countries, they did not address the growing presence of Chinese technology infrastructure on the African continent... In African markets, a lack of local champions and infrastructure financing and construction capacity constraints have created a dependence on Chinese-financed projects."¹⁰⁹ Although the U.S. leveraged its resources and alliances in Europe, it failed to invest in its partnerships in Africa, allowing China to lay the groundwork for earning 5G contracts.

The United States leveraged the FCC, trade controls, the State Department, and legislation to hamper the rise of Huawei. Given its lack of funding, it resorted to leveraging intelligence-sharing partnerships or economic agreements to influence the deployment of 5G worldwide. As a result, its public appeals mainly influenced countries with which it had established pre-existing relationships, specifically its allies. China, on the other hand, invested heavily in the deployment of technology in developing countries for decades, offering them low-cost equipment until it became a trusted partner. Whereas the United States' strategies only influenced American allies, China leveraged its considerable funding to establish new, strong relationships with developing countries and gained momentum in Africa, a region neglected by the United States.

¹⁰⁸ Xi, "Analysts: China Expanding Influence in Africa Via Telecom Network Deals"

¹⁰⁹ Xi, "Analysts: China Expanding Influence in Africa Via Telecom Network Deals"

Chapter V: Case Study

The race to 5G between China and the U.S. places Europe squarely in the middle. For European countries, failing to ban Huawei risks upsetting long-standing alliances with the United States. At the same time, many European countries grew to have strong trading relationships with China. The United States forced Germany to make a difficult decision between the two. Although one of the wealthiest nations in Europe, Germany has fallen behind its neighbors in terms of high-speed internet infrastructure. This concern increases the importance of a swift 5G rollout.¹¹⁰ As one of Europe's strongest U.S. allies, failing to ban Huawei risked the stability of the U.S.-Germany alliance. On the other hand, banning Huawei could strain Germany's relationship with China, one of its most important trading partners and the largest market for many German companies.¹¹¹ To mitigate pressures from China and the United States, Germany tread an ambiguous middle ground for as long as possible before ultimately siding with the United States.

At first, Germany, facing the dilemma, delayed any certain decision. Horst Seehofer, Germany's top security official, publicly addressed U.S. concerns about security in early 2020. While conceding that Germany's protection from espionage remained a top priority for the nation, he expressed concerns that banning Chinese providers would significantly delay the implementation of new networks, thus harming Germany's economic position on the global

¹¹⁰ William Boston and Stu Woo, "Huawei Gets Conditional Green Light in Germany as Government Approves Security Bill," *The Wall Street Journal*, December 2020, <https://www.wsj.com/articles/huawei-gets-conditional-green-light-in-germany-as-government-approves-security-bill-11608117504>.

¹¹¹ Kelvin Chan, "Europe Resists Mounting US Pressure on Huawei 5G Technology," *AP News*, February 2020, <https://apnews.com/article/56a0580a4b0621c0a4c33e579bf0dcfc>.

stage.¹¹² Since “Germany’s industry needs powerful networks now, and not just in a few years,” economic concerns initially threatened to outweigh security concerns.¹¹³

German officials expressed logistical concerns in addition to economic concerns about the potential impact of banning Huawei to placate the United States. European telecommunications providers commonly used Huawei equipment for their 4G networks. Banning the use of Huawei equipment for 5G could lead to compatibility issues with new equipment. Additionally, Germany’s three largest network operators all source equipment from Huawei.¹¹⁴ Incompatible equipment could force Germany to pay higher costs and face delays in the rollout of 5G. Countries adopting Huawei infrastructure, however, would gain the economic advantage of being among the first to benefit from the advanced technology ushered in by 5G.

In January 2020, German Chancellor Angela Merkel denounced attempts to ban Huawei from 5G. Merkel has exhibited an aversion to portraying China as an opponent. Her hesitation stems from a fear of repeating the dynamics between the West and the Soviet Union during the Cold War. Jörg Wuttke, head of the EU Chamber of Commerce in China, echoed these concerns: “If we have this continental drifting apart of our nations, populations, and public opinion and so forth, that is a concern... [This] is not the Soviet Union, where you basically had a common border but no other interest. We have no border with China, but we have huge global supply chains and economic interests.”¹¹⁵ Playing into the divisive competitor dynamic between the

¹¹² Chan, “Europe Resists Mounting US Pressure on Huawei 5G Technology”

¹¹³ Bjorn Duben, “Try as It Might, Germany Isn’t Warming to Huawei,” *The Diplomat*, January 2020, <https://thediplomat.com/2020/01/try-as-it-might-germany-isnt-warming-to-huawei/>.

¹¹⁴ Andreas Rinke, “Merkel’s Conservatives Stop Short of Huawei 5G Ban in Germany,” *Reuters*, February 2020, <https://www.reuters.com/article/us-germany-usa-huawei/merkels-conservatives-stop-short-of-huawei-5g-ban-in-germany-idUSKBN205146>.

¹¹⁵ Erika Solomon and Guy Chazan, “We Need a Real Policy for China’: Germany Ponders Post-Merkel Shift,” *Financial Times*, January 2021, <https://www.ft.com/content/0de447eb-999d-452f-a1c9-d235cc5ea6d9>.

West and China threatens to further complicate some of the world's largest challenges, such as climate change. Given China's documented human rights abuses and repressive practices at home, however, opponents met Merkel's partnership approach with mounting criticism. She faced accusations that she prioritized German interests over fundamental issues of human rights.¹¹⁶ Regardless of criticism, Germany has long walked the middle ground between China and the U.S. to maintain partnerships on critical issues with both.

Merkel cautioned that signaling out one telecommunications provider could be counterproductive.¹¹⁷ At the annual meeting of the World Economic Forum in Switzerland in January 2020, Merkel said of the dilemma: "How do I make myself secure? I think I make myself the most secure through diversification and redundancy where it is necessary; those are the technical approaches to secure myself. I don't think I make myself particularly secure if I completely eliminate providers in their entirety and then don't know how they develop – I am skeptical about that."¹¹⁸ Although never mentioning Huawei by name, Merkel alluded to the controversial security concerns facing Huawei. She indicated that banning any one network could introduce additional security concerns. Merkel diplomatically refrained from making a definitive statement on China or the United States to prevent straining ties with either nation.

Merkel's statements set Germany apart from other European countries, including France and the United Kingdom. France's Constitutional Council, on one hand, approved a ruling that forced wireless carriers to remove Huawei gear from densely populated areas that will be the first to receive 5G technology. France allowed for some leeway and offered time-limited waivers

¹¹⁶ Solomon and Chazan, "We Need a Real Policy for China': Germany Ponders Post-Merkel Shift"

¹¹⁷ "Huawei in Germany: Merkel Says It's Risky to Ban Any 5G Provider," *Al Jazeera*, January 2020, <https://www.aljazeera.com/economy/2020/1/23/huawei-in-germany-merkel-says-its-risky-to-ban-any-5g-provider>.

¹¹⁸ "Huawei in Germany: Merkel Says It's Risky to Ban Any 5G Provider"

on 5G for telecommunications companies using Huawei's products. The waivers provided companies the opportunity to phase out Huawei's products, rather than mandating immediate action. France's largest telecommunications companies, including Altice Europe NV and Bouygues Telecom nevertheless promptly executed the French government's demands and removed Huawei from France's largest cities, leaving its equipment operating only in rural regions of France.¹¹⁹ The equipment replacement will introduce the opportunity to install 5G kits from other providers that are incompatible with the existing Huawei equipment. Although they complied, Altice and Bouygues expressed disappointment with the government's demands. Whereas they relied on 5G equipment from Huawei, their two largest competitors, Orange SA and Iliad SA sourced their equipment from Nokia and Ericsson, respectively.¹²⁰ The anti-Huawei regulation puts Altice and Bouygues at a competitive disadvantage in the French telecommunications sector. Bouygues complained that replacing Huawei equipment with Ericsson equipment on its 3,000 towers would take until 2028.¹²¹ After watching the controversy in France unfold, other European onlookers, including Germany, have hesitated to commit to the long and drawn-out process of banning, restricting, or replacing Huawei equipment.

The Huawei ban in the United Kingdom also likely influenced Germany's decision. At first, the UK promised to allow Huawei a limited role in its 5G networks. US sanctions imposed upon Huawei, however, caused the UK to reverse course in July 2020.¹²² Experts at the National Cyber Security Centre evaluated the consequences of the sanctions and determined that the

¹¹⁹ Helene Fouquet and Tara Patel, "France's Huawei Ban Begins to Kick In With Purge in Urban Areas," *Bloomberg*, March 2020, <https://www.bloomberg.com/news/articles/2021-03-01/france-s-huawei-ban-begins-to-kick-in-with-purge-in-urban-areas>.

¹²⁰ Fouquet and Patel, "France's Huawei Ban Begins to Kick In With Purge in Urban Areas"

¹²¹ Fouquet and Patel, "France's Huawei Ban Begins to Kick In With Purge in Urban Areas"

¹²² "Huawei to Be Removed from UK 5G Networks by 2027," *United Kingdom Government*, n.d., <https://www.gov.uk/government/news/huawei-to-be-removed-from-uk-5g-networks-by-2027>.

sanctions would limit Huawei's access to technology, forcing it to reimagine its supply chain. Digital Secretary Oliver Dowden said: "Following US sanctions against Huawei and updated technical advice from our cyber experts, the government has decided it is necessary to ban Huawei from our 5G networks."¹²³ NCSC advised that confirming the security of Huawei equipment in the future would prove increasingly difficult and, as a result, the government installed a prohibition on the purchase of Huawei equipment beginning January 1, 2021.¹²⁴ Additionally, the British government announced plans to remove Huawei from its existing networks by the end of 2027. US sanctions on Huawei, coupled with existing security concerns, pressured the United Kingdom to ban the telecommunications company completely. Germany, faced with the same concerns, opted for a slower and more measured approach.

The United Kingdom's decision represented an important win for the American government. In addition to emphasizing vaguely the security concerns and implementing sanctions against Huawei, then-Secretary of State Mike Pompeo implied in July 2020 that any decision short of a Huawei ban would threaten U.K.-U.S. intelligence sharing. The long-standing relationship between the United States and the United Kingdom provided the United States with additional leverage.¹²⁵ The decision demonstrated that U.S. threats and pressure could convince allies to adopt hard-line policies to align themselves with the United States. The U.S. government leveraged these same tools and long-standing relationships in Germany.

The United States' anti-Huawei pressure on its European allies has been undeniable. In 2020, the Trump administration threatened to reduce its intelligence-sharing with Germany unless it blocked Huawei. In acknowledgment of this approach, one German official stated: "The

¹²³ "Huawei to Be Removed from UK 5G Networks by 2027"

¹²⁴ "Huawei to Be Removed from UK 5G Networks by 2027,"

¹²⁵ Adam Segal, "The United Kingdom Bans Huawei From 5G Networks," *Council on Foreign Relations*, July 2020, <https://www.cfr.org/blog/united-kingdom-bans-huawei-5g-networks-0>.

American pressure has just been brutal.”¹²⁶ Mike Pompeo also issued a warning to the Italian government on a trip to Rome. He apprised Italian leaders that “Chinese technology companies ‘with ties to the Chinese Communist party’ were a threat to Italy’s national security and the privacy of its citizens.”¹²⁷ Such unabashed warnings have rippled through the continent in recent months.

In response to American pressure, Huawei has expressed dissatisfaction with efforts to ban Huawei in Europe. Abraham Liu, Huawei’s chief representative to the European Union, emphasized the country’s long history in Europe, stating that the company has “research centres in over 12 countries, and we have established quite a broad collaboration relationship with over 150 universities, and this kind of cooperation has been conducted under the rules of law, you know, in European rules of law.”¹²⁸ By highlighting Huawei’s previous relationships with European countries, Liu attempted to discredit new security concerns.

Huawei also reacted to Europe’s economic concerns. A Huawei spokesperson wrote that the United Kingdom’s ban of Huawei “threatens to move Britain into the digital slow lane, push up bills and deepen the digital divide... Regrettably our future in the UK has become politicized, this is about US trade policy and not security. Over the past 20 years, Huawei has focused on

¹²⁶ Guy Chazan and Nic Fildes, “Germany Crackdown Set to Exclude Huawei from 5G Rollout,” *Financial Times*, September 2020, <https://www.ft.com/content/35197477-acef-4429-a1d8-71743ee8d8e3>.

¹²⁷ Chazan and Fildes, “Germany Crackdown Set to Exclude Huawei from 5G Rollout”

¹²⁸ Annabel Murphy and Jack Parrock, “Huawei 5G: European Countries Playing ‘politics’ with Network Bans, Chinese Company Says,” *Euronews.Next*, July 2021, <https://www.euronews.com/next/2021/07/28/huawei-eyes-a-place-within-europe-s-digital-future-despite-5g-bans-in-some-countries>.

building a better connected UK.”¹²⁹ Huawei attempted to quell security concerns, pointing to the United States’ economic concerns as the true motive for the ban.

Despite facing similar pressures from China and the United States, Europe has taken a disjointed approach to 5G policy. As a result, European leaders have proposed joint European approaches. In January 2020, the European Union recommended that its members restrict 5G gear from “high risk” suppliers in a set of policy recommendations known as the 5G Toolbox.¹³⁰ While not mentioning Huawei specifically in the Toolbox, the restriction of high-risk suppliers would impact Huawei most directly. Some countries, including Finland, Poland, and Sweden, implemented the European Union’s recommendations but faced resistance from Huawei in court, yielding mixed results.¹³¹ Other nations, including Germany, forged their own path to avoid geopolitical or legal conflict. Charles Michel, president of the EU leaders’ council also attempted to unite members of the bloc on the issue of cybersecurity, but no united action came of the attempts.¹³² Countries’ differing relationships with China and the U.S. naturally lead each to pursue different outcomes favorable to each nation, which explains Germany’s deviation from the examples set by its neighbors and allies.

German lawmakers voted on 5G restrictions to address both economic and security concerns. The conservative Christian Democrats and Christian Social Union held a vote in

¹²⁹ Paul Sandle and William James, “UK Bans Huawei from Its 5G Network: Reaction,” *Reuters*, July 2020, <https://www.reuters.com/article/us-britain-huawei-reaction-instantview/uk-bans-huawei-from-its-5g-network-reaction-idUSKCN24F1JL>.

¹³⁰ “Germany’s 5G Defiance: My Way or Huawei?,” *EIAS*, May 2021, <https://eias.org/op-ed/germanys-5g-defiance-my-way-or-huawei/>.

¹³¹ Boston and Woo, “Huawei Gets Conditional Green Light in Germany as Government Approves Security Bill”

¹³² “Merkel Disagrees with Security Hawks, Resists Ban on Huawei,” *CGTN*, September 2020, <https://news.cgtn.com/news/2020-09-24/Merkel-disagrees-with-security-hawks-resists-ban-on-Huawei-U2tAUcT91m/index.html>.

February 2020 to adopt an official position on Huawei's participation in Germany's 5G networks. Leaders supported a position paper on 5G mobile networks that set stricter rules on foreign providers of 5G equipment but did not outright ban Huawei.¹³³ The document set out a risk management approach and addressed security concerns about 5G. Notably, any mention of Huawei is absent from the paper. Based on context, however, readers can extrapolate that the document responds to Huawei-related concerns.¹³⁴

The paper clearly established a middle ground in light of Merkel's stance to allow Huawei to do business in Germany while implementing security measures to appease the United States.¹³⁵ The position paper did not include a supplier's country of origin as an exclusion criterion to avoid pointing out Chinese companies.¹³⁶ To appease the United States, it did cite companies' "trustworthiness" as an exclusion criterion. The compromise resulted from months of intense debate among Germany's coalition government.

Based on Germany's hesitation to ban Huawei, the American anti-Huawei message initially seemed to fall on deaf ears.¹³⁷ Merkel proposed a deal with Huawei in December 2020 to build 5G networks in Germany, under the security regulations specified in the position paper earlier that year.¹³⁸ She pursued a technical agreement with strict technology standards and a high

¹³³ Rinke, "Merkel's Conservatives Stop Short of Huawei 5G Ban in Germany"

¹³⁴ Philipp Grull, "German Conservatives Vote 'in Unison' against Excluding Huawei from 5G Network," *Euractiv*, February 2020, <https://www.euractiv.com/section/5g/news/german-conservatives-vote-in-unison-against-excluding-huawei-from-5g-network/>.

¹³⁵ Boston and Woo, "Huawei Gets Conditional Green Light in Germany as Government Approves Security Bill"

¹³⁶ Philipp Grull, "Huawei Shouldn't Be Getting Its Hopes up for German 5G Expansion Just yet," *Euractiv*, February 2020, <https://www.euractiv.com/section/5g/news/huawei-shouldnt-be-getting-its-hopes-up-for-german-5g-expansion-just-yet/>.

¹³⁷ Chan, "Europe Resists Mounting US Pressure on Huawei 5G Technology"

¹³⁸ "German Chancellor Merkel Gives Nod to Huawei 5G Deal despite Opposition," *Business Standard*, December 2020,

degree of transparency.¹³⁹ Under this deal, Huawei would be held financially liable for any instances of compromised security. Additionally, Germany security agencies would be granted the technical and legal means to scrutinize the system's integrity.¹⁴⁰ Despite increased regulations and security measures, onlookers interpreted the decision as a major setback for the United States.

Merkel's party did not completely align itself with her position on Huawei. Norbert Röttgen, a member of the German Parliament, for instance, advocated for a position more closely in agreement with that of the United States. Merkel's opponents argued that although companies are required to adhere to certain security standards, adopting Huawei's 5G technology encourages dependence on China.¹⁴¹ Leaving Germany's telecommunications in the hands of China, regardless of the espionage or cyber threats, forces it to sacrifice some degree of independence, which constitutes a separate danger. She ultimately failed to garner the support necessary to finalize a 5G deal with Huawei.

Merkel's bill went to parliament but negotiations largely stalled amid the ever-mounting US pressure to toughen Germany's stance. In the meantime, Merkel drove forward an investment agreement with China in early 2021 to preserve trade relations between the two countries, regardless of the 5G outcome.¹⁴² Huawei refused to comment directly on the German bill. Instead, it said, "it was a 'purely private company' that was co-operating with the German security authorities and could 'see no plausible reasons to limit our access to the [German]

https://www.business-standard.com/article/international/german-chancellor-merkel-gives-nod-to-huawei-5g-deal-despite-opposition-120121700287_1.html.

¹³⁹ Boston and Woo, "Huawei Gets Conditional Green Light in Germany as Government Approves Security Bill"

¹⁴⁰ "German Chancellor Merkel Gives Nod to Huawei 5G Deal despite Opposition"

¹⁴¹ Boston and Woo, "Huawei Gets Conditional Green Light in Germany as Government Approves Security Bill"

¹⁴² Laurens Cerulus, "Germany Falls in Line with EU on Huawei," *Politico*, April 2021, <https://www.politico.eu/article/germany-europe-huawei-5g-data-privacy-cybersecurity/>.

market.”¹⁴³ As pressure intensified, Germany continued attempting to placate both the United States and China for as long as possible. Regardless of any legal action, two of Germany’s largest mobile operators, Deutsche Telekom and Telefónica limited their use of Huawei systems in the intelligent part of the network, the network “core.”¹⁴⁴ Despite mounting Chinese and American pressure for a conclusive 5G deal, German ministries and coalition parties failed to agree on policy and a provider.

Finally, in April of 2021, German lawmakers passed legislation aligning its 5G policy with that of other European countries. The IT Security Law 2.0 restricts the abilities of “untrustworthy” providers of 5G and forces telecommunications companies to inform the government if they enter deals for critical components of 5G technology or infrastructure. It also gives the government power to block deals made by telecommunications companies.¹⁴⁵ Specifically, the law empowers the interior ministry to block 5G contracts and weakens the power of the economy ministry, which has been historically friendly toward Huawei.¹⁴⁶ Additionally, lawmakers specified that “the use of new critical 5G components have to match ‘security policy goals’ of Germany, the EU, and NATO.”¹⁴⁷ NATO and the European Union have both adopted stances warning against the use of Chinese technology in telecommunications networks. Alignment with both global organizations positioned Germany in line with the legislation on sensitive network technology introduced by France and the United Kingdom. Although Germany did not explicitly ban Huawei like the United Kingdom and France “Germany... will strangle it in red tape... The final outcome is the same.”¹⁴⁸ The restrictions,

¹⁴³ Chazan and Fildes, “Germany Crackdown Set to Exclude Huawei from 5G Rollout,”

¹⁴⁴ Chazan and Fildes, “Germany Crackdown Set to Exclude Huawei from 5G Rollout,”

¹⁴⁵ Cerulus, “Germany Falls in Line with EU on Huawei”

¹⁴⁶ Cerulus, “Germany Falls in Line with EU on Huawei”

¹⁴⁷ Cerulus, “Germany Falls in Line with EU on Huawei”

¹⁴⁸ Andreas Rinke and Douglas Busvine, “Germany Moves to Toughen Huawei Oversight: Sources,” September 2020,

effectively banning Huawei, appeased the United States while striking another substantial blow to Huawei's standing in Europe.

The German case demonstrates the economic, political, and security trade-offs that countries consider when determining their 5G policies. A unified European policy on 5G has proven difficult to compose, as states individually forge their own systems to address these evolving issues. Whereas France and the United Kingdom banned Huawei early on, Germany delayed a decision between China and the United States for fear of upsetting an important alliance with the United States and its vital trade relations with China. Angela Merkel feared banning Huawei to appease the United States would alienate China and further complicate international collaboration on other key issues. The United States government leveraged its intelligence-sharing relationship with Germany to drive it to align its 5G policy with that of the United States. After months of intense pressure, German lawmakers ultimately passed legislation that effectively banned Huawei from its 5G networks, citing security concerns, and sided with the United States.

Conclusion

So far, Europe and Africa have been the primary subjects of the United States and China's lobbying efforts. As other regions prepare themselves to upgrade to 5G, both countries will inevitably direct their solicitations to other regions. Given Latin America's economic dependence on China and its physical proximity to the United States, the region will soon face increased pressure from both countries. Similarly to Europe, Latin American countries have so far aimed to maintain a friendly relationship with both powerhouses. New diplomatic pressure from Beijing and Washington will force a number of Latin American nations to finally choose whether to permit Huawei equipment in their 5G infrastructure or opt for an United States-approved alternative.

As the race plays out across the world, the stakes continue to increase. Given the economic, technological, and national security advantages, 5G has the power to determine the power dynamics of the future. Examining the race to 5G supremacy from the United States' perspective, however, one could argue that the U.S. trails significantly behind China. The Biden administration has failed to produce a comprehensive strategy on 5G, leading to speculation on whether it will continue to employ the Trump administration's tactics. A continuation of its disjointed approach, however, will be no match for China's organized tactics. Without a comprehensive 5G strategy, the United States risks its economic stability and security.

Although the United States suffers from a number of disadvantages that hinder its progress in 5G, it must overcome its disadvantages with an exhaustive strategy to harness the power of 5G. Whereas China benefits from the efficiencies and directed development possible in communist autocracies, the United States faces bureaucracies, a critical public, and a disconnect between the government and private sector. Challenging China will require the U.S. government

to coordinate with its numerous actors to promote interagency collaboration, assertive leadership, cooperation between the public and private sector, and collaboration with trusted allies. The United States needs to solidify its commitment to the race by prioritizing 5G deployment and innovation if it aims to maintain its position as a superpower in the decades to come.

Appendix

Country	US or China? ¹⁴⁹	Military Agreement with China ¹⁵⁰	Countries that chose Huawei and have military agreements with China	Military Agreement with US ¹⁵¹	Countries that chose US and have military agreements with US	Economic Relations with China ¹⁵²	Countries that chose Huawei and have trade agreements with China	Economic Relations with US ¹⁵³	Countries that Chose US and have economic relations with US
Afghanistan	N/A		No Match	x	No Match	x	No Match		No Match
Albania	US		No Match	x	Match	x	No Match		No Match
Algeria	N/A		No Match		No Match	x	No Match		No Match
Andorra	China		No Match		No Match		No Match		No Match
Angola	China		No Match		No Match	x	Match	x	No Match
Antigua and Barbuda	N/A		No Match	x	No Match		No Match		No Match
Argentina	China		No Match	x	No Match	x	Match	x	No Match
Armenia	China		No Match	x	No Match	x	Match		No Match
Australia	N/A		No Match	x	No Match	x	No Match	x	No Match
Austria	N/A		No Match	x	No Match	x	No Match		No Match
Azerbaijan	China		No Match	x	No Match	x	Match		No Match
Bahamas	China		No Match	x	No Match	x	Match		No Match
Bahrain	China		No Match	x	No Match	x	Match	x	No Match
Bangladesh	China		No Match		No Match	x	Match	x	No Match

¹⁴⁹ Sacks, “China’s Huawei Is Winning the 5G Race. Here’s What the United States Should Do To Respond”

¹⁵⁰ “Military Alliances of the World,” *Foreign Policy Institute*, February 14, 2020, <https://foreignpolicy.org/tr/military-alliances-of-the-world/>.

¹⁵¹ “Military Alliances of the World”

¹⁵² “China,” *The Observatory of Economic Complexity*, n.d., <https://oec.world/en/profile/country/chn>.

¹⁵³ “Countries & Regions,” *Office of the United States Trade Representative*, n.d., <https://ustr.gov/countries-regions>.

Barbados	N/A		No Match	x	No Match	x	No Match		No Match
Belarus	China		No Match	x	No Match		No Match		No Match
Belgium	US		No Match	x	No Match	x	No Match		No Match
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Bosnia and Herzegovina	China		No Match	x	No Match	x	Match		No Match
Botswana	N/A		No Match		No Match	x	No Match	x	No Match
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Bulgaria	US		No Match	x	Match	x	No Match		No Match
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Cameroon	N/A		No Match		No Match	x	No Match	x	No Match
Canada	Canada		No Match	x	No Match	x	No Match	x	No Match
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Chad	N/A		No Match		No Match	x	No Match	x	No Match
Chile	US		No Match	x	No Match	x	No Match	x	No Match
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Comoros	China		No Match		No Match	x	Match	x	No Match
Congo	N/A		No Match		No Match		No Match	x	No Match
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Denmark	US		No Match	x	Match	x	No Match		No Match
Djibouti	N/A		No Match		No Match	x	No Match	x	No Match
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East Timor	N/A		No Match		No Match		No Match		No Match
Ecuador	N/A		No Match	x	No Match	x	No Match	x	No Match
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Equatorial Guinea	N/A		No Match		No Match	x	No Match	x	No Match
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Ivory Coast	N/A		No Match		No Match	x	No Match	x	No Match
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Micronesia	N/A		No Match		No Match	x	No Match		No Match
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Netherlands			No Match	x	No Match	x	No Match		No Match
New Zealand	US		No Match	x	No Match	x	No Match	x	No Match
Nicaragua	N/A		No Match	x	No Match	x	No Match	x	No Match
Nigeria	N/A		No Match		No Match	x	No Match	x	No Match
North Korea	China	x	Match		No Match	x	Match		No Match
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Oman	China		No Match		No Match	x	Match		No Match
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Palestinian Territories	N/A		No Match		No Match		No Match		No Match
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Russia	China	x	No Match	x	No Match	x	Match	x	No Match
Rwanda	N/A		No Match		No Match	x	No Match	x	No Match
Samoa	N/A		No Match		No Match	x	No Match		No Match
San Marino			No Match		No Match		No Match		No Match
Sao Tome and Principe	N/A		No Match		No Match		No Match	x	No Match
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Senegal	China		No Match		No Match	x	Match	x	No Match
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Singapore	Europe		No Match		No Match	x	No Match	x	No Match
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South Sudan	N/A		No Match		No Match	x	No Match	x	No Match
Spain	US		No Match	x	No Match	x	No Match		No Match

Sri Lanka	N/A		No Match		No Match		No Match	x	No Match
Sudan	N/A		No Match		No Match	x	No Match		No Match
Suriname	N/A		No Match	x	No Match	x	No Match		No Match
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Syria	N/A		No Match		No Match	x	No Match		No Match
Taiwan	US		No Match	x	Match	x	No Match	x	Match
Tajikistan	China	x	Match	x	No Match	x	Match		No Match
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Thailand	China		No Match	x	No Match	x	Match	x	No Match
Togo	US		No Match		No Match	x	No Match	x	No Match
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Turkey	China		No Match	x	No Match	x	Match	x	No Match
Turkmenistan	N/A		No Match	x	No Match	x	No Match		No Match
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Uruguay	China		No Match	x	No Match	x	Match	x	No Match
Uzbekistan	China	x	Match	x	No Match	x	Match		No Match
Vatican City	N/A		No Match		No Match		No Match		No Match
Venezuela	N/A		No Match	x	No Match	x	No Match	x	No Match
Vietnam	N/A		No Match		No Match	x	No Match	x	No Match
Yemen	N/A		No Match		No Match	x	No Match		No Match
Zambia	N/A		No Match		No Match	x	No Match	x	No Match
Zimbabwe	N/A		No Match		No Match	x	No Match	x	No Match

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