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Chinese model promotes smartphone outside electronics center notorious for selling fake, gray market, and pirated electronics, in Beijing, September 27, 2015 (Stephen Shaver/UPI)

From “Made in China” to “Created in China”

Intellectual Property Rights in the People’s Republic of China

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Frication between the United States and the People’s Republic of China (PRC) on technology captures the headlines regularly. American leaders

discuss potential bans on U.S. investment in high-end Chinese tech companies involved with advanced semiconductors, artificial intelligence (AI), 5G

technology, and quantum computing. U.S. leaders and the Taiwan Semiconductor Manufacturing Company recently announced that Taipei would invest \$12 billion to open a semiconductor facility in Arizona to support 5G and other advanced technologies in the United States and revised the investment in late 2022 to include a second semiconductor chip plant for a total investment of \$40 billion.¹ The first plant will produce 4-nanometer chips, while the second will produce the industry's most advanced chips at 3 nanometers to meet the U.S. annual demand of 600,000 wafers per year.²

The PRC's growing influence has generated a cottage industry of scholars and writers who do everything from explaining the inner workings of the Chinese Communist Party (CCP) to exposing threats posed by Chinese territorial ambitions and the pending eclipse of the United States as a global power. President Xi Jinping stated in 2014 that the first-mover advantage would go to "whoever holds the nose of the ox of science and technology innovation."³ American leaders must better understand China's quest for technological superiority and intellectual property and continue modifying policies more aggressively.

Data indicate that the PRC continues to be guilty of flagrant intellectual property theft (IPT), forced technology transfers, and trademark and intellectual patent infringement (IPI). While it is outside the scope of this article, many factors are involved, and U.S. businesses might be partially responsible for lackadaisical agreements and protection processes in their quest for market access in China. Nevertheless, a 2016 report issued by the U.S. Chamber of Commerce Global Intellectual Property Center indicated that approximately 86 percent of counterfeit goods continued to emanate from the PRC.⁴ Simply looking at China as the source of counterfeit products might suggest that IPT is rampant and that little has changed.

However, another aspect of China's growth is missed. The CCP is committed to leading and innovating in several high-tech sectors, which will continue to

drive increased intellectual property (IP) protection for Chinese and foreign companies. The data support a shift toward greater protection of intellectual property and patents within the country. Chinese companies are becoming more protective of their IP, and there were three times as many IP-related lawsuits filed in 2020 as in 2016.⁵ Hence, it is worth exploring the transformation of intellectual property rights (IPR) in China, particularly given the increased competition and restrictions on American high-tech products. This is driving China to find international and internal replacements to mitigate risks to Chinese interests.

This article focuses on progress in China's protection of intellectual property. Specifically, it looks at China's changes toward protecting IP as the PRC continues to drive economic growth as one of the world's leading economies. Today in China, the reality of IPT is somewhat more complex. Some Chinese companies that are global leaders—such as Huawei, with its 5G network chips—are built on government subsidies and nontariff barriers to create national champions under the protection of the state.⁶ As James Lewis reported in 2020, China does not hesitate to use "unfair practices and policies to advance its firms, extract concessions, or block competition by foreign companies in China."⁷ This has become more typical of foreign companies' challenges in China's markets.

The PRC has made significant progress toward greater IP protection and will continue to do so. However, it might not become an innovation hub because of stringent centralized control by the CCP. China's vast resources and population mean that the PRC will seize and dominate some sectors simply because of scale. Several implications for U.S. national security demand modification and substantial changes to American research and development (R&D) programs. Three suggestions are advanced herein to ensure America retains a competitive edge: increase funding to the Defense Advanced Research Projects Agency (DARPA); increase funding to university and college R&D programs; and expand and redefine the Advanced

Robotics for Manufacturing Institute to follow the model (which is explored later) of Germany's Fraunhofer-Gesellschaft, which began in 1949 as a nonprofit organization and became one of the world's leading applied research organizations. A rudimentary historical framework helps us grasp the distinct differences in Chinese culture that are easily overlooked.

Background

Chinese education and administrative vocations historically focused on rote memorization in imperial China as early as the Tang dynasty during the late classic period (618–907 CE). During the imperial period, candidates had to pass an examination to demonstrate basic knowledge of Chinese classics to qualify for employment in government jobs. Memorizing information was prized, and original thoughts, synthesis, and analysis were not valued. Vestiges of the system still exist in the PRC and Taiwan (Republic of China). However, the influence of Marxism and Leninism and the importance of a single version of truth became the core of PRC society.

Furthermore, the Cultural Revolution (1966–1976) under Chairman Mao Zedong purged academics and innovative thinkers while promoting blind obedience to communist ideology, as presented by Mao. Taiwan charted a new democratic path that embraced capitalism, innovation, and global collaboration, and still does today. This explains why it is one of a handful of countries that dominates advanced microchips 7 nanometers and below.⁸ It is worth noting that although China is the world's largest consumer of semiconductors and chips, it has yet to develop facilities to fabricate more advanced chips. The PRC relies on advanced chips from other countries to support its supplies.

Given China's historical focus on memorizing facts rather than critical thinking and creativity for its citizens, is it only natural that it was slow to catch on to the notion that ideas are the property of individuals? As Lawrence Page writes, "An arguable effect of these values is that the perceived need to protect IP is outweighed by the tendency toward

placing collective duties above individual rights.”⁹ With the growth of industrial production in the 1980s and 1990s, China’s developing economy snowballed through counterfeiting, mimicry, and reverse-engineering products to provide cheaper alternatives globally. One of the consequences of the practice was that many companies sought to make money quickly rather than build quality products and establish brand names and long-term relationships with consumers.¹⁰

Intellectual property primarily refers to *patents, copyrights, trademarks, and trade secrets*, though these terms are not mutually exclusive or easily defined. The U.S. relationship with China over trade imbalances and IP has been tense recently. It is easy to jump to conclusions and condemn China for insufficient IPR, but the details must be set in context. Ian Harvey and Jennifer Morgan point out, “All too often, fair concerns about the ability of Western companies to compete with Chinese ones, or fears about the outsourcing of production to take advantage of cheap labor, are miscategorized as IPR issues.”¹¹ Although not plentiful, some studies have demonstrated that it is not uncommon for “complaints” from U.S. senior business executives to be based on a lack of understanding of IP, as well as their role in further exacerbating the problem in China, which can often be a result of weak patents and oversight in registering patents in China.¹² More detailed analysis helps sort the facts from fiction.

Transforming IP

Before 1984, patent laws did not exist in China. The growth of intellectual property in China made tremendous progress in the 1980s and 1990s, with Chinese representatives attending all international IPR conventions. Before this period, China was listed as one of the top violators of IP, driven mainly by movie and software violations. Numerous fines and court judgments imposed on Chinese companies—ranging from infringements on the Walt Disney Company’s IPR by manufacturing and selling unlicensed products to 200,000 unlicensed copies

of Microsoft’s Disk Operating System—were common. However, the penalty did not outweigh the benefits in many cases. To cite one example, the fine for pirating was only \$2,500.¹³ Flagrant violations by Chinese companies continued to generate tensions with larger foreign companies. In the late 1990s, it was clear that Beijing was progressing toward raising standards and cleaning up trade practices to open markets worldwide. During this window, China began passing trademark laws (1982) and patent laws (1984), and establishing special IP courts in five regions: Hainan, Guangdong, Fujian, Beijing, and Shanghai.¹⁴ The German government also helped China establish an electronic patent database in 1995. A software title verification office created in Beijing in May 1997 primarily served as a liaison for U.S. software companies. Subsequent revisions to China’s copyright laws were expanded in 2001 to include online copyright protection.¹⁵

The U.S.-China agreement in December 2001 marked China’s entry into the World Trade Organization (WTO), ushered in a wave of changes, and solidified the basis and guidelines for the Chinese socialized market. The PRC formed the General Administration of Quality Supervision, Inspection, and Quarantine department to assess 21,000 technical standards while revising 9,000 others to bring various industries in compliance with WTO rules.¹⁶ However, central to China’s entry into the world economy was maintaining a developing-country status that conveyed more lenient policies.¹⁷ China corrected several unfair trade practices, but the CCP’s desire to boost economic growth outweighed the anticipated costs. Entry into the WTO helped China’s exports and increased participation in a larger global market, ultimately refining its competitive edge. The growth in Chinese exports is illustrative and showcases the Chinese transformation driven by its entry into the WTO, although the rapid growth created problems. In 1998, Chinese exports were USD 320 billion, surging to over USD 600 billion in 2005, though stimulating foreign direct

investment in the Chinese economy also doubled to over USD 100 billion.¹⁸

The PRC’s watershed moment for IP began in 2005, as it established the milestones of China’s IP protection strategy. China’s State Council announced the Intellectual Property Strategy Action Plan (2014–2020), which guided the goals and steps for program implementation.¹⁹ The key objectives of the program were to increase China’s creation of IP, enhance the integration of IP into the industry, improve the protection of IP, and create a system to manage it.²⁰ While the improvements in IP protection were noticeable, there were still several gaps and continued infractions.

One of the PRC’s greatest challenges to IP protection is impossible to eradicate. The CCP is intrinsically tied to IP courts and the country’s legal system. While the courts might not have complete autonomy, the Party will be forced to reduce corruption and respond to public demands. Although many changes have taken place in China, there will always be isolated pockets or areas difficult to control. For example, the Chinese city of Putian is known as the counterfeit-sneaker capital of the world, where corruption in courts and political interference by influential companies are ubiquitous, despite efforts to eradicate the problem.²¹

In 2015, Peter Yu wrote about reports of IPT in China: “As troubling as these developments have been, China has also slowly, and somewhat paradoxically, emerged as one of the world’s leading intellectual property powers.”²² The riddle is more easily explained by the size of the Chinese government and the vast territory that must be monitored for violations. In other words, China is improving IPR, though its government structure hampers it. James Brander, Victor Cui, and Ilan Vertinsky note, “A key institutional characteristic of China that impairs adherence to international IP protection is the fragmented nature of its governance system. The central government, provincial governments, and individual ministries within government have competing and overlapping areas of authority.”²³



Assembly plant workers assemble engines at Geely Automobile Manufacturing Plant, March 14, 2017, Linhai, Zhejiang Province, China (Jenson/Shutterstock)

Despite this challenge, China continues to make regular improvements to IPR. Local government officials can find local consumer demands more compelling than the rules and regulations established by Beijing, invoking the famous Chinese expression, “The mountains are high, and the emperor is far away.” Nevertheless, national interest drives the protection and enforcement of IPR, while China’s strong central government provides a more responsive policy with fewer of the operational constraints present in the United States or Europe.

While China continues to be the home to manufacturing most of the world’s counterfeits, it also has a long history of IPT and forced technology transfers as a condition for foreign companies to operate in China. According to the Office of the United States Trade Representative (USTR)’s April 2019 *Special 301 Report*, the Chinese government uses “joint venture requirements, foreign investment restrictions, and administrative review and licensing processes to force or pressure technology transfers from American companies.”²⁴ While not

all intellectual property is forced from companies, joint ventures between foreign and Chinese companies and foreign direct investment provide a mechanism to collect IP. Intellectual property covers various categories, including copyrights, trademarks, and patents. China’s focus on critical high-tech sectors began in 2015 as part of the 13th and 14th Five Year Plans, and is outlined in its Made in China 2025 (MIC2025) program, which focuses on innovation that dictates tighter IP protection.²⁵

The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) and the World Intellectual Property Organization provide critical documents for creating responsible IP regulation. Both recognize several types of intellectual property and rights, though most are captured in IP in motion pictures, art, literature, software, music, chemicals, and trademarked goods. Still, emerging technologies will force consistent revisions to these documents.²⁶ The PRC is shaping norms, as it has sponsored revisions to the TRIPS agreement shaping the nuances of future patents in

biological and genetic research.²⁷ The PRC’s MIC2025 seems to garner large shares of emerging technologies that encompass biological and genetic research.

In 2005, the PRC became the world leader in IP-related lawsuits, a trend that continues today. China’s leadership in patent protection, coupled with its strong government and industry linkages, suggest more resources will be devoted to critical industries such as AI and robotics. China’s creation of USD 1.55 trillion government guidance funds captures the scale of the problem and the volume of resources the CCP is devoting to technological innovation.²⁸

Statistics published by the PRC’s State Intellectual Property Office show increased patent infringement seizures and court cases. Additionally, litigation by foreign plaintiffs against Chinese defendants grew from 177 filings in 2006 to 745 cases in 2015.²⁹ For these reasons, a more thorough review of the nuances of IPT in China is crucial. At the same time, the number of registered patents in China highlights the progress and strides in patent protection.



Maglev train exiting Shanghai Pudong International Airport, China, on May 20, 2006 (Courtesy Alex Needham)

USTR's *Special 301 Report* placed China on the "Priority Watch List." The report cited examples of China committing intellectual property infringement and other concerns.³⁰ The USTR document recognized China's governmental changes, claiming that "China failed to make fundamental structural changes to strengthen IP protection and enforcement."³¹ While the report captured a few bright spots, the details of IP changes in China are overlooked.

To stimulate innovation and entrepreneurs, China recognizes that it must protect these innovations from internal and external competitors by more effectively managing IP. In a meeting with the Politburo, Xi Jinping announced that China must have more robust laws to improve the business environment and strengthen IP rights domestically and abroad.³² The PRC's technological innovation and MIC2025 hinge on innovation in critical high-tech sectors vulnerable to IPT and represent a threat to national objectives outlined by the CCP. MIC2025 was released in 2015 and reflected the CCP's 10-year plan to update Chinese manufacturing and focus on the top tier of value-additive manufacturing with more complex and sophisticated products. Many industries

tie into the fourth industrial revolution that will integrate big data, cloud computing, and other emerging technologies into the global supply chain.³³ China is already leading in some areas, such as 5G technology. Peter Yu wrote in 2017, "Among corporate applicants . . . Huawei Technologies and ZTE Corporation had the world's first- and second-largest volumes of international patent applications, respectively."³⁴ At least in communications infrastructure, Chinese innovation appears among some of the top companies in the world.

As businesses expand into new areas, the CCP recognizes that IPT reduces company profits and might deter foreign and Chinese software companies from investing further in innovation directed at China's consumers. The PRC's commitment to acting as the leader in many high-tech industries underscores its voracious appetite for attaching strings to deals with Western companies to ensure that they sign technology transfers as a condition for doing business in China. America is not alone in facing challenges with doing business in China, and German lobbyists are vocal about the difficulties. However, the conversation has shifted from IP to forced technology transfer agreements, which appears to be

expected as China attempts to comply with international norms.

Although it took place in 2001, an example of how Chinese companies interact with the West to conform to the law is illustrated by the German consortium ThyssenKrupp-Siemens (TKS).³⁵ TKS signed a contract with China to build a maglev (magnetic levitation) train with more than 200 kilometers of track at the cost of over EUR 20 billion. Shortly after starting the project, China demanded a significant discount due to technical issues with similar systems in Europe. Less than a year after the track was completed, Chinese technicians reverse-engineered the track and cars, producing an eerily similar prototype, canceling the more significant construction contract. Despite these frustrations, TKS eventually completed a much shorter (30-kilometer) track to the Shanghai airport and received a fraction of the quoted price.³⁶ These events capture the gauntlets many Western companies face when doing business in China. A 2019 U.S. Business Council survey produced only 5 percent of respondents who were approached about signing such agreements, suggesting that China's companies have become more subtle in acquiring foreign

technology, representing a slight shift in policy to moving away from foreign direct investment.³⁷

Nevertheless, the high-speed rail (HSR) example portends another challenge. Once China borrowed and reverse-engineered rail technologies, its HSR industries took off. The PRC created extensive rail networks and now is home to one of the largest and most modern global rail systems. Chinese companies also began to bid on international rail projects and undercut other countries. The net result is that between 2008 and 2014, China became the world leader in HSR, with over 11,000 kilometers of domestic track rated at speeds greater than 250 kilometers per hour.³⁸ Because of China's economies-of-scale advantage, it is now the industry leader, specializing in low-cost track installation and networks. The PRC has pioneered ultrafast networks with trains capable of traveling up to 360 kilometers per hour, all at a fraction of the cost of rival companies in Europe and North America.³⁹ The HSR industry might become increasingly common as China dedicates its vast economy and financial resources to other sectors.

Patents

China's commitment to becoming a technological leader and global innovator is driving an increase in registered patents, which stood at 13,751 in 1998, and with an astonishing 353,313 by 2012.⁴⁰ According to the World Bank, by 2019, Chinese patent applications more than tripled to 1,243,568.⁴¹ While the sharp increase in patent applications does not necessarily translate into patent grants and true innovation, it does represent a trend. The number of registered patents increased by 122 percent between 1998 and 2012, reinforcing changes in China as the CCP attempts to stimulate innovation and establish a creative environment like that in the West. The World Intellectual Property Organization database highlights in 2022 that IP filings for Chinese residents were 1,464,605, though only 798,347 patents were granted.⁴² This suggests that many patent applications are frivolous and

useless for industry and consumers. The top Chinese patent applicants are Huawei, BOE Technology Group, Guang Dong Oppo Mobile Telecommunications, and ZTE Corporation, dwarfing all other patent applications.⁴³

The sharp increase in patent applications comes with associated problems, as authors Brander, Cui, and Vertinsky highlight: "The large surge in patenting in China without developing a matching institutional capacity to examine patent applications properly contributes to patent thickets (that is, dense webs of overlapping rights), which increase litigation and reduce the system's capacity to protect legitimate IPRs."⁴⁴ According to the Congressional Research Service, in 2019 the United States led in the number of patent applications filed under the Patent Cooperation Treaty (PCT), an international patent system, with 52,005 PCT applications filed, but it was closely followed by China (with 50,563 applications) and Japan (with 47,888).⁴⁵ Intellectual property drives industrial growth and is an integral part of economic growth, higher wages, and exports, which are crucial to maintaining a competitive edge in the global economy.

In 2019, the PRC revised the trademark law and passed an anti-unfair competition law to prosecute those who leak trade secrets. In 2020, revisions to the patent law reduced the burden of proof for defendants, making it easier to file complaints with patent courts. Copyright law penalties for damages were raised tenfold to RMB 5 million (USD 773,000).⁴⁶ The importance of IP is not lost on China's leadership; the emphasis on fostering innovation and the need to protect Chinese entrepreneurs are partially responsible for increasing IPR disputes in China. IP lawsuits are rising in Chinese courts, among both Chinese and non-Chinese plaintiffs. For example, there were only 177 cases in 2006, but by 2015, the number of cases had grown to 745.⁴⁷ The numbers have increased dramatically over the past few years. In 2019, for instance, Chinese courts reported 22,722 new cases involving patent disputes, with 3,176 new IP cases filed with the highest court in China, the Supreme People's IP Court.⁴⁸

China's recent quest to lead in key technology sectors outlined in MIC2025 will continue to drive changes to improve IP protection. The 10 industrial sectors that China is targeting are information technology (AI), robotics, green energy, aerospace, ocean engineering, railway equipment, power equipment, medical devices, agricultural machinery, and new materials (which involve chemistry, physics, and metallurgy).⁴⁹ Several Chinese companies are currently leaders in some of these technologies. A few examples are Baidu (AI and autonomous vehicles), SMIC (semiconductors), DJI, and Megvi (AI and drones). It should also be mentioned that many more Chinese companies are also applying to American and European patent offices.

Two conclusions are possible based on these challenges in China. One that appears the most likely is that China will naturally conform to international standards for IP once it creates the appropriately scaled institutional framework to support the workload and infrastructure. However, Brander, Cui, and Vertinsky make different predictions for the future of Chinese IP protection. They argue that the PRC will adopt international standards only once the Western world applies significant pressure, specifically through the TRIPS agreement, which must be updated and renegotiated.⁵⁰ The original agreement was established in 1995 and covered many types of IP, though technological innovation created new fields with the rapid growth of advanced technologies. The new agreement should specify what is and is not admissible for protection, mainly with the emerging field of biological entities. They correctly argue that as a global leader, China must be a stakeholder in all processes and negotiations involving international bodies and institutions.

IP protection must be balanced and implemented so that patents are not granted in a comprehensive manner that would stifle research and innovations, particularly in technological sectors. It is possible to create a rigid patent system where monopolies might be held by a large company that impedes innovation of other firms and future research while

also stiffly regulating “patent trolls or assertion entities” that never produce anything tangible, impose taxes, and assess fees on companies.⁵¹ Brander, Cui, and Vertinsky argue that standards for granting patents in the United States and China are too lenient and low, while a single standard needs to be modified as 20-year patent protection from the filing date might not make sense.⁵² They miss the rapidly evolving high-tech industry that should be captured by a limited span, given the nature of the business and rapid transformation of some sectors. A 5-year window might be more viable.

The 2019 creation of an IP tribunal is a step in the right direction and allows appeals to local judgments to the Supreme People’s Court through connections to high-level members of the CCP.⁵³ Reports show that as many as 19 more courts will be debuted soon.⁵⁴ An off-the-record case lodged by an American company against one of China’s tech Brobdingnagians in a large city undermined this small win when local police omitted U.S. representatives from communications while negotiating privately with the court, and the case was dismissed.⁵⁵

The future of IPR in China looks promising, though there are still challenges. Over the past few years, China has made tremendous strides to safeguard IP locally to protect Chinese entrepreneurs and globally by creating specialized IP courts, a Supreme Court IP tribunal, and a host of laws and regulations regarding IP.⁵⁶ However, Beijing’s IP infrastructure is integrated into the legal system, which the CCP closely monitors. Another more potent criticism is that online infringement is more prevalent and harder to regulate. At the same time, China’s lack of a “civil discovery process would mandate a philosophical shift in the country’s legal system, one that would empower the plaintiff over the defendant. . . . So far, China has not indicated that it is willing to move in that direction.”⁵⁷

China’s famous WeChat platform protects users from companies looking for infringement while allowing users to create multiple accounts to effectively generate anonymous transactions, which are difficult to track back to counterfeit

product sales.⁵⁸ Nevertheless, developed regions of China reveal a court system of good quality, and the cost of IP litigation is a fraction of that in the United States. At the same time, judgments are often processed fast by international standards, with most resolved within a year.⁵⁹ In 2005, China became the world leader in IP-related lawsuits, a trend that continues today.⁶⁰ On further inspection, China’s large economy is growing rapidly, and it is making changes to IP protection that are reasonable and consistent with any Western standards. The media and politicians depict China in an unfavorable light that ignores the tremendous strides made as the country takes the stage as one of the most powerful economies globally.

Some critics look at the Great Chinese Firewall and strict controls of the CCP and the tremendous focus placed on a homogeneous society that controls risk-taking and limits creativity. They conclude that such a culture can never truly be innovative, or at least that innovative breakthroughs that impact the world will be rare. This was the conclusion reached by Carly Fiorina, former chief executive officer of Hewlett-Packard from 1999 to 2005.⁶¹

Conclusion

While China is making strides in protecting IP and patent applications, the implications for U.S. companies are concerning. Intellectual property is the linchpin of innovation. American analysts should be less concerned with China’s IPI issues and more mindful of internal changes and the strides the CCP is making toward safeguarding IP. China’s increase in patent applications should be concerning and underscores the improvements inside China for greater IP protection. That Chinese entrepreneurs are also registering patents in the European Union and the United States is also an indication that change is brewing below the surface in China regarding IP. The roughly 20,000 new court cases involving patent disputes indicate a shift in the PRC. The creation of special IP courts, with 19 more planned, foretells further

patent and intellectual rights protection in the country.

China’s quest to be a global leader in emerging technology, such as AI and other high-tech industries (10 integral to the CCP’s Made in China 2025 plan), means that it might succeed in many areas. While the United States has led in these technologies for many years, the CCP is focused on making strides in these sectors. Furthermore, the PRC is dedicating significant investment dollars to the program and allocation of “government guidance funds.” These funds are public-private investments that, as of the first quarter of 2020, registered RMB 11 trillion (USD 1.55 trillion).⁶² These funds are directed toward developing industries critical to the PRC’s national security, from semiconductors to AI. In addition to special funds directed to R&D, the Chinese government offers direct subsidies and tax rebates to companies in key industries. China’s advantage is that it can and will heavily fund these sectors, whereas the U.S. Government has outsourced much R&D to the private sector.

In the United States, the commercial sector drives much of the technological sector, while funding to defense agencies and research has waned. Due to IP concerns, many American companies are secretive with research programs and do not focus on the specialized military applications that support and address emergent military requirements. To bolster military applications to robotics and AI, the United States needs to increase DARPA’s funding to at least \$10.5 billion over the next 5 years, and it should be expanded along the so-called Fraunhofer model—a reference to the Fraunhofer-Gesellschaft—to focus on the warfighter and key emerging fields in applied science.⁶³

The interests of U.S. companies and the government are often at odds. This is not a problem with authoritarian governments like China. In the United States, due to concerns about IP, some companies, such as Google (2015), elected not to renew contracts with the government. Google’s actions were driven by its purchase of several robotic companies in 2013, though it continues to bid on some military contracts.⁶⁴ It has also declined



World Intellectual Property Organization Director General Francis Gurry speaks at Trademark Awards Ceremony in Yangzhou, China, June 30, 2017 (Courtesy Li Shiming)

to participate in Department of Defense robotics events, such as DARPA's robot-building contest, and refuses government funding.⁶⁵ Google has declined to share information and does not participate in and collaborate with the close-knit robotics community, which some critics suggest can slow the advancement of research in the field. China's government and centralized control mean that the country does not have to struggle as much against the competing interests of private companies.

While the United States needs to increase funding to DARPA, reinforcing and publicizing public-private partnerships would bolster American research efforts in crucial high-tech areas. America lacks a large organization like Germany's Fraunhofer-Gesellschaft that integrates the private and public sectors to concentrate on multiple areas of advancing applied science. However, there are a few examples, such as the Advanced Robotics for Manufacturing (ARM) Institute—one of the few large Federally funded collaborative projects focusing on manufacturing—though America needs more such programs. While ARM expanded to cover other areas and was instrumental in assisting the Department of Defense's response to the COVID-19 pandemic, it is insufficient to address

emergent technologies and research growth.⁶⁶ However, if the program were expanded and altered, it could bolster American innovation and ensure that the United States retains leadership in vital technological sectors.

Better examples of private research partnerships with the government might only raise political hackles if the focus is on something other than the defense industry. Germany's use of research to stay relevant and retain jobs and manufacturing in the face of Chinese competition is helpful. While there are several factors at work, R&D programs bolster innovation and research for the industry.

One such program is the Fraunhofer model, which began in 1949 as a non-profit organization and became one of the world's leading applied research organizations. According to the 2020 Fraunhofer Annual Report, the organization's 75 institutes and research units throughout Germany have 28,000 employees, operating with a research budget of EUR 2.8 billion (USD 3.6 billion).⁶⁷ It continues to expand, receiving a large portion of its income through industry and government projects. America needs a similar organization that an expanded ARM could fill, which would pay dividends specifically with

applied research that overlaps with the MIC2025 core projects.

While expanding DARPA and increasing funding will help, it might not be enough to counter China's resources, such as the USD 1 trillion that the CCP allocated toward government guidance funds. University R&D is another area that has gradually increased from approximately \$60 billion in 2007 to almost \$77 billion in 2017, with half coming from the Federal Government.⁶⁸ The Federal Government can increase funding to colleges and universities, which peaked at 73 percent in the late 1960s and had ebbed and flowed to a level of 53.5 percent as of 2017.⁶⁹ In 2020, total R&D investments were at \$708 billion, with \$517.4 billion from business, \$142.8 billion from the public sector, \$22.6 billion from higher education, and \$25.1 billion from nonprofit organizations.⁷⁰ A key opportunity is increasing funding from the government, which is quite low, hovering around 5 percent consistently since 2006.⁷¹ Today, the private sector invests 3.6 times as much money as the U.S. Government. This leads to critical industries outsourcing elements of manufacturing to the lowest bidder in other countries. During the COVID-19 pandemic, American leaders and the public



Huawei display at Internationale Funkausstellung 2018, Berlin, September 2, 2018 (Courtesy Matti Blume)

became painfully aware of strained supply chains for medical supplies and drugs and of U.S. reliance on other countries. However, the lion's share of attention over the past few years has centered on the semiconductor industry. The danger of having high business R&D investment and low government investment, which Darrell M. West pointed out, is highlighted by these examples.⁷²

In the upcoming geopolitical contest with China, it is crucial to remember American strengths. Several advantages include geography, the U.S. dollar as the world leader in currency reserves at 64 percent, and innovation with tech giants such as Google, Facebook, and Amazon. On the other hand, China is rapidly advancing with companies such as Baidu, Alibaba, and Tencent. The United States must make similar adjustments, while encouraging the private sector to participate and providing grants for research in areas where it wants to assume global leadership. Increased funding for military research and a return to expanded funding for DARPA could bolster American research in key high-tech sectors with military applications. China's leaders are dedicating over a trillion dollars to crucial industries. While the United States cannot match these investments dollar for

dollar, we can leverage ingenuity and the inventive spirit that is the core of American culture if we start now.

While there continue to be IPR violations in China, China analysts need to be more mindful of China's rising influence in generating intellectual property. The reality is that China's growing influence in patent applications and innovation is the real threat. Although still relevant, China's intellectual property theft is a distraction and largely hype. Chinese companies will secure a larger share of patents in high-tech fields. This threat is real, while the PRC's IPT has largely evaporated. Urgent changes are necessary for U.S. R&D programs. Time is not on America's side. **JFQ**

Notes

¹ Leigh Hartman, "Taiwan's TSMC to Build \$12 Billion Semiconductor Plant in the U.S.," *Share America*, May 20, 2020, <https://share.america.gov/company-to-build-12-billion-semiconductor-plant-in-u-s/>; Emma Kinery, "TSMC to Up Arizona Investment to \$40 Billion With Second Semiconductor Chip Plant," *CNBC*, December 2, 2022, <https://www.cnbc.com/2022/12/06/tsmc-to-up-arizona-investment-to-40-billion-with-second-semiconductor-chip-plant.html>.

² Emma Kinery, "TSMC to Up Arizona Investment to \$40 Billion With Second Semiconductor Chip Plant."

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