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A decade ago, planners in Beijing unveiled Made in China 2025, an ambitious scheme to take leadership of the industries of the future. The plan identified ten sectors for investment, including energy, semiconductors, industrial automation, and high-tech materials. It aimed to upgrade China's manufacturing in these sectors and others, reduce the country's dependence on imports and foreign firms, and improve the competitiveness of Chinese companies in global markets. The overarching goal was to transform China into a technological leader and turn China's national champion firms into global ones. The government backed this vision with enormous financial support, spending one to two percent of GDP each year on direct and indirect subsidies, cheap credit, and tax breaks.

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Illustration by Gregori Saavedra

China has been wildly successful in these efforts. It not only leads the world in electric vehicles and clean technology power generation; it is also dominant in drones, industrial automation, and other electronics products. Its lock on rare-earth magnets produced a quick trade deal with U.S. President Donald Trump. Chinese firms are on track to master the more sophisticated technological goods produced by the United States, Europe, and other parts of Asia.

And yet China's model still has many skeptics. Lavish funding, they point out, has led to waste and corruption. It has created industries in which dozens of competitors manufacture similar products and struggle to make a profit. The resulting deflation makes companies wary of hiring new staff or raising wages, leading to lower consumer confidence and weaker growth. China's economy, which once looked poised to overtake the United States' as the world's biggest, is mired in a slowdown and may never match the American one in total output.

These problems are not trivial. But it is a serious error to think they are big enough to derail China's technological momentum. Beijing's industrial policy succeeded not simply because planners picked the right sectors and subsidized them. It worked because the state built out the deep infrastructure needed to become a resilient technological powerhouse. It created an innovation ecosystem centered on powerful electricity and digital networks, and it established a massive workforce with advanced manufacturing knowledge. Call it an all-of-the-above technology strategy. This approach has enabled China to develop new technologies and scale them up faster than any other country. Its model is unlikely to be pushed off course by sluggish economic growth or U.S. sanctions.

China's industrial and technological strength is now a permanent feature of the world economy. The United States should compete with China to keep its overall technological leadership and sustain the industries needed for broad-based prosperity and national security. But American policymakers must recognize that their current playbook—export controls, tariffs, and scattershot industrial policy—is ineffective. Simply trying to slow China down will not work. Washington must instead focus on building up its own systems of industrial strength by making patient, long-term investments not just in select, key industries but in energy, information, and transportation infrastructure. If it doesn't, the United States will face more deindustrialization and lose its technological leadership.

BECOMING STRONG

The notoriously difficult Nürburgring racetrack is nicknamed the Green Hell for its twisting, 13-mile course through the mountains in western Germany. It is a track that tests even the steeliest drivers and the most advanced vehicles. The cars that have typically performed best are designed by celebrated German companies such as BMW, Porsche, and Mercedes, or by long-established manufacturers in Italy, Japan, and South Korea.

But in June 2025, the course saw a new speed record for electric vehicles, and the car that set it was not made by the typical champions. It was set by Xiaomi, a Chinese company better known for its moderately priced smartphones and rice cookers. It produced its first car only a year before. But Xiaomi nonetheless made the third-fastest car—electric or otherwise—ever to race through the Green Hell.

Xiaomi's triumph on the racetrack was a symbol of China's surprisingly swift rise to clean energy dominance. China made nearly three-quarters of the world's electric vehicles in 2024 and accounted for 40 percent of global EV exports. It has a lock on the solar supply chain. Chinese companies make most of the world's batteries, both for EVs and for other uses. And the country produces 60 percent of the electrolyzers used to extract hydrogen from water, which is the most effective way to produce clean hydrogen-based power.

The standard explanation for China's technological success is that the central government targeted various industries for support; provided hundreds of billions of dollars in subsidies, tax breaks, and low-interest loans to get these sectors going; and helped Chinese firms steal or copy technology from other states. This is part of what took place. But that story misses the bigger picture. China succeeded not only because it subsidized particular industries but also because it invested in the deep infrastructure—underlying physical systems and human expertise—that enables innovation and efficient production.

Some of this infrastructure consists of transportation systems, such as roads, railways, and ports. Over the last 30 years, China has built a national expressway network twice the length of the American interstate system, a high-speed train network with more miles of track than the rest of the world combined, and a formidable network of ports, the largest of which, in Shanghai, moves more cargo in some years than all U.S. ports put together.

But if China had stopped there, it would not have reached today's technological heights. Other infrastructure systems have proved crucial. One is China's digital network. In its infancy, the Internet was widely thought to corrode authoritarian regimes because it removed their monopoly on information and made it easier for ordinary people to organize across large distances. In 2000, U.S. President Bill Clinton declared that controlling the Internet was like "trying to nail Jell-O to a wall." But China's leadership concluded the opposite. They bet that high-quality data infrastructure would strengthen the government by enabling it to better monitor and manage public opinion, as well as track people's movements, while hugely benefiting the country's industrial sectors and creating a high-tech ecosystem.

So China nailed Jell-O to the wall. It built a domestic Internet that rapidly connected virtually the entire population while blocking what its people could see from abroad. The gamble paid off. Thanks to Beijing's early and aggressive promotion of mobile phones, Chinese firms helped pioneer the mobile Internet. Top platforms such as ByteDance, Alibaba, and Tencent became world-class innovators. Huawei became the world's leading producer of 5G equipment. The Chinese population now uses smartphones constantly, and the Communist Party remains very much in charge.

IT'S ELECTRIC

The next key infrastructure system behind China's prowess is its electric grid. Over the past quarter century, China has led the world in building power plants, adding the equivalent of the United Kingdom's total supply every year. It now generates more electricity each year than the United States and the European Union combined. The country has invested heavily in ultrahigh voltage transmission lines, which can carry electricity efficiently over long distances, and in all types of battery storage. This abundant power supply has enabled the rapid growth of electricity-reliant transport systems, namely high-speed rail and electric vehicles.

China has overcome the obstacles that long prevented electricity from becoming the world's main energy and supplanting the direct combustion of fossil fuels: that it was hard to move, hard to store, and ineffective at fueling transport. As a result, China is well on its way to becoming the world's first economy powered mainly by electricity. Electricity accounts for 21 percent of energy use in the world as a whole and 22 percent of energy use in the United States. In China, electricity is nearly 30 percent

of energy use, more than in any other large country except Japan. And this share is growing fast: about six percent a year, compared with 2.6 percent for the world as a whole and 0.6 percent for the United States.

China's electrification did not arise out of a master plan. Instead, it was the product of technocratic responses to discrete issues such as power shortages in industrial zones and the need to free up rail capacity for purposes other than moving coal. Now, however, rapid electrification serves a clear strategic purpose. It is a motor of industrial innovation—"powering the future," as Damien Ma and Lizzi Lee put it in a July *Foreign Affairs* article. And the government is keenly aware that abundant, cheap electricity provides the country with a crucial edge in the power-intensive industries of the future, most obviously artificial intelligence. Beijing thus strives to ensure that its electricity system remains the biggest and best in the world.

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China's most subtle piece of deep infrastructure is its more than 70-million-person industrial workforce—the largest in the world. Thanks to the country's intense buildup of complex manufacturing supply chains, Chinese factory managers, engineers, and workers have decades of "process knowledge"—hands-on knowledge, gained from experience—about how to make things and how to make them better. This process knowledge enables iterative innovation, or constantly tweaking products so that they can be made more efficiently, at better quality, and with lower costs. It also enables scaling: Chinese factories can rally a large, experienced workforce behind making almost any new product. Finally, and most important, process knowledge allows China to create entire new industries. A factory worker in Shenzhen might assemble iPhones one year and Huawei Mate phones the next and then move on to build drones for DJI or electric vehicle batteries for CATL.

Process knowledge in the Chinese workforce may be Beijing's greatest economic asset. But it is hard to quantify. That is one reason why the rest of the world has persistently underestimated China's capabilities. Some analysts believe that China is the country that assembles most of the world's smartphones and other electronics because its workforce costs are low. In reality, the country remains the world's leader because its workforce has proved its worth in sophistication, scale, and speed.

Analysts also miss the red-hot ambition of China's entrepreneurs. The country is full of businesspeople with the optimism, the daring, or the

foolishness to try disrupting sectors. Xiaomi's legendary founder, Lei Jun, gambled on EVs in 2021, announcing that his company, then valued at $80 billion, would invest $10 billion in them and that it would be his "last major entrepreneurial project." On the German racetrack, it paid off. Lei was able to plug into an electronics ecosystem, battery partners, and an experienced workforce to make high-speed EVs in just a few years' time.

To see why American companies often struggle to do the same, compare Xiaomi's experience with that of Apple. In 2014, the computing giant considered developing electric vehicles. It was hardly a crazy idea. Apple had a market capitalization of $600 billion and a cash hoard of $40 billion, giving it far deeper pockets than Xiaomi. By conventional measures, it also had greater technological sophistication. But the United States does not have the energy system or the manufacturing capacity of China, so there was no easy infrastructure for Apple to tap into. As a result, in 2024, the company's board pulled the plug on a decade of EV development. That same year, Xiaomi expanded its manufacturing capacity and repeatedly raised its delivery target. Meanwhile, the American EV champion, Tesla, faces declining sales in all of its top markets, including China. Chinese buyers now believe that domestic brands are more innovative than Tesla, and more in tune with fast-changing consumer tastes.

ADVERSE REACTION

It is a mistake to underestimate China. But the country does face serious economic challenges, many of which arise at least in part from the very industrial policies that have led to its triumphs. China's technocrats have steered resources not just into high-productivity infrastructure but also into state-owned enterprises that contribute little to the country's vibrant tech ecosystem, rack up huge debts, and drag down the economy's efficiency. The politically driven constraints on some of the country's most creative entrepreneurs, such as Jack Ma, the founder of Alibaba, and Zhang Yiming, the co-founder of ByteDance—who were humiliated when Beijing expanded its power over the consumer Internet—have chilled private-sector confidence.

Unregulated subsidies, meanwhile, have led to widespread graft. A prime example is China's semiconductor industry, which has received over $100 billion in direct state industrial policy support since 2014. Some of the projects funded by this money were outright frauds. Other projects were legitimate, but both businesspeople and government officials stole from them. More than a dozen senior chip industry figures

have been jailed for corruption since 2022, including the head of Tsinghua Unigroup (which operates several important chipmakers) and the chief of China's national integrated circuit fund. Two sitting ministers of industry and information technology were fired for graft.

China's subsidies may also, at times, suppress innovation. Generous manufacturing spending helps promote the tech ecosystem, but it also enables less efficient firms to stay in business far longer than they would in a more market-driven economy. That lowers profits for everyone, as companies continually cut their prices to maintain market share. This, in turn, means that manufacturing companies cannot spend as much on research and development. In fact, they need to be cautious about hiring new staff or raising wages.

The solar industry is a case in point. Owning the solar supply chain is a strategic triumph for the state, but companies producing solar modules mostly sell undifferentiated products, fighting for minuscule profits while cutting prices to the bone. The same is true for manufacturers of EVs, smartphones, and many other products, with too many companies making similar products at paper-thin margins. China's tech sectors are global success stories, but the companies in them are often miserable.

If China is too generous with tech and manufacturing businesses, then it is not generous enough with those providing services. Beijing chronically overregulates service sectors, cracking down on Internet companies that the government sees as engaging in monopolistic practices or threatening political or social instability. It tightly controls finance, health care, and education. As a result, job growth in these sectors has been weak, which means job growth in China as a whole has greatly suffered. Even in this industry-centric country, services employ about 60 percent of the urban workforce and have accounted for all net job creation in the past decade. With jobs hard to come by, wages rising little or at all, and the price of houses—which are most Chinese people's main asset—falling, Chinese consumers have become reluctant to spend. Private businesses, seeing weak demand, have in turn become even more reluctant to hire or raise wages.

China's current model, then, virtually guarantees slower economic growth. Thanks to the vicious circle Beijing has created, the economy now routinely struggles to reach its annual growth target of five percent and is constantly battling deflation. Meanwhile, because domestic demand is sluggish, more and more of the output of China's prodigiously productive manufacturing sector will need to be exported, leading to ever

larger trade surpluses. China's trade surplus is already almost a trillion dollars, more than double the figure of just five years earlier.

The risks for Beijing are obvious. Slower growth means that the economy could become less dynamic, and tech firms could lose the ability or drive to keep innovating. Ever-rising trade surpluses could trigger much more severe and coordinated protectionism from the rest of the world, with dozens of countries joining the United States in erecting tariff barriers to Chinese imports.

But Beijing is likely to overcome these risks, just as it has overcome many challenges in the past. It has begun to recognize that subsidies are too high and has started withdrawing them. Smaller and less efficient players will exit the market. Consolidation is already visible in the electric vehicle sector, in which the number of companies has fallen from 57 to 49 since 2022. A third of EV producers now sell at least 10,000 cars a month, up from less than a quarter of producers three years ago. As for protectionism, most countries will find that there are simply no cost-effective alternatives to the products China exports. There are also ways to evade tariff barriers, such as by shipping goods through third countries or by setting up assembly plants in other states (as the Chinese car manufacturer BYD is doing in Brazil and Hungary).

Chinese officials, for their part, seem to believe that the costs of lower growth, deflation, and irritated trade partners are worth paying. "We must recognize the fundamental importance of the real economy . . . and never deindustrialize," said Chinese leader Xi Jinping in 2020, a year in which China's manufacturers met the challenge of the COVID-19 pandemic by surging the production of medical equipment and consumer goods. The message was clear: Beijing's main goal is not fast growth but self-sufficiency and technological progress.

CAN'T STOP, WON'T STOP

Washington has not stood idly by as China's tech and manufacturing sectors progress. Alarmed by the ambitions of Made in China 2025, the first Trump administration breathed life into some of the most moribund offices inside the Department of Commerce, summoning a powerful bureaucratic apparatus to choke off China's access to critical materials. U.S. officials realized that China was highly dependent on Western technology inputs, such as leading-edge semiconductors and semiconductor manufacturing equipment. They thus gambled that a full blockade of these technologies would severely slow China's technological engine. This was

a bipartisan proposition: when U.S. President Joe Biden came into office, in 2021, he maintained his predecessor's restrictions. In fact, the Biden administration tightened export controls on advanced chips, especially those essential for artificial intelligence, and on semiconductor equipment.

And yet the success of these controls has been mixed at best. In 2018, two big Chinese tech companies, ZTE and Fujian Jinhua, nearly collapsed after being cut off from American technology. But more capable businesses, aided by Washington lawyers and lobbyists, have been able to bounce back. (Trump recently lifted restrictions on leading-edge AI chips made by Nvidia, allowing the company to again sell its products to China.) Huawei was clearly battered after the Commerce Department sanctioned it in 2019. But by 2025, the firm announced that its previous year's revenues had recovered to 2019 levels. It is still recognizably the same company, one that excels at making 5G equipment and handsets. Except now, it is also one of China's leading semiconductor innovators, after it invested billions in replacing American chips.

Other companies have done an even better job of weathering U.S. restrictions. SMIC, one of China's most important chip foundries, has doubled its revenues since it was sanctioned in 2020. It still lags far behind the industry-leading TSMC in profitability, but it has made certain technological breakthroughs, learning to produce seven-nanometer chips—a technological breakthrough that was considered unlikely after its sanctions. Similarly, restrictions on AI technology did little to prevent the rise of DeepSeek, which has produced an AI reasoning model matched by only a few other firms, all in Silicon Valley.

DeepSeek's success is not hard to understand. Chinese AI firms may not have access to the same leading-edge chips that American ones do, but they do have plentiful access to excellent talent, mature chips, as well as pools of data. They also have a near-unlimited supply of cheap electricity—something their U.S. competitors lack. As a result, according to global technical benchmarks, Chinese large language models are, at most, six months behind American leaders, a gap that is steadily shrinking. Far from blocking China's progress, U.S. tech restrictions have triggered a Sputnik moment in China. Its companies are bigger, meaner, and significantly less dependent on U.S. companies than they were just a decade earlier.

Some American officials realize that the United States cannot win just by attacking China's industries. The Biden administration's economic planners, for instance, created an industrial policy designed to help the United States advance its own strategic sectors. The country passed the

CHIPS Act, which beefed up semiconductor production, and the Inflation Reduction Act, which subsidized clean technologies. But despite earmarking hundreds of billions of dollars, these endeavors have mostly foundered.

The reason for these failures is simple. The United States has not built up enough deep infrastructure of its own. Toward the beginning of his term, Biden unveiled an ambitious proposal to deliver Internet service to almost every American. But this "Internet for All" plan had not connected anyone before he left office. There is still no national network of EV charging stations, even though Congress earmarked billions to create one. And Washington has failed to dismantle the bureaucratic and regulatory barriers to building electric transmission systems, which make it hard for energy companies to take advantage of the tax credits the Inflation Reduction Act created for solar and wind projects.

Now, those credits are poised to disappear. Trump's July budget reconciliation bill phases out his predecessor's solar and wind subsidies for most projects that haven't begun by the end of 2026. The CHIPS Act remains on the books, but the president has derided the law as "horrible" and "ridiculous." Trump's tariffs, meanwhile, have caused deep uncertainty among manufacturers, who are pausing investments while scrambling to maintain their supply chains. The White House claims that the tariffs will force manufacturers to make their goods on American soil once the restrictions take full effect. But the administration's analysis is faulty. Manufacturers depend on imports for many of their inputs, and they have proved reluctant to make big investment decisions based on Trump's wavering pronouncements. In fact, the country shed over 10,000 manufacturing jobs between April and July alone, just after Trump announced his plan to impose high tariffs on virtually every country.

Trump, of course, is hardly unique in his failure to deliver. American politicians love to celebrate whenever a new mine or semiconductor facility opens. But the U.S. industrial sector continues to shrink amid product delays, layoffs, and falling production quality. Real manufacturing output, which had risen steadily until the 2008 financial crisis, plunged then and has never recovered. This shriveling is happening even in defense manufacturing. Despite an influx of cash, almost every class of U.S. naval ship under construction is behind schedule, some by as much as three years. Producers of artillery shells are only slowly ramping up manufacturing, even though Washington has depleted its stockpiles to help Ukraine. And U.S. efforts to wean its military off Chinese rare-earth minerals have faltered.

The United States does retain its advantage over China in several critical areas: software, biotech, and AI, as well as in its university-driven innovation ecosystem. But these institutions face an uncertain future. Since returning to office, Trump has set about defunding scientific research and depriving the country of skilled labor. Government agencies are now scrutinizing top universities, including Harvard and Columbia, and yanking government grants and threatening to revoke universities' tax-exempt status over exaggerated charges of anti-Semitism. The White House has slashed funding for the National Science Foundation and the National Institutes of Health. Meanwhile, Trump's hostility toward immigrants has driven researchers who would come to the United States to look for positions at companies and universities elsewhere. Aggressive deportations are hurting America's construction industry. The country simply has not set up its innovation ecosystem well for the years ahead.

BACK TO BASICS

The United States can, and should, reverse Trump's spending cuts and immigration restrictions as soon as is feasible. But competing effectively against China requires more than just removing self-imposed restraints. Washington's failings extend across administrations for a reason: American officials, Democrats and Republicans alike, have not taken China's competence seriously. "China doesn't innovate—it steals," wrote Arkansas Senator Tom Cotton on social media in April, epitomizing how Americans trivialize Chinese accomplishments. Too many U.S. leaders continue to believe that a more exquisite export control regime will halt China's technological momentum. They are sending lawyers into an engineering fight. They need to realize that no matter how hard the United States squeezes, it will not break China's industrial and technological system.

What Washington should do is strengthen its own capacity. That means starting the hard work of building up the United States' deep infrastructure. Washington should not try to replicate Beijing's massive and often wasteful investments in all systems. But it should do better than Biden's ad-hoc, sector-by-sector approach. And it must abandon Trump's strategy of hoping that the tariff cudgel will force a reshoring of industry, and his focus on old heavy industries such as steel.

Instead, policymakers must start to think in ecosystem terms, as China has. The United States has long-standing strengths in entrepreneurship and finance, so state-led investments in modern deep infrastructure are likely to have big payoffs, just as investments in railroads and highways

did in the nineteenth and twentieth centuries. Large-scale infrastructure projects can stimulate demand for different technologies and create the process knowledge needed to build them, which are crucial first steps in rebuilding the manufacturing base. A top priority should be building a bigger and better electricity system that makes use of nuclear power, natural gas, and renewable energy sources. To maximize its use of renewables, the United States should invest in building more battery storage and high-voltage transmission lines.

The United States will also need to find ways to reduce cost structures throughout its industries. Because it is a rich country with high wages and labor and environmental standards, it will never be able to compete with China or India in terms of availability of low-cost labor, and it should not try. But to be serious about rebuilding industry, Washington must display a commitment to making its markets attractive for capital-intensive sectors. Eliminating Trump's ruinous tariffs, which will make American manufacturing prohibitively expensive, is essential, as is providing abundant, cheap energy. Yet so is permitting reform that eliminates the excessive regulatory costs of new construction, ample government funding for basic research and development, and liberal immigration policies that enable companies to source the best talent from anywhere in the world. The last is not strictly a cost measure, but it is essential to rebuilding U.S. process knowledge. Much of that knowledge now exists abroad, and the United States must be willing to import it.

Above all, Washington should not underestimate what it is up against. Beijing has made achieving technological supremacy a top political priority. The subsidies it used to push technological progress produced plenty of waste, but that was a side-effect of achieving leadership in the industries of the future. To compete, the United States must also make a commitment to leading in these industries, and it must be more willing to accept mistakes and some waste as the price of success.

China's model has worked because its policymakers have gotten a lot of things right and have given Chinese entrepreneurs the conditions for success. The country may have problems, but it will continue to be effective. And the longer it succeeds, the more the United States and its allies will deindustrialize under pressure from Chinese firms in energy, industrial goods, and perhaps even artificial intelligence. If the United States is to compete effectively, its policymakers must spend less time worrying about how to weaken their rival and more time figuring out how to make their country the best and most vigorous version of itself.