

# Who Will Lead the World in Technology: U.S., Europe, or China?



By Alex Berezow, PhD — January 21, 2020

*Innovation is built upon an ecosystem that takes decades to mature. Yet, China has already made substantial advances in computer science, chemistry, engineering, and robotics -- all of which pose a direct challenge to U.S. technological supremacy. However, the U.S. will remain dominant and largely unchallenged in biotech and medicine for the foreseeable future.*



Credit: Public Domain/Wikipedia [1]

China is catching up with the rest of the advanced world economically and technologically. Vast infrastructure projects – from high speed rail to 5G – have led many to wonder if China will soon surpass the United States as the global leader in technology. The question was brought into particular focus in the arena of biotechnology when, in late 2018, scientist He Jiankui announced that he had gene-edited two human babies.

Taken together, is this evidence that Chinese technology is on a trajectory to outpace the United States? Or are European competitors the real threat to American technological supremacy? The answer to these questions, at least for the next decade if not longer, is, “Not quite yet, but it depends on the field.”

Though the U.S. will remain dominant and largely unchallenged in biotech and medicine for the

foreseeable future, [China has already made substantial advances](#) [2] in computer science, chemistry, engineering, and robotics, all of which pose a direct challenge to U.S. supremacy and serve to boost their abilities in telecommunications, software, artificial intelligence, materials science, and military weapons technology. However, when considering technological trends, it is not adequate to simply consider whose computers and trains run the fastest or whose weapons are the biggest. Innovation is built upon an ecosystem that takes decades to mature.

Therefore, to understand the future of technological domination, one must consider several factors of production: Higher education, cultural attitudes, funding and financial incentives, and the legal framework.

**Higher education.** American universities are the best in the world. According to [Times Higher Education's 2020 rankings](#) [3], the United States is home to 40 of the global top 100 universities. By comparison, Europe has 36 (eleven in the United Kingdom, eight in Germany, seven in the Netherlands, four in Switzerland, three in France, two in Sweden, and one in Finland), and China has three (six if Hong Kong is included). Similarly, [U.S. News & World Report](#) [4] places 44 of the top 100 universities in the United States.

It is difficult to overstate the importance of this educational advantage. Academia provides the basic research that industry uses to develop new technologies and products. Furthermore, great universities aren't built overnight. The U.S. edges out Europe in terms of the quality of their institutions of higher education, but both far surpass those of China.

Where China is making substantial progress is in the quantity and quality of its research output. *R&D Magazine's* 2019 Global Funding Forecast says that China wants to beat the U.S. in scientific publications, and it is literally willing to cheat and steal to accomplish that. R&D adds that the “unprecedented scale of infiltration activity that China has been engaging in universities, media, think tanks and corporations... far exceeds anything envisioned by Russia in the past.”

[Nature Index](#) [5] reports that while the U.S. still dominates the number of high-quality scientific publications, China is rapidly closing the gap. However, Chinese research focuses [primarily on chemistry and physics](#) [6], not the life sciences. When it comes to biomedicine, China is firmly entrenched in the distant past. The Chinese government endorses – and its public willingly accepts – traditional Chinese medicine, which is largely pseudoscientific nonsense that fails when put to the test in clinical trials. Yet, as [Aeon explains](#) [7], every major Chinese city has a traditional medicine hospital and university.

**Cultural attitudes.** Perhaps because of our long history of individualism, innovation is a key feature of the American spirit. Indeed, Founding Father Benjamin Franklin was a prolific inventor. Despite constituting only about 4% of the world's population, Americans are responsible for 22% of [global patent applications](#) [8], with China coming in second with 21%.

But patents don't tell the whole story. Chinese culture, particularly its education system, reveres tradition, is obsequious toward authority, and does not encourage the sort of “outside-the-box” thinking that innovation requires. Schools brainwash their kids with [Communist Party-approved groupthink](#) [9]. China's schools notoriously practice rote memorization, which certainly helps prepare students for the standardized tests that the Chinese dominate. But, [Inside Higher Education](#)

[10] reported on a study that concluded that the highest-performing Chinese students are less creative than others. [Fear of failure](#) [11] is also deeply ingrained in Chinese culture, a collective phobia that likely prevents the emergence of would-be entrepreneurs.

On paper, Europe should be every bit as innovative as the U.S., but it certainly doesn't seem that way. The blame probably lies with Europe's aversion to Schumpeterian creative destruction, as a report from the [Information Technology and Innovation Foundation](#) [12] eloquently states. "Unless Europe embraces the idea that innovation entails plant closures and job losses, new technologies with uncertain social or environmental impacts, and new kinds of business models and organizations, it will be challenging for Europe to keep up in the race for global innovation advantage," the authors write.

**Funding and financial incentives.** According to the previously referenced *R&D Magazine* report, the entire world spent roughly \$2.3 trillion on research and development in 2019. Almost 25% (\$581 billion) came from the U.S., 22% (\$519 billion, PPP-adjusted) came from China, and 20% (\$472 billion, PPP-adjusted) came from Europe. China has been greatly increasing its R&D investment in recent years, and at its current rate, may surpass the U.S. sometime this decade. *R&D Magazine* predicts this will occur in 2024.

In the U.S., nearly 2/3 of research dollars are spent by industry. It is difficult to make such a distinction in China, since most major companies are either partially owned or subsidized by the government. This means that China's ability to further ramp up its R&D spending and business investment probably exceeds that of the U.S.

The U.S. has a distinct financial advantage compared to Europe, however, and not just for R&D. Venture capital funding in Europe is stingy compared to the U.S., partially due to the continent's cultural aversion to risk. American companies received nearly 3.5 times the amount of investment as European companies, according to [Atomico](#) [13]. And as [BioSpace](#) [14] reports, European biotech firms prefer to list on American exchanges because the initial public offerings are three times bigger.

**Legal framework.** "If at first you don't succeed, try, try again," is the unofficial motto of American startup culture. There is no shame in opening a business and failing. In fact, many entrepreneurs see it as a badge of honor because they learned something valuable in the process. Bankruptcy laws make it relatively easy to pick up the pieces and start over.

While Americans take those truths for granted, they simply do not exist in many other countries, including European ones. [Failure is frowned upon in Germany](#) [15], and laws make it possible for entrepreneurs to be held financially or even criminally liable if the business becomes insolvent. Furthermore, enshrined within one of the European Union's treaties is the "precautionary principle," which in theory exists to minimize risks to public health and safety but in practice is used as a blunt weapon to bludgeon technologies that Europeans dislike, such as genetically modified food.

Though Chinese culture may not be an incubator for innovation, its legal framework might be. At the very least, China does not seem remotely concerned if it behaves in ways that Western nations would deem unethical. The aforementioned Dr. He, who created the world's first

genetically engineered human babies, was [seeking glory and honor from his fellow countrymen](#) [16]. He ended up in jail, instead, but probably only because his announcement was met with widespread condemnation by the international scientific community. In the meantime, the Chinese government uses facial recognition technology and artificial intelligence to spy on its own citizens and imprisons Uighurs in reeducation camps. A country that is not guided by a moral compass has the ability to make rapid technological progress, but the ethics, quality, and safety of those products will remain outstanding questions.

Ironically, China faces a substantial problem with intellectual property theft. Yes, the Chinese steal IP from Americans (and Europeans), but they also steal it from each other. Innovation is difficult when potentially profitable ideas cannot be protected. Also, companies with substantial government backing can become inefficient or strong-armed into supporting various political goals.

**Intangibles.** Finally, there is an “intangible factor” that essentially boils down to this question: Where do scientists *want* to do research? With the possible exceptions of theoretical physics (because Europe hosts the Large Hadron Collider) and fields such as [computer science](#) [17] and [civil engineering](#) [18] (which are dominated by universities in China and Singapore), most cutting-edge research in most fields – especially in biology and medicine – occurs in the U.S. The fact that the U.S. has more Nobel Prize winners than any other nation attests to that.

For these reasons, the graduate schools of American (and European) universities are [filled with foreign students](#) [19]. Science is an international endeavor, and a technologically successful country must attract the world’s best talent. But very few scientists want to move to China. That fact is unlikely to change, so long as it insists on remaining an authoritarian country.

Still, the U.S. cannot become complacent. The Information Technology & Innovation Foundation believes that China is following in the footsteps of Korea and Japan, namely, transitioning from copier to innovator. Americans should redouble their efforts accordingly.

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[1] [https://en.wikipedia.org/wiki/Biotechnology#/media/File:Rose\\_grown\\_from\\_tissue\\_culture.jpg](https://en.wikipedia.org/wiki/Biotechnology#/media/File:Rose_grown_from_tissue_culture.jpg)

[2] <https://www.economist.com/technology-quarterly/2020/01/02/with-the-states-help-chinese-technology-is-booming>

[3] <https://www.timeshighereducation.com/world-university-rankings/2020/world-ranking>

[4] <https://www.usnews.com/education/best-global-universities/search?region=&country=united-states&subject=&name=>

[5] <https://www.natureindex.com/news-blog/top-ten-countries-research-science-twenty-nineteen>

[6] <https://www.natureindex.com/country-outputs/china>

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[8] <https://www.forbes.com/sites/rebeccafannin/2019/04/28/china-gains-to-21-of-patent-filings-globally-right-behind-us-leader-at-22/#6e4d7fdb4ac3>

[9] <https://www.rfa.org/english/news/china/textbook-controls-01072020141724.html>

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- [16] <https://www.statnews.com/2018/12/17/crispr-shocker-genome-editing-scientist-he-jiankui/>
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