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A Competitive Era for China's Universities

How Increased Funding Is Paving the Way

CSET Data Brief

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Executive Summary

In order to achieve its ambitious science and technology (S&T) development goals, the Chinese government has privileged a select group of universities with progressively larger amounts of funding over time. While China's focus on higher education, science, and technology is not new, the evolution of Chinese universities, from gutted and resource-starved institutions during the Cultural Revolution to centers of research and international collaboration today, is a success story of China's policies and programs. However, in addition to providing a boon to China's economic development, the Chinese government's increasing support for universities presents the United States and its allies with security challenges given the integrated approach China takes to S&T development. Chinese leaders view universities as key players in military modernization, economic growth, and promoting China's soft power, complicating efforts for the United States and its allies to design policies for research security.

This data brief illuminates the scale of Chinese government funding for higher education, science, and technology by exploring budget and expense reports for key governmental organizations and 34 of China's most elite "Double First Class" universities. It finds that education is a core priority for the Chinese government, and that elite universities have seen specific waves of funding changes, with significant increases taking place since 2017. Key findings include:

- Central Chinese government funding for higher education has more than doubled over the last decade. When adjusted for purchasing power parity (PPP), Ministry of Education (MOE) spending on higher education exceeds $179 billion.*
- Funding for China's most well-known universities has increased year over year since 2017, with individual institutions' budgets now exceeding $5 billion.
- Within China's broader civilian S&T ecosystem, universities dominate in the field of basic research, but are also integrated into the rest of the technology development cycle.
- The Chinese Communist Party's (CCP) involvement in funding and managing universities presents challenges for U.S. and other foreign institutions that wish to partner with them.

* All figures in this report are presented in PPP-adjusted U.S. dollars. To convert from RMB, we first divided values by 6.759, to account for the dollar-yuan exchange rate in 2017, the first year of our dataset. We then multiplied by 3.699 to account for differences in government-consumption purchasing-power. See "Table 2.4, consumption expenditure by government," in "Purchasing Power Parities and the Size of World Economies: Results from the 2017 International Comparison Program" (World Bank Group, 2020), https://openknowledge.worldbank.org/handle/10986/33623.

Introduction

Revitalizing universities remains a core component of China's long-term S&T development strategy. In support of this goal, the Chinese government has significantly increased funding for higher education and research over the last decade, with the average elite university budget amounting to $4.8 billion in 2019.[1] However, despite being named in multiple Chinese central government plans and programs, the scale and scope of China's investments in higher education, science, and technology are not well documented in English. Understanding the scope and scale of China's investments—and the significant differences between the U.S. and Chinese university research systems—is essential as U.S. policymakers consider the best way to support U.S. higher education, and as they seek new ways to defend against unwanted technology transfer.

In this data brief, CSET has compiled the year-over-year budget and expense reports of 34 leading Chinese universities, which are directly financed and administered by China's central government. The brief highlights the scale of their funding, as well as the focus of their investments in basic research, applied research, and experimental development. It also draws on information published by China's Ministry of Education (MOE) and Ministry of Science and Technology (MOST) to underscore the scale of state funding for education, science, and technology. The brief begins with a short history of China's major S&T initiatives before highlighting the differences between the Chinese and U.S. higher education systems—such as the role of the CCP in appointing high-level university administrators and directing university research portfolios to meet the needs of the state. It concludes that the CCP plays a dominant role in funding basic research in China—including what is referred to as "strategic basic research"—and finances universities to carry out much of the country's work on basic research and development (R&D).

The Role of Universities in China's Broader S&T Ecosystem

Universities in China differ significantly from those in the United States, with the most glaring difference being that the CCP exercises extensive control over university administration, staffing, and research priorities. University presidents, for example, are typically not selected by search committees comprised of senior faculty, but by the Organization Department of the university's CCP committee.[2] Universities are also active participants in the CCP's propaganda and influence apparatus. Under General Secretary Xi Jinping, the MOE and Communist Youth League have required universities to recruit and operate teams of "network civilization volunteers" (网络文明志愿者) to

suppress speech deemed to endanger social stability, and to shape the information environment within and outside of China.[3]

The CCP's influence extends to Chinese universities' research portfolios, and shapes the ways in which universities engage with international partners. This creates a system that serves the goals of the state in ways that differ significantly from how universities are supported in the United States. The MOE plays a direct role in managing universities' research portfolios. The MOE's annual budget justification stipulates that it is responsible for "planning and guiding the research by institutions of higher education in natural sciences, philosophy, and social sciences" to ensure that they "undertake the state's key projects and programs for the development of science and technology."[4] National R&D objectives and development plans also guide the activities of China's funding agencies, such as the National Natural Science Foundation of China (国家自然科学基金委员会; NSFC), and have underpinned National Key Research Project funds granted under the 973 Program (973 计划). More recently, this funding appears to support China's emphasis on strategic emerging industries. This funding is often made available to State Key Laboratories (国家重点实验室) that are located within Chinese universities.[5]

At first read, universities in the United States may appear to receive and distribute resources in similar ways to those in China. For example, universities such as Carnegie Mellon University, the Georgia Institute of Technology, and the University of Arizona frequently collaborate with the U.S. defense industry. In China, however, the situation is far more integrated and political. The central government evaluates teaching and research staff—in addition to universities as a whole—based in part on their "ideological performance."[6] Tsinghua University, China's premier educational institution, insists in its annual budget report that it "cultivates the characteristics of being both 'Red and Expert'" (又红又专) to "carry forward the tradition of patriotic education and pursuit of excellence."[7] Several institutions have founded centers dedicated to the study of Xi Jinping Thought, and China's National Social Science Fund awards grants to advance China's international discourse power and the development of Marxism.[8] The NSFC also stipulates that its grants "focus on areas where progress in basic research is vital to addressing key national challenges."[9] The Chinese government has also recently changed the wording of university charters to emphasize loyalty to the state and ruling CCP at the expense of freedom of thought.[10]

It is a common practice for Chinese universities to own companies and subsidiaries from which they derive a significant portion of their revenue, and many of these subsidiaries cooperate or codevelop products with state-owned enterprises.[11] Analysis from the Center for Advanced Defense Studies in 2021 uncovered twenty thousand

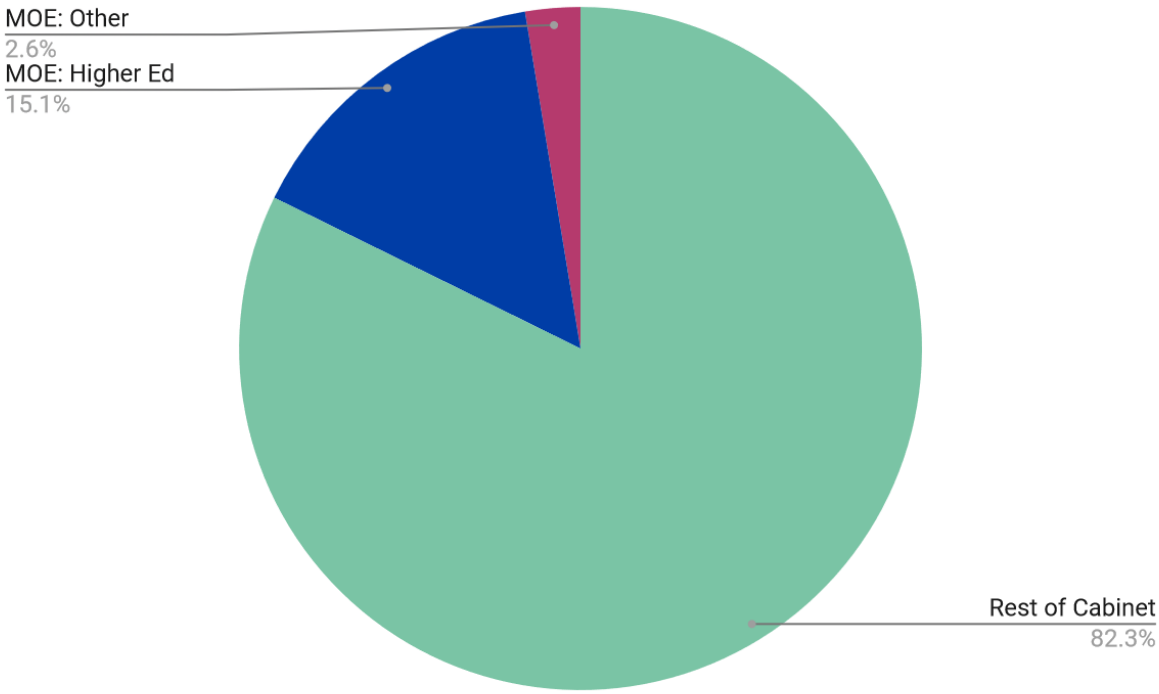
such subsidiaries partially or wholly owned by 79 Chinese universities.[12] State-owned enterprises and defense conglomerates frequently serve as minority or majority shareholders, and shape their R&D activities directly or indirectly.[13] Elite universities are also key drivers within China's defense innovation base. They contribute to the country's military modernization by spearheading dual-use research, fulfilling research and equipment contracts for the Chinese People's Liberation Army, and training the next generation of Chinese defense engineers.[14]

Chinese universities must balance enormous cultural and institutional pressures—including administrative controls from the MOE, political controls from CCP committees, and competition for resources and funding—while adapting to the research preferences and ideas of an increasingly cosmopolitan university professoriate. These ideological and practical features of the Chinese education system complicate prospects for international collaboration and, along with other concerns, have contributed to a push by some U.S. policymakers for tighter restrictions on academic exchange with China.

State Support for Education, Science, and Technology

Based on careful analysis of available budget documents, the MOE appears to have the largest publicly disclosed budget of any civilian organization in China. While the MOE holds many responsibilities—such as certifying teachers, standardizing curricula and textbooks, and establishing national education goals and standards—its primary focus is on higher education, especially as it relates to S&T. The ministry directly manages 75 colleges and universities throughout China, some of which are already world-class research centers.[15] Adjusted for PPP, spending on higher education (高等教育) amounted to $167 billion in 2019, representing nearly 90 percent of the ministry's budget. It is the single largest line item in the central Chinese government's publicly disclosed 2019 budget for civilian organizations.

Figure 1. Education Budget Compared to the Rest of China's Spending on Civilian Departments (2019)



Source: Ministry of Education 2019 departmental budget justification and CSET Chinese State Council Budget Tracker.[16]

China's focus on education, science, and technology is not new, but Chinese universities have evolved over the last half century to become centers of research and international collaboration. By the late 1970s, the government and Communist Party set about revitalizing the country's higher education system, which had been gutted during the Cultural Revolution.[17] Importing know-how from economically developed countries like the United States had been a consistent goal long before, but the devastation it wrought strengthened the need to acquire technology by any means.[18] In 1978 Deng Xiaoping launched the "Four Modernizations," which entailed investing in agriculture, industry, S&T, and national defense to make China a world power by the twenty-first century.

Since 1978, the CCP has launched a series of S&T plans designed to fill China's strategic gaps.[19] The CCP's emphasis on S&T crystallized in 1986, when it launched the National High-Tech R&D Program, also known as the 863 Program (863 计划). Under the plan, hundreds of billions of U.S. dollars' worth of funding would be appropriated for Chinese R&D centers, with a focus on *applied* research in biology, spaceflight, information technology, lasers, automation, energy, oceanography, and new materials.[20]

By 1997, Chinese leaders also began to recognize the importance of *basic* research in advancing China's status as a world power. They began a similar funding initiative known as the National Basic Research Program (or 973 Program), which went on to fund a large portion of research projects undertaken at Chinese universities and their affiliated State Key Laboratories.

With robust but not unlimited resources and ambitious development objectives, the Chinese government has had to privilege a select group of universities to lead the country's S&T development. In 1995, 1998, and 2006, the MOE released a series of plans (Project 211, Project 985, and Program 111) that aimed to identify and resource the country's one hundred or so premier academic institutions.[21] In the following years, the MOE provided these universities with billions of U.S. dollars' worth in research funding, and the CCP attempted to persuade some of the world's most renowned scientists and professors to take up research and teaching positions among their faculties—a trend that still continues today.[22]

In 2017, the MOE released its most recent higher education plan, the "Double First Class University" (双一流大学) initiative, named for its goal of establishing world-class universities with world-class academic disciplines.[23] The plan lists 140 universities, 42 of which are counted as "Double First Class" institutions. We use this group of 42 universities as a barometer for Chinese S&T investment, and refer to them collectively as "elite universities." Of these 42 elite universities, 34 publish annual budget reports and disclose the amount of funding they dedicate to R&D. In addition to elite government-funded universities, China's higher education ecosystem also features private universities, such as Westlake University in Hangzhou, and joint ventures with institutions abroad—but these institutions publish only limited information about their budgets and revenue streams.

Today, the six best-financed universities in China are all members of the C9 league, also known as "China's Ivy League."[24] Each dedicates significant resources to S&T and hosts an array of R&D centers. Tsinghua University, for example, states in its annual funding report that it houses one National Research Center, 13 State Key Laboratories, 11 National Engineering Laboratories, 17 key laboratories of the Ministry of Education, and 19 key laboratories of the Beijing municipal government.[25] The Chinese government spearheads advances in basic S&T by resourcing R&D centers within these universities.[26]

Table 2. Top Chinese Universities by Disclosed S&T Investments (2019)

University	Basic S&T	Other S&T	Total Disclosed S&T Spending
University of Science and Technology of China*	$1,160,106,988	$799,688,884	$1,959,795,872
Tsinghua University*	$213,644,805	$110,839,257	$324,484,062
Peking University*	$218,077,913	$27,352,570	$245,430,483
Zhejiang University*	$135,592,293	$41,605,021	$177,197,314
Fudan University*	$120,503,722	$2,161,718	$122,665,440
Nanjing University*	$106,100,498	Not Disclosed	$106,100,498
Huazhong University of Science and Technology	$51,556,748	$51,464,533	$103,021,282
Jilin University	$84,450,047	$6,589,134	$91,039,182
Yunnan University	$15,898,202	$72,167,988	$88,066,190
Xiamen University	$50,479,009	$25,415,233	$75,894,242
Total: Top 10 Universities	$2,156,410,225	$1,137,284,338	$3,293,694,565

Source: CSET university funding dataset (34 universities with available budget documents).

* Universities in the C9 League.

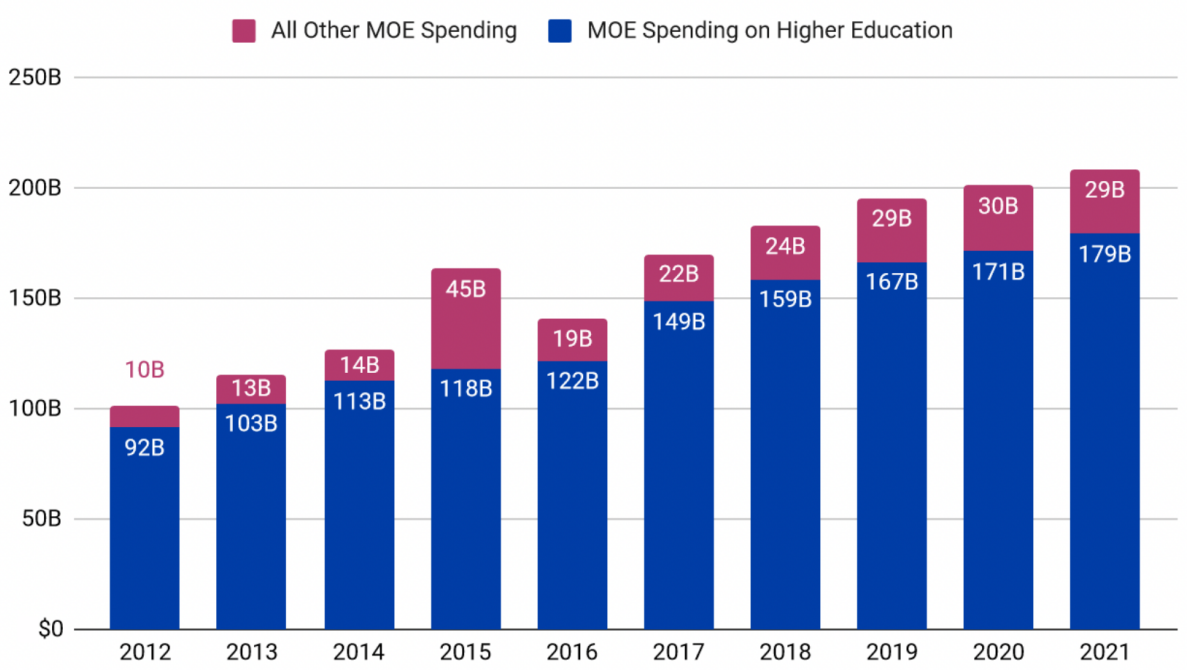
The CCP and Chinese government are responsible for funding significant portions of S&T in China, especially basic R&D. Organizations such as the Chinese Academy of Sciences and the NSFC are the country's largest funders of basic research.[27] Yet there is significant competition, but also cooperation, between China's elite university system and national research organizations like the CAS and NSFC. For example, many of the research grants awarded by these organizations are actually executed by faculty and staff at elite Chinese universities, with funding made available to State Key Laboratories that are located within them.[28] At the same time, CAS conducts a substantial amount of applied and basic research, and runs some additional universities, itself.[29] China's high-end universities must also compete with CAS for high-level talent and central government research funding. On net, however, research from the China Aerospace Studies Institute (CASI) finds that of the majority of government-funded basic R&D in China is performed by institutions of higher education.[30]

Universities appear to dominate basic research within China's broader civilian S&T ecosystem. Among the 34 elite universities examined in this study, basic research (基础研究) accounted for 69 percent ($2.8 billion) of their total spending on S&T ($4.1 billion). The operating expenses of some State Key Laboratories are likewise captured within the "basic research" line item, highlighting the increased importance that China has placed on the earliest stages of technology development. CASI research found that, in 2019, 59 percent of basic research performed in China was completed by universities. Little is known, however, about defense-related or otherwise classified research expenditures.

Central Chinese Government Support for University Research Is Increasing

Over the last decade, the Chinese government has provided the country's elite universities with progressively larger sums of funding, much of which is earmarked for R&D. From 2012 to 2021, the number of universities under MOE's direct supervision declined from 114 to 75. However, the ministry's annual spending on "higher education"—funds primarily used to run the universities directly under its control—nearly doubled, from $92 to $179 billion. Ultimately, however, central government funding accounts for a small portion of the total resources that the Chinese government dedicates to education. CSET's report *Education in China and the United States* found that 90 percent of education spending is driven at the local level, accounting for $968 billion when adjusted for PPP in 2018, but it is not known how much of this total is spent specifically on higher education.[31]

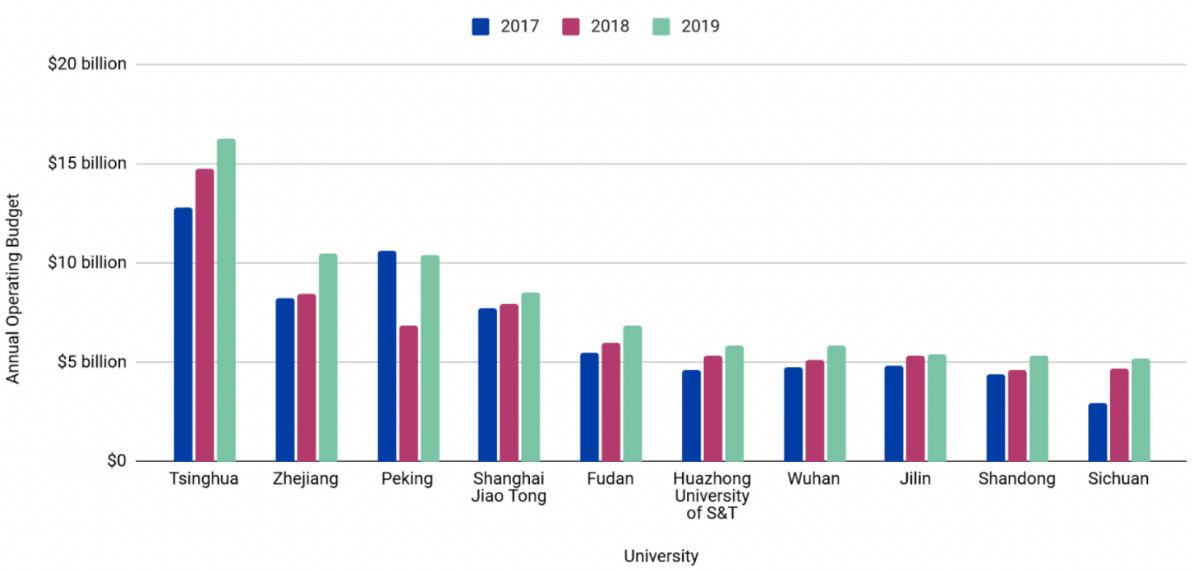
Figure 2. Chinese MOE Spending on Higher Education, 2012–2021



Source: Compiled and adapted from Ministry of Education annual budget reports.

Today, elite U.S. and Chinese universities receive comparable resources. The 10 Chinese universities depicted in Figure 3 each received more than $5 billion from the Chinese government in 2019. They also lead the country in S&T expenditure, with each institution typically spending more than $75 million on research activities annually.[32] By comparison, elite universities in the United States, such as Harvard University ($5.4 billion), Massachusetts Institute of Technology ($3.7 billion), and the University of California, Berkeley ($3 billion) also have operating budgets of several billion dollars.[33]

Figure 3. Top Chinese University Budgets Now Exceed $5 Billion Each Year (2017-2019)



Source: CSET university funding dataset (34 universities with available budget documents).

China's sustained investments in its university research have paid off, and its educational system is growing highly competitive with that of the United States. Prior CSET research has shown that elite Chinese universities have climbed in global university rankings and attracted esteemed multinational technology companies as partners.[34] By 2025, China is also expected to produce twice as many STEM PhDs as the United States.[35] Many of these graduates are taught by professors who received their education and training in the United States, United Kingdom, Germany, Singapore, and Japan.[36] As this data brief demonstrates, China's rapid gains have been supported by increasing investment in higher education, which includes talent recruitment.

At the same time that China's investment in higher education has been increasing, however, universities in the United States have received less government support. Between 2000 and 2015, state funding per student at U.S. public and private higher education institutions fell by about 31 percent.[37] Similar analysis by the Center on Budget and Policy Priorities finds that U.S. states collectively cut funding for colleges and universities by 16 percent in real terms between 2008 and 2017, and per-student funding in Alabama, Arizona, Illinois, Louisiana, New Mexico, Oklahoma, Pennsylvania, and South Carolina has fallen by more than 30 percent.[38] In terms of S&T expenditure, between 2011 and 2017, U.S. government funding for university research as a share of GDP fell by nearly 25 percent. Preliminary data from the National Science Foundation indicates that China surpassed the United States in aggregate R&D spending for the first time in 2019.[39]

Conclusion

China's increasing financial support for its universities illustrates its long-term approach to building a robust S&T foundation. Central government policies describe universities as both a way to support future discovery, and as a way to access technological know-how from overseas in order to fill China's strategic gaps. While not the only component needed to build a national innovation base, robust university-based research efforts have the potential to create new centers of excellence for prioritized research areas, as well as to challenge U.S. primacy in these domains.

This data brief has offered only a limited look at funding available to China's most elite universities. Future research should explore how CCP aspirations to cultivate universities that are both "Red and Expert" will affect non-STEM fields, like history and philosophy, and how this model may compare to liberal arts universities in the United States. More research is also needed to understand the complex relationships between CAS, NSFC, and universities; as well as the growing role of think tanks within China.[40]

However, as the United States and its allies consider new approaches to research security, it will be crucial to consider the dominant role of China's government in supporting and controlling the research agenda at its universities. Elite universities in China help the government meet its strategic military and economic goals in a much more integrated way than universities in other countries. The United States and like-minded allies may need to reconsider support for and investment in this key piece of the national innovation base in order to support the education of the next generation of tech workers, and to provide the foundational research for the industries of the future.

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Appendix I: Methodology

To assess Chinese university investments in S&T, we canvassed the annual departmental budget (部门预算) reports of China's 42 "Double First Class" universities from 2017 to 2019. Of these 42 universities, 37 published annual reports.[41] For each university, we noted the total operating budget of the university, as well as line items for foreign student scholarships, State Key Laboratories, and basic, applied, and advanced research at each university. The study also draws on central government spending reports from CSET's Chinese State Council Budget Tracker and statistics from China's MOST.

The following table offers an explanation of common budget codes used in Chinese budget documents:

Budget Code	Title of Line Item (English)	Title of Line Item (Chinese)
206	S&T Expenditure	科学技术支出
20602	Basic Research	基础研究
2060204	Key Laboratories and Related Facilities	重点实验室及相关设施
20603	Applied Research	应用研究
2060303	High-Tech Research	高技术研究
20604	Major R&D Projects	技术研究与开发

Appendix II: Elite Chinese Universities

This appendix includes all 42 "elite" Chinese universities considered in this report, and details which 34 published detailed budget information in 2019. We considered all 42 "Double First Class" universities identified by China's MOE. "Class A" universities are institutions the MOE considers to be well on their way to becoming world-class universities; "Class B" institutions at least have the potential to do so.[42]

Name (English)	Name (Chinese)	Type of University	Budget Data Available?
Beijing Institute of Technology	北京理工大学	Class A	**No**
Beijing Normal University	北京师范大学	Class A	Yes
Beijing University of Aeronautics and Astronautics (Beihang University)	北京航空航天大学	Class A	**No**
Central South University	中南大学	Class A	Yes
China Agricultural University	中国农业大学	Class A	Yes
Chongqing University	重庆大学	Class A	Yes
Dalian University of Technology	大连理工大学	Class A	Yes
East China Normal University	华东师范大学	Class A	Yes
Fudan University	复旦大学	Class A	Yes
Harbin Institute of Technology	哈尔滨工业大学	Class A	**No**
Huazhong University of Science and Technology	华中科技大学	Class A	Yes
Hunan University	湖南大学	Class B	Yes
Jilin University	吉林大学	Class A	Yes
Lanzhou University	兰州大学	Class A	Yes
Minzu University of China	中央民族大学	Class A	**No**
Nanjing University	南京大学	Class A	Yes
Nankai University	南开大学	Class A	Yes
National University of Defense Technology	国防科技大学	Class A	**No**
Northeastern University	东北大学	Class B	Yes

Northwest Agriculture & Forestry Technology University	西北农林科技大学	Class B	Yes
Northwestern Polytechnical University	西北工业大学	Class A	**No**
Ocean University of China	中国海洋大学	Class A	Yes
Peking University	北京大学	Class A	Yes
Renmin University	中国人民大学	Class A	Yes
Shandong University	山东大学	Class A	Yes
Shanghai Jiaotong University	上海交通大学	Class A	Yes
Sichuan University	四川大学	Class A	Yes
South China University of Technology	华南理工大学	Class A	Yes
Southeast University	东南大学	Class A	Yes
Sun Yat-sen University	中山大学	Class A	Yes
Tianjin University	天津大学	Class A	Yes
Tongji University	同济大学	Class A	Yes
Tsinghua University	清华大学	Class A	Yes
University of Electronic Science and Technology of China	电子科技大学	Class A	Yes
University of Science and Technology of China	中国科学技术大学	Class A	Yes
Wuhan University	武汉大学	Class A	Yes
Xi'an Jiaotong University	西安交通大学	Class A	Yes
Xiamen University	厦门大学	Class A	Yes
Xinjiang University	新疆大学	Class B	**No**
Yunnan University	云南大学	Class B	Yes
Zhejiang University	浙江大学	Class A	Yes
Zhengzhou University	郑州大学	Class B	**No**

Endnotes

[1] This figure represents the average budget among the 34 elite Chinese universities listed in Appendix II.

[2] Hua Jiang and Xiabin Li, "Party Secretaries in Chinese Higher Education Institutions: What Roles Do They Play?," *Journal of International Education and Leadership* 6, no. 2 (Summer 2016): 1-13, https://files.eric.ed.gov/fulltext/EJ1135210.pdf.

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[12] Coby Goldberg, "Open Gates" (Center for Advanced Defense Studies, June 2021), https://c4ads.org/open-gates.

[13] Goldberg, "Open Gates."

[14] Craig Singleton, "The Middle Kingdom Meets Higher Education" (Foundation for Defense of Democracies, December 9, 2021), https://www.fdd.org/analysis/2021/12/09/the-middle-kingdom-meets-higher-education/; Ryan Fedasiuk and Emily Weinstein, "Universities and the Chinese Defense Technology Workforce" (Center for Security and Emerging Technology, December 2020), https://cset.georgetown.edu/research/universities-and-the-chinese-defense-technology-workforce/.

[15] Jack Corrigan and Simon Rodriguez, "Chinese and U.S. University Rankings" (Center for Security and Emerging Technology, January 2022), https://cset.georgetown.edu/publication/chinese-and-u-s-university-rankings/.

[16] Fedasiuk et al., "Chinese State Council Budget Tracker." "Cabinet" refers to the 24 cabinet-level departments of the Chinese State Council (国务院组成部门) that publish itemized budgets.

[17] By some estimates, the number of Chinese enrollments in post-secondary educational institutions declined from 674,400 to fewer than 47,800 during the Cultural Revolution. William Saywell, "Education in China Since Mao," *Canadian Journal of Higher Education* 10, no. 1 (1980): 1-27, https://files.eric.ed.gov/fulltext/EJ228175.pdf.

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[20] Qiang Zhi and Margaret M. Pearson, "China's Hybrid Adaptive Bureaucracy: The Case of the 863 Program for Science and Technology," *Governance* 30, no. 3 (September 27, 2016): 407-424, https://gvpt.umd.edu/sites/gvpt.umd.edu/files/pubs/zhi_pearson-2016-governance.pdf.

[21] A full list of constituent universities can be found in Appendix II.

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[27] Fedasiuk, Weinstein, Murphy, and Loera, "Chinese State Council Budget Tracker."

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