China D-Tech Watch

ANALYSIS

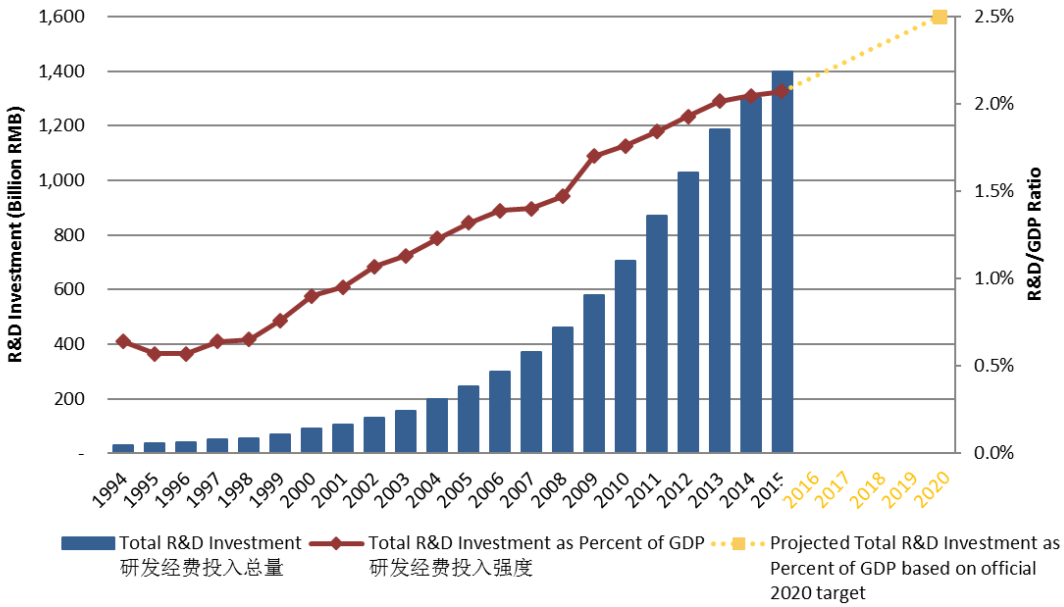
November 29, 2016

China's R&D Investment Growth and Share of Defense R&D

The 2015 national research and development (R&D) figures released by China's National Bureau of Statistics on November 11 indicate that R&D investment in China appears to be healthy and moving forward. Total R&D investment as a percentage of GDP is up. Investment in basic research as a percentage of total R&D investment is also up. Based on a 2013 study by Sun Yutao and Cong Cao, we estimate that national security-related expenditures were approximately RMB 162.6 billion (US $23.6 billion) in 2015.

Total R&D investment was RMB 1.4 trillion (US $203.2 billion), an increase of 7.6 percent over 2014. R&D investment as a percentage of gross domestic product (GDP) reached 2.07 percent, the third year in a row that the ratio has exceeded 2 percent and a 0.2 percent increase from 2014 (Figure 1).

Figure 1. China's Investment in R&D and Share of GDP, 1994–2020



Source: Data from National Bureau of Statistics, Ministry of Science and Technology, *China Statistical Yearbook on Science and Technology*, multiple years.

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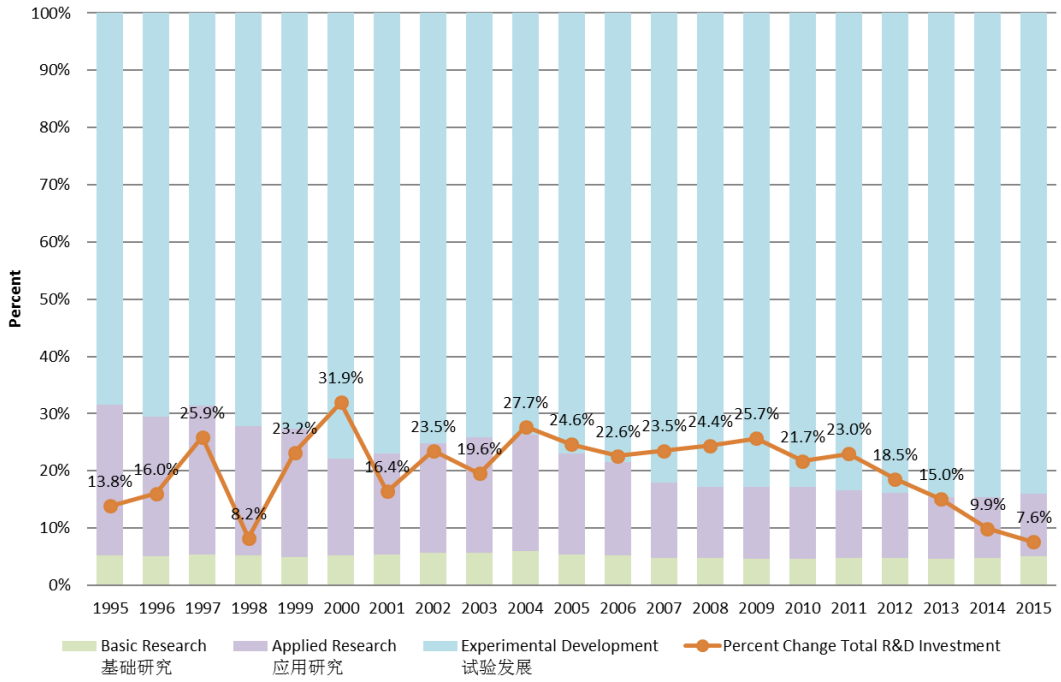
Figure 2. China's R&D Investment Growth and Investments in R&D Category



Source: Data from National Bureau of Statistics, Ministry of Science and Technology, *China Statistical Yearbook on Science and Technology,* multiple years.

Investment in basic research as a percentage of total R&D investment increased for the first time in almost a decade, moving past its eight-year benchmark of 4.7 percent to 5.1 percent (Figure 2).[1]

The planned trajectory of China's R&D spending, however, may be hindered by a slowing pace in growth of total R&D investment. Since 2009, annual growth of R&D spending has decreased rapidly from 25.7 percent to 7.6 percent in 2015—the lowest rate of R&D spending growth China has seen in two decades. The slowdown is not unexpected, since Chinese GDP growth has also slowed, but it comes on the heels of China's announcement of an innovation-driven development strategy and many other efforts to increase China's status as a global science and technology power.[2] At first glance, these two trends seem at odds, as robust R&D spending growth is key to the upgrading of Chinese innovation systems.

This slowdown in total R&D growth will make it difficult for China to reach its 2020 goal of a 2.5 percent R&D/GDP ratio. This goal was initially set in 2006 in the Medium- and Long-Term Plan for Development of Science and Technology (2006–2020) and renewed in 2016 in the 13th Five Year Plan on National Science,

[1] "统计局: 2015 年中国研发投入总量和强度保持双增长" [Statistics Bureau: 2015 China R&D Investment Totals and Intensity Maintains Double Growth], 中国新闻网 [*China News*], November 11, 2016, http://www.chinanews.com/gn/2016/11-11/8059872.shtml.

[2] "China Unveils Three-Step Strategy for Innovation-Driven Development," Xinhua, May 19, 2016, http://news.xinhuanet.com/english/2016-05/19/c_135372956.htm.

Technology, and Innovation.[3] To achieve 2.5 percent by 2020, China will need to increase its R&D investment as a share of GDP by 0.86 percentage points each year. That is achievable and not beyond what China has done before, but it will require a shift in China's current R&D investment strategy.

China's new GDP calculation method also complicates the story. In January 2016, the NBS announced revised GDP figures based on a new calculation method that includes R&D as a capital account instead of a cost, essentially shifting R&D from an intermediate good to an end product.[4] This is in accordance with international standards for GDP calculation and allows for better comparisons between China's GDP and other countries. In its 2015 calculation of R&D as a share of GDP, however, NBS chose to use the unrevised and lower 2015 GDP figure, thus producing a higher R&D/GDP ratio. The change is not large, but using the revised 2015 GDP figure puts China's 2015 R&D/GDP ratio at 2.05 percent rather than the reported 2.07 percent—a figure more distant from its 2020 goal.

China has not always met its R&D targets, including its stepping-stone goal in the 11th Five-Year S&T Plan to reach a 2 percent R&D/GDP ratio by 2010.[5] The 2020 goal of 2.5 percent is much more important for China, however, as indicated by its reemphasis in the 13th Five Year Plan on National Science, Technology, and Innovation. This would put China's R&D/GDP ratio above the 2013 OECD average of 2.36 percent but still behind advanced nations such as the United States, Germany, Japan, and South Korea.[6] To achieve its goal, China will need to carefully manage its spending growth, including additional factors that play into the dynamics of its R&D investment, such as the balance between government and enterprise investment and central and local government S&T appropriations.

Central and local government S&T appropriations are particularly important due to the direct control government decision-makers have over them. Central S&T appropriation includes both S&T expenditures and S&T appropriations under other expenditure items. R&D expenditure is included under S&T expenditure.[7] Although not the only source of funding, these S&T appropriations also determine funding levels for central government priorities such as the 863 and 973 plans, the Strategic Emerging Industries initiative, and the Made in China 2025 Plan. Over the past two decades, Chinese central government S&T appropriations have declined relative to local (provincial) government S&T appropriations, shifting from more than 70 percent of total government S&T appropriations in the early 1990s to less than 50 percent since 2007 (Figure 3). This may largely be due to a definition change in 2007 that decreased the range of expenditures included in S&T appropriations.[8]

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[3] State Council, "国务院关于印发十三五" 国家科技创新规划的通知" [Notice Regarding State Council Publication of "13th Five Year" National Science, Technology, and Innovation Plan], July 28, 2016, http://www.gov.cn/zhengce/content/2016-08/08/content_5098072.htm.

[4] National Bureau of Statistics, "国家统计局关于改革研发支出核算方法修订国内生产总值核算数据的公告" [National Bureau of Statistics Notice Regarding Revised R&D Expenditure Calculation Method and Revised Gross Domestic Product Figures], July 5, 2015, http://www.stats.gov.cn/tjsj/zxfb/201607/t20160705_1373924.html.

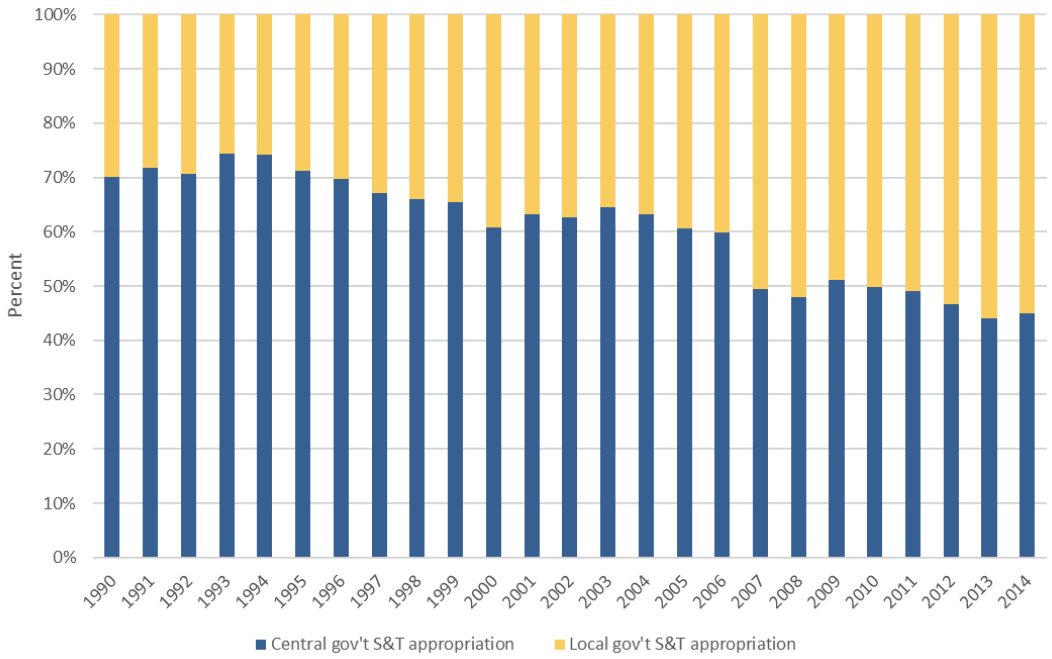
[5] Ministry of Science and Technology, "国家"十一五"科学技术发展规划" [National 11th Five-Year Science and Technology Development Plan], October 31, 2006, http://www.most.gov.cn/kjgh/kjfzgh/200610/t20061031_55485.htm.

[6] National Science Board, *Science and Engineering Indicators 2016*, https://www.nsf.gov/statistics/2016/nsb20161/#/report/chapter-4/cross-national-comparisons-of-r-d-performance.

[7] Sun Yutao and Cong Cao, "Demystifying Central Government R&D Spending in China," *Science*, August 29, 2014.

[8] Ibid.

Figure 3. S&T Appropriations of Central and Local Governments in China



Source: Data from National Bureau of Statistics, Ministry of Science and Technology, *China Statistical Yearbook on Science and Technology,* multiple years.

However, there are reasons to remain optimistic about China's R&D trajectory. First, China's 2015 growth in total R&D investment (7.69 percent) is still higher than its 2015 GDP growth (6.9 percent). This means that R&D investment is growing faster than the overall economy, if only modestly.

Second, China is devoting resources not just to increasing the amount of investment in S&T projects but also to making its investments more effective. China's ongoing major S&T management reform will consolidate the many plans and programs that currently fund Chinese S&T projects (including the foundational 863 and 973 plans) into five major S&T categories.[9] The aim is to make China's S&T spending more efficient and less duplicative, with positive effects on R&D and S&T outcomes beyond a mere increase in levels of investment.

How Much Goes to Defense R&D?

One unanswered question is whether or not these official national R&D expenditures include defense-related activities. The official explanation given by the NSB is that these R&D funds "refer to the expenditures of the *whole society* (全社会) for basic research, applied research, and experimental development within the fiscal year. This includes personnel costs, raw material costs, purchase and construction costs of fixed assets, management fees and other expenses used for research and experimental development activities."

[9] Mu-ming Poo and Ling Wang, "Jianguo Hou: Major Reforms in China's S&T Funding Mechanisms", *National Science Review*, September 12, 2016, http://nsr.oxfordjournals.org/content/early/2016/09/12/nsr.nww057.abstract.

One indicator that defense R&D expenditures are included comes from a 2009 R&D Resources Inventory Survey by the NSB in conjunction with the Ministry of Science and Technology, National Development and Reform Commission, Ministry of Education, Ministry of Finance, and the State Administration for Science, Technology, and Industry for National Defense (SASTIND).[10] The 2009 survey provides a figure of RMB 58 billion for total national R&D expenditures for 2009, which is the same number that the NSB issued for 2009 national R&D expenditures. SASTIND's involvement in the 2009 survey suggests that defense R&D activities are included by the NSB as part of national R&D expenditures.

If the NSB's yearly national figures for R&D expenditures do include defense R&D, is there a way to estimate how much is spent on defense R&D? The NSB figures offer no useful insights on this question, but a 2013 study by Sun Yutao and Cong Cao may. Their analysis of S&T financial data from 71 central government agencies in 2011 showed that these agencies accounted for 45.9 percent of central government S&T expenditures.[11] The study pointed out that eight national security-related agencies did not disclose their S&T expenditures, which would have accounted for the remaining 54.1 percent of S&T outlays, or RMB 209 billion (US $15.8 billion) in 2011. These national security agencies included SASTIND, the Ministry of State Security, and the Ministry of National Defense, which is a proxy for the People's Liberation Army.

Applying this 54/46 ratio between national security and civilian expenditures to the reported 2015 central-level S&T total appropriations of RMB 301.2 billion, national security-related expenditures would have been RMB 162.6 billion (US $23.6 billion), of which the overwhelming proportion would have gone to defense-related R&D activities.

[10] China National Bureau of Statistics, *Second Research and Development Resources Inventory Compilation, 2009 Key Statistics Report* [第二次全国科学研究与试验发展 (R&D) 资源清查主要数据公报], http://www.stats.gov.cn/tjsj/tjgb/rdpcgb/qgkjjftrtjgb/201011/t20101122_30482.html

[11] Sun Yutao and Cong Cao, "Demystifying Central Government R&D Spending in China."