



**Committee of 100**

# Issue Brief

July 2007

## Chinese Research and Development

*This is part one of a two-part overview of the Chinese government's plans to further research and development through a new, 15-year science and technology plan. Part two will feature an interview with Leroy Chiao, Distinguished Chair Professor at Louisiana State University*

*and astronaut; and Paul Chu, Professor of Physics at the Texas Center for Superconductivity at the University of Houston and President of the Hong Kong University of Science & Technology, each commenting on China's research and development program.*

China's 15-year Science and Technology (S&T) plan calls for the Chinese government to invest RMB 1 trillion (US\$125 billion) in research and development (R&D) by 2020. This new S&T plan aims to shift Chinese R&D away from reliance on foreign technology and move Chinese R&D towards domestic innovation and technology transfer through foreign partnerships. What lies ahead for Chinese R&D?

### **China's Former S&T Policy**

China's previous S&T policy-- in place from 1949 until 1992-- was copied from the Soviet Union, and was hierarchical and stratified, preventing the dissemination of research findings to the general population.<sup>1</sup> For example, universities conducted little R&D and the state-owned entities that did engage in R&D did not communicate well with one another, the government, or the general population. Further, under the former S&T policy, intellectual property was considered a public good and not protected, thus stymieing R&D and related technological innovation.<sup>1</sup>

### **Developing a New S&T Policy**

In part to remedy the poor results of the previous S&T policy, the Chinese government recently has proactively promoted initiatives and reformed its legal system to promote S&T-based R&D. The Chinese government's efforts are centered on three main objectives: 1) importing technology from abroad; 2) shifting research to industrial enterprises; and 3) creating new "spin off" companies from the Chinese Academy of Science (such as Lenovo).<sup>1</sup> These objectives complement China's large domestic market, a highly driven and ambitious work force, and a strategic view of the importance of technology development for economic development.<sup>1</sup> The Chinese government also has changed its S&T policy by introducing competition into the S&T system.

Chinese government officials repeatedly have emphasized their desire to promote technological advancement. In January 2006, President Hu Jintao announced a ground-breaking 15-year S&T plan that aims to make China a global scientific, technological, and economic power.<sup>2</sup> The S&T Plan emphasizes independent, domestic innovation in place of reliance on foreign technology. One of the most important measures in promoting China's science and technology R&D is China's tax policies.<sup>2</sup> According to the Institute of Policy and Management, tax related topics have accounted for 25% of all of the S&T laws and regulations passed in the last two decades. The Chinese

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government is also placing greater emphasis on appointing top government officials with technical expertise.<sup>1</sup> For example, newly appointed Science and Technology Minister Wan Gong has private sector experience as a former engineer for Audi, and is not a member of the Communist Party.

The Chinese government has increased R&D expenditures, showing that calls for greater commitment to S&T are not illusory. Total R&D expenditures increased from 0.6% of China's GDP in 1995 to 1.5% of GDP in 2005. According to the new 15-year S&T plan, R&D expenditures will be 2.5% of GDP by 2020.<sup>3</sup> The number of Chinese researchers increased by 77% over the period 1994 to 2004, to 926,000 people engaged in research (compare with 1.3 million people in the U.S. engaged in research).<sup>4</sup> Universities have also become a significant source for technological innovation, accounting for 17.5% of total full-time R&D personnel, a significant increase over previous years. This increase was made possible, in part, through the government's decision to implement reforms aimed at withdrawing the government from participation in competitive sectors. Although China's R&D investment is increasing, it is unclear whether such investment is independently sustainable or whether it is too dependent on foreign investment.

China's S&T policy reform is incomplete because (a) the shift away from direct government control of S&T policy is not complete; and (b) intellectual property rights are insufficiently protected.<sup>1</sup> This renders the policy reform incomplete because the top-down S&T approach used by the Chinese government may not sufficiently encourage innovation. Further, S&T policies often conflict or overlap one another, making them less effective. While there are positive indicators that intellectual property right enforcement is improving in China, the Chinese government needs to improve enforcement of intellectual property laws and increase sanctions for violations of such laws.<sup>1</sup>

### **Recent Developments**

Many of China's recent R&D projects show a desire to launch directly into the highest levels of technological innovation and production, goals that are facilitated by China's aggressive S&T policy reform. Three of China's major research areas include agri-biotechnology, aircraft, and space travel. Agri-biotechnology is important for the Chinese government's attempts to develop a sustainable domestic food supply for its rapidly growing and urbanizing population. The Chinese government will significantly increase its biotechnology spending by 2010. According to Zhang Liang Chen, President of the Agricultural University of China, "spending on biotechnology is expected to increase fivefold."<sup>5</sup> In addition, the Swiss company Syngenta AG recently announced that it signed a five-year, agriculture biotechnology agreement with the Beijing-based Institute of Genetics and Developmental Biology to study, develop, and commercialize agri-biotech products including such as drought-resistant seeds.<sup>6</sup>

The Chinese government is also highly interested in research related to aircraft development and space technology. For example, the Chinese government recently announced that it plans to build a passenger aircraft to compete against those made by Boeing and Airbus to provide a domestic alternative for the fastest-growing passenger aircraft market in the world. In addition, the Chinese government hopes to foster progress in other high-tech industries related to aircraft design and construction. Aircraft manufacturers such as Embraer of Brazil, Bombardier of Canada, and Diamond Air of Austria are establishing ties with China.<sup>7</sup>

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China's space program, and the government's interest in related technologies, began with the efforts related to the launch of its first manned space flight in 2003. The Chinese government has also pursued satellite-related technologies, and developed a satellite navigation system named Bidou and a GPS system to compete with Europe's Galileo.<sup>8</sup> The second part of this series will feature a Chinese-American scientist, who will offer his thoughts on the space programs of each country.

### **Concerns as China Develops**

The speed with which technology has advanced in China creates concerns along with its many benefits. For growth to be sustainable, the Chinese government must address the digital divide and environmental protection in a comprehensive manner. Currently, there is a large gap in access to technology between urban and rural areas. Although Vice Minister of Information Industry Xi Guohua claims that all towns and townships in China will have broadband Internet by 2010, only 3.1% of the rural population currently has Internet access, as compared to 20.2% of urban residents.<sup>9</sup>

### **The U.S. Reaction**

The Chinese government's emphasis on fostering domestic innovation is on the mind of many U.S. policymakers. Some policymakers see the 15-year S&T Plan as a blueprint for the rise of a significant and uncooperative competitor. Others see this plan as an opportunity to partner with Chinese companies to develop international-standard services and companies and as a challenge to the U.S. government to invest in U.S. R&D.

Several U.S. universities are enthusiastic about China's increase in R&D spending and are devising ways to benefit from China's enhanced S&T policy. Arizona State University's Shanghai MBA and Science and Technology week is leveraging programs with Chinese research institutions in hopes of fostering a mutually beneficial research relationship. The University of Southern California has developed extensive programs designed at promoting a positive research relationship with Chinese students and universities.

On the other hand, U.S. businesses and policymakers have expressed concerns about the implications of China's progress in R&D. A 2005 study conducted by the consulting firm A.T. Kearney found that many American executives fear that China may soon surpass the U.S. in technological innovation as 59% feel that their competition will come primarily from China, and 90% believe the threat will intensify.<sup>10</sup>

In March 2006, the Appropriations Committee Subcommittee for Science held a hearing on the NASA budget that turned into a discussion on China's space program and how it threatens the U.S. Representative Frank Wolf said "if China beats us there, we will have lost the space program. They are basically, fundamentally in competition with us." More recently, after China successfully destroyed a low Earth-orbit satellite with a missile, the U.S. government logged a formal diplomatic complaint, worrying that the Chinese could destroy highly critical U.S. satellites during a time of war.<sup>11</sup> These fears are aggravated by the shrinking United States R&D workforce. Fewer and fewer American students pursue advanced degrees in science and technology, and an increasing number of foreign students are choosing to attend universities and launch research careers and companies in countries other than the U.S.<sup>12</sup>

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## Comparison to International S&T Trends

China ranks third in world for R&D investment, at 1.8% of GDP in 2006, spending about the same as the European Union.<sup>13</sup> China has internationalized its science and technology-related R&D over the past few decades – working with partners from the United States, the European Union, Australia, New

Zealand and Japan to build alliances and gain S&T expertise. The Chinese government is also looking to build more alliances with overseas universities to amplify research and development, such as the Beijing Science and Technology week collaboration at Arizona State University.<sup>14</sup>

## Outlook

The Chinese government has recently focused on forging strong international ties, and working closely with researchers from several countries to gain expertise. The government seems particularly interested in cooperative arrangements with foreign universities. Chinese researchers also understand the strategic importance of technology on fostering and securing the economic development and growth of their country. The new 15-year S&T plan identifies 11 key areas of research, eight “frontier technologies”, 13 engineering mega-projects, and four science mega-projects.<sup>1</sup>

At the same time, China’s new S&T plan faces a number of challenges, including creating an atmosphere in which innovation is encouraged, making capital available to small companies, and increasing the tolerance for risk. International links may not be successful, as multinational corporations may be wary of technology transfer requirements or may siphon the most talented away from China, hurting Chinese startups. Further, intellectual property protection must continue to be enforced and provide for harsher sanctions.<sup>1</sup>

The future of China’s science and technology sector is difficult to predict. Currently, the industry is a study in contrasts – it has both small but highly productive centers of research and a much larger rural population with limited access to modern technology. Growth and sustainability in research and development will largely depend on whether and how quickly skills and knowledge are dispersed to a wider population.

## Sources

- 1) Adam Segal. “The Competitiveness of Chinese R&D”. Asian Science and Technology Forum. CSC Executive Briefing Center, Falls Church, Virginia. 27 June 2007.
- 2) Kathleen A. Walsh Testimony before US-China Economic & Security Review Commission [http://www.uscc.gov/hearings/2005hearings/written\\_testimonies/05\\_21\\_22wrts/walsh\\_kathleen\\_wrts.htm](http://www.uscc.gov/hearings/2005hearings/written_testimonies/05_21_22wrts/walsh_kathleen_wrts.htm)
- 3) R&D Magazine, *Global R&D Report: Changes in the R&D Community*, (September 2005), available at <http://www.rdmag.com>
- 4) China to beat Japan in R&D spend <http://news.bbc.co.uk/go/pr/fr/-/2/hi/business/6205782.stm>



5) China to quadruple agri-biotech spending  
[http://www.ft.com/cms/s/bfaaa2c6-d31c-11db-829f-000b5df10621,dwp\\_uuid=9c33700c-4c86-11da-89df-0000779e2340.html](http://www.ft.com/cms/s/bfaaa2c6-d31c-11db-829f-000b5df10621,dwp_uuid=9c33700c-4c86-11da-89df-0000779e2340.html)

6) Syngenta Collaborates with China's IGDB on Agriculture Biotechnology Research  
[www.agbios.com/main.php?action=ShowNewsItem&id=8593](http://www.agbios.com/main.php?action=ShowNewsItem&id=8593)

7) Lofty Ambitions [www.economist.com/business/displaystory.cfm?story\\_id=8670327](http://www.economist.com/business/displaystory.cfm?story_id=8670327)

8) China's technological thrust poses formidable challenge  
[http://www.ft.com/cms/s/f0f36702-1da7-11dc-89f7-000b5df10621,dwp\\_uuid=e38c2836-176e-11dc-86d1-000b5df10621.html](http://www.ft.com/cms/s/f0f36702-1da7-11dc-89f7-000b5df10621,dwp_uuid=e38c2836-176e-11dc-86d1-000b5df10621.html)

9) China speeds up narrowing the digital technology gap  
[http://english.people.com.cn/200706/21/eng20070621\\_386465.html](http://english.people.com.cn/200706/21/eng20070621_386465.html)

10) China, India Rival US Competitiveness  
[Http://english.people.com.cn/200502/25/eng20050225\\_174681.html](http://english.people.com.cn/200502/25/eng20050225_174681.html)

11) U.S. official: Chinese test missile obliterates satellite  
<http://www.cnn.com/2007/TECH/space/01/18/china.missile/index.html>

12) Council on Competitiveness Say US has Little to Fear but Fear Itself  
[www.manufacturingnews.com/news/06/1130/art1.html](http://www.manufacturingnews.com/news/06/1130/art1.html)

13) China to beat Japan in R&D spending  
<http://news.bbc.co.uk/go/pr/fr/-/2/hi/business/6205782.stm>

14) Jonathan Fink. "Building Collaborative Relationships with Chinese Research Institutions". Asian Science and Technology Forum. CSC Executive Briefing Center, Falls Church, Virginia. 27 June 2007.

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Prepared by Michael Burke, Tovah LaDier, and Williams Mullen Strategies

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