

# A Mission-oriented Pattern of S&T Policy in China

Yu Meng

School of Public Policy  
Georgia Institute of Technology

March 16, 2007

## **Introduction**

In the United States, science and technology (S&T) policy was driven by the shifting recognition of the relationship between basic research and applied research. Most policy makers, scholars and business entrepreneurs associate the priority selection and funding allocation with basic/applied research relationship. Unlike the US, there was no open debate on basic versus applied research in China. Then, a few important questions would be prompted about how policy makers in China make decisions on this issue, what theories they consider as a base for these decisions, are these theories different from the theories discussed in the US. Given China's unique characteristics (different political system, large population, lower level of average education, lower level of economic development, and lower level of S&T development) and its rising status in the global economy, answers to these questions would benefit for more understanding on S&T policy in the specific country as well as for S&T policy analysis in general.

This is a historic/comparative study and all information for analysis is collected from government documents, formal publications, and official online resources. The paper is divided into three sections. The first section gives a brief review on S&T change in the US and relatively detailed review on Chinese S&T policy over past five decades. And a mission-oriented pattern of Chinese S&T policy is drawn from the comparisons. The second part provides explanations, rooting in learning tradition and contextual conditions, for the orientation. The final section presents discussion on new trend seen from the policy and the tentative conclusion based on the current study.

## **An overview of S&T policy in the US and in China**

### ***The US S&T policy in the history***

In Morin's (1993) overview of the history of American S&T development, scientific research activities, since the birth of the United States, had been independent from government with the ideology against power concentration. The research community was small in size and depended primarily on private resources at its initial stage. Then, the WW II became the turning point where the central management over scientific activities and the focus of basic research activities seemed to be effective – their contribution to national military and economic strength was prominent and clearly seen. Recognition of the advantages led to Vannevar Bush's (1945) famous proposal immediately after the war, *The Endless Frontier*. Bush and his colleagues provided the evidence that the fundamental knowledge had been exhausted during the war, argued and verified a positive relationship between scientific research and postwar economic development, and then proposed to establish an independent agency with its funds managed by civilian scientists. The underlying rationale of Bush's proposal is a linear model that locates the basic research in the core of a relationship between basic, applied research and economic development. Finally, the National Science Foundation (NSF) was founded in 1950 with a mission of funding basic research.

With the rise of a debate on the distinction between basic and applied science in late 1960s, the paradigm of the simplified linear relationship between them has caught doubts (Waterman, 1965; Brooks, 1967). A dynamic paradigm taking account multiple actors and network among them thus emerged and many theories were born from it, such as Mode 2, national innovation system, triple-helix, and so forth. The dynamic paradigm as well as these theories functioned as a theoretic guide for S&T

policy in the US. As “the government does not believe that it is good enough simply to trust to the automatic emergence of applicable results [from basic research] which industry then uses” (cited from Stokes, 1997:59), the government enacted a series of laws and programs aiming to encourage more direct interactions between research institutions and industry as well as entrepreneurial adventure of research institutions (See Table 1).

**Table1. Selected US Legislation encouraging entrepreneurial activities**

|      |   |
|------|---|
| 1980 | Stevenson-Wydler Technology Innovation Act                        |
| 1980 | Bayh-Dole Act, and Reagan’s 1983 Memo on Government Patent Policy |
| 1982 | Small Business Innovation Development Act                         |
| 1984 | National cooperative Research Act                                 |
| 1993 | Defense Appropriations Act, Technology Reinvestment Program       |

Source: Slaughter and Leslie (1997)

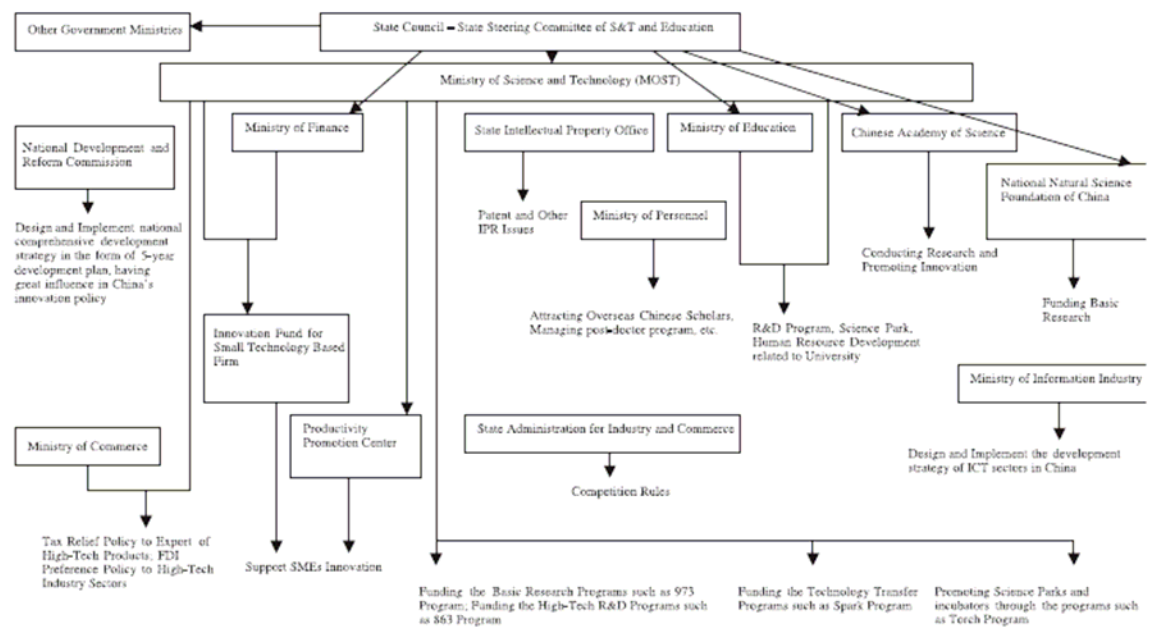
The policy change in the US reveals a move from a basic research focus to a comprehensive focus considering all stakeholders and their complicated relationships. At the same time, the government, as an important stakeholder, has been involved in the networking system rather than an authority right above the system.

***China’s S&T policy in the history***

Figure 1 illustrates the major administrative stakeholders related to the S&T policy in China and their relations. Even though the S&T policy institutional system has been experiencing considerable reforms with the market-oriented principles, the vertically bureaucratic relationship between these relevant institutions remains apparent. As shown in the figure, the State (National) Steering Committee of S&T and Education locates in the highest rank among these institutions, undertaking a leading role in the governmental coordination for national strategic policies in S&T and education (Huang, et al., 2004). The Ministry of Science and Technology (MOST) was born from the State Science and Technology Commission in 1998 and since then became

the most important implementation entity of S&T policy, carrying out a series of programs to fund basic and applied research and development (R&D) (MOST website). Compared with parallel and collaborative relations between various institutions in the US, Chinese S&T policy related institutions are characterized by hierarchy and limited number. As hierarchical and limited number of institutions denotes a top-down manner of policy design, this manner implies an approach of studying officially documented policies (including national plans and programs). This approach is especially helpful when reliable and accurate data are not available.

**Figure 1. China's S&T polity institutions**



Source: Huang, et al. (2004)

Before releasing the 2006-2020 Chinese National Science and Technology Development Plan in February 2006, China has laid out seven strategic S&T plans since 1949 (MOST website; Hu, 2003; He, 2006). A summary of relevant information on background, guideline, and prioritized tasks of the eight national plans is given in the Appendix.

Chinese society experienced tremendous changes during past several decades, political instability in the early days and economic transformation recently. Those plans were set for the purpose of providing guidance and strategies for S&T development at different stages, and so the social contextual information was inevitably imprinted on those plans. However, the purpose of the current study is to uncover a more general characteristic of Chinese S&T policies over time. In other words, I attempt to abstract a “Chinese model” that captures the characteristics of S&T policy beyond a particular historical period.

Over time, we can see some stable and changing elements in these plans:

- In all of the seven plans, priorities were given to natural resource exploitation technology, agricultural S&T, S&T for strengthening national defense, for building infrastructure, and for improving public health.
- In the first and second plans, measuring technology was especially emphasized but it disappeared in the later ones.
- Since the second plan, industrial technology had been considered as an important direction to develop S&T, but the initial focus was limited on heavy industry and then became broader to include heavy, light, and high-tech industries.
- Basic research was mentioned since the second plan but it had always to be related to the imperative tasks in different periods and could never be completely independent.
- Concerns were extended from economic development to both economic and social development.

When relating these changes with their contextual conditions, a general pattern revealed from these plans is a mission-oriented value attached to Chinese S&T advancement. Considered to be able to provide efficient solutions for the identified problems in China, applied research and technologies were put in the most important place. And because of the same consideration, even though the concept of basic

research was encompassed in the national strategic plan since 1986, it was not simply the endeavor aiming to increase knowledge and understanding (Stokes, 1997) but one toward promoting and updating technologies. Chinese centralized S&T system and the premature market decide that a significant proportion of funding for S&T comes from government, and the dependent relationship, combined with the national priority, limits basic research only within a few fields – agriculture, energy, material, resources and environment, and population and health – and tacks a mission-oriented value on it.

### **Explanations for the utilitarian orientation**

#### ***The status of scientific community in China***

Historically, the learning style of the East is distinctive from that of the West. In Nakayama's (1984) study of academic and scientific traditions, an argumentative tradition was recorded in Plato's *Dialogues* and confirmed by Aristotle who "makes every effort to present a variety of diverse and opposing views" and "establishes an academic style that strives for precision and clarity even when the author's own opinions are involved" (Nakayama, 1984: 33). Such a style allows scholars and researchers to freely pursue truth and knowledge. In contrast, since Emperor Han Wu Ti (154-87 B.C.) commanded that "all that is not encompassed by the arts and disciplines of Confucius be prohibited," Confucianism had become orthodoxy and pertained to the political system (Nakayama, 1984: 33). Later, the establishment of official examination not only tightened the relationship but also brought a utilitarian purpose to learning – pursuing an official position. Under these conditions, the academic community has long been lacking its interest in scientific dimension (Nakayama, 1984: 33), losing its autonomy, struggling for survival by following governmental mandates. So, until the May Fourth movement in 1919 when the

concept of modern science was introduced to China, those who actually conducted scientific or technologic research were craftsmen and farmers. Until the late Qing dynasty, with the introduction of Western educational system and modern science, scientists had not been distinguished from political officials, farmers and craftsmen. But the time for Chinese scientists to become an independent group was so short that no tradition of independence was established. After the liberation in 1949, China adopted Soviet Union model for S&T institution reform, which restored a subordinate status of academic community in general, and the scientific community in particular. The dependence of the scientific community on central government suggests all its activities have to conform to the national goals preset by the government.

### ***Contextual situation of China***

In a general discussion on science, the proposal that science is characterized by universalism (Merton, [1942]1973) has elicited criticism from different schools (Zuckerman, 1988). As universalism denotes impersonal criteria for assessing scientific contribution and fairness of a reward system (Long and Fox, 1995), it also implies the equal status of different fields in science and the same development path of science across countries. However, the insight from social constructive school indicates that science is just one component of the whole society and could not be separated from the rest of the society (Hill, 1986; Cao, 2004). Therefore, the policy functioned as a guiding and regulating tool for S&T development should also seriously consider China's real situation and base the policy on the consideration.

In a specific term of priority setting, Moravcsik (1985) and Hill (1986) provided a thoughtful theory on how developing countries adopt strategies to develop their S&T.

According to them, developing countries would test theories and technologies achieved by developed countries and would set priorities and build scientific infrastructures based on their own problems and circumstances. Disagreeing with Moravcsik's assumption that more science is good, Hill thought developing countries, due to their increasing disadvantage in knowledge flows, do not have time to stand in the frontier of S&T fields.

Hill(1986) proposed to identify clear priorities targeting the factual situation which direct the scarce resources to the focuses where a powerful solution would be gained. After reiterating S&T is just a component of a whole national system, Hill argued that priority setting should start from a thorough understanding on the rest of the national system. "Targeting" is an important concept in Hill's theory which helps policymakers as well as scientists in developing countries to identify their countries' factual situation and set priority accordingly by asking the following three questions:

1. *What are key links in the technological systems of the national economy that have been broken by the introduction of modernizing technologies? What are the key "gaps" in the national technological system that only national science is likely to fill?*
2. *What areas of scientific research can be selected and fostered to reintegrate higher and lower technological systems within the economy?*
3. *What areas of fundamental research need to receive greatest financial support with respect to*
  - *potential contribution to the development of critical national physical and social resources;*
  - *"generic" technologies that could have the greatest multiplier effect through the total economy?(cited from Hill, 1986, p.30)*

Table 2 gives a snapshot of the economic and social context of China, compared with that of the US. China has much larger population, with estimated total population in

2010 as more than four times as that of the US. The most prominent feature of China is the largest share of agriculture population (60.8%) in the world, almost sixty times as that in the US (1.6%). Additionally, measured by per capita GNP in 2003, China is much poorer than the US; measured by education expenditure, enrollment ratio and school expectancy, China is still at the lower level of education. Much smaller numbers on three indicators about Gross domestic expenditure on R&D (GERD) indicate China's lower S&T development level. Indicators of natural resources reflect China's comparable or marginally richer resources in totality term, but the natural resource per capita in China is scarce. Both life expectancy (71 years old compared to 77 years old in the US) and infant mortality (37 per 1000 infants, almost five times as that in the US) tell the needs of business improving public health in China.

**Table 2. Information on selected economic and social indicators on China and the US**

|  | China     | US        |
|--|-----------|-----------|
| <b>General</b>   |           |           |
| Per capita GNP (US\$) in 2003                                | 1,100     | 37,870    |
| Total estimated Population (1000) in 2010                    | 1,372,903 | 314,922   |
| Estimated Agr Pop (1000) in 2010                             | 834,439   | 5,164     |
| Estimated ratio of Agr. Pop (%) in 2010                      | 60.8      | 1.6       |
| <b>Education</b>   |           |           |
| Total educational spending of GDP (%) in 2000                | 2         | 6         |
| Gross enrollment ratio (primary&secondary, both sex) 2002/03 | 90        | 96        |
| School expectancy in 2003                                    | 11        | 16        |
| <b>S&amp;T</b>   |           |           |
| Gross domestic expenditure on R&D (% of GDP) in 2002         | 1.23      | 2.67      |
| GERD in 2002 (billion US\$)                                  | 15        | 278       |
| GERD per capita in 2002                                      | \$7       | \$954     |
| <b>Resource</b>  |           |           |
| Land Use Total Area (1000Ha)                                 | 959,806   | 962,909   |
| Agricultural Area (1000Ha) in 2005                           | 554,851   | 409,300   |
| Arable & Permanent Crops (1000Ha) in 2005                    | 154,850   | 175,500   |
| Total renewable fresh water resources (mio m3) in 2005       | 2,896,569 | 2,478,000 |
| <b>Health</b>  |           |           |
| Life expectancy at birth in 2003                             | 71        | 77        |
| Infant mortality (per 1000) in 2003                          | 37        | 8         |

**Source:**

The World Health Organization Report 2005

People's Daily [http://english.people.com.cn/200212/30/eng20021230\\_109314.shtml](http://english.people.com.cn/200212/30/eng20021230_109314.shtml)

United Nations water resource indicators <http://unstats.un.org/unsd/environment/waterresources.htm>

World Bank Education Data <http://devdata.worldbank.org/edstats/ed.asp>

UNESCO Institute for Statistics <http://stats.uis.unesco.org/TableViewer/tableView.aspx>

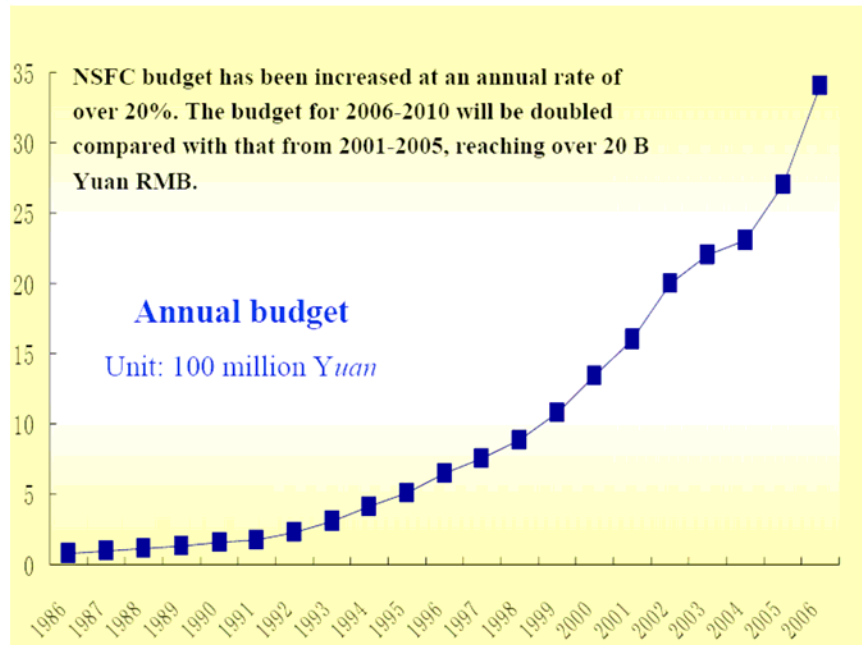
These indicators help identify the critical problems in China – large population and weak economic foundation. All the other problems are associated with these two basic problems. It is obvious that the goal of S&T activities in China is much different from that in the US, with the former to solve the factual problems while trying to reduce the gap between China and developed countries and the latter to “strive for leadership in the most promising areas and perform at a world-class level in the other major fields in S&T” (The ATP document, 2001). Correspondingly, more efforts put in applied research and technologies development found in the seven national strategic plans can be interpreted as contest-based policy design. As the disadvantaged situations became key restrictions for China’s S&T development, it also provides opportunities for S&T research. For instance, large agriculture population decides the important role of the whole economy in China, suggesting a large market and substantial demands for agriculture technology and biologic technology. The incentives from the demand side and the limitations from the supply side, together, reconfirm the mission-oriented model in Chinese S&T policy.

### **Discussion and conclusion**

Due to the lack of budget or appropriation on different fields in each plan, a concrete quantitative proof of the mission-oriented model cannot be provided in this study. But an indirect way to examine the role of basic research in Chinese S&T policy is to look at the budget of NSFC. Founded in 1986, NSFC is a national funding organization directly under the State Council with the mission of funding basic research. Receiving almost all the investment from the central government, NSFC has a total budget for funding basic research projects in 2006 is 3.4 billion Yuan (\$425 million). The annual increase rate of NSFC’s budget during the past two decades is 20% (Zhang, 2006).

The exciting increase could not hide the small absolute numbers when comparing with the budget of American NSF, \$1,353 million in 1986 and \$3.043 million in 2003 (NSF,online).

**Figure 2: NSFC annual budget, 1986-2006**



Source: Zhang (2006), <http://crds.jst.go.jp/CRC/report/200608CRC1.pdf>

Although a mission-oriented model has its historical and contextual reasons and could be regarded as a strategy for China to dealing with S&T development under disadvantaged conditions, the model is likely to stifle interest and creativity. As the missions are related to a few identified critical problems, resources only flow to limited fields related to solutions for these problems, and so opportunities of making innovative progress in other fields may be lost. What policy would be more appropriate for future S&T development is subject to careful investigation and consideration.

## Reference

- Brooks, H. 1967. Applied Science and Technological Progress. *Science*, Vol.156: 1706-12
- Bush, V. 1945. Science: The Endless Frontier.  
<http://www.nsf.gov/od/lpa/nsf50/vbush1945.htm>
- Cao, C. 2004. *China's Scientific Elite*. London and New York: RoutledgeCurzon.
- Chinese Ministry of Science and Technology,  
<http://www.most.gov.cn/ztl/qgkjdh/qgkjdhbjzl/qgkjdhbjzcq/index.htm>
- Hill, S. 1986. The Hidden Agenda of Science Studies for Developing Countries. *Science and Technology Studies*, Vol.4, No.3/4: 29-32.
- Hu, W.W.2003. A Summary of Research on the Influential Plans for Science and Technology Development in China. *Studies in the History of Natural Sciences*, Vol.22: 61-69.
- Huang, C., C. Amorim, M. Spinoglio, B.Gouveia, and A. Medina. 2004. Organization, Programme and Structure: An Analysis of the Chinese Innovation Policy Framework. *R&D Management*, Vol.34, No.4: 367-387.
- Long, J.S. and M.F. Fox. 1995. Scientific Careers: Universalism and Particularism. *Annual Review of Sociology*, Vol.21: 45-71.
- Merton, R.K. [1942] 1973. *The Sociology of Science*. Chicago: University Chicago Press.
- Moravcsik, M.J. 1985. Science in the Developing Countries: An Unexplored and Fruitful Area for Research in Science Studies. *AS Review*, Vol.3: 2-23.
- Morin, A.J. 1993. *Science Policy and Politics*. New Jersey: Prentice-Hall Inc.
- Nakayama, S. 1984. *Academic and Scientific Traditions in China, Japan, and the West*. Tokyo: University of Tokyo Press.
- National Science Foundation, <http://www.nsf.gov/statics/nsf04335/pdf/tables.pdf>
- Stokes, D.E. 1997. *Pasteur's Quadrant: Basic Science and Technological Innovation*. Washington, DC: Brookings Institution Press.
- The ATP Funded Technologies documented by National Institute of Standards and Technology (NIST) in 2001.*
- Volti, R.1982. *Technology, Politics, and Society in China*. Boulder, CO: Westview.

Waterman, A.T. 1965. The Changing Environment of Science. *Science*, Vol.147: 15.

Zhang, Y.L. 2006. NSFC and the International Cooperation.  
<http://crds.jst.go.jp/CRC/report/200608CRC1.pdf>

Zuckerman, H. and R.K. Merton. [1972] 1973. Age, Aging, and Age Stratification in Science. In R.K. Merton (ed.) *The Sociology of Science: The Theoretical and Empirical Investigations*. Chicago, IL: University of Chicago Press.

US:

When the men who wrote the Constitution of the United States came to consider whether and how scientific endeavors should be supported in their new nation, the issue soon became subordinated to the larger and more fundamental question of the powers to be delegated by the states to the central authority.

For many years, the scientific efforts of the nation were associated with activities for which the federal government has a clear constitutional mandate, and the government has little part in the great technological changes that were taking place.

A number of lessons were learned from the wartime experience which has a lasting effect on postwar science and on the much larger and very different efforts of WW II. One such lesson was the central role of research in developing economic strength. A second was the value of massive group research as a means of addressing critical problems. A third was the importance of establishing centralized control of scientific and technical resources in meeting a national emergency.

After the war, the large private foundations played an increasingly important role in supporting research, mainly in their own laboratories. The large research universities grew larger, and an increasing number of state-supported institutions, which had been focused only on agricultural and engineering research, began to emulate them.

Industrial research, though highly concentrated in the largest firms in a few industries, grew most rapidly of all. All of this went on almost entirely without government attention or support. The business and intellectual establishments were convinced that government intervention was both dangerous and inefficient in any sphere of activity, and the scientific community was persuaded that science could not flourish unless it was insulated from political influence.

The trends in federal expenditures for research and development from 1900 to 1940 show that a slow growth to 1915, a quick rise during WWI, steady growth in the 1920s that almost stopped during the depression of the mid-1930s, and then the rapid escalation that resulted from New Deal programs. Under Roosevelt's leadership, the New Deal agencies were focused on social and economic problems and tried to introduce some degree of central planning in seeking to ameliorate them.

A report titled as Research – A National Resource reflects the broader view of federal responsibilities that was emerging, which included a concern for the strength of university and industrial research as well as for the effectiveness of the government's scientific agencies. The report recognized the relationship of research and training, distinguished between basic and applied research and acknowledged the importance of the former, and for the first time considered the possibility of federal support for research conducted by outside organizations.

The events of WW II changed forever the character of research and its relationship with government. The prewar research community was small in size, based largely on private resources, and aloof from politics. Wartime and postwar research became an enormous enterprise, financed mainly by government, and inextricably involved in political processes. The pattern of the wartime effort was set very early by a remarkable group of men who were simultaneously effective as patriots, scientists, politicians, and administrators led by Vannevar Bush.

What Bush and his colleagues envisioned and quickly brought into being was an agency with its own funds, managed by civilian scientists who reported directly to the president, and independent of but coordinated with military and other government research activities. They sought to achieve speed and efficiency by capitalizing on the strengths of the nation's existing research organizations, rather than bringing scientists to work in newly built laboratories as in WW I. To do this, their great

innovation was the research contract, which enabled universities and industrial firms to work on wartime projects on a nonprofit but fully reimbursed basis and at the same time provided stability and independence to the individual investigators. In a debate about how government undertake their responsibilities for research activities in science, two major groups of protagonists – Kilgore (Dem from WV) and Bush - emerged, representing different constituencies and different points of view about government and science. Kilgore proposed the establishment of a well-funded central agency NSF that would support basic and applied civilian, military, and medical research and bring them to bear on national needs. To make sure the agency served public rather than private interests, the agency would be managed by a director appointed by and accountable to the president, and the scientific guidance it required would be provided by a board acting only in an advisory capacity. Bush and his colleagues saw that the reservoir of fundamental knowledge that had fueled the war effort and could fuel peacetime advances had been depleted; that the flow of new talent into science and engineering had dried up during the war; and that the academic institutions that produced both research and researchers could not do an effective job in the postwar without substantial and consistent federal support. Their principle concern was with the health of the research community and of its institutions, which they regarded as essential to the national welfare in themselves and for their own sake. They were also concerned with the dangers of political interference with the freedom of research and of permitting a centralized bureaucracy to control money given to scientific and educational institutions. In July 1945 a report called Science – The Endless Frontier was produced and has served as the Magna Charta for US science ever since.

## China Bets Big on Big Plan

The long-awaited S&T plan, a set of marching orders handed down to scientists last month, may set the tone of science in China for years to come. It specifies 16 major engineering projects, including design of large aircraft, moon exploration, and drug development. Four major basic research programs are high-lighted: protein science, topics in quantum physics, nanotechnology, and developmental and reproductive science. Although not stated in the plan, R&D spending by all sources, industry included, will rise from 236 billion yuan (\$30 billion) in 2005 to 900 billion yuan (\$113 billion) in 2020, Chinese officials announced last month. Basic research is slated to climb from 6% of R&D expenditure in 2004 to as much as 15% in 15 years. However, “basic science is still not playing a central role in the government’s mind,” asserts Shing-Tung Yau, a mathematician at Harvard Univ. As in the past, scientific activity will be yoked tightly to economic development. “New scientific knowledge and inventions need to be industrialized and transformed,” say Lu Yongxiang, president of the Chinese Academy of Sciences. A buzzword permeating the document and on the lips of science officials is “innovation”: the key, the plan states, to reducing China’s reliance on imported technology and intellectual property. Industry is expected to shoulder a heavier load than it currently does. For encouragement, the plan offers companies tax incentives to spend more on R&D. Others worry that a heavy emphasis on applied science and megaprojects will stifle creativity. “The most innovative ideas come from very few creative scientists at rare moments, whereas planning of large-scale projects requires the consensus of many scientists,” says Yi Rao, a neurobiologist at Northwestern University and deputy director for academic affairs of China’s National Institute of Biological Sciences. “It is unrealistic to expect very innovative science projects to come out of planning.”

Drafting the S&T plan was not straightforward. Twenty working groups involving 2000 scientists and officials wrangled over the document for close to 3 years, revising it a dozen times at a cost of \$10 million.

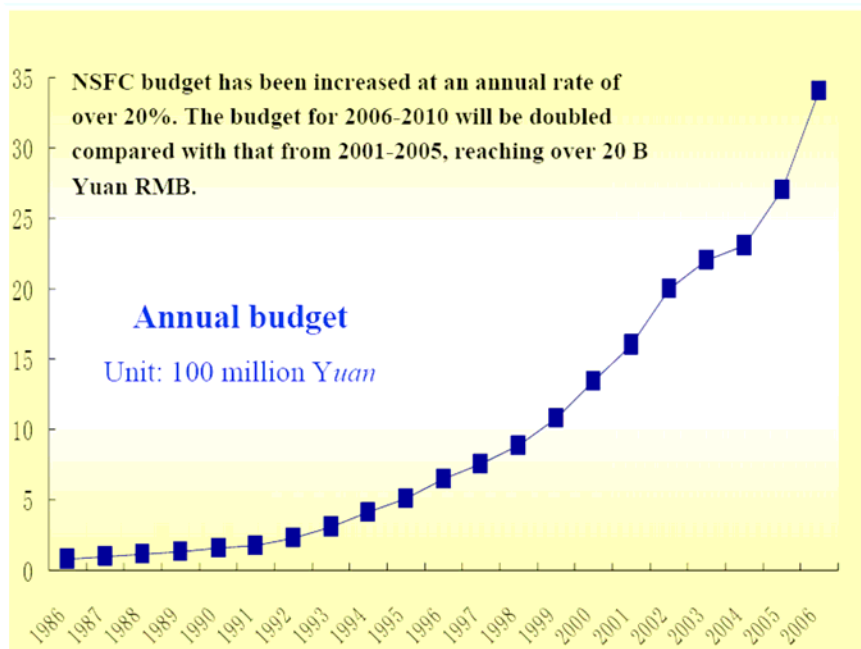
The four basic science programs deemed most strategic are areas in which China has already invested considerable sums. Each megaprogram is expected to receive about \$1 billion over the next 15 years, says a researcher close to government planners. Some critics worry that money will be wasted and that expensive new instruments will languish because there are too few skilled scientists to use them. Others see a strategic flaw: Enshrining narrow priorities in a 15-year plan could make it hard to change course in the future, noting that the plan ignores “many important areas.” “scientists may shift their research focus to favored areas in the plan. If they don’t, they can hardly get funding,” says Deng Xingwang, an agricultural biotechnologist and director of NIBS.

Even the country’s bastion of basic research funding, the NNSF of China, seems to toe the line. Although its budget is slated to increase by \$50 million to between \$400 million and \$500 million this year, sources say, its 2006 handbook stresses “an integration of the national strategic need and the independent development of science.”

## NSFC

Founded in 1986, NSFC is a national funding organization directly under the State Council for the management of the National Natural Science Fund, with the mission to support creative research and foster talents in basic science in China.

With almost 100% of the investment from the central government, NSFC's total budget in 2006 is 3.4 billion Yuan (\$425 million). The annual increase rate of NSFC's budget during the past two decades is 20%. (Chen Yiyun, <http://crds.jst.go.jp/CRC/report/200608CRC1.pdf>)



|      |           |
|------|-----------|
| 1970 | 274,789   |
|      | 318,286   |
|      | 427,270   |
|      | 463,953   |
|      | 520,256   |
|      | 570,015   |
|      | 595,776   |
|      | 688,300   |
|      | 743,502   |
|      | 800,025   |
|      | 873,687   |
|      | 955,464   |
|      | 973,165   |
|      | 1,061,990 |
|      | 1,202,820 |
|      | 1,345,583 |

|  |           |
|--|-----------|
|  | 1,353,335 |
|  | 1,470,505 |
|  | 1,523,773 |
|  | 1,670,396 |
|  | 1,689,535 |
|  | 1,785,223 |
|  | 1,868,397 |
|  | 1,881,889 |
|  | 2,040,358 |
|  | 2,149,277 |
|  | 2,188,313 |
|  | 2,248,520 |
|  | 2,289,337 |
|  | 2,506,031 |
|  | 2,725,512 |
|  | 3,043,484 |

Source: NSF/Division of Science Resources Statistics, Survey of Federal Funds for Research and Development: Fiscal Years 2001, 2002, and 2003

<http://www.nsf.gov/statistics/nsf04335/pdf/tables.pdf>

