
IMPERATIVES FOR CAS REFORM

NSR: ‘Pioneer Initiative’ (PI) has drawn much attention from the scientific community. What led to this remarkable Initiative for CAS reform?

Bai: On July 17, 2013, Chinese President Xi Jinping paid an extensive visit to the CAS Institute of High-Energy Physics, toured Beijing Electron Positron Collider facility, met representatives of three generations of CAS scientists (the ‘aged, middle-age, and young’), and participated in a CAS meeting, in which I gave a report on the overall progress of CAS. After listening to the reports and discussions, President Xi gave a long speech on his view of the future CAS development. In this speech, he affirmed the contributions CAS has made during the past six decades, and stressed that CAS should take its unique advantage of an organization with triple roles — as research institutes, national academy, and educational institution, and strive to become the country’s main source of innovative ideas, talents, and achievements. He further challenged CAS in taking the pioneering role in achieving ‘Four Firsts’ in China — first in achieving leap-forward development of S&T, first in building high grounds for cultivating innovative talents, first in establishing high-quality S&T national think tank, and first in building internationally leading research institutes.

In response to the appeal of President Xi to CAS and his recent call for comprehensive and thorough reform in China’s infrastructure for S&T development, we began to draft a roadmap for CAS in the next 15 years, and formulated the ‘Pioneer Initiative’.

NSR: Can we regard PI not only as a response to President Xi’s appeal, but also CAS’ self-assessment and planning for achieving its mission in the coming decades?

Bai: Indeed. Looking back at the history of CAS, we are now reaching the critical juncture at which reform is inevitable. The CAS was established on November 1, 1949, one month after the founding of People’s Republic of China. Upon the outset, Premier Zhou Enlai called for pooling the resources of the entire country in support of the development of CAS, and some best scientists in the country and recruited from abroad were assembled into CAS — ‘Empower the Chinese Academy of Sciences to make it the locomotive that leads the country in advancing the development of science and training young scientists’, Zhou proclaimed. At the time CAS was truly unique in China, and represented in real sense the country’s only S&T power house. Over the years, CAS grew and expanded its scope, by 2013 consisting of 104 research institutes and centers across the country.

In recent years, however, the research capability and achievements of many universities and ministry-sponsored research institutes have risen rapidly, with many research areas and programs often overlapping with those of CAS. This has raised the question as to the role of CAS within China’s strategic plan for its S&T development. This issue is real and urgent. Given the new era we are facing and the mission charged by the government, CAS reform becomes inevitable. We propose in the PI that CAS will proceed with the reform in steps. By
Four categories of new CAS research units based on the nature and goal of research activities

2020, we will accomplish the initial step of institutional re-structuring of a major portion of CAS research units, and by 2030, fully complete re-structuring and achieve the overall goals of ‘Four Firsts’ called for by President Xi. The establishment of modern innovative research organizations based on four distinct categories of research units within CAS will lay the foundation for China to become a major S&T power in the world by 2050.

**NSR**: Prior to announcement of the PI, what was the preparatory work CAS has done?

**Bai**: The PI emerged after a series of investigative and strategic meetings as well as consultation conferences. First, we established a CAS Advisory Committee, with members consisting of leaders from various ministries, to provide advice on the CAS reform. After the PI was drafted, we held a series of conferences in various cities to collect suggestions and opinions from a wide spectrum of scientific community. On July 7, 2014, PI passed the review by the National S&T System Reform Steering Committee. Vice Premier Liu Yandong and other leaders considered the Initiative to be a reform that is ‘creative and extensive’ as well as ‘eyebrow-raising and inspiring’. Most notably, President Xi made concrete and clear written instructions on the Initiative. He expressed his opinion that the Initiative has definitive goal and thoughtful design, and is on the whole a sound Initiative, but the key is the successful execution of the Initiative and the realization of its goal of contributing to China’s development into a major S&T based country in the world. Xi also clearly pointed out that in order to achieve ‘Four Firsts’, CAS reform must be ‘comprehensive and thorough, focusing the research on frontier areas of S&T, addressing the economic demands of the country, integrating the functions of research institutes, academy, and higher education, overcoming all intrinsic and extrinsic barriers, crossing boundaries within and without CAS, fully activating administration, human resources, facilities, funding, and research program, and making CAS China’s main driving force for future development’. He also instructed the government to carefully examine and adequately support the Initiative. Premier Li Keqiang and Vice Premier Zhang Gaoli subsequently made corresponding instructions, asking various government agencies to provide necessary support for the execution of the Initiative, including funding of research programs, recruitment and management of human resources, and translation of research outputs to industrial applications.

**RESTRUCTURING RESEARCH ORGANIZATION**

**NSR**: The PI calls for large-scale restructuring of CAS research units into four categories. What is the rationale and criteria for the categorization?

**Bai**: The categorization is based on the nature and goal of research activities. New research units within each category will have distinct research goals and special emphasis in the direction of their research and innovation.

Innovative Academies are applied research units in specific areas that integrate the resources and talents of the entire CAS, with clear goals for innovative outputs that could drive major advances in technological and economic development. Five innovative institutes have been designated in the initial phase, including microsatellites, space science, marine information science, information technology and drug development. The sixth one on advanced nuclear fission energy,
Thorium Molten Salt Reactor (TMSR), is also planned. In total, 20 innovative academies will be established by 2020. Centers of Excellence will perform basic research in the frontier sciences, with the goal of solving major scientific problems, developing new research areas, achieving scientific breakthroughs and advances of major impact in the world. Researchers from all CAS institutes with the expertise in the area will be selected to join the Center. Four centers have recently been established in the areas of quantum information, Tibet Plateau Geo-system, particle physics, and brain science. The goal is to establish 20 such centers by 2020.

Mega-Science Research Centers will be built on major facilities and platforms for innovative research in S&T, open to the entire country and to the world. About 70% of all such facilities currently existing in China were built by CAS, reflecting the unique feature and advantage of CAS that are difficult for universities to match. The facilities will include Hefei Major Science Center, based on big science facilities such as Tokamak for controlled fusion and high magnetic fields for multidisciplinary research, and Shanghai Major Science Center based on Shanghai Synchrotron Radiation Facility and Shanghai Protein Science Facility. Other facilities under planning include the Beijing Major Science Center based on the Protein Science Facility and Particle Collider Facility, as well as those in Lanzhou based on the Heavy Ion Accelerator Facility, and Dongguan based on China Spallation Neutron Source. We also plan to consolidate the 14 research vessels of CAS into a fleet, under central coordination and management, in order to improve the efficiency in their utilization.

Feature Institutes will be devoted to research in specialized areas relevant to sustainable economic and social development in China. For example, Institute of Mountain Hazards and Environment in Chengdu specializes in research on natural disasters, and had recently formulated a plan for solving serious landslide problem in Tibet that is required for establishing the Tibet-Nepal Port. Another example is Institute of Psychology, which specializes in research that provided immediate help in psychological consultation for earthquake survivors.

NSR: Can these four categories include all 104 research institutes and centers currently existing in CAS?

Bai: About 70 institutes could be included in these four categories. Some traditional institutes such as Institutes of Mathematics and Systems Sciences, Institute of Chemistry, Institute of Physics, Institute of Biophysics, Institute of Geology and Geophysics, etc. which were established on the basis of disciplines and have strong research capabilities, will provide direct service to the University of CAS (UCAS) and University of Science and Technology of China. For example, Institutes of Mathematical Sciences will be the major part of School of Mathematical Sciences of UCAS. Under this scheme, institute researchers will perform teaching duties as a formal part of their work, and there will be no need for UCAS to acquire research facility and capability. This will tightly integrate the research and education functions of CAS, while keeping CAS institutes as independent units within CAS. Other institutes and centers that do not fit into the above scheme will be merged or dissolved, with their researchers gradually integrated into the four categories of units described above. We encourage merging of institutes that are of the same category with closely related research programs, so as to avoid scattering of resources and duplication of research. For example, the former Center for Earth Observation and the former Institute of Remote Sensing have been merged recently, and more merging is planned.

NSR: How would the reform affect the future distribution of research funding and institutional development?

Bai: Half of the annual budget of the CAS comes directly from the CAS funding, and the rest from competitive research grants. The salaries of personnel, retired personnel and the costs of health care and other benefits all come from the budget. To secure sufficient funds, the researchers need to write many grant applications, leading to unnecessary competition, duplication, and fragmentation of the research programs. To address this problem, CAS will strengthen the funding mechanism that is guided by the potential major research outcomes, focusing on major research areas and S&T goals. We will establish a mechanism for efficient convergent investment of human resources, funding, and facilities, in order to increase the cost effectiveness of research funding.

NSR: Each new unit within the four categories will consist of researchers from research institutes and centers spread across the entire country. How could the re-structuring achieve the integration of research goals and ensure fruitful collaboration and team work?

Bai: This is an important issue. In the past, CAS institutes were relatively isolated and lacked cooperation and communication because of cross-institutional barrier or geographic separation. There are nearly 20 institutes in biological sciences, loaded with low-quality programs that are often repetitious and fragmented, a problem further exacerbated by the evaluation system of the researchers and institutes that are based on the success of grant applications. There are more than 20 institutes with research program on LED, some focusing on materials and others on
assembly, and isolated from each other, making industrial and commercial translation ineffective. There are 6,000 LED enterprises in China — what problems did CAS institutes help them to solve? Scientists want to be the first in their findings, publish good papers, but enterprises need high-quality integration of results and cost effectiveness, and being first in finding one thing is not sufficient. There is clear discrepancy in the needs of scientists and enterprises. This is true in other areas as well, such as energy sources. The re-structuring of CAS units into four distinct categories is aiming at solving this problem.

For example, stable research funding and additional salary bonus will be incentives for team members of the new research units to relieve the anxiety of researchers on funding issues. Corresponding policies on authorships in publications and credit allocation of intellectual properties will be established to facilitate collaboration and team work.

**NSR:** Establishment of high-level S&T think tank is one of the four main goals of the Initiative. What is the status of current S&T think tank in China? What could be the unique feature of the CAS think tank?

**Bai:** For example, the S&T think tank of CAS suffered in the past from the lack of unified and shared support and research platform, poor organization and coordination, insufficient sensitivity to the country’s needs, inadequate research methods and management system, and relatively low yields of high-quality innovative ideas. Thus the potential function of the think tank has not been realized.

In the Initiative, we will organize a CAS S&T Strategy and Consulting Institute. Through this institute, we aim to explore new mechanisms for an effective research and management platform, making CAS a source of innovative ideas for solving major problems in China’s economic and social development, as well as opinions and recommendations of impact for the government’s S&T planning, policies, and decisions. We hope the CAS will become a reliable and trustworthy think tank for the country, and internationally renowned for its distinct features and impact.

**NURTURING SCIENTIFIC TALENTS**

**NSR:** The resource of scientific talents, especially young talents, is critical for achieving the goals of the Initiative. What new measures are in store?

**Bai:** As early as 1994, the CAS initiated ‘The 100-Talent Program’, which has successfully recruited more than 1,000 young Chinese scientists from abroad. Over the past two decades, these scientists have provided an important base for the development of CAS, and this program has become one of the most successful career development programs in China.

With the implementation of the Initiative, we will initiate a series of new programs, including a new ‘100-Talent Program’ and a distinguished investigator program that aim at recruiting and nurturing high-level innovative scientists. On the other hand, as I proposed when assuming the CAS Presidency, CAS will ‘initiative for the forest, but let trees freely grow’. We will further improve the research and living environment for young scientists to develop their career, in order to fully realize their potential and play key roles in creative research activities.

**NSR:** Stable support for the young scientists and an evaluation system that allows long-term exploration on difficult problems seem to be critical elements for innovative research. Is there any measure along this direction in CAS?

**Bai:** The ‘100-Talent Program’ of the CAS has such intention, but for how long and to what extent we could stably support a scientist is still under consideration. On the other hand, we must distinguish the difference between exploratory and task-oriented research. Many CAS units perform contracted research with clear goals and timelines. There are also more than 400 CAS-affiliated companies. Thus, differential modes of support and evaluation must be adopted.

**NSR:** Besides nurturing young talents, CAS also has a mission in educating the next generation of scientists. Can you comment on the newly established University of CAS (UCAS)?

**Bai:** The UCAS will fully demonstrate the unique ‘Three-in-One’ feature of CAS, combining distinct roles of the national academy, research institutes, and educational institution. Members of CAS will set the direction for the development of various disciplines within UCAS and inspire the students for their scientific pursuit, while CAS institute researchers will offer practical instruction and active research experience for their scientific training. Each UCAS student will be assigned a CAS researcher as a mentor — such educational resources can hardly be matched by other universities.

I want to emphasize that close link between CAS research institutes and UCAS is critical for cultivating innovative talents. This is why we need research-intensive universities to integrate teaching and research. Given the large amount of excellent researchers, facilities and research programs in CAS, there is no reason for CAS not to serve the country in educating our young generation. In fact, CAS has already cultivated more than one hundred thousand graduate students in the past in our graduate programs associated with various institutes. Beginning this year, UCAS is also admitting 300 undergraduates.

**NSR:** Would UCAS set up branch campuses outside Beijing, given that CAS research units are distributed across the country?

**Bai:** Branch campuses could be set up in places where there are CAS branch offices. But there will not be many. For example, a UCAS Shanghai campus could be considered. We will proceed step by step.

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—Chunli Bai
INTERVIEW

INTERNATIONAL COLLABORATION AND OPEN POLICY

NSR: In this age of globalization, international collaboration is playing an increasingly significant role in scientific research. How is CAS moving along this direction?

Bai: CAS has always stressed the open-door policy in research activity, and has been actively engaged in collaboration with academic and industrial organizations both at home and abroad. In order to further enhance and expand international collaboration, CAS is taking the following actions. First, we are implementing an ‘International Recruitment Program’ that aims to attract high-quality overseas Chinese scientists and graduate students to work at CAS. We are also offering international fellowships under ‘the CAS President’s International Fellowship Initiative (PIFI)’, to support highly-qualified international scientists and postgraduate students to work and/or study at CAS institutions and to strengthen their scientific links and collaboration with CAS researchers. We expect to increase the number of foreign researchers from 1% up to 3% in 2020.

To fully open CAS resources, we are establishing S&T Service Network to accelerate the dissemination, translation and transfer of knowledge and technological advances into practical application. We are also developing national open S&T public resource platforms of international standards, which will be accessible to the public and the entire scientific community.

In order to develop sustainable platforms for international collaboration in scientific research, CAS is collaborating with international partner institutions for the establishment of joint centers of excellence overseas, say, in developing countries. Currently, five such units are being planned, including the CAS South America Center for Astronomy, China-Africa Joint Research Center, CAS-INPE Joint Laboratory on Space Weather, CAS Central Asia Drug Research & Development Center, and CAS Central Asia Eco & Environmental Research Center.

DISCONTENT AND INEVITABLE REFORM

NSR: Reform often implies re-allocation of resources according to new rules; it inevitably brings discontent and pressure to the person in charge. How do you deal with this problem?

Bai: I began my service in CAS in 1996 as the Vice President in charge of education and human resources. Now it is my 19th year in the CAS. I am emotionally attached to CAS, and fully understand some of the dissenting opinions. After all, our opinions are often biased by our positions within the system. When I was a group leader at the Institute of Chemistry, I could not understand why the institute director charged management overhead on my research grants. However, when I myself became the director, I realized that much of logistic service, building maintenance, electricity and water all need funding that requires researchers to chip in their resources.

The reform of CAS administrative structure has already begun since last year. The CAS governance structure in the past has many problems. Originally established on the basis of disciplines, various bureaus had overlapping functions but separate budgets, lacking efficient coordination and clear management hierarchy. We thus dissolved five bureaus and reorganized them into three, causing drastic changes in existing positions including bureau directors and division heads, and nobody got promotion during the reform. The reform of CAS administrative structure can be viewed as a prelude to the current reform down to research units. This will be more difficult and I am ready to face the challenge.

CAS must produce some unique and breakthrough achievements in S&T that better justify its existence as the most prominent research institution in China. —Chunli Bai

As the CAS President, I must consider the CAS development based on the mission of CAS and the needs of the country. To avoid discontent, I could maintain the status quo, without antagonizing anybody. We can continue to count the increasing number of high-impact papers each year, and fulfill our duties as charged by the government, such as providing contributions to the recent major advance in the manned space flight. These are glorious achievements that CAS could claim to have fulfilled its mission. However, at this critical juncture of China’s development into a major S&T power, CAS must produce some unique and breakthrough achievements in S&T that better justify its existence as the most prominent research institution in China. As the President of CAS, I have to take the responsibility, and carry out this reform that is clearly inevitable and timely for CAS.

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