SCIENCE INTERVIEW

China's Science Reforms: The View From the Top

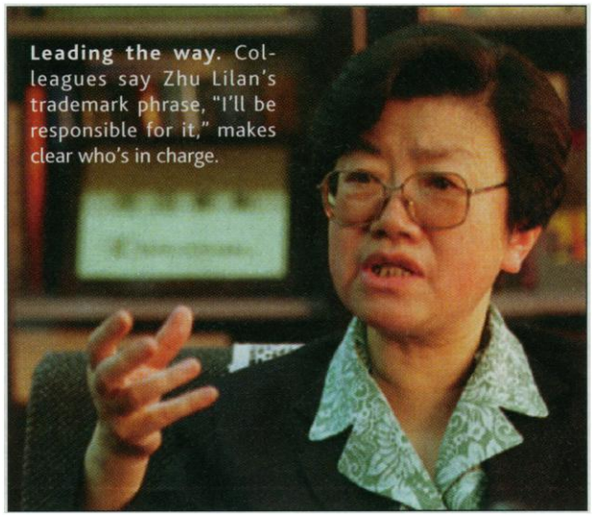
Zhu Lilan, a polymer chemist, discusses China's efforts to improve science and harness it to sustained economic growth

BEIJING—Zhu Lilan has already earned at least a footnote in history for being China's very first minister of science and technology. But the former polymer chemist isn't content with that achievement. "Only through making a real contribution can you justify your position," she says. In fact, hundreds of thousands of Chinese scientists are being asked to do exactly that—justify their positions—as part of a massive, long-term government reform aimed at harnessing new technologies for economic growth. "Before, the state allocated financial resources according to how many people you had under you," she says. "Now it will be according to what you do and how well you do it."

Zhu, 63, is a product of the old research system, modeled after that of the Soviet Union, where many senior Chinese scientists were trained. After studying polymer chemistry at I. I. Mechnikov Odessa State University in Ukraine, Zhu joined the Chinese Academy of Sciences' (CAS's) Institute of Chemistry in Beijing in 1961 and rose through the ranks to become director in 1985. The next year she moved to the State Science and Technology Commission (SSTC) as vice minister, the first woman to hold that post. There she oversaw segments of a new program, called the 863 project, to develop world-class high technology in 15 areas.

Wang Dahang, a prominent optical scientist who co-authored a proposal to the government that led to the 863 project, says Zhu "played an active role in making the project a success. She set up a system of running the project through expert committees, which proved very effective." Last year the science commission was turned into the Ministry of Science and Technology (MOST), and Zhu succeeded longtime SSTC Minister Song Jian at the helm (*Science*, 27 March 1998, p. 2034).

Her promotion comes at a crucial time for Chinese science. The government has made research one of the pillars of economic progress and pledged to increase R&D spending substantially. CAS, which operates the country's leading research laboratories, is being given $650 million over 3 years—an amount equal to the academy's current operating budget—for a "Knowledge Innovation Program" (*Science*, 8 January, p. 150). The goal is hardly controversial: increased support for fewer, top-level researchers and greater reliance on peer review to raise the quality of the basic science being supported. But the process—cutting overall staffing of 68,000 by more than half and introducing wide-ranging management reforms—is expected to be a painful one.



Leading the way. Colleagues say Zhu Lilan's trademark phrase, "I'll be responsible for it," makes clear who's in charge.

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China's system of support for more applied technology is also undergoing a painful shake-up. MOST itself has just launched the 5-year, $300 million 973 Program, so named because it was approved in March 1997 (*Science*, 18 December 1998, p. 2171). Its generous grants to peer-reviewed proposals in six broad areas deemed economically or socially important—life and information sciences, agriculture, natural resources and the environment, energy, and new materials—come at the same time hundreds of technology labs are losing their guaranteed state funding.

Although most scientists agree with the need to make Chinese R&D more efficient, some criticize the harsh medicine being administered. And others, including Wang, argue that the government should pay more attention to basic science and understand that its findings don't necessarily translate into immediate economic payoffs. There is also a push to broaden the decision-making process and bring in more working scientists to set R&D priorities.

Zhu has earned a reputation as a no-nonsense administrator who isn't afraid of tackling such issues. "I'm known as a harsh old lady," Zhu said at her elevation to the SSTC post in 1986, "although I'm not mean." However, subordinates say she's quick to cut people short if she feels that their presentations are long-winded. And they say that her trademark response to policy debates—"I'll be responsible for it"—serves as a not-so-subtle reminder that she enjoys exercising her power and that she expects colleagues to meet her high standards.

Zhu discussed these and other matters shaping Chinese science in a 2-hour interview on 29 January in her office in Beijing. An edited transcript follows.

Q: *CAS has undertaken a major reform that involves cuts in the number of institutes and staff. How did that reform originate?*

A. Reform has been in progress since 1985, when the government decided that scientific research and development must be oriented toward the economic development of the country and that economic development must rely on the progress of science and technology. At that time, the science and technology establishment was not rational. Too many scientists were involved in pure research and not enough were engaged in solving problems of national economic development. As a result, [it was decided that] there must be a movement of people within the science and technology sector.

The objective is not to cut the number of people. Rather, we want scientists and researchers to find where they can make their best contribution. In basic research, we wish to see fewer but the very best scientists, with more people moving toward the marketplace and serving economic development. The goal is to enable [business] enterprises to become the main source of technological innovation, while the research institutions and universities become the main source of knowledge innovation. Some intermediary organizations or agencies will emerge to facilitate the commercialization of research achievements.

On a practical level, it is up to [each institute] to reform itself. We give them a goal and allow individual institutes to reach the goal in their own ways. [The institutes] approach us, not for permission but to get support and help. For example, the academy has been granted a

large amount of money [for the Knowledge Innovation Program]. MOST, as a government agency, has set the final goal and will monitor the use of that money. We will say, "The state has given you scores of billions of yuan [8.3 yuan equal $1]. How many scientific achievements have you made? How many technological innovations have you made? If you have filed no patents and published no papers in *Science*, you will be held responsible!

Q: *Will similar reforms be implemented at universities and other national institutes?*

A. Yes. This stage of reform is to be completed within 3 years. For example, 10 former ministries have been made bureaus or departments within the State Economic and Trade Commission. The reform of 242 mostly applied research institutes under these former ministries must be completed by June. The aim is not to reduce the number of research institutes or the number of scientists and researchers, but to run these research institutes like enterprises, to industrialize science and technology. These institutions are still entitled to apply for financial assistance for their projects and to participate in our national programs, including the 973 Program. But [winners will be chosen] through competition.

Q: *Traditionally it has been difficult for researchers to move from one institution to another. Will the reforms allow for greater mobility?*

A. We wholly encourage them to do so. But, really, not many are willing to move.

Q: *How were the priority areas selected for the 973 Program?*

A. There were three steps. First, we in MOST, the National Natural Science Foundation (NNSF), and the whole science community reached consensus on the guidelines or principles, the criteria for selecting projects, and the selection procedure. Then we established an expert committee headed by [former CAS president] Zhou Guangzhao and including other prominent scientists from various disciplines. The priority areas were first reviewed at a lower level within MOST, then by the expert committee, before MOST made the final decision.

Q: *Last year China adopted new rules on the export of genetic materials. There is also concern from abroad about censorship of the Internet and control over e-mail. Do you think these policies will hamper attempts to improve scientific links between China and the rest of the world?*

A. A lot of scientific advances, like the Internet, are like double-edged swords. They have both positive and negative aspects. If you fail to handle the negative aspect well, the positive impact will be limited. Our general principle is to promote the healthy development [of such tools]. The challenge is how we make sure that our regulations benefit such development. Many questions concerning the Internet are being debated and discussed throughout the world and also in China.

There are a lot of high school and even primary school pupils interested in using the Internet. On the whole, this is a good thing. But there is also some inappropriate material on the Net, erotic pictures, for example. So we cannot let them have free access without checks. As for genetic materials, on the whole we intend to facilitate collaboration, but we have to ensure mutual benefit under established rules. These rules should enhance the collaboration, not stop it.

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>
> —Zhu Lilan

Q: *Who sets policy for CAS and NNSF?*

A. Policy is a form of guidance rather than an order. We solicit suggestions from all those concerned and we reach a consensus. On that basis, everyone in the field has to make efforts to achieve the goals established by the policy.

Take fundamental research. Scientists would like greater freedom to pursue their own interests. But we are a developing country with limited financial resources. We respect the individual interests of scientists, but we try to persuade them to match their individual interests with national needs and challenges. Some scientists do not totally agree with that, but we have to find ways to combine the two.

Q: *Why did the State Science and Technology Commission become the Ministry of Science and Technology?*

A. There's no essential difference between the ministry and the commission. To us the most important point is the [national] strategy of reinvigorating China through science and education. This strategy makes me both happy and anxious: happy because the leaders of our society are attaching more importance to science and education, and anxious because we must make sure that we can help advance social progress and economic development.

Q: *What is the relationship between the ministry, CAS, and the NNSF? And what is the role of the State Council and the new Leading Group on Science and Education?*

A. The roles of the three organizations you mentioned are fundamentally different. Our ministry is responsible for formulating national policies on science and technology and overseeing national programs or initiatives. We have no research institutes whatsoever. CAS is a research entity [with] about 100 research institutes that carry out work in accordance with national policy. The NNSF was set up [in 1985] to develop China's basic research, and the researchers it supports have more freedom [than in projects supported by individual ministries].

The Leading Group on Science and Education [of which Zhu and Lu Yongxiang, president of CAS, are members] is part of the State Council and is headed by Premier Zhu Rongji himself. It coordinates all efforts related to science and technology carried out by the different ministries and commissions.

Q: *What challenges face developing countries seeking to move into the front ranks of science?*

A. We have entered a new era in which scientific and technological development is vast and extremely quick, and its impact on economic development is also powerful. This presents a new opportunity for latecomers. To give one practical example, in developed countries, thousands of miles of copper cables have been laid for communication lines. But the latecomers, the newly developing countries, can go in one step to fiber-optic cables.

Q: *What do you hope to accomplish as the first minister of MOST?*

A. We aim to increase the contribution of science and technology to the national economy by another 10 percentage points. We estimate that advances in science and technology currently account for 40% of the annual growth in agricultural production and for 30% of industrial growth. The idea is to rely on scientific progress while proceeding from market demands, in accord with a Chinese saying that roughly translates as reaching for the sky while keeping your feet on the ground.

–DENNIS NORMILE AND XIONG LEI

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