

WORKING PAPER

**China's Development Policy
in Science and Technology**

Prof. Song Jian

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Foreword

This lecture by Professor Song Jian was delivered at IIASA in March 1987, five months before I became Director of the Institute. My first hand knowledge of this event is therefore limited to the written text.

In a few pages, Professor Song Jian provides some most instructive and perceptive guidelines not only for the accelerating development of the most populous country in the world, but for a country of any size that sets its sights upon becoming a peer within the group of economically and socially advanced societies. Even though caution is advised in claiming too much success with current programs, great confidence is expressed in the eventual achievements resulting from the opening of China to a new world of opportunities.

Robert H. Pry
Director

China's Development Policy in Science and Technology

Address at IIASA by Prof. Song Jian,
Chairman, State Science and Technology Commission (SSTCC)
People's Republic of China

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During the last decade or so, systems analysis and its associated theories and methodologies have come to enjoy an increasingly favorable reputation, not only in the scientific community, but also among the public. The winning of Nobel Prizes by L.V. Kantorovich–T.C. Koopmans and Ilya Prigogine marked an even more thriving period for systems analysis. A few years back, some young social scientists regarded systems analysis as a panacea for all social dilemmas. Recently, others advocated synergetics, dissipative structure theory, and catastrophe theory, as though catastrophe theory would eventually bring happiness to mankind! In any case, through its remarkable achievements and successful applications, systems analysis has gained strong recognition and appreciation and evoked equally great expectations. This is certainly very encouraging in one sense, but a mixed blessing in another.

Some years ago, when I was still wholly devoted to research, I, too, felt that systems analysts could one day unequivocally formulate all the world's problems with mathematical equations. It seemed to me that some officials were often caught in dilemmas and troubles only because of their lack of knowledge of systems analysis. It was even convinced that, once we could discover the key control variable of problems under consideration, we would be able to solve any of them readily. If that were true, we would be living in a much better world today. A few months ago, I came across an article, titled "Economic Sciences and Mathematical Models", in a September issue of Pravda. The author, too, believed in the omnipotent power of mathematical models and computers for solving any economic problems on earth. So I was happy not to be alone in my optimism.

However, since I began to handle government affairs, I have gradually come to realize that my faith in the omnipotence of systems science was at least partly misplaced. We must admit frankly that many important issues are simply beyond quantitative description. The mathematical tools proved by systems science today fall far short of describing all social phenomena, let alone accounting for such complicated factors as political movements, in China or elsewhere. I came to the understanding that many serious

problems in society as well as in science and technology policy-making often call for combination of scenario analysis and system analysis. In many cases, one can do better by using simple logic and popular verbal expressions in persuading people to do something. Unfortunately, this was something I underestimated in the past.

I will, therefore, use scenario analysis instead of mathematical equations in my talk today.

I. Reform and Opening to the Outside World

Many of us feel that the world today is full of uncertainties, misfortunes, and sometimes miracles. But it is not my intention to elaborate on problems of a global scale as many of you at IIASA do. I seek your permission to speak about some local problems, i.e., what is happening in China. I hope this topic will be of some interest to you.

For many historical reasons, China has long isolated herself from the outside world. After the ten years of the "Cultural Revolution", the door began to open and the Chinese people, as if suddenly awakened from a dream, found themselves in a thoroughly changed world. During those years, many comparatively poor nations bid farewell to poverty and joined the rank of developed countries. In China, meanwhile, per capita income remains less than 250 US dollars in 1980, and people still lived on scanty means. This caused grave concern and became a strong motivating force for a national reexamination. Historians searched for reasons why China was so slow in developing. Writers produced sentimental literature to arouse social consciousness. Natural scientists examined social problems extensively, neglecting their own professional explorations. Political leaders and social theoreticians bravely proposed policies of reform, advocated opening China to the outside world, and even went so far as to initiate the unique concept of "one country, two systems". The whole nation plunged itself into an endeavor to restructure its political and economic systems as well as its scientific technological, and educational enterprises. China made up its mind to draw on all positive experiences of developed countries in economic, scientific, technological, and management fields so as to establish a new socialist society in conformity with its traditional culture.

The reform carried out across China has multifold objectives. It aims to emancipate productive forces, accelerate economic development, and perfect legal institutions that will ensure and protect the rights of people to life, liberty, and democracy. The possibilities of political catastrophe must be precluded once and for all. The reform started in the

rural areas and has proved to be a great success. Two years ago, it was introduced to urban areas and the result has been encouraging. Production has steadily gone up during the last five years, while markets have flourished and household income increased by 2.6 times. National industrial and agricultural production has been increasing at an annual rate of more than 11 percent. China's economy has entered into a period of stable and continued development. Surprisingly, the government is now worried about the fast-paced growth and is trying to slow it down.

Recently, such study has been devoted to the concept of "separating management from ownership", and such a program has been implemented on an experimental basis. Some medium and small state-owned enterprises will be contracted or leased to private groups or collectives for independent management. This approach aims to transfer all management responsibility and authority to entrepreneurs while retaining socialist ownership. The experience with small enterprises has proved successful so far. In this way, it is expected to inject vigor and vitality into all state-run businesses.

China's determination to open itself to the outside world is based on a fundamental understanding of the nature of modern society: science and technology have woven our world into a closely related, international system. No country wishing to keep up with the rest of the world can stay aloof from it. No country, no nation can enjoy the full blessings of modern civilization if it remains in a closed, self-sufficient, and isolated environment. The globe has shrunk to no more than a village. Gone are the days of idyllic rural life. Based on this understanding, China is determined to join the international system. Thus, all our efforts, whether political, diplomatic, economic, scientific and technological, or social, must be considered in such a worldwide context, and all policy decisions must be judged within this framework as well. This policy has already resulted in initial success.

Needless to say, all things in China are far from perfect. Difficulties do exist, and reforms inevitably involve risks. Therefore, the Chinese government is taking an extremely cautious approach, as if skating on thin ice. But we are full of confidence. A harmonious, democratic, free, and vital society, friendly to all nations, is being born. China, this ancient nation, is awakening and will appear rejuvenated. She is extending her hands to all kind hearts. Peace and development, more friends, more strength - these are China's unfaltering convictions.

II. The Sparks Program

Since it is my responsibility to outline the development strategy of China's science and technology, I would now like to speak about an important aspect of the reform that is related to science and technology policy.

During the past 30 years or so, Chinese scientists have made valuable contributions to their country. In an almost totally isolated environment, they mastered space technology, nuclear technology, synthesized for the first time bovine insulin, and so on. All this has been well recognized by the international scientific community. However, due to faults in management systems rather than negligence of scientists, science and technology were not closely linked with economic life and social development of the country. Scientists and engineers seemed to live in a world quite apart from everyday social life, devoted totally to their own professional interests in an "ivory tower", and paying little attention to the nation's economic life.

China has a rural population of 800 million, some 80 percent of the total. Like many people in developing countries, they have subsisted over the past in a modest natural economy and under the trammels of their ancestral traditions. This situation urgently calls for change. It is incumbent upon scientists and engineers to help farmers change their way of life. A philosopher once said that science is not for private and selfish enjoyment; those fortunate enough to engage in scientific research must, first of all, serve people with their knowledge. Recently, Chinese scientists and engineers have resolved to help the people of rural areas update their views and outlooks in particular, helping farmers cast away their long-accustomed concepts of a self-sufficient natural economy by introducing new ways of production and new styles of life, taking full advantage of modern science and technology.

Towards these ends, we initiated the "Sparks Program". The objectives are to train millions of young farmers into technically skilled personnel, to establish a number of technology-based demonstration enterprises, and to develop and supply mechanical equipment suited to production and social activities in rural areas.

As with all developing countries, capital accumulation poses a serious problem for the vast stretch of China's countryside. Yet, based on small government appropriations and local governmental support, we have succeeded in collecting more than 2.3 billion yuan (US\$ 1 billion), mainly from farmers, and in 1986 more than 4,000 small demonstration enterprises were set up under the Sparks Program. Last year, over once million young farmers received training and each of them learned to use one or two special production technologies with which they can start small businesses. Total production in

rural and small township enterprises in 1986 reached 330 billion yuan – the equivalent of 100 billion US dollars – an increase of 20 percent over the previous years.

Where should China's rural economy head? This is a strategic issue of far-reaching significance. The historical path of Western countries by allowing farmers to go bankrupt and flood into congested urban areas would not be an appropriate choice for socialist China. China's development strategy is to create many medium-size and small cities and townships in its vast rural areas and achieve industrialization right there. The government will finance the public services – communication, energy supply, transportation – to transform the whole of China into a network of cities, and avoid pressure on metropolises from rural population outflow. The Chinese government and scientists are exerting a concerted effort toward achieving this strategic goal and expect full benefits from its.

Last year, tens of thousands of young scientists and engineers, breaking free from the restraints of old systems and departing from governmental and research institutions, courageously went to rural and remote areas to start small enterprises. Some of them became factory directors and chief engineers. Together with local farmers, they set up orchards, greenhouses, aquacultural businesses, food processing industries, poultry and animal husbandry enterprises, building material firms, etc. With the introduction of different kinds of ownership and management, either on an individual, partnership, or corporate basis, many small public enterprises were leased to entrepreneurs together with full management authority, which, to a great extent, improved their performance and labor productivity. Rural household income increased greatly, and government tax revenue grew considerably. All that has paved the way for rural industrialization. As a result, the individual, the collective, and the state all benefited greatly, in contrast with the past practice of rigid government planning.

Indeed, there are people who are rather concerned whether this new approach will lead to income polarization, that the rich and the poor will grow too far apart. We believe that this will not happen in China. The government will balance individual incomes through taxation. This is a distinctive form of society and ideology and, as Deng Xiaoping once expressed, it is one of many features of the socialist system with Chinese characteristics.

As stated earlier, the Sparks Program aims at popularizing the concept of a modern commodity economy and the methodologies of science and technology in the vast rural areas. It has received full support from governments at various levels and a warm welcome from peasants. In fact, it has already created a great momentum for rural industrial development throughout the country. In spite of the money-contraction policy by all banks in China during the past two years, the total output from rural industries increased

by 20 percent in 1986 over 1985. Many international organizations considered the Sparks Program a good experiment for all developing countries. A number of European countries and international organizations have shown interest. The World Bank is considering low-interest loans for it, and the United Nations Fund for Science and Technology wishes to share this experience with other developing countries. But let's wait a while. When China's GNP has achieved a fourfold increase over today, we will have something better to offer.

At any rate, I am a staunch advocate of the Sparks Program and have full confidence in its success.

III. High Technology In China

We are well aware that the Sparks Program is just a project for rural economic take-off. It alone cannot turn China into a developed country. To do that, we need modern industries with high technology. China cannot remain backward in high technology areas for long. Therefore, it has set out to formulate and implement a development program of high technologies. It intends to bring about a transition during the next 10 to 15 years toward modernizing China's industry, agriculture, and service sectors. The program will cover biotechnology, informatics, automation technology, material sciences, energy technology, laser and space technologies, and so on.

China has decided to accord top priority to the development of bioengineering, in view of the country's large population, which will increase considerably toward the end of this century despite remarkable success in family planning and strict implementation of the one-child policy. This is due mainly to the inertial effect of population dynamics. It has been proved that, in a linear approximation, the time constant of population dynamic process equals the average life expectancy, which is about 70 years. Therefore, the Chinese population size is expected to exceed 1.2 billion by year the 2000 and may reach as high as 1.5 billion by 2050. Agriculture, animal husbandry, medicine, health care, and all other activities closely related to human life will then depend on progress in biotechnology. We shall attempt to develop high-yield, disease- and frost-resistant plant strains; new breeds of domestic animals and poultry; new medicines for hepatitis, cancer, and cardiovascular diseases; and upgrade traditional Chinese medicine to a modern and scientific level. At the same time, research will go into eugenics and child care, to guide people in bringing up a new generation superior both mentally and physically to their parents.

The development of high technologies has become the strategic goal for many countries. Developing countries cannot afford to lag behind from long in this regard and allow further economic disparity with developed countries. The Chinese government has decided to allocate a considerable amount of resources during the next 15 years to support high technology development. Extensive cooperative programs will be carried out with all countries, on bilateral or multilateral bases, including joint research. For example, China enjoys excellence in bioengineering and has thousands of first-rate scientists in this field. For the first time in the world, they synthesized bovine insulin in 1965 and have succeeded recently in synthesizing yeast phenylalanine transfer RNA. In the hybridization of rice, wheat, and corn and cross-breeding of fish, etc., they have also made much progress and begun exporting these results to Western countries.

China is prepared to enter into cooperative relations in various forms with developed countries in high technology. China is open, and we share the common belief that science knows no national boundary. No matter where they are developed, the fruits of science and technology are meant for all mankind.

As a developing country, China cannot yet afford to support full-scale development of all scientific disciplines, as many more fortunate countries do. However, China is making great efforts in building up its research facilities both in basic and applied sciences. We are presently constructing a 2x2000 MeV electron-positron collider and a 100 MeV heavy ion accelerator. A kind of TOKAMAK facility is already in operation. During the next 3 to 5 years, we plan to build 50 national laboratories and research centers equipped with modern facilities, in which young scientists can fully exercise their wisdom and translate ideas into realities.

At the same time, China must bring up large numbers of well-trained scientists in frontier sciences and basic research for tomorrow. Apart from training in its own universities and institutions, China encourages and supports its young people to study abroad. During the past few years, more than 33,000 young and middle-aged students and scholars have been sent abroad, and some 20,000 are still studying in the USA and Europe. It is planned that 6,000 students or scholars will be sent abroad annually in the future.

In addition, we will undertake extensive international cooperation. While some Chinese scientists have had opportunities to do research abroad, scientists from other countries are equally welcome to join their colleagues in China in programs of mutual interest.

China is open to all countries, and our welcome goes to all who wish to visit China, whether for lecturing, joint research, or just to take a look at what is happening in that vast land. You will surely find that the once-sleeping giant is now moving toward

modernization at a rate unprecedented in history. The ancient kingdom will soon emerge as a young and vigorous nation.