The Continuing Evolution of China's S&T Program

Chen Zhaoying[1]
Executive Director, National Center for Science and Technology Evaluation (NCSTE)
Beijing, China

Abstract

Mirroring the progress of reform and development of Science and Technology in China, China's S&T Programs[2] are an effective means for the government to direct and readjust S&T activities and compose an important channel for the state to invest in R&D activities.

To begin with a brief review of the birth, the development and the status of China's S&T programs, the paper will then briefly introduce the Programs under implementation, i.e. the S&T Programs in the 10th five-year plan period. Thirdly, the paper will analyze the composition and evolution of China's S&T programs from the aspects of strategic goals, sources of fund, input priorities, human resources involved in programs, government's role as well as administrative mechanism.

The paper will also list several critical issues on China's S&T programs, which have all along been hot issues in China's S&T circles and some of which are still widely argued and disagreed. The author attempts to reveal main points of different views, disputes, and the issues which bear further discussion.

Instead of an overall introduction of China's S&T programs, the paper will focus on the analysis and discussion of the programs from the perspective of a policy researcher and program evaluator. At the end of the paper, the author would like to share her personal observations of, reflections on and puzzles about S&T programs in China with the reader.

[1] This paper is written by the authors in her personal capacities. The views and opinions expressed in the paper do not necessarily correspond with the views of NCSTE.
[2] China's S&T programs mentioned hereinafter are S&T initiatives at national level, not including S&T programs for military purpose.

1.0 Introduction

This paper will, through a review and an analysis of China's S&T Program, meet the target of clarifying the issues on China's S&T development during the recent two decades.

Why is it indispensable to review and study China's S&T Program if one hopes to understand S&T development in China in the recent two decades?

Mirroring the progress of reform and development of China's S&T in the past two decades, China's S&T Programs are effective means for government's macro regulation of S&T development. They also compose a crucial channel for government's R&D input and embody the state's will in S&T. The author believes that S&T Programs play a crucial role in helping observe and study China's S&T development because

1. If one hopes to understand China's S&T activities in the recent two decades (R&D activities in particular), one should first of all know its S&T Programs. In China, as the government has all along been the main investor and organizer of S&T activities, S&T Programs are accordingly the primary means to put S&T activities in practice, i.e. if the government means to support a S&T activity, it must be preceded by a program so that the government will put in capital and management in accordance with the program. For instance, the construction of the National Laboratory of China was carried out by strictly following the program.

2. If one expects to understand the role of the government in China's innovation system, one must first study the role of S&T Programs in this system because S&T Programs in China are innovative activities organized by the government.

3. If one hopes to study the reform process of China's S&T, one had better spend some time in reviewing S&T Programs in China, which, the author believes, mirror China's S&T reform process in the past 20 years. By reviewing this, you will see the process of the transformation of government functions, S&T institutes, and behavior modes of those who engage in S&T.

4. If one expects to understand China's S&T community, one must start with studying China's S&T programs because the participants of programs cover almost all the top-ranking research institutes, universities and scientists. It is known that many outstanding scientists reached scholarly maturity by undertaking state S&T programs. Various academic colonies have come into being based on different S&T programs, e.g. the colony based on 863 Program. Some argue that S&T programs should attract scientists and specialists nationwide instead of small exclusive colonies. In my opinion, it is natural that S&T programs engender various scholarly colonies, but the key is such colonies should be open and dynamic, not introverted.

How does the paper review China's S&T Program in the past two decades?

Some Western friends have talked about their confusions: on the one hand, they see incredible changes are taking place in China every day, economic development, city constructions, the open-mindedness of the youth, etceteras; whereas on the other hand, some areas are ever immune to substantial reforms, in social and political mechanisms, for example.

The author maintains that "changing and unchanged" can to some extent sum up the characteristics of transformations in China in the recent two decades. On the one hand,

since the implementation of the policy of reform and opening up, China bid farewell to its closed-door history. That is the trend of the time and cannot take the road back. China's policy generally speaking is moving towards increasing openness and transparency. On the other hand, the reform is still faced with considerable resistance and in many fields substantial changes have not taken place yet, especially in personnel system, decision-making mechanism, supervision mechanism, etceteras.

From this perspective, the paper will emphasize particularly on the evolution of China's S&T Program in the recent 20 years. The reason why the author decides 'Continuing Evolution' as the title of the paper is to stress that changes are impossible to take place overnight. For the moment, the changing aspects and the unchanged dimensions are coexistent. From the various respects such as the stratagem of plans, core activities, resource allocation and government roles, etceteras, the paper will analyze the process and characteristics of S&T Program in China, especially some sign policy, activities and viewpoints. At the same time, the paper will pinpoint certain elements in S&T Program in China. For example, the paper will explore the reason why some policy and management modes have met enormous frustrations and undergone little change although they are badly in need of transformation. The author notices that few research of China's S&T Program is done from this perspective.

In terms of the issues on China's S&T Program, disagreements widely exist between the official documents and scholars and even among scholars themselves. Analysis and understanding of the disagreements will be of great value. Trying borrowing Stakeholder Dialogue Approach (SDA), hosting roundtable meetings and inviting representatives from different interest groups to discuss hot issues on China's S&T Program during various

studies, the author obtained the opportunities to hear different voices. Thus the paper attempts to expose different voices and viewpoints from various perspectives as objectively as possible.

The study suffers a number of limitations in terms of scope and depth.

The first limitation follows from the secrecy regulations of the Chinese government. As a result, this paper will limit its study within civil S&T Programs. Although military S&T Programs are a crucial component part of S&T Program in China, they can hardly be covered in the paper.

The second limitation follows from the author's limited experience in research and evaluation. The paper will focus on China's S&T Program in the charge of the Ministry of Science and Technology, the national programs in particular.

The third limitation, if you call it so, is the author's perspective. The paper will not be a comprehensive introduction to China's S&T Programs, which can be easily found in the official Website of the Ministry of Science and Technology in China, but will analyze and discuss the issues concerned from the perspective of a S&T policy researcher and a evaluator. The author has been working for a research and consulting institution on S&T policies for over ten years, and especially in the past several years, as the evaluation project leader, carried out the evaluations of China's important S&T Programs. By evaluating the Programs, the author and her colleagues have widely collected the information on the aim, result, impact and management mechanism of China's S&T Programs. Taking advantage of this occasion, the author would like to share the findings of China's S&T Program research, the views on some hot issues as well as the confusions we are still faced to.

2.0 Birth and Development of China's S&T Programs

China's S&T program made its debut in the 6th five-year plan period. In 1982 where China just launched its sail for opening-up and reform, the then State Planning Commission (Currently the State Development and Reform Commission), and State Science and Technology Commission (currently Ministry of Science and Technology) jointly prepared the national S&T development plan for 2000. More than several thousand experts were invited to discuss the status of different sectors both at home and abroad and relevant S&T issues. As the result of the meeting[3], the State Planning Commission and State Science and Technology Commission jointly drafted the National Program for Key S&T Issues for the 6th five-year plan, the program was then taken as part of the national economic and social development planning, the first of its kind for China's S&T programs.

Since the birth of China's first S&T program, 5 five-year plan periods have elapsed. China's S&T programs have become effective means for the government to direct and readjust S&T activities on a macro basis, as well as an important channel for the state to invest in R&D activities, or a concrete expression of the state will in S&T activities. In the last two decades, more than ten major S&T programs were launched and implemented in China. As a result, a general S&T development pattern built on three levels-economic construction, high tech development and basic research-has been established with different S&T programs playing their respective roles at three levels. The implementation of these S&T programs has resulted in numerous important achievements. Many of the results of far reaching significance to the development of China's national economy and S&T itself

[3] Later this well-known meeting was frequently called "Jingfeng meeting" as it was held in the Jingfeng Hotel that was located in the outskirts of Beijing.

are derived from these national S&T programs. It is obvious that S&T programs have played a key role in enhancing China's S&T strength.

During the last decades, great changes had taken place in international political and economic patterns and China's reform and opening had been steadily deepened. After China's accession to the World Trade Organization, new challenges such as governmental function restructuring, the construction of national innovation system, S&T system reform and industrial restructuring were all raised up before China's S&T programs.

The following are a brief introduction to China's S&T programs currently under implementation, namely the S&T programs under the 10th five-year planning system. They reflect the current status of China's S&T programs. During the 10th five-year plan period, China's S&T program system is supposed to mainly work on three issues: firstly make direct state R&D input in S&T activities; secondly make guiding R&D input on behalf of the state; and last but not least build up the macro environment for R&D input, including infrastructure construction such as research bases as well as soft environment construction such as policies, laws and regulations.

On the basis of studying and analyzing overseas successful experience on S&T programs and the roles of China's S&T programs, the Chinese Ministry of Science and Technology has worked out a so-called '3 plus 2' national S&T planning system for the 10th five-year plan. The "3 plus 2" system is made of two components with 3 referring to master part composed of 3 core R&D programs and 2 referring to the 2 groups of programs for S&T environment and conditions.

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Master part is composed of 3 core programs:

863 Program: mainly addressing the strategic high technology issues relating to the nation's long and medium term development.

National Program for Key S&T issues: mainly working on major technical issues in line with major demands of national economic construction and sustainable social development and improving people's life quality.

Basic Research Program: on the one hand the National Natural Science Foundation sponsors general basic study projects with the topics mainly chosen by scientists themselves, and on the other hand the Program will work on major basic scientific issues in line with national objectives.

2 groups of programs include:

- Programs on improvement of R&D infrastructures, such as the Program for National key labs.
- Programs on environmental creation for S&T results diffusions and applications, such as Torch Program and Sparkle Program.

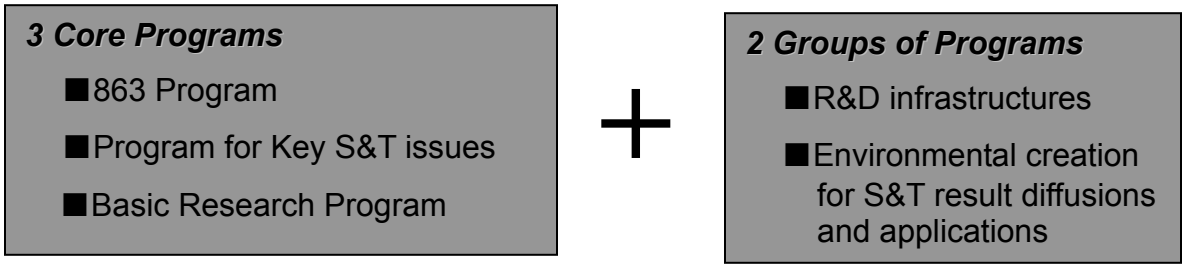

Fig.1 The "3 plus 2" system

3.0 Major elements of national S&T program and its evolution

This part will discuss the composition and associated evolution of China's S&T programs from different facets such as strategic goals, sources of fund, input priorities, human resources involved in programs, governmental roles and program management mechanism. As China's S&T programs have experienced a slow evolutionary process, it is quite difficult to line out a clear demarcation for different phases, and therefore the following 'phases' are so divided only for easy understanding.

In the early 1980s, China's S&T programs had made 'S&T serving for economic construction' the major strategic objective. The programs mainly worked on key S&T issues with the following criteria for topic selection: addressing urgent needs of national economic development; addressing major issues for remarkably improving product quality and increasing export.

During the period from the mid-1980s to the 1990s, S&T programs had shifted the focus of strategic objectives from tracking down the international advanced level to proprietary innovation.

The 863 program is a typical example. It made tracking down and narrowing down gaps its major strategic objectives for the initial period of the Program in 1986. It made necessary changes in the course of implementation to be in line with the international high tech development trend and changing national needs. It reassessed and readjusted strategic objectives to focus on enhancing proprietary innovation capacity, encouraging and supporting increasing proprietary results. After China's accession to WTO, S&T programs started to pay more attention to the part that market has failed and to the infrastructure and

environment construction for S&T development. The S&T planning system for the 10th five-year period has reflected this change. At present, a dedicated program for S&T infrastructures construction has been launched. It can be predicted that during the next five-year plan period, China's S&T programs will make their strategic objectives to embody governmental functions with emphasis on personnel training，R&D infrastructure and environment construction.

In terms of input priorities of China's S&T programs, it is apparent that the government has been working hard to address what is needed by the state but the market has failed to provide, and other issues such as interagency and interregional R&D activities. Governmental input will be gradually retreated from competitive fields, though it will not do so in an immediate manner.

On the issue of China's S&T program management, people have shifted their attention from management efficiency to the balance between fairness and efficiency as the result of enhanced awareness of "tax payer". Program management will therefore become more open and more transparent. China's S&T authorities are experiencing a series of changes in the program management, and the government will be gradually released from concrete program management activities with more attention to the guiding roles for S&T development and formulating and updating relevant laws and regulations. However, management reform and governmental function changing will be more difficult and slow than expected.

China's S&T programs will become pluralistic for its participants. After China's accession to WTO, all project implementers will enjoy the same national treatment. In the next few

years, the implementers of national S&T programs will remain dominated by China's domestic R&D institutes and universities, though other types of institutions or individuals, such as enterprises, overseas institutions or individuals may, upon passing relevant qualification examination, be contracted to implement S&T programs.

The following are the basic facts and preliminary analysis of program expenditure sources, input distributions and participating personnel on the basis of the statistics of 6 major China's S&T programs during the period of 1996-2000, or the 9th five-year plan period.

Input in China's S&T programs

Total input

Since the launch of the first S&T program, China's S&T programs have enjoyed a sustained growth for the total input. During the period of 1996-2000, the input in the programs from governmental, industrial and social channels had amounted to RMB 200 billion with an average annual growth of 32%. The input recorded in 2000 is 3 times that of 1996.

Expenditure sources

As shown by the statistics for the period of 1994-2000, China's S&T programs' expenditure sources did not see large change in structures, though these programs had witnessed a sustained growth for their total expenditure. The master part of programs were dominated by R&D projects with half of its expenditure originated from the government, followed by the equity capital of project implementers which is about the same amount as provided by the government. The rest expenditure sources such as bank loans or foreign

loans took a very limited portion by less than 5%.

Other S&T programs such as the one aiming at results diffusions and applications, for examples Torch Program and Sparkle Program, were mainly financed by the equity capital of project implementers at a percentage about 60 of the total with 30% from loans and only about 3% from the government under the name guiding fund.

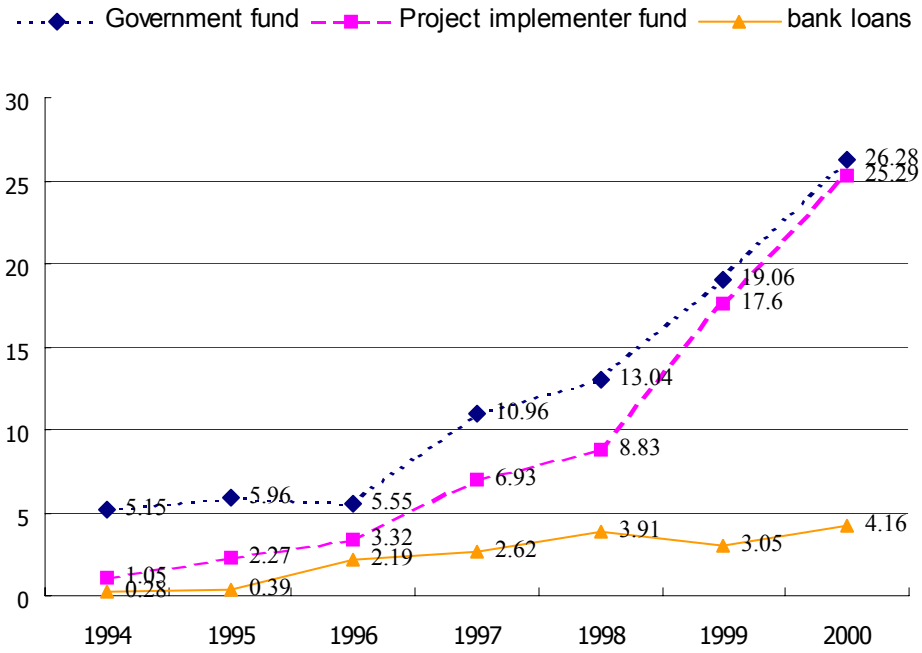

Fig. 2 Expenditure sources of China's S&T programs (R&D programs)

2. Distributions of S&T programs' expenditure

At the technical phase of R&D projects under China's S&T programs, distributions of program expenditure by activity type had been basically stable for consecutive years with

an exceptional large increase of input in Basic Research Program in 2000, which raised the weight of basic research activities.

R&D projects under China's S&T programs have covered varieties of topics including natural sciences, agriculture, medical sciences and engineering technology with limited coverage of social and humanistic studies.

When viewing major project implementers by type, during the period of 1996-2000, industrial businesses had a raised weight among the total implementers contracted to R&D projects. In 1996, R&D projects were mainly contracted to R&D institutes or universities. In 2000, industrial expenditure on R&D projects was raised from 20.6% in 1996 to 30.2% in 2000.

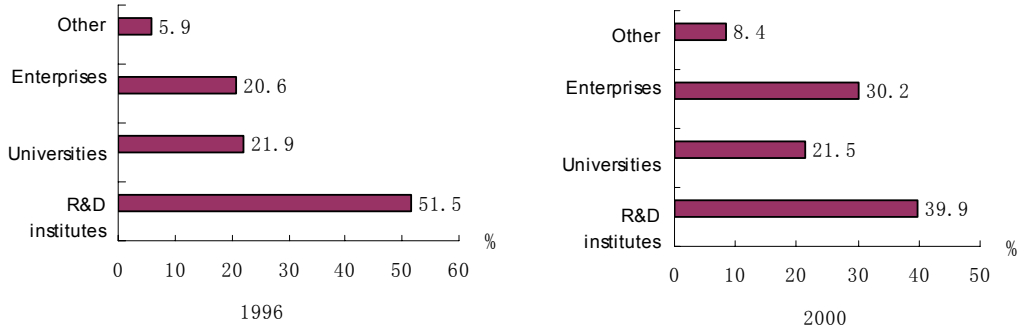

Fig.3 Distributions of expenditure on R&D projects by type of implementers

In the context of geographic distributions of expenditure, China's S&T programs have seen a clear geographic inclination with higher in the east and lower in the middle and west. Since 1994, the distributions of expenditure have basically followed the pattern of 2/3 for the east and 1/3 for the middle and west. The east region has not only gathered large expenditure sources but also witnessed a fast growth, though all geographic regions have

recorded a growth to different degrees. Overall speaking, the gap between the east and the west is widening.

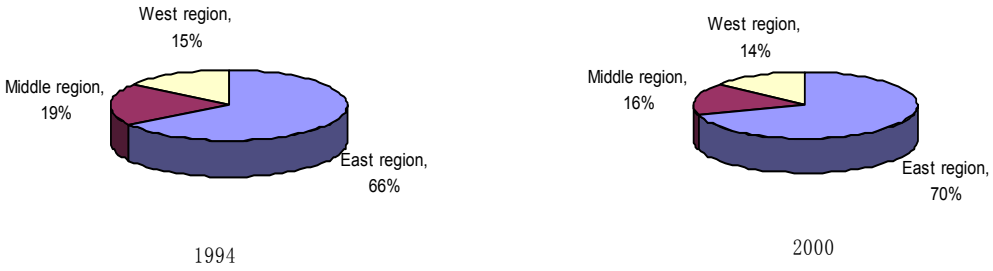

Fig. 4 Geographic distributions of expenditure on R&D projects under S&T programs

As driven by the demand for fine research conditions and high caliber personnel, R&D projects under China's S&T programs have been forced to gather in the areas of ready R&D conditions. During the period of 1996-2000, Beijing took the lion's share of R&D expenditure by 36.2% of the total program expenditure with Guangdong at 8%, Shanghai 6.5% and Jiangsu 5.8%.

Participating personnel of China's S&T programs

During the period of 1996-2000, China's S&T programs had seen an augmented participating population amounting to 810,000 person/time, with an average annual growth of 21%. Of them, the one involved in R&D projects reached 160,000 person/time with an average annual growth of 32%. The participating personnel were distributed in 14 primary disciplines with agriculture and computer science being the most popular.

Of the R&D project participants, the one from R&D institutes accounted for 50% with 30% from universities and about 20% from industries or other institutions, mainly for Program for Key Technical Issues.

Table1: Classification of R&D project participants by implementer type

%

	Total	R&D institutes	Universities	Enterprises	Others
Total	**100**	**52.56**	**29.24**	**11.53**	**6.68**
Basic research program	9.72	6.97	2.71	0	0.04
863 program	25.3	9.58	11.02	3.06	1.65
Program for Key S&T issues	64.98	36.01	15.51	8.47	4.99

The geographic distributions of S&T program participants followed a pattern that is very close to the expenditure pattern with 63.7% for the east, 20.5% for the middle and 15.8% for the west. S&T personnel in the west region are mainly concentrated in Sichuan and Shan'xi provinces. Other provinces in the west suffered a serious shortage of S&T personnel. The gap between the east and west is continuously widening.

In 2001, the Ministry of Science and Technology published the S&T policy for development of China's west under the 10^{th} five-year plan, which stressed the line that S&T personnel is the primary resource and innovation capacity building. As shown by the incomplete statistics, China's S&T programs have established 40 major projects relating to development of China's west with a total investment of RMB 2 billion, of which about 10% came from the Central Treasury.

4.0 Critical Issues on China's S&T Programs

In this section we present the critical issues on China's S&T Program. The issues can not, of course, cover all issues concerned with China's S&T programs. The choice of the issues were not based on certain theory but on the real problems met in implementation of the programs.

In review of the available materials, it became apparent that much more has been written about the content of the programs than the making of it. In other words, much more emphasis has been placed on what-to-do and how-to-do in the S&T Program during each five-year-period than on why-do-this and why-not-do-that.

In the paper, the author attempts to approach the critical issues from the following dimensions:

- The main arguments on the issue of China's S&T Program for the moment;
- The author's basic analyses on the issue, such as its evolution in the past two decades;
- The issues that entail further discussions and the missing dimensions at present.

Issue #1

China's Accession to WTO and its Impacts on China's S&T Programs

Being part of WTO is an important milestone erected in the process of China's reform and opening up. Its impacts have reached far beyond the economic sector. Numerous other aspects such as the Chinese government administrative system, China's legislature and

legal system, employment and social welfare, education and S&T development will eventually feel the impacts. In the context of China's S&T programs, what impacts will be on strategies and policies, or on management and operation after China's accession to WTO? What will the Chinese government and S&T community do about it? This is currently a hot topic under debate.

Since accession to the WTO, the Chinese Government has been facing huge arduous reforms in the fields of foreign trade management, financial management, industrial management and banking and foreign exchange management. China has to abolish those runnings contradictory against WTO's rules in its existing management system so as to be in line with international norms. Comparing with the above mentioned management functions, the pressure and impacts on Chinese S&T authorities are relatively indirect with less urgency for its reform timetable. However, what needs to be readjusted on strategic objectives and S&T program management? How do we work out corresponding readjustment and a clear reform timetable? These have become important issues drawing great attention of China's national S&T program management and associated researchers.

On the issue of input priority of national S&T programs, S&T and economics experts have so far reached a basic consensus: after China's accession to WTO, the governmental input in S&T programs shall gradually be pulled out from competitive fields. However, experts have differed views on which competitive R&D activities shall exclude the governmental involvement and on other relevant issues like timetable and ways for such retreat. There are mainly two arguments on the above mentioned issues: one is for the immediate withdrawal of governmental support to competitive R&D activities after entry into the WTO, and the other advocates for strengthening governmental support for industrial innovation activities

so as to make industries more competitive. The reason is that China accesses to the WTO in the capacity of a developing country. China has the right and obligations to support its own weak industries and is favored with a 5-year transitional period upon its entry into WTO.

The author believes that in the future China's S&T programs will still have their targets set for different levels, and the government will not immediately retreat from competitive fields. However, S&T programs will tilt more on addressing the issues that the market has failed to but the state has a need for, and on interagency and interregional R&D activities. For some historical reasons, some of the industrial R&D activities, especially that of state owned businesses, got their support through S&T programs. After China becoming part of WTO, S&T programs will have a reduced portion of expenditure for direct supporting industrial R&D activities. However, such reduction will remain proportional. The R&D activities relating to the common problems shared by industrial developments such as industrial standards and common technology still need the support from S&T programs.

On the issue of China's S&T programs' supporting targets, or project implementers, it is understood that after China's accession to WTO, all the implementers will enjoy the national treatment, whatever their type be. It can be expected that in the next few years, the implementers of S&T programs will remain dominated by China's domestic R&D institutes and universities, though other types of institutions or individuals, such as enterprises, overseas institutions or individuals will be allowed, upon passing relevant qualification examination, to be contracted to national S&T programs. Detailed policies are in the drafting process and people will soon see them out one after the other.

The use of S&T programs' budget calls for many improvements. The first improvement

shall find its expression in expenditure on personnel. Under the planned economy, the project implementer got fixed budget support from the state and S&T programs' budget only served as a subsidy to R&D activities, not allowed for wage paying. However, along with the institutional reform in the country, there will be a very limited number of institutions left under the full state budget support. In the meanwhile, S&T programs will have different implementers such as enterprises, overseas institutions or individuals. In this context, personnel wages will become a necessary issue to be addressed in program budget. In recent years, some of S&T programs have broken down this limit by allowing 5%-15% project budget to be used for paying wages, though not sufficient enough, especially in the fields of basic research and software. This issue remains in debate.

China's accession to WTO will produce series direct or indirect impacts on the governmental management of S&T activities. The Chinese government needs to define R&D priorities and strategic objectives for different R&D activities. In the next few years, China's S&T resources including personnel, information, expenditure and infrastructures will experience another restructured combination. In summary, the impacts of China's accession to WTO will not show in a day or two but rather in a long and gradual process. A sustained attention is therefore needed for keeping a clear picture in mind.

Issue #2

The Government Roles in China's S&T Programs

Over the years, it has been continuously discussed who should take responsibility for S&T

Programs, how should the responsibilities be divided between the parties involved in the Program administration and what roles the government should play in the administration of S&T Programs.

In the context of S&T programs management, as generally requested by WTO for changing governmental functions, the Chinese government shall further improve openness and transparency in its decision making. Chinese S&T authorities will see or have already seen the following changes in program management functions:

Intensify the guiding and coordinating functions of the government, namely providing guidance for S&T development and formulating and updating relevant policies, laws and regulations.

Weaken the governmental direct control over the resources. The government will be of a limited approval and management power over certain matters, such as direct approval power and associated jurisdiction over the establishment of projects and institutions.

Separate some activities such as accounting, auditing, bidding, results verification, project monitoring and evaluation from the government, and gradually make them the businesses run by professional institutions in the society.

The above mentioned changes have been seen on the road. For example, authorities concerned are cutting down or abolishing certain administrative approval rights. However, the author has found that the process will be more difficult and slower than expected.

Theoretically, government should concentrate on its role in making policies, laws and regulations and specific programs should be carried out by special institutions independent

of government. To realize this, Chinese policy researchers give quantities of examples to persuade government especially after China's accession to the WTO. However, in practice, it is hard for the government to refrain from specific project administration. Government officials always put too much effort into the administration of specific projects and can always justify their behaviors with excuses such as S&T Programs concern big S&T projects and state interest and China's NGOs are too weak to take the responsibility so far, etceteras. As a result, although it is a trend for the government to change its roles, it will be an evolution that is not possible to be completed overnight.

It is found that the government has made its direct involvement in some of industrial development activities under S&T Programs. S&T experts and relevant administrative authorities have repeatedly questioned the rationality.

One view argues that the industrialization projects have taken too large a portion in Programs with governmental involvement in some projects unsuitable for such investment. Another view takes that as China is a developing country in the transition from the planned economy to the market economy, it is necessary for the government to be involved in undertakings that industrial enterprises have no capacity for the time being.

The essence of the arguments on this issue is not whether the government should or should not be involved in the industrialization activities, but rather the extent of such involvement. Under internationally acknowledged principles, the evaluation of governmental involvement shall fall on the relevance degree between the industrialization project financed by the government and public interests.

As a matter of fact, the appropriations allocated by the state treasury for S&T Programs

were only starting funds in nature. For example, during the 9th five-year plan period, the S&T Programs had seen the implementation of 50 industrialization projects that were mainly financed by industrial enterprises. Most of these projects fall in the category of diffusion and application demonstration of common technologies. In this context, the governmental involvement will be helpful for enterprises to acquire common technologies at lower costs. It can be the case that some common technologies will find their market even without governmental financing. However, being a developing country, China's current economic structures are more desirable for the industries employing low and medium level technologies but poor for high tech applications. In this context, governmental role is quite critical in diffusion and spin-off of high tech results.

The author also found in its investigation that a limited number of projects are poor selections caused by rush and impatience for industrialization in program implementation. As a result, the target products derived from these projects cannot be shared by others in nature unsuitable for governmental investment and not going along with the goals of the Programs, either.

Issue #3

Strategic Goals of China's S&T Programs: Narrowing Down Technology Gaps

Tracking after advanced international level and narrowing down the gaps with developed countries is one of the fundamental goals of China's S&T Program. As a result, while the people estimate the role of S&T Programs in the development of China's S&T, it is natural

for them to ask what effects the implementation of S&T Programs has on narrowing down technology gaps.

The following is an attempt to answer this question by taking 863 Program as an example. In the evaluation of the 863 Program[4] after its being implemented for 15 years, the focus of attention is: What roles has 863 Program played in narrowing down such gaps and how large are these gaps at the moment?

Major view on this issue from different perspectives:

View 1: When 863 Program was started, China's most technological fields also made their starts with a gap of a decade or more behind the developed world. Thanks to the 15-year implementation of the Program, the technology gaps in the fields or subjects under the Program have been reduced to two to three years.

View 2[5]: We shall not let ourselves reach an overestimation of the current situation, though

[4] Under the trust of the Chinese Ministry of Science and Technology, the National Center for S&T Evaluation had worked on the evaluation of the 15-year activities of National High Technology Research and Development Program of China (863 Program) from August 2000 to February 2001. The evaluation criteria cover the four aspects of the program (relevance, effectiveness, efficiency and the positive/negative impact). The evaluation reports explain reasons for successes or failures and state lessons learned. The approaches of the evaluation include questionnaire surveys, interviews, fieldwork, case studies, comprehensive analysis, etc. The evaluation has for the first time in China introduced the mode of participatory evaluation with stakeholder-dialogue-oriented approach. These approaches have created conditions necessary for the participation, dialogue and communication of all interested groups. In the evaluation several workshops were organized with selected stakeholders on the principles of "Round-Tabling". The stakeholders are representatives from the industry, government institutions, scientists and other organizations. The evaluation report has been distributed among concerned government agencies so as to provide evidence for the government to improve the Program. The main conclusions of the report have been published for the general public. The author was the projector leader of the Evaluation.

Program 863 has indeed made outstanding contributions to narrowing down the gaps. For example, China has now possessed a qualified expertise team in related fields. However, when comparing with developed nations, the scale of such a team remains small. We also see apparent gaps in patents and products, and more in innovation capability.

View 3[6]: It is difficult to measure the gaps narrowed down. High technology develops fast with greatly shortened life cycle. For example, a ten-year gap in 1986 is almost equal to a range of two years today. However, both gaps mean a generation gap.

Before the reform and opening-up, 'narrowing down gaps' was never set as the strategic goal of China's S&T Programs. Since the 1980s the reform and opening-up policy awaked China's awareness of the gaps with the developed countries in S&T. In 863 Program starting from 1986, narrowing down the gaps was set as a crucial strategic goal. At the end of last century, 15 years after the implementation of the Program, this issue was picked up again. This mirrors the evolution of China's S&T policy and strategies.

While evaluating 863 Program, the author became aware that, it is difficult to measure the gaps as there are neither acknowledged indicators nor methods. However, as a developing nation trying catching-up strategies, "Narrowing-Down-Gap" concept is of clear policy importance in China. Especially when formulating 863 Program, narrowing down the gaps with internationally advanced level was listed as a major target of the Program. Now both decision makers and the public hope to see a basic comment on the changes of such gaps.

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[5] At a round table meeting for biological field in the evaluation, the participants shared the said view. The investigations among 246 domestic and foreign experts (83 of them were from abroad) also showed that 60% of the investigated had similar views.

[6] These are the views expressed at meeting for IT field.

In this context, the evaluation team established an evaluation framework on a trial basis so as to create a basic dialogue platform for discussing the gap issues, and worked out its preliminary comments under the framework. We reached the conclusion that 863 Program has played a decisive role in raising China's high tech R&D level. The fields or subjects selected by the Program have seen remarkably narrowed gaps with advanced countries and the increasing dialogue capacity of Chinese scientists with scientists from the world. China now is able to be part of the process formulating international standards and regulations and major international cooperation projects. Viewing along with the development trend, such gap will further be narrowed down with necessary support.

Facing continuously widening gaps between developing and developed worlds in general term, the implementation of 863 Program has created fine precious opportunities for further development. On the other hand, we have to clearly recognize that China still see apparent gaps from advanced countries in comprehensive term, especially in innovation capacity, invention patent and supporting conditions. It won't be wise for the positioning and implementation of 863 Program in next phase, if we ignore or refuse to acknowledge this reality.

Issue #4

Equity and Efficiency in Administration of China's S&T Programs

In the recent two decades, the implementation of China's S&T Programs has undergone a period witnessing China's transition from a planned economy to a market system. To adapt

the Programs to this unique historical background, the administrators have been ceaselessly experimenting better administration modes. There are a large number of essays and reports on the administration of the S&T Programs. Especially at the beginning of each five-year plan period, administrative modes and mechanisms of the Programs have always been hot issues. Among the proposals on S&T issues submitted to the National People's Congress, there are many concerning the equity in administration of the S&T Programs. Often entrusted by the program administrators, the author herself has been responsible for the replies to the proposals.

As equity and efficiency is an eternal issue in the administration, that of S&T Programs is no exception. Many questions have been posed on the administration of S&T Programs, they all end up concerning how to strike a balance between equity and efficiency.

The author has observed that in the recent 20 years, the attention to this issue has been evolving. In the beginning of the reform and opening-up, the main focus was on the efficiency of scientific researches in order to speed up the output of intellectual personnel and scientific researches to narrow down the gap with the international advanced scientific levels. By then the criticisms on the administration of S&T Programs concentrate on valuing a person according to his seniority rather than his qualifications, capabilities, over-elaborate administrative formalities, low efficiency, etceteras. Now, with the deepening of the reform, the public is more aware of their position as 'tax-payers', and start to pay more attention to the equitableness and standardization of government input. While the state takes S&T Programs as an important aspect of government input, the attention to the equity of the allocation of resources is increasing and the criticisms and discussions of the administration of S&T Programs are more and more concerning the programmed

allocation of resources as well as the transparency of the administration of programs.

For instance, so far it is disputed on the resource allocation in state S&T programs within the S&T circles. One issue is that the resources tend to be concentrated so that more and more program input is focused on some conspicuous experts or institutions. Some say that this phenomenon is unfair and abnormal — a small circle has been formed within the big S&T circle; people in the small circle can easily obtain funds and ultimately a vested interest group has formed. Whereas others argue that the phenomenon is natural; it is right to select programs by the criteria of performance; a national S&T team is good to produce achievements and it cannot be regarded as a small circle.

Therefore the author maintains that the shift of attention from the efficiency to the balance between equity and efficiency is a sign of the progress of the society as well as a challenge to the program administration.

Issue #5

Openness of Administration in China's S&T Programs

In my opinion, we cannot talk about the evolution of the administration of China's S&T programs without mentioning the openness and transparency of administration.

In the western world, in accordance with law, the information about the government administration has been available to the public. However in China, the openness and transparency of administration is a new topic catching attention only in recent years. Over

the years, the administrative rules and information of the government have been closed to the public and most of the public failed to be aware of their right to be informed in this aspect as well. Even those involved in the science and technology programs who are better educated and have the stronger awareness of democracy in China are no exception. Only recently, especially after China's accession to the WTO, this issue tended to attract increasing attention.

In the recent years, the transparency and openness of program administration has been put on the agenda. Since the tenth five-year Plan, specific measures have been taken in three core R&D programs to strengthen openness of administration. The concrete measures include: widely seeking suggestions and advice of various sectors and regions; project tender was added into the administration of the Programs; overseas specialists should be invited to the evaluation and review of the project. By this means, the transparency of project determination has been enhanced

While writing the paper, the author was leading a research team to conduct a survey on the openness of S&T Program administration. The survey revealed that a considerable number of participants (55%) hold that the openness of Program administration is not satisfying. Those who consider it necessary to improve the openness amount to 92.9%, which describes that strengthening the openness of S&T Program administration is the common demands of various aspects.

The participants also hold that what should be first publicized in the Program administration are the guide of a Program and the determination of a project, next the allocation of the fund and the execution of the project.

Some of the administrators are concerned that increased openness may undermine efficiency. However, the findings of the survey indicate otherwise. 53.1% participants maintain that the increase openness of S&T Program administration will do no harm to efficiency, 28.1% contend that it will affect efficiency but is still worthwhile.

The survey reveals that program administrators, project undertakers and others concerned about S&T programs all reach agreement on strengthening the openness of the administration of S&T programs.

The findings on the interrelations between openness and efficiency in the administration of S&T programs are crystal clear: the present lack of efficiency in the administration of S&T programs was not in the least resulted from the emphasis on openness and impartiality.

In terms of the actuality of the administration of S&T programs, the segments set to improve openness have not evidently undermined the efficiency of the administration. Through the analysis of each link of program administration and the stipulated implementation time we see that the link set and the time increased in the procedure of administration to promote openness are not excessive to affect efficiency.

In accordance with the requirement of the reform of the administration of China's government, it is an inevitable trend to improve or even accelerate the openness and transparency of the administration of state S&T programs. The author maintains that the premise to consider the balance of openness and efficiency is that the issue of openness of administration has been resolved. However by far, the essential demand for the openness of administration has not yet been met. Theoretically, the information publicity is essential rather than exceptional. But this conception has far from taken root in China. It is common

practice that information is selectively made known to the public. In this case, unless we put the establishment of the openness system of administration as the prior concern, it is meaningless to discuss the balance of openness and efficiency.

One of the most important conclusions of the study is that openness is the golden rule of the administration of S&T Program. It was pointed out in the report that in the past the policy-making of S&T programs has been developed in a hierarchical and often closed environment with little public consultation. For government there is inevitably the responsibility to make a much better effort in the future to undertake competent public communications about issues attracting public attention. The main reason is that the costs of failing to do so can be very high. The administrators of the Programs will benefit from transparency and openness. Openness stimulates public debate and accountability.

Now the key is how to put it into practice. However, not all the program administrators has realized the importance of transparency and are still trying to avoid publishing information with all kinds of excuses. Generally speaking, slow as it was, the trend to enforce the openness and transparency of the program administration is unfolding.

5.0 Observations and Considerations

The state S&T program is an important channel for government's R&D input and the embodiment of state's will in S&T. As a result, the review and study of state S&T programs can provide facts, findings and inspirations for analysis and study of the relevant issues on the development of China's S&T.

In the past 20 years, China's S&T circles have experienced vast restructuring and reorientation. Giving a table about various aspects of S&T programs, including strategic objectives, input priorities, government roles, program management, participants, etceteras, the author attempts to briefly sum up the evolutionary trend of China's S&T programs in the recent two decades in the following table. The first line expresses the main elements or dimensions of state S&T programs. The second line expresses the situation in the beginning of 1980s, which is basically static. The situation illustrated by the third line is more complicated, which includes not only the recent situation, but also the situation that is unfolding. So it is dynamic and unstable.

The major elements of China's S&T Program have been shifting:

	From		*To*
Strategic objectives	Serving for economic construction enhances economic growth	→	narrowing down gaps enhancing proprietary innovation capacity, R&D infrastructure Environment construction
Input priorities	urgent needs of economic development improving product quality increasing export	→	Public goods market has failed to provide interagency and interregional R&D activities gradually retreated from competitive fields
Government roles	direct control over the resources	→	providing guidance for S&T development formulating and updating relevant policies, laws and regulations
Program management	management efficiency	→	balance between fairness and efficiency more open and transparent
Participants	domestic R&D institutes and universities	→	R&D Institutions, enterprises, social groups, overseas institutions or individuals

The above mentioned changes have been seen on the road. However, the author has found that the process will be more difficult and slower than expected. Meanwhile, the state S&T program in China has undergone an evolution as well, which is best characterized by the following three points:

Changing and Unchanged

On the one hand, the structuring, objective, administration mode and priorities of each S&T program have undergone remarkable changes in the recent 20 years. At the beginning of each five year plan period in particular, the government has always organized overall research and discussion and enacts a series of policies and regulations. On the other hand, though the government's role in the administration of programs and some aspects in the decision-making mechanism of programs call for changes, the transformation is much more difficult and slower than expected.

Difficult and Easy

The issues on state S&T programs appear very complicated, concerning the system of the nation, labor division of different departments and sophisticated historical reasons. But the author observes that the complicated issues can sometimes be approached easily with general international tenets. For instance, this year the author was invited to a team studying the criticisms on state S&T programs for further improvement organized by the Ministry of Science and Technology. After the program administrators gave a cluster of complicated factors to prove it difficult to take effective measures to solve the problems, the team offered a simple solution, appraising the administrative mode of each program with the principle of openness and transparency of administration and accordingly proposed the way to make improvement. It turned out to be very successful. We strongly believe that the openness is the golden rule of the administration of state S&T programs. With the increasing awareness of this seemingly simple principle, many complicated problems can be easily solved.

Certain and Uncertain

What changes took place in China's S&T policy and programs after its accession to WTO? How do we predict the trend of changes? The general trend is certain, on which the specialists from S&T and economics circles have already reached consensus. At the request of changing government's functions after China's entry into WTO, the government will further enhance the openness and transparency of administrative policy-making and government's input to state S&T programs will gradually withdraw from competing fields. However, how do we work out corresponding readjustment and a clear reform timetable? This is currently a hot topic under debate. It is difficult at present stage to picture what the S&T program system will look like for the 11th five-year planning period.

In a word, after China's accession to WTO, the tendency of the development of S&T calls for continuing attention.

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