The Tao of Science and State in Post-Mao China: An Inquiry into their Interaction

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Introduction

Chinese science and state[1] have been witnessing profound structural and normative changes in the last two decades. These changes have occurred due to a number of factors in the national arena that are effects of the changing internal and external contexts which began in 1978. During this period, the Chinese state has moved from using an authoritarian model to following a developmental model.[2] In a similar manner, Chinese science has gone through a process of restructuring and reform leading to the enhancement of its contributions not only to the economic and social development of China but also to its political goals. In the context of these changes, the paper traces the trajectory of two pertinent issues: (1) to what extent the Chinese state has shaped the development of science and in turn been shaped by science in the last two decades; (2) and how both science and state defined the developmental path of China. Section II places the debate regarding science and state in post-Mao China in a theoretical framework focusing on the changes seen and challenges faced by science and state. This section also situates it in the state and society paradigm and development discourse. Section III details the interface between science and state: how science and state interacted with and influenced each other and how their dynamics contributed to the development of China. To provide substance to the study, it grounds the debate regarding science and state in China within a field study on the perceptions of science and state in Beijing and Shanghai which forms part of section IV. The questionnaire method was adopted, administered through random sampling, and data was collected from Beijing and Shanghai to see if any differences exist in the way people from these two cities view the interface between science and state in post-Mao China. The last section highlights the conclusions of the study.

Science and State in Post-Mao China: A Theoretical Framework

Both science and state in post-Mao China had seen some of the most radical changes and challenges in the short history of communist China which played a major role in reconfiguring the dynamics between them.

Science and State: Changes and Challenges

Chinese science witnessed radical reforms under the leadership of Deng Xiaoping. During this period, it started to shed its communist coverings and ideological wrappings to acquire a new look which has more in common with the way science has been developing in the West for quite sometime. But unlike in the West, science in China has been co-opted by the state to serve the society (read: the state) and its developmental programs. Interestingly, though it was co-opted by the state, the state's support for the development of science and technology has been crucial. Former President Jiang Zemin stressed that "challenges such as optimizing the economic structure…fostering coordinated development of the whole society cannot be comprehensively addressed without the integrated development of science and technology"(Jiang 2003: ii). The major challenge for Chinese science during this period was to carve a niche for itself and play a pivotal role in China's development while acquiring substantial space for itself in the rapid technological changes taking place around the globe.

Some of the changes that the Chinese state has gone through in the post-Mao period are remarkable. During this period, it has moved from using a totalitarian, authoritarian, neo-authoritarian and then to a developmental model. These changes are by no means insignificant. The Chinese state has moved from one model to another without a major threat to its position and without derailing its developmental goals. The dominant pattern of the Chinese state in the first decade after 1978 was *state-reforming* wherein the Chinese leaders under Deng Xiaoping have attempted at reforming the state institutions in line with the economic reform program. Later in the 1990s, after the Tiananmen Square crisis, there was an attempt at *state-strengthening*. A challenge for the state was carrying forward with its development at a time when communism in Russia was waning and the neighboring countries were leapfrogging in their developmental processes. These changes redefined the relations between state and society.

State and Society Paradigm

The state-society paradigm is generally used in understanding state and society in two distinct ways. One, by reifying, the state pits itself against society. In this paradigm, if the state is strong then society is weak and vice versa. It also focuses on the crisis between the two. The second one considers how both evolve, constitute and transform each other. In this study, the second framework is applied to understand how relations between science and state as two subsystems of society transform each other and consequently, contribute to the overall development of China.

Arthur Rosenbaum (1992), in his introduction to the book *State and Society in China*, uses the state-society paradigm in the first sense when he extrapolates that the changes that have been ushered in after 1978 have led to the declining reach of the state in rejuvenating society. This may be true to a certain extent but eschewed primarily because its analysis is rather too critical of society and shows bias towards the state. Because the state in post-Mao China has changed radically in comparison to what it was during Mao's period, Victor Nee and David Mozingo (1983) along with other contributors to the book *State and Society in Contemporary China* agree that neither the bureaucratic nor the totalitarian models are useful tools to explain how state-society relationships have evolved since 1949. They go on to argue that fundamental state-society relationships shape the evolution of contemporary China and that there is a search for the sources and the character of the social forces contending for expression in China today. Tony Saich (2001) asserts that a number of changes such as the tactical retreat of the state both by design and default and the ascendancy of law in shaping both the state and society have led many scholars to reconceptualize the relationship between state and society. But this reconceptualization has been quite complicated because both state and society are in transition--a moving target. He also posits that China is a country where multiple models of state-society relation may be operating at the same time. He characterizes the Chinese state as a negotiated state and the society as more fluid and dynamic. Wang Xu (1999) makes a strong case for the need for mutual cooperation whereas David Goodman (2001) looks at the mutual interdependent nature of society and state. The discussion on science and the state in post-Mao China belongs to this genre of cooperation, mutual accommodation and transformation for a better state, science and society.

Situating Chinese Science and State in Development Discourse

For development to be comprehensive and effective, it requires a number of institutions and processes. Of these, state and science are two vital institutions. They are not contenders but partners in development.[3] The former provides direction and support while the latter supplies certain elements of social capital and technological innovation capabilities which are crucial to development.

Development discourse looks at the debate from various theoretical positions such as modernization and dependency. This has further been substantiated by case studies comparing Newly Industrializing Economies (NIEs) in East Asia with those in Latin America (Gereffi 1989). East Asian or NIE modelsl substantively affirmed the role of a strong state in carrying forward and coordinating developmental processes (Henderson and Appelbaum 1992). China is one of the latest countries to join this model. China, despite its large population and complexities, with its consistent and steady development in the last two decades, further takes development discourse to newer heights by providing another model, which I call *development as development*, wherein the focus is on development for the sake of development and not on comprehensive development where people, particularly the poor, find adequate space.

Amartya Sen (1999) makes a case for freedom-oriented development wherein he views development as a two-step process of expansion of freedom and removal of unfreedoms. For him development takes place when a number of 'unfreedoms'--poverty, tyranny, lack of public infrastructure, slavery, lack of educational and health opportunities, lack of social rights, gender discrimination--are removed. He goes on to argue that an integrated analysis of economic, social and political activities involving a variety of institutions many of which are interactive is indispensable to understanding development. He further argues that development increases human freedom. Following Amartya Sen's concept of development as freedom, any development, be it the development of science, that does not promote freedom is fraught with problems and has serious ramifications both for those who promote it and for those who are affected by it. Huijiong Wang (2003) deems that a proper development strategy, what he calls "integrated approach," must take into consideration all four components--S&T, economy, society, the environment--as well as the mutual interaction among them.

Interface between Science and State in Post-Mao China

The Chinese state under Deng Xiaoping which has the historical mission of using science to strengthen China (Segal 2003) has accorded science a significant place in China's development policy. The Chinese state has played a pivotal role in this process. Thus, this period saw a number of reforms introduced in the field of science and technology. The interface between science and state in post-Mao China can be found in four major arenas, the first of which is the ideological support for the development of science and the role of the state in that process. The state built bridges between science and the national goals it has set for the country. The state also connected the development of science with the economic development of China. This section delineates these themes. The discussion also includes S&T reforms, problems encountered in the process and the contribution made by science and state to China's development.

Ideological Base

The Chinese state under the leadership of Deng Xiaoping heralded a new era for S&T in China by laying down ideological foundations for it. Deng stated that "the crux of Four Modernizations is the mastery of modern science and technology. Without modern science and technology, it is impossible to build modern agriculture, modern industry or modern national defense" (Deng 1978: 10). The second thing he did was to elevate scientific experimentation to the level of class struggle and struggle for production. He exhorted his countrymen to "deepen the three great revolutionary movements of class struggle, struggle for production and scientific experiment" (Deng 1978: 16) and called on the scientists to help him build a modern and robust China. This call has boosted the enthusiasm of S&T personnel. In fact, it is this sound ideological base that set S&T development through policy formulation in China on a strong grounding.

S&T and National Goals

The second most important input made by the Chinese state is to link S&T policies with national goals such as building a modern and powerful socialist state, reducing the gap between China and the developed countries and quadrupling GDP by 2000 AD. The state believed that S&T could play a crucial role in realizing these national goals.

S&T and Economy

The third major contribution made by the Chinese state is to link science policies with economic construction. The leadership considered science as a primary engine of economic development. Once again, Deng Xiaoping provided the base for strengthening the linkages between science and economic reforms. He said, “The development of modern science and technology has bound science and production (an economic activity) ever more tightly together. Science and technology as productive forces are manifesting their tremendous role ever more obviously”(Deng 1978: 10). With regard to the role of science in determining economic development, “modern science has opened the way for the progress of production techniques and determined the direction of their development”(Deng 1978: 10). The state continued to strengthen the links between science and economy through the 1980s and thereafter.

The whole gamut of relations between science and state has been further complicated by the role of the party and defense establishment. The party, seeing itself as the vanguard of ideological purity and having witnessed some internal reforms, wanted to maintain some sort of control over every segment of the society including science. Any move that dilutes the ideology of the party is opposed vehemently. Besides the party, the People’s Liberation Army also had an impact on the advancement of science because of its historic role during the communist movement. The defense establishment, having been part of the four modernizations, wanted the state to contribute to its own modernization drive which in an indirect manner diverted the state’s attention from science to defense. This was felt when the annual defense budget began to increase in the 1990s.

S&T Reforms

In fact, the interlacing between science and the state could be seen in the restructuring of the science and technology (S&T) organizational system including all its decision-making bodies, making it function as an agent of the state and the party. The need for a thorough overhauling of S&T institutions was felt by almost all the prominent leaders, from Deng to Hu Jintao, at the beginning of the 21st century. As a result, a number of old institutions had been revived and restructured and new institutions were set up. What is central to this process is the empowerment given to S&T institutions to provide enormous opportunities to venture into new areas. For instance, in the reform period, various S&T institutions could enter into collaboration with their counterparts abroad and sign contracts with private enterprises. These provisions, besides others, led to certain structural and functional changes within scientific institutions and the effects in turn began to slowly spill over to the rest of society and polity.

In the same vein, reforms were introduced in the research field consisting of scientists, research and development (R&D) and science programs. Firstly, a considerable number of scientists do not share the state’s views on issues relating to science. Secondly, the results of R&D have a direct bearing on society. Finally, science programs such as Torch, 863, 973, Spark have been aimed at making science contribute to various sectors of society. Initiatives such as an award system, freedom to provide consultancy services to non-state sector and thereby earn more than the non-professionals, and the provision of mobility from one place and institution to another have empowered scientists.

The third actor, technology transfer, represents the international system. It is through this actor that many of the Western influences percolate to the state, society and economy. The policies formulated in regard to acquisition of technology have three distinct aspects: they are comprehensive, productive and conflictual. They are comprehensive because since 1978 there have been more countries from without and more regions and agencies from within participating in the technology transfer process. They are productive because they contribute to the economic development in general and S&T system in particular. More importantly, they are conflictual in the sense that the Chinese consider the cultural values of the West that accompany technology at variance with their ideological underpinnings. Nevertheless, they have been pursuing technology transfer with vigour. This process has enormous implications for the state not only in the aspect of science but also that of society. Technology transfer brought China rich dividends in terms of S&T development and economic growth but it has also created problems for the state. Though the Chinese state tried to filter the “spiritual pollution” that takes place during transfer of technology, it has not been entirely successful.

As the reform process expanded and continued after a major reform program in 1985, a slow rift began to emerge between science and the state because of the difference between the goals of the state and those of the science community which were newly evolving. Some of the goals of the state were modernization and maintaining internal stability whereas the science community’s goals were greater professional freedom, more funding, better infrastructure, more international exchanges and less intervention from the state. The science community felt that the reforms introduced by the state vis-à-vis science have not addressed all these issues, particularly greater professional freedom and minimal intervention from the party-state. The state felt that the science community’s “unreasonable” goals if acceded to would undermine its grip over the science community and would motivate other sectors of society to follow suit and thereby cause internal instability.

Crisis between Science and State

A consequence of the reform program initiated by Deng Xiaoping is that science began playing two other roles in addition to its traditional role of facilitating development. Firstly, it became a *social force* in attempting to bring certain attitudinal changes among various sections of the society. For instance, some sections of the science community wanted the rest of the society to follow them in the way in which they relate to the state. Secondly, it emerged as a potent *political force* in making attempts to implant democratic values in China. Majority of the science community have been partners with the state in its efforts to accomplish development goals while some scientists like Fang Lizhi, emboldened by the path-breaking reforms, went beyond their professional role to play a political role by demanding that the state initiate political reforms in China, consequently threatening the state and causing some friction between science and state. This is largely due to the belief that liberal values such as freedom of expression and thrust on the importance of facts, which are so fundamental to the very development of science, were discouraged by the state. The science community felt that state's overbearing intrusion into its domain has been adversely affecting not only the development of science but also of society. For instance, the science community was expected to agree with party-state's views on quantum mechanics, general relativity and cosmology which are at variance with scientific facts. However, what Chinese science in general and Chinese scientists in particular have, following Amartya Sen's analysis of freedom, is professional freedom with considerable social freedom, but little or no political freedom in the sense of Western political paradigms. To make this point clearer, a comparison with comparable counterparts is in order. For instance, counterparts in India have political freedom but less professional freedom in terms of entering contracts and doing consultancy. Benefiting from these personally is not possible. The state grants to the science community what it considers feasible in order to maintain control. Lack of proper understanding and willingness to accommodate each other's goals led to the souring of relations between science and state. In the early 1990s and thereafter, the interface between science and the state has been marked by caution. The scientific establishment has been wary of playing the role of a political force against the state. The Chinese state has further resolved to strengthen science despite the aberrations in the 1980s.

Contribution to Development

Though many scholars attribute the development of science to the state, in fact, a considerable share of the credit must also go to the science community which played a major role by suggesting most of the reforms when they were consulted by the government. In that sense, the science community has contributed substantially to its own development. This also has a positive and indirect impact on the state when it initiated reforms in other areas, for instance, the development of industries and defense modernization.

The interface between science and the state in China has contributed to the overall development of China, boosting economic growth since the early 1980s. Though there is no established consensus on the contribution of S&T (science and technology) to the development as yet, some scholars attribute to S&T a substantial contribution in promoting development. For instance, Leong Liew attributes the unaccounted 29 percent of growth to technical and institutional change in the World Bank estimates of growth in China between 1978 and 1995.[4] To develop China, both science and state are vigorously promoting some of the most sought after areas of research such as high-technology, space and lunar expedition[5] while neglecting the intermediate technologies that Schumacher (1993) so convincingly argued for. Moreover, there is little concern for green technologies which would have a long-term and positive impact on the sustainable development process. Thus, China has been following a path I call *development as development* whereby development takes place without political freedom but with economic and professional freedom.

Case Studies: Beijing and Shanghai

The developmental pattern in post-Mao China followed a specific path beginning in southern Guangdong, slowly moving to the central region where Shanghai is the centre, and then is now focused in the Bohai region where Beijing is located. Beijing and Shanghai (Hook 1998) represent two different facets and cultures of China given their geographical location and historical trajectories. In the twentieth century, the evolution of the former into the political capital and the latter into the financial capital makes the divergence more stark and complex.

Beijing, being the seat of political power, used its advantages in making sure it has well established and well funded S&T institutes. It also created Zhong Guan Cun, the Chinese version of Silicon Valley. On the flip side of the story, the Beijing science community also comes under direct scrutiny of the centre. A major factor that sets Shanghai (Chen 2003) apart from other cities in modern China is its entrepreneurial spirit and its bold drive for innovation. It is also known for its penchant for keeping abreast of technology and new ways of improving economic and social life (Young 1996). Details of the science and technological capabilities of the two regions with regard to the number of S&T institutions operating, number of scientists and engineers conducting research and amount of funding available for S&T development are given in Table 1 which convincingly demonstrates the differences in the technological inputs and outputs between Beijing and Shanghai. While Beijing has a maximum number of institutions, scientists and engineers, better funding and more number of papers published, Shanghai leads in patenting, particularly in design, and the number of technology contracts executed with foreign firms. This shows that the orientation of S&T in Shanghai is rather different from that of Beijing, basically because of Shanghai's entrepreneurial culture.

With these divergences in the backdrop, Beijing and Shanghai approach the development of science and technology and the interface between science and state rather differently. Table 2 throws some light on this. About 39.1 and 45.8 percent of the respondents in Beijing and Shanghai respectively said that the relations between science and the state in the 1980s were moderate, corroborating the assessment that they had tension between them in the 1980s. In contrast to this, majority of the respondents, 44.9 and 49.2 percent respectively, said the relations between science and the state at the beginning of the twenty first century were good. Though majority of the respondents said the nature of the state is market socialist, the views are quite diverse. While more than fifty percent attributed the development of science to scientists in Shanghai, a little less than that was attributed to the state in Beijing.

Conclusion

Science and the state with different objectives and goals for enhancing legitimacy of their existence, despite some aberrations in the late 1980s, have been successful in finding a middle path in promoting development in the 1990s and thereafter. But the development they have sought to accomplish is rather limited in its scope and comprehensiveness. It is here that both science and the state need to endeavor to support a people-centered development rather than *development as development*. When one applies Amartya Sen's concept of *development as freedom*, science is in favor of it whereas the state has yet to fully embrace it. Cooperation between science and the state is essential not only for laying robust foundations for people-centered development but also for their individual survival.

Endnotes

[1] This study considers science, including technology and state as institutions within the society following the Weberian framework and the Migdalian model particularly applied to the state. See Weber, Max, *The Theory of Social and Economic Organization,* ed. Parsons, Talcott, (New York: Free Press, 1964), pp. 436 and Migdal, Joel S., *State in Society: Studying How States and Societies Constitute One Another*. (Cambridge: Cambridge University Press, 2001), pp. 291.
The organizational structure of science, the research system consisting of scientists and science programmes, and technology transfer process as integral components of science as well as government, party and the defence establishment are selected as part of the state for analysis in this study.

[2] This argument is advanced keeping in view that no state is authoritarian, neo-authoritarian or even developmental in its totality. What is significant here is that when a state is characterized as developmental it is primarily dominated by developmental concerns. See Castells, Manuel, "Four Asian Tigers with a Dragon Head: A Comparative Analysis of the State, Economy, and Society in the Pacific Rim," in Appelbaum, Richard P. and Henderson, Jeffrey, ed., *States and Development in the Asian Pacific Rim* (Newbury Park, California: Sage Publications, 1992), p. 57.

[3] In fact, they need to be considered in this manner for their mutual benefit and for development to be smooth particularly in the transitional economies and polities.

[4] About 50 percent was attributed to capital and labour input and improvements in the quality of labour and about 16 percent to sectoral reallocation. For more on this see Liew, Leong H., "Marketization, Democracy and Economic Growth in China," in Anis Chowdary and Iyanatul Islam, ed., *Beyond the Asian Crisis: Pathways to Sustainable Growth* (Cheltenham: Edward Elgar, 2001), p. 311.

[5] The Chinese government publishes a detailed annual report on the development of high-technology industries but nothing of this sort is available in the area of intermediate technologies. See also Segal, Adam, *Digital Dragon: High-Technology Enterprises in China* (Ithaca: Cornell University Press, 2003), pp. 180.

Table 1: S&T Capabilities in Beijing and Shanghai, 2002

S&T Inputs & Outputs	Beijing	Shanghai
1. No. of Research Institutions Chinese Academy of Science* (2003)	37	9
2. No. of Scientists & Engineers	257326	178875
3. Amount of Funding (10,000 yuan)	4452878	2783230
Government Funds	2150964	627725
Enterprise Funds	1535966	1811169
Bank Loans	94362	113831
4. Patents Granted (Total)	6345	6695
Invention	1061	341
Utility Model	3721	2805
Design	1563	3549
5. Scientific Papers Published (Total)	14507	6085
SCI	7488	3224
EI	4402	2055
ISTP	2617	806
6. Technology Contracts Imported	13718	67394

Source: National Bureau of Statistics and Ministry of Science and Technology, *China Statistical Yearbook on Science and technology 2003* (Beijing: China Statistics Press, 2003).

* See http://english.cas.ac.cn/eng2003/dmk01a/institutes.asp

Table 2: Perceptions on Science and State in Post-Mao China: Beijing and Shanghai, 2004

Question	Beijing	Shanghai
1.Interface between Science and State in the 1980s		
Excellent	4. 3%	6.8%
Good	33.3%	18.6%
Moderate	39.1%	45.8%
Bad	4.3%	13.6%
Critical	1.4%	.0%
No Response	17.4%	15.3%
2. Interface between Science and State in the 21st Century		
Excellent	13.0%	13.6%
Good	44.9%	49.2%
Moderate	15.9%	16.9%
Bad	4.3%	3.4%
Critical	1.4%	.0%
No Response	20.3%	16.9%
3. Nature of State		
Capitalist	4.3%	3.4%
Socialist	17.4%	39.0%
Market Socialist	55.1%	42.4%
Neo-Authoritarian	10.1%	.0%
Developmental	13.0%	11.9%
No Response	.0%	3.4%
4. Scientists' Contribution to the Development of Science		
100 percent	15.9%	6.8%
70 percent	34.8%	55.9%
50 percent	31.9%	30.5%
30 percent	15.9%	6.8%
No Response	1.4%	.0%
5. State's Contribution to the Development of Science		
100 percent	8.7%	6.8%
70 percent	46.4%	42.4%
50 percent	30.4	33.9%

30 percent	11.6%	11.9%
No Response	2.9%	5.1%

Only 128 questionnaires, 69 from Beijing and 59 from Shanghai, could be collected given the sensitive nature of the subject. The consistency of the details ascertained and the analysis done may be contestable only until such a time when a topic of this kind could be carried out without any apprehension.

References

Chen Jiahai. "The Shanghai Pattern on the Road to Socialism with Chinese Characteristics." SASS Papers (9), Shanghai Academy of Social Studies, 2003, 42-48.

Deng Xiaoping. "Speech at Opening Ceremony of National Science Conference." 18 March 1978. Peking Review. Vol. 21, no. 12, 24 March 1978. 10.

Gereffi, Gary. "Rethinking Development Theory: Insights from East Asia and Latin America." *Sociological Forum.* Vol. 4, no. 4, 1989. 505-33.

Goodman, David. 2001. "The Interdependence of State and Society: The Political Sociology of Legal Leadership" in *Remaking the Chinese State: Strategies, Society and Security*. Chien-min Chao and Bruce J. Dickson (eds). London: Routledge.

Henderson, Jeffrey and Richard Appelbaum. 1992. "Situating the State in East Asian Development Process," in *States and Development in the Asia Pacific Rim*. Richard Appelbaum and Jeffrey Henderson (eds). Newbury Park, California: Sage Publications.

Hook, Brian (ed). 1998. *Beijing and Tianjin: Towards a Mellenial Megalopolis*. Hong Kong: Oxford University Press.

______________. 1998. *Shanghai and Yangtze Delta: A City Reborn*. Hong Kong: Oxford University Press.

Jiang, Zemin. 2003. "Preface" in *Science Progress in China*. Lu Yongxiang (ed). Beijing: Science Press.

Nee, Victor and David Mozingo (eds). 1983. *State and Society in Contemporary China.* Ithaca: Cornell University Press.

Rosenbaum, Arthur. 1992. "Introduction" in *State and Society in China: The Consequences of Reform*. Arthur Rosenbaum (ed). Boulder: Westview Press.

Saich, Tony. 2001. *Governance and Politics in China*. Houndmills: Palgrave.

Schumacher, E.F. 1993. *Small is Beautiful: A Study of Economics as if People Mattered*. London: Vintage.

Segal, Adam. 2003. *Digital Dragon: High Technology Enterprises in China*. Ithaca: Cornell University Press.

Sen, Amartya. 1999. *Development as Freedom*. Oxford: Oxford University Press.

Wang Huijong. 2003. *Integrated Study of China's Development and Reform: Preliminary Explorations of Social System*. Beijing: Foreign Language Press.

Wang Xu. "Mutual Empowerment of State and Society: Its Nature, Conditions, Mechanisms, and Limits." *Comparative Politics*, Vol. 31, no. 2. January 1999. 231-249.

Young, Y.M. 1996. "Introduction." *Shanghai: Transformation and Modernization under China's Open Policy*. Hong Kong: The Chinese University Press.