

Missile Science, Population Science: The Origins of China's One-Child Policy*

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ABSTRACT This article traces the origins of China's one-child-for-virtually-all policy to Maoist militarism and post-Mao military-to-civilian conversion. Focusing on the work of Song Jian, leading missile scientist and scientific architect of the strict one-child policy, it shows how during 1978–80 the resources of defence science and the self-confidence of the elite scientist enabled him boldly and arbitrarily to modify the work of the Club of Rome and use that Sinified cybernetics of population to redefine the nation's population problem, create a radical one-child-for-all solution to it, and persuade China's leaders that his "scientific" solution was the only way out. Although the advent of "scientific decision-making" in the population arena helpfully broke a political logjam, allowing China's leaders to adopt a strong policy on population control, the making of social policy by an elite scientist/engineer from the defence world posed dangers for the Party and China's people. The case of population policy is important because it provides rare insight into the way scientists have sometimes shaped elite policy-making and because the social and political consequences of the one-child policy have been so troubling.

Now a quarter of a century old, China's one-child policy remains one of the most puzzling projects of the post-Mao party-state. Since its introduction as a nation-wide policy in 1980, the leadership has deemed rapid population growth a threat to China's national security and global ambitions requiring all-out mobilization, whatever the cost.¹ Where did this insistent, control-the-numbers-at-any-cost approach to population control come from? Despite the large literatures on shifts in the one-child policy, its enforcement and its demographic effects, the origins of that unusual policy remain a mystery. The most significant clue is the key role of a set of population projections by the control theorist Song Jian.² In Western

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1. Lee and Wang note that the draconian birth planning programme of the 1980s and 1990s was based on "little more than 19th-century [Malthusian] theory" attributing China's poverty largely to overpopulation. James Z. Lee and Wang Feng, *One Quarter of Humanity: Malthusian Mythology and Chinese Realities, 1700–2000* (Cambridge, MA: Harvard University Press, 1999), p. 21. This article employs the conventional term, one-child policy, even though since 1984 many rural couples have been allowed two children.

2. H. Yuan Tien, *China's Strategic Demographic Initiative* (New York: Praeger, 1991), pp. 107–112; Thomas Scharping, *Birth Control in China, 1949–2000* (London: Routledge, 2003), pp. 39–40, 53.

publications in his field of systems science and control theory, Song has claimed credit for authoring the policy: “[Our 1980 projections] shocked the scientific circles and politicians, [leading the government to] follow a policy of ‘one child system’.”³ Yet neither Song nor Western students of Chinese population affairs have shed light on the source of those projections, the larger body of work to which they presumably belonged, or the politics by which Song’s proposal apparently was transformed into national policy.

Cybernetics is the science of control and communication in complex machine systems.⁴ Its frequently close association with weapons development led me to the literature on China’s defence science. Population studies and military studies are rarely brought together, but in the study of China they must be, for Song Jian was one of the nation’s leading strategic weaponeers. Because of the enormous secrecy surrounding China’s defence research, for the past 25 years Song has avoided mentioning his military science and engineering background in his population writings. Yet the literature on China’s defence R&D allows us to make some striking connections. During the Maoist decades, as John Wilson Lewis, Xue Litai and Evan A. Feigenbaum have shown, Chinese science was virtually all military science.⁵ As a result, at the beginning of the Deng era, China’s strategic weaponeers were the only fully functioning scientists capable of responding rapidly and effectively to the call to apply modern science and technology to the challenge of rapid economic modernization. When Deng began to encourage defence conversion in the mid-1970s, some of the most talented defence scientists and engineers were able to preserve their power and transport their worldviews into a new era by adapting the science and technology they knew best to the new growth fields of social and economic development.⁶ This is the larger context in which the one-child policy was born.

An innovative scientist, talented technician, and savvy politician, Song Jian was a major figure in China’s defence science establishment for nearly 40 years (1960–97), playing key roles first in building China’s military-industrial complex and later in converting it to civilian uses. Yet Song was not just a military scientist. He belonged to a class of elite scientists, strategic defence experts whose native brilliance, signal contributions to national defence, and long list of accolades from top scientists

3. Song Jian, “System science and policy-making” (1995), in Song Jian, *Song Jian kexue lunwen xuanji (Selected Scientific Papers of Song Jian)* (Beijing: Kexue chubanshe, 1999), p. 537.

4. The classic text is Norbert Wiener, *Cybernetics; or Control and Communication in the Animal and the Machine* (New York: Technology Press, 1948). In China cybernetics is generally called “control theory science.” See Song Jian, “System science and policy-making,” p. 534.

5. John Wilson Lewis and Xue Litai, *China Builds the Bomb* (Stanford: Stanford University Press, 1988); John Wilson Lewis and Xue Litai, *China’s Strategic Seapower: The Politics of Force Modernization in the Nuclear Age* (Stanford: Stanford University Press, 1994); Evan A. Feigenbaum, *China’s Techno-Warriors: National Security and Strategic Competition from the Nuclear to the Information Age* (Stanford: Stanford University Press, 2003).

6. This argument extends Feigenbaum’s arguments to social and economic policy-making. See *ibid.* pp. 71–140.

and politicians led them to see themselves, and others to see them, as “superscientists” who could speak with originality and authority on any subject and command attention. In China the most prominent elite scientists, the aerospace engineer Qian Xuesen and the nuclear physicist Qian Sanqiang, gained extraordinary prestige and influence among political leaders.⁷ The story is much the same elsewhere.⁸ This article argues that Song’s background in the defence science establishment and his status as an elite scientist gave him the scientific, political, and cultural resources and the self-confidence to redefine the nation’s population problem, create a radically new “scientific” solution to it, and persuade China’s leaders that his policy of one child for all was the only way out of China’s demographic impasse.

The literature on defence conversion in the early Deng years stresses the positive contributions of a civilianized defence S&T to the nation’s modernization. Carol Hamrin and Nina Halpern argue that the growing participation of intellectuals in the policy process from around 1980–81 ushered in a more systematic, realistic and data-driven process of policy-making that was far superior to the erratic, ideological, vision-driven mode that had prevailed under Mao.⁹ This argument is incontrovertible on a general level, but when one looks at particular economic and social policies that were shaped by scientists and engineers, a more complex picture emerges. Whether expertise is superior to Marxian ideology as a basis for public policy depends on the specifics: what type of scientific and/or engineering expertise is applied; what factors does the science include and exclude; what logics get built into the policy? For understandable reasons, the political science literature on policy-making in China starts with political leaders and the state, bringing in scientists as secondary, largely advisory actors. The science itself is held at arm’s length. To answer questions such as those above, we need to reverse the usual order of policy studies and start with the scientists and the science they made.

An important body of work on Chinese science and science policy explores the political dynamics, organization and implications of their post-Mao development.¹⁰ To understand the role of science and scientists

7. See n. 5.

8. E.g. Herbert F. York, *The Advisors: Oppenheimer, Teller, and the Superbomb* (Stanford: Stanford University Press, 1989); William J. Broad, *Teller’s War: The Top-Secret Story behind the Star Wars Deception* (New York: Simon and Schuster, 1992); Lorna Anderson, *Britain and the H-Bomb* (Hampshire: Palgrave, 2001); David Holloway, *Stalin and the Bomb: The Soviet Union and Atomic Energy, 1939–1956* (New Haven: Yale University Press, 1994).

9. Carol Hamrin, *China and the Challenge of the Future: Changing Political Patterns* (Boulder: Westview, 1990), esp. pp. 51–53; Nina P. Halpern, “Scientific decision making: the organization of expert advice in post-Mao China,” in Denis Fred Simon and Merle Goldman (eds.), *Science and Technology in Post-Mao China* (Cambridge, MA: Council on E. Asian Studies, Harvard University, 1989), pp. 157–174.

10. Key monographs include Richard P. Suttmeier, *Science, Technology and China’s Drive for Modernization* (Stanford: Hoover, 1990); Tony Saich, *China’s Science Policy in the 80s* (Manchester: Manchester University Press, 1989); H. Lyman Miller, *Science and Dissent in Post-Mao China: The Politics of Knowledge* (Seattle: University of Washington Press, 1996).

in the formation of specific policies, however, we need to follow the lead of science studies and look deeper, into the micro intellectual and political practices by which policy science is made and politically advanced. Science studies holds that science is humanly made in such a way that its intellectual practices come to reflect the training and intellectual predilections of its makers as well as the culture and politics of the larger context in which science is made.¹¹ This work suggests that through close examination of the models, mathematics and other elements of Song's population work we can see which techniques and rationalities were imported into population science and, in turn, population policy. This more epistemic approach complements the informal personal-network and formal institutional approaches conventionally used in the study of central-level Chinese policy-making.

In this article I explore the making of China's population science and policy in the formative years from 1978 to 1980. My notion of population policy is a broad one that embraces, first, the way the population problem is framed, secondly the policy solution to that problem, and thirdly the larger strategy for enforcing that policy. The Song Jian episode in Chinese policy-making is of special interest because it provides rare insight into the political dynamics by which scientists have occasionally shaped CCP policy, and because the social and political consequences of the one-child policy have been so far-reaching and so troubling. This article and the book on which it is based draw on nearly 20 years of interviews with China's population scientists, officials and policy makers, including interviews with Song and other key players in December 2003.¹² They draw too on documentary research on the history of Chinese population science and policy, and participant observation of scientific practice and culture conducted while engaging in research collaborations with Chinese population specialists in the 1980s and early 1990s. My understanding of Chinese missile science is informed by consultations with a Chinese specialist in aerospace engineering trained in China and the United States.

The Making of an Elite Scientist

In the revolutionary turmoil that was Maoist China, most of the social sciences were abolished, the natural sciences decimated. Yet because of Mao's military view of the world and the very real threats of attack from the United States and, after 1960, also the Soviet Union, military science became a privileged site of knowledge and technology production. Most privileged of all was the strategic weapons community of scientists and engineers charged with building the atomic bomb and the missile systems to deliver the payload.

11. The classic studies are Bruno Latour and Steve Woolgar, *Laboratory Life: The Construction of Scientific Facts* (Princeton: Princeton University Press, 1986); Bruno Latour, *Science in Action: How to Follow Scientists and Engineers Through Society* (Cambridge, MA: Harvard University Press, 1987).

12. Susan Greenhalgh, *Science, Modernity, and the Making of China's One-Child Policy*, in progress.

Strategic defence science: a protected and privileged domain. During Mao's lifetime, the strategic defence community was not only protected from violence, it also received a huge proportion of the nation's scarce developmental resources.¹³ It absorbed the best trained and most talented scientists, enjoyed use of the best equipment and most modern facilities, and virtually monopolized the modern industrial sector. In the Mao era, scientists and engineers working on strategic weapons were a privileged and powerful group. They had access to foreign literature, to data and to computers with which to analyse them. The institutions in which they worked encouraged the construction of personal networks that gave them access to the highest levels of the government and involved some in important national policy decisions. Defence scientists and engineers worked in an environment with an entrepreneurial, risk-taking culture that encouraged bold initiatives and rewarded technical accomplishment with political influence and cultural prestige. These scientific, political, and cultural resources would be important to the creation and promotion of post-Mao population policy.

A builder of the military-industrial complex. Song Jian inhabited the highest echelons of this privileged and powerful segment of Chinese society. His rise began early. In 1946, at the age of 14, he left his home village in Shandong's Rongcheng county and enlisted in the Eighth Route Army.¹⁴ With this move he essentially joined the CCP movement, apparently securing his Party credentials. In 1953 he passed the exam and, on the recommendation of Liu Shaoqi, was sent to the Soviet Union, where he was trained in cybernetics and military science. An outstanding student, Song studied with the world-famous control theorist A. A. Fel'dbaum, received an associate PhD degree from Moscow University, and published seven papers in Russian on the theory of optimal control, later earning the acclaim of Soviet and American scientists.

Song returned to China after the Sino-Soviet split in 1960. From his position in the second sub-academy (in charge of control systems) of the fifth academy (in charge of missiles and space – in 1965 to become the Seventh Machine Building Ministry, or missile ministry for short) of the Ministry of National Defence, he became the nation's leading control theorist and a foremost expert on missile guidance and control systems.¹⁵ Early on Song was singled out for praise and patronage by Qian Xuesen, the US-educated father of China's space programme and top military science advisor to Mao and Premier Zhou Enlai.¹⁶ It was Qian who declared that it was Song, not he, who was the country's leading control

13. This discussion is based on Feigenbaum, *China's Techno-Warriors*; Lewis and Xue, *China Builds the Bomb* and *China's Strategic Seapower*; John Wilson Lewis, Hua Di and Xue Litai "Beijing's defence establishment," *International Security*, Vol. 15, No. 4 (1991), pp. 86–109.

14. The following biography is based on Huang Shouzeng, "Song Jian jianli" ("Brief biography of Song Jian"), in Song Jian, *Selected Scientific Papers*, pp. 744–752.

15. Song was first to apply optimal control theory to missile guidance and control.

16. On Qian, see Feigenbaum, *China's Techno-Warriors*; Lewis and Xue, *China's Strategic Seapower*; Iris Chang, *Thread of the Silkworm* (New York: Basic, 1995).

theory scientist. Qian showered the young Song with favoured opportunities for scientific advance. At Qian's behest, Song was invited to head a new Control Theory Research Office in the Mathematics Institute of the Chinese Academy of Sciences, and chosen to co-author the revised edition of Qian's two-volume *Engineering Cybernetics*, a bible for generations of Chinese defence scientists and engineers. Song's abundant talent, technical accomplishments, and political patronage and savoir faire combined to propel him into the ranks of the topmost defence scientists and engineers. During the Cultural Revolution, after Song's house was ransacked by the Red Guards, Zhou placed him on his list of about 50 scientists who, because of their indispensability to the nation's defence, would enjoy special state protection. Song was sent to the Jiuquan missile base in the Gobi Desert, where he spent over a year broadening his scientific knowledge by reading in astronomy, nuclear physics and other fields. In 1969 he returned to Beijing, where he continued his work on missile control and guidance systems, attracting the attention of Zhou for his work on anti-missile missiles (*fan daodan daodan*). In 1978 Song was awarded the post of deputy director of the missile ministry's second academy.

A leader in defence conversion: the appeal of population cybernetics. In 1977–78, Deng Xiaoping was reducing investment in military R&D and urging defence scientists to turn their energies to solving the nation's many economic problems. One of China's most serious problems was its huge and still swiftly growing population. After Mao's death in 1976, a strong consensus had emerged at the highest levels of government that the rapid growth of a largely rural population was a major obstacle to the achievement of the "four modernizations." The sorry history of population studies and population control under Mao was only too well known in Chinese intellectual circles. These were the historical currents prevailing in mid-1978 when, on a visit to Helsinki, Finland to attend the Seventh Triennial World Congress of the International Federation of Automatic Control, Song encountered a radically new (to China), cybernetic-based natural science of population and its control that was tied to the well-known work of the Club of Rome.¹⁷ Composed largely of natural scientists, who saw population in biological terms, the Club of Rome presented a global systems model in which population growth was destroying the environment and required strong, even drastic, control.¹⁸

Song immediately saw the promise of the systems science approach. Based on mathematics, this Western cybernetics of population would produce what seemed to him a precise, scientific solution to the popu-

17. Song Jian, "Systems science and China's economic reforms" (1985), in Yang Jiachi (ed.), *Control Science and Technology for Development (CSTD '85)* (Oxford: Pergamon, 1986), pp. 2–3.

18. Donella H. Meadows *et al.*, *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind* (New York: Universe, 1972); Mihajlo Mesarovic and Eduard Pestel, *Mankind at the Turning Point: The Second Report to the Club of Rome* (New York: E.P. Dutton & Co, 1974).

lation problem. Such a solution appeared far superior to the Marxian social science perspectives that had dominated for so long, leaving population control vulnerable to ideological attack. In the West, the Club of Rome work had provoked an outcry from social scientists concerned about the application of cybernetics' mechanistic models to the solution of human problems.¹⁹ Song apparently did not encounter such critiques. Quite the contrary, the congress at which he discovered the new approach was infused with a spirit of scientific certainty, progress and messianic fervour about the potential of control science to solve the world's problems.²⁰ That context seems to have nurtured the belief that the cybernetics of population represented the best of international science, for Song's writings would soon treat it with the same zeal that pervaded the Helsinki meeting. Developing such an approach for China would utilize and showcase Song's cybernetic skills, while giving him an exceptional opportunity to respond to the call for defence conversion by helping to solve one of the country's most urgent problems. The appeal, evidently, was irresistible.

Part of that appeal may well have lain in the opportunity population provided for Song to mobilize his talents as an elite scientist, one who could quickly master new fields and find brilliant solutions that lesser minds had missed. Song's population writings, analysed below, provide ample evidence that he saw himself in these terms. Unusually for population work, Song's writings would occasionally draw on fields as diverse as astronomy, geography and environmental science.²¹ After 1980 his articles would sometimes note the praise his work had earned from China's leaders and famous foreign specialists.²² Song would also write with a supreme self-confidence that his techniques and policy proposals were not only right but also the very best available. It was as though everything he wrote was by definition correct and compelling. These unconventional features of his work make sense when one sees Song as he apparently saw himself: as an elite scientist who stood head and shoulders above the rest. Song's abundant self-assurance is crucial to the story told below.

Even as he was developing the population science that would alter the nation's population control strategy, Song continued to work in missile and aerospace science. In publications he kept his two sciences separate, but they were very much intermeshed in his career and, one must imagine, in his thinking. In February 1980, the month he scored a key victory in the population battles (described below), Song became the

19. E.g. H. S. D. Cole *et al.* (eds.), *Models of Doom: A Critique of the Limits to Growth* (New York: Universe, 1973).

20. A. Niemi *et al.* (eds.), *A Link Between Science and Applications of Automatic Control*, 4 vols. (Oxford: Pergamon, 1979).

21. Esp. Song Jian, "Cong xiandai kexue kan renkou wenti" ("Population problems from the perspective of modern science"), *Guangming ribao* (*Guangming Daily*), 3 October 1980, in Song Jian, *Selected Scientific Papers*, pp. 549–554.

22. E.g. Song Jian, "Some developments in mathematical demography and their application to the People's Republic of China," *Theoretical Population Biology*, Vol. 22 (1982), pp. 382–83; Song Jian, "Systems science and China's economic reforms"; Song Jian, "System science and policy-making."

principal deputy chief designer of China's submarine-launched ballistic missile. From this important post, he moved rapidly up the scientific-political hierarchy. In 1982, shortly after the strict one-child policy he helped devise became national policy, he was named vice-minister of the (newly named) Ministry of Space Industry. The internal repudiation of Song's extreme approach to population limitation in 1984 did not slow his political ascent. In 1985 he assumed the headship of the powerful State Science and Technology Commission, and in 1986 he became a state councillor, positions he held until his retirement in 1998. Not merely a leading scientist, Song had become one of the nation's political leaders, in charge of the domain that Deng had named the key to China's attainment of wealth, power and global position.

Defence Science Resources: Making Population Policy

With the death of Mao, the control of population growth became an urgent issue on China's reform agenda.²³ In March 1978 the state planning of births was made a constitutional obligation. Paramount leader Deng Xiaoping was a strong advocate of population control, having spoken out on the link between China's population growth and poverty at least four times between 1975 and late 1978.²⁴ Yet throughout the 1970s population was a weakly institutionalized sector, with few institutions or standard operating procedures for processing policy issues. In this context, policy entrepreneurs would have room to exert appreciable influence over the policy outcome. In June 1978 the State Council formed a new and enlarged Birth Planning Leading Small Group, placing vice-premier Chen Muhua, a Politburo member whose portfolio was in foreign economic affairs, in charge. Chen was the main formal channel through which scientists' policy proposals would enter the CCP decision process.

The key policy question was what level of population control was needed. From December 1973 birth work had been guided by the *wanxishao* policy (calling for later marriage, longer child spacing and fewer offspring). Under the slogan "one is not few, two are just right, three are too many," "few" effectively meant two. This policy had produced striking demographic results, halving the total fertility rate from just under six to just under three children per woman during the 1970s.²⁵ Yet age data made available to the new Leading Group in June 1978 showed a baby boom looming on the horizon because of the large cohorts born in the 1960s. Clearly, the existing limit of two children per couple would not restrain the growth of China's huge population, already nearing 1 billion. The Leading Group proposed a new guideline: "one is

23. On the elite politics of population at this time, see Susan Greenhalgh and Edwin A. Winckler, *Governing China's Population: From Leninist to Neoliberal Biopolitics* (Stanford: Stanford University Press, 2005), ch. 4.

24. Entries in Yang Kuixue *et al.* (eds.) *Zhongguo renkou yu jihua shengyu dashi yaolan (Main Events in China's Population and Birth Planning [History])* (Beijing: Zhongguo renkou chubanshe, 2001).

25. The total fertility rate is the average number of children that would be born per woman if all women lived to the end of their childbearing years and bore children according to a given set of age-specific fertility rates.

best, two at most.” The new slogan, the first official advocacy of (though not demand for) one-child families, was endorsed by the Central Committee in Document 69 of October 1978.²⁶ In late 1978 and 1979, a number of provinces, taking their cue from Document 69, decided that if “one was best,” they should be politically progressive and advocate one child for all. While most provinces eventually adopted regulations encouraging one as best, those were considered local policies.²⁷ The centre had not reached a decision on this sensitive matter.

The historic third plenum of December 1978 and the larger shift of the Party’s focus to achieving the four modernizations gave new urgency to efforts to control population growth. Deeply worried about economic growth and grain availability, during 1979 Deng Xiaoping and Li Xian-nian, senior vice-premier and vice Party chairman, spoke out strongly on population control. In April Chen Yun, Party elder and top authority on economic matters, became the first leader to openly call for a widespread one-child policy, urging the adoption of a law demanding that each couple have one child. Clearly, there was some support at the top for at least encouraging one-child families. Yet the critical questions of the *speed* and *universality* of a one-child policy remained unresolved. Fearful of making the same mistake they had made 20 years earlier when they silenced Ma Yinchu (see below),²⁸ in the summer of 1979 China’s leaders opened the “forbidden zone” of population and authorized the build-up of a corps of specialists to help them scientifically formulate and legitimate a new policy to restrain population growth.

A social science of population: the handicaps of history. Who would fill the ranks of population experts? In the late 1950s population studies had been abolished, its most vocal spokesman, the eminent economist Ma Yinchu, silenced and persecuted.²⁹ In the mid-1970s, the state began quietly to restore the Marxian social science of population to provide the ideological rationale for the rapidly expanding programme of state birth planning.³⁰ Although the social scientists recovered their ability to conduct population research with impressive rapidity, after 20 years of intellectual isolation, deskilling and political intimidation, they entered the contest to shape China’s population policy with distinct handicaps.

The most prominent group of specialists was a handful of statisticians working at the Beijing College of Economics, and later the People’s University of China, under the direction of Liu Zheng. Using the limited demographic data available and the relatively simple statistics of the planned economy, they undertook descriptive empirical research to gauge the structure and likely growth trends of the population. With population still a politically risky subject and the need for strong population control

26. Yang *et al.*, *Main Events*, p. 66.

27. Interview with top population official in the 1970s, 25 December 2003, Beijing.

28. Interview with Chinese population specialist, 1 May 2003, Minneapolis.

29. H. Yuan Tien, *China’s Population Struggle* (Columbus: Ohio State University Press, 1973), pp. 163–231.

30. Interviews with Chinese population specialist, 13 November 1985, Beijing; and birth planning official, 15 December 2003, Beijing.

not yet politically secured, Liu and his colleagues were preoccupied with developing a Marxian formulation of China's population problems to give ideological legitimacy to the project. Drawing on Frederick Engels' notion of the two-fold character of production (of material goods and human beings), as well as indigenous Chinese framings based on the planned economy and, of course, Mao's population thought, they defined China's population problem as one of serious imbalance between population growth on the one hand, and social and economic development on the other.³¹ In their framing, excessive population growth was undermining China's modernization by hampering progress in employment, accumulation, living standards and education. Weighing the social costs of a one-child policy (in particular, distortions in the age structure) and the political difficulties of enforcing such a rule in the countryside, the Liu group proposed a moderate policy of rapidly eliminating third births while gradually raising the proportion of first births. Their proposal, which was submitted to the Central Committee and State Council in April 1979 and became the leading policy recommendation during most of 1979, called for first births to reach 50 per cent in the cities and 25 per cent in the villages by 2000.³²

A physical science of population: the advantages of military science. While the largely university-based social scientists were creating an indigenous, socially-oriented approach to China's population problems, in the research academies of the Seventh Ministry of Machine Building, Song Jian was busy developing a very different approach based on foreign models and rooted in the physical science of cybernetics. In this endeavour, the scientific resources and political capital Song enjoyed as a prominent defence scientist-engineer gave him enormous advantages. His access to international science was certainly one of those advantages.

Soon after returning from his mid-1978 trip to Europe, Song recruited two talented subordinates in the missile ministry – Yu Jingyuan, a systems engineer, and Li Guangyuan, a mathematically trained computer expert – to work with him. A year later they asked Tian Xueyuan, an economist at the Chinese Academy of Social Sciences, to join the team to help them understand demography, a subject new to them (and to Tian).³³ For concepts and methods, the physical scientists and engineers drew on the systems science and control theory research that Song had discovered in Europe, modifying them to fit the Chinese context. The group's prior work on missile control would ease the task of learning this new subject.

One of the greatest advantages enjoyed by the military scientists was their access to large computers. As in many countries, in China computers had been developed by the military for weapons applications. The

31. Liu Zheng *et al.*, *Renkou lilun (Population Theory)* (Beijing: Shangwu yinshuguan, 1977).

32. Liu Zheng, Wu Cangping and Lin Fude, "Dui kongzhi woguo renkou zengzhang de wu dian jianyi" ("Five recommendations for controlling China's population growth"), *Renkou yanjiu (Population Research)*, No. 3 (1980), pp. 1–5.

33. Interview with member of Song group, 16 November 1999, Beijing.

ability to process large quantities of data rapidly and accurately enabled Song and his colleagues to perform modelling tasks the social scientists, who had only calculators, could scarcely imagine. According to one member of the team, it took but five minutes of borrowed time on the missile ministry's large computers to run all the population computations.³⁴ Moreover, unlike the social scientists, who possessed only basic statistical skills, the physical scientists were highly trained mathematicians who had used sophisticated mathematics in working on the some of the most complex tasks of advanced weapons development. These skills enabled them to develop models that were both different from, and much more sophisticated than, any demographic models available in China – or almost anywhere – at the time. Such complex models were not necessary to understand population dynamics, but they were original and, with their esoteric equations, they would impress many who could not understand them

Finally, in their years in the weapons development community, the physical scientists and engineers had imbibed that community's culture of bold experimentation and risk-taking. Whereas the social scientists were encumbered by an ingrained caution and fear borne of years of political persecution, the military scientists possessed the self-assurance to enter an entirely new field, borrow a set of foreign techniques they had encountered only briefly, modify them in significant ways, and then employ those techniques to quickly develop and press for a radically new solution to social problems that had vexed the nation for decades.³⁵ Of course, these bold manoeuvres carried risks and dangers. But those would emerge only later.

A Sinified Cybernetics of Population: Shaping the Policy's Content

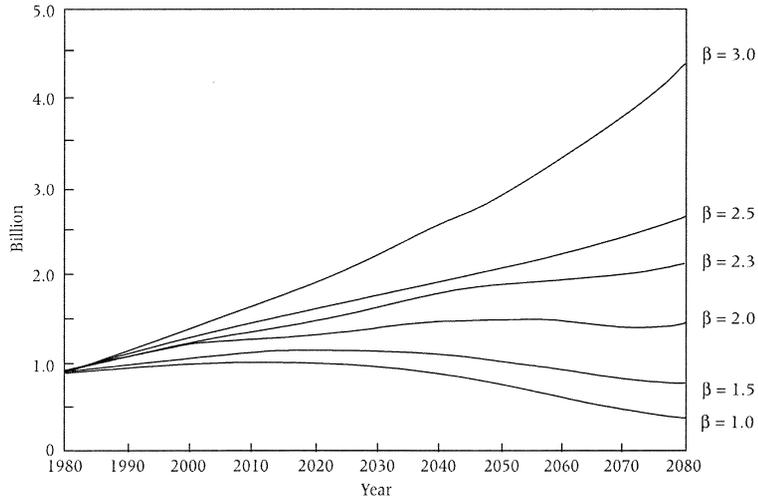
Drawing techniques and logics from the Club of Rome and from defence science, the Song group redefined China's population issues in natural and physical science terms. The result was a more urgent problem, a more radical solution, and a more top-down, big-push strategy of enforcement than had been considered before.

The population problem: a threat to national survival and global ambitions. Before the natural scientists entered the debates, concerns about population growth centred on its deleterious effects on economic growth and thus the achievement of the four modernizations. China's demographers believed that future population growth would probably be very worrying, but the specifics eluded them. The Song group profoundly recast the population problem by revealing the precise numerical extent of that increase, and by drawing attention to the fearful environmental consequences of a gargantuan growth in human numbers.

34. Interview with member of Song team, 24 December 2003, Beijing.

35. Depiction of social science based on interviews with Chinese social scientists in Beijing, Tianjin, Xi'an, Chengdu, Nanjing, Shanghai and Guangzhou in 1985 and 1986, and with the cyberneticists in Beijing in 1986, 1987 and 2003.

Figure 1: Future Projected Trends of Population Control



Source:

Song Jian and Li Guangyuan, "Renkou fazhan wenti de dingliang yanjiu" ("Quantitative research on the problem of population development") *Jingji yanjiu (Economy Research)*, No. 2, pp. 60–67. Reproduced in Greenhalgh, "Science, Modernity, p. 180.

The Song team first computed a set of population projections for the 100-year period 1980–2080 that purported to show in very precise terms how fast and how much the numbers of Chinese would rise (see Figure 1). To a demographer examining this work, the projections would have appeared *precise* but not especially *accurate*, since at the time there were no reliable data on the Chinese population. The scientists briefly noted the data difficulties but dismissed them as minor technical problems.³⁶ To that demographer the forecasts would also have appeared relatively meaningless, for population growth in the distant future is affected by a large number of unpredictable factors. This issue was not raised in the Chinese work. Methodological concerns aside, the results were stunning. The projections revealed that if fertility remained at the 1975 level of 3.0 children per woman, China's population would top 4 billion in 2080 and keep on growing. The 1978 level of 2.3 children produced lower numbers, but the same trend of endless growth. Only at fertility levels of 1.5 and 1.0 would the population quickly stabilize and begin to shrink. These expanding numbers were so worrying to the scientists because of their dire effects on China's natural resources and environment. By eroding lakes, forests and other natural resources, and by polluting the environment, the rapid growth of human numbers, they suggested, would threaten the resources needed to maintain economic progress.³⁷

36. For the data story, see Susan Greenhalgh, "Science, modernity, and the making of China's one-child policy," *Population and Development Review*, Vol. 29, No. 2 (2003), pp. 163–196. On data problems, see Judith Banister, *China's Changing Population* (Stanford: Stanford University Press, 1987), pp. 12–20.

37. Song Jian, "Population problems from the perspective;" Song Jian, "Population development – goals and plans," in Liu Zheng, Song Jian *et al.* (eds.), *China's Population: Problems and Prospects* (Beijing: New World Press, 1980), pp. 25–31.

In framing their concerns about population and the environment, the scientists advanced two larger arguments that closely paralleled arguments long used in the defence community to justify large expenditures on strategic weaponry. Now, however, the enemy was not external but internal: the Chinese people themselves. First, China's impending population explosion was depicted as a threat to national security and even survival, for by degrading the nation's ecosystem, population growth would eventually destroy the resources necessary to sustain human life.³⁸ This first argument drew heavily on the catastrophic framings of the Club of Rome, but its language of threats to national security would have been comfortable and appealing to scientists accustomed to making the case for military resources in such terms.

The second argument, however, could only have come from China. Given the scientists' background, we can assume that it was modelled on a doctrine that lay at the heart of military thinking. In the Mao years, China's military scientists had developed and successfully promoted a unique doctrine that framed the acquisition of atomic bombs and nuclear missiles as strategic matters affecting not just China's security, but also its standing and power in the world.³⁹ In June 1978 Li Xiannian had told the new Leading Group that birth planning was a "strategic issue" (*zhanlüe wenti*) that affects the four modernizations, as well as the nation's prosperity, wealth and power.⁴⁰ In early 1980, Song gave that term a new, quasi-military cast by suggesting that China's population growth constituted a threat to the world and, in turn, China's standing in the global community. The larger argument ran as follows. As the world's most populous and a still fast-growing country, China was the single greatest contributor to the explosive rates of global population growth that were threatening human survival by destroying the world's environment.⁴¹ By arresting the fierce growth of human numbers, China could accelerate its own modernization and help alleviate a global crisis. Through population control, China would join the world's powers as an economic powerhouse and a socially responsible member of the community of nations. Compared to the social scientific construction of population as a problem of imbalance in domestic development resources, these new, almost militaristic framings of the population problem both raised the stakes involved in gaining control over population growth and intensified the sense of urgency surrounding that project.

The policy solution: from missile control mathematics to population control mathematics. If population growth posed a threat to the nation's security and global ambitions, the solution could only be a drastic one in which the interests of individuals would have to be forcefully subordinated to those of the nation. In devising a scientific solution to the

38. *Ibid.*

39. Feigenbaum, *China's Techno-Warriors*, pp. 13–68.

40. Yang *et al.*, *Great Events*, p. 64

41. E.g. Song Jian, "Population problems from the perspective," "Population development," "Some developments in mathematical demography," pp. 382–383.

problem, Song and his colleagues (especially Yu) turned to the cybernetic techniques of optimal control whose use Song had pioneered in the development of missile guidance systems. From a mathematical point of view, missile control techniques lent themselves readily to population control problems, because the trajectories of missiles and populations charted over time followed similar lines, and because the optimization problems for controlling the two objects took functionally similar forms.⁴² Inspired by some little-known Dutch work that Song had discovered in Europe,⁴³ Song and Yu posed the optimization problem for population as finding the best fertility trajectory that would produce a future ideal population target, given certain constraints. Although different parameters (missile velocity, position and thrust as opposed to population density, death rate and migration rate) produced somewhat different models, the mathematics of partial differential equations used in the two cases was virtually identical. In an interview Song himself stressed the relative ease of the conversion.⁴⁴

The application of these techniques produced some jarring results. Based on some heroic assumptions and educated guesswork about future trends in many economic and ecological variables, the Song group first performed calculations showing that the “ideal” target population 100 years in the future was 650 to 700 million (two-thirds China’s 1980 population of 1 billion).⁴⁵ Despite its shaky basis, this target was crucial, for it implied that China had already exceeded its “carrying capacity,” that below-replacement fertility was imperative to achieve sustainability, and that the longer China waited for fertility to decline the more environmental damage it would sustain. The mathematics of optimization showed that the “optimal” fertility trajectory by which to keep population within that target was to reduce fertility rapidly to one child so that by 1985 all couples would have but one; maintain fertility at that level for the next 20 to 40 years; and then gradually raise it to replacement level of 2.1 children per woman. The solution was, in the Song group’s term, rapid one-childization (*yitaihua*) country-wide.

In adapting the Dutch work to the Chinese situation, Song and his team modified it in highly significant, yet unremarked, ways. First, they essentially dropped the social acceptability constraint and assumed, arbitrarily, that Chinese couples would accept a one-child limit. Secondly, they shrank the period of time over which fertility would be lowered to

42. Based on consultations with Chinese missile specialist and Chinese population cyberneticist, 16 December 2003.

43. Huibert Kwakernaak, “Application of control theory to population policy,” in A. Bensoussan and J.L. Lions (eds.), *Lecture Notes in Control and Information Sciences: New Trends in Systems Analysis* (Berlin: Springer-Verlag, 1977), pp. 359–378; also G.J. Olsder and R.C.W. Stribos, “Population planning: a distributed time optimal control problem,” in Jean Cea (ed.), *Lecture Notes in Computer Science; Optimization Techniques: Modeling and Optimization in the Service of Man, Part 1* (Berlin: Springer-Verlag, 1976), pp. 721–735.

44. Interview, 24 December 2003, Beijing.

45. Song Jian, “Population problems from the perspective.” For details, Song Jian *et al.*, *Renkou yuce he renkou kongzhi (Population Projections and Population Control)* (Beijing: Renmin chubanshe, 1982).

its “optimal” level. The Dutch researchers suggested reducing fertility by 40 per cent over 40 years; the Chinese scientists proposed lowering fertility by well over 50 per cent in a mere five years. Thirdly, the proposal to shrink the Chinese population by one-third followed British and Dutch research suggesting the desirability of reducing those nations’ populations by about 45 to 65 per cent.⁴⁶ In borrowing this idea the Chinese scientists transformed what was but a heuristic device for thinking through policy options in Europe into a concrete policy proposal for use on a real population in China. The demographer observing these activities would have considered it legitimate to modify the European research, but more problematic to represent the sinified work as “international science.”

As physical scientists and engineers, the Song team did not fully appreciate the vulnerability of their object of control, population, to complex socio-cultural and political-economic influences. Perhaps they simply were not interested in such matters; both Song and Yu indicated that what intrigued them was the mathematics of population.⁴⁷ Nevertheless, the issue of enforcement was an essential part of policy analysis. Although working in an unfamiliar field, the scientists did not reach out to the social science community for help in grasping and incorporating social dynamics into their models. They did include Tian Xueyuan in their group, but that was a largely token gesture that did not alter the cybernetic science. Instead, in a bold move of natural-scientific imperialism, the scientists redefined population as a biological object belonging to their empirical domain, nature, and extolled the language of natural science, mathematics, as the infallible producer of precise and accurate truths.⁴⁸ By defining population as a biological entity whose “main features” could be captured in a few vital rates (fertility, mortality and so on), the scientists could construe hard-to-quantify forces such as peasant reproductive culture, social structure and politics as peripheral matters that did not alter the conclusions reached by the mathematics of control theory. By construing questions of enforcement and human costs as external to the science, the mathematicians were able to promote a radical policy of one child for all as the best and only scientific solution to the problem.

Enforcement strategy: a “big push” from the top. As a defence scientist, Song had devoted his career to working on huge, complex and costly weapons projects that not only served statist ends but also required state-centric solutions. In an atmosphere of urgent threat to China’s national security, many of those projects were pursued with a “big-push” thrust that entailed total leadership commitment and massive mobilization

46. Kwakernaak, “Application of control theory,” p. 365; Edward Goldsmith *et al.*, *Blueprint for Survival* (Boston: Houghton Mifflin, 1972).

47. Interviews, 21 and 24 December 2003, Beijing.

48. Song Jian, “Population problems from the perspective”; Song Jian and Li Guangyuan, “Renkou kongzhi wenti” (“Problems of population control”), *Ziran zazhi (Nature)*, Vol. 2, No. 9 (1979), pp. 570–74. Almost every Song publication for a non-technical audience featured the scientific rhetoric of the precision, accuracy and truth of modern mathematics.

of the nation's resources.⁴⁹ Song himself was a proponent of big-push approaches to weapons development.⁵⁰

Although the Song group had little to say about enforcement of population policy, their work had an indirect impact on enforcement strategy through the policy it encouraged. The one-child-for-all policy both assumed and required the use of big-push, top-down approaches in the social domain. In the late 1970s, China's population experts and policy makers knew that a one-child family was an impossible demand in the countryside. Abundant research had shown that the organization of rural socioeconomic life and entrenched gender values made at least two children and one son vital to peasant security and even survival.⁵¹ Given the large gap separating state demands from peasant desires, a gap that would grow with the spread of rural reform, reaching one-child-per-couple would require a big push from the top, a full mobilization of Party and state resources, and complete commitment by leaders at all levels. Campaigns were nothing new in the birth sector – they had been the major mode of enforcing birth policy from the early 1970s. Yet the one-child policy would take the big-push strategy to a new level. Instead of attending to mass views, as required by the mass line, the new policy would override them. Instead of prohibiting coercion, the use of coercion would have to be quietly accepted “in the interests of achieving greater goals.” Finally, because of the difficulty of reaching this new goal and the urgency of doing so, the one-child policy would demand an even greater leadership commitment than had been required by the later-longer-fewer policy of the 1970s.

Such an approach could best be carried out by a nation-wide system of planning and target setting centred in the state. The Song group contributed a new vision of such an apparatus and an ambition to turn it into reality. In their writings Song and his colleagues laid out their ideal vision of a birth planning technocracy in which technicians in the state were in charge of designing and running a multi-level system of social engineering aimed at managing the growth of the entire population from the top, with little input from the objects of control at the bottom.⁵²

Defence Science Politics: Winning the Policy Battle

As noted above, in the 1960s and 1970s, China's defence specialists had worked in an institutional setting that had encouraged scientific entrepreneurship, facilitated the construction of personal networks to political decision makers, given them exceptional influence in the policy

49. Wendy Frieman, “China's military R&D system: reform and reorientation,” in Simon and Goldman, *Science and Technology*, pp. 265; Feigenbaum, *China's Techno-Warriors*, pp. 139–140.

50. Frieman, “China's military R&D,” p. 284.

51. Li Xiuzhen, “Dangqian jihua shengyu gongzuo de xingshi he renwu” (“The situation and duties of birth planning work today (13 December 1979)”), *Renkou yanjiu*, No. 1 (1980), p. 5.

52. Song Jian, “Population problems from the perspective”; Song Jian, Chi-Hsian Tuan and Jing-Yuan Yu, *Population Control in China: Theory and Applications* (New York: Praeger, 1985), pp. 29–32.

arena, and rewarded them handsomely with cultural prestige. In 1979–80, Song and his colleagues mobilized these resources from the world of defence R&D in a new contest to persuade China’s leaders that their solution to the population problem was the correct and necessary one. Those resources would be crucial to the group’s success.

Gaining converts to the cause. In entrepreneurial fashion, in early 1979 Song and his colleagues began actively recruiting converts for their ideas in China’s defence-science community. They presented their work to colleagues in the Institute of Mathematics at the Academy of Sciences, the Association of Systems Engineering and the Expert Committee on Automation Theory. At the Second National Symposium on Population Theory, held in Chengdu from 7 to 13 December, Song and Li Guangyuan presented the group’s findings for the first time to a large audience of population specialists and policy makers. The vast majority of papers delivered at that historic conference were qualitative social science contributions that addressed such issues as problems in the Marxian theory of population-economy relations.⁵³ In this sea of mostly cautious words, the paper by the physical scientists must have really stood out.⁵⁴ Filled with numbers, equations and bold assertions, it showed that the population problem was much more serious than people had thought, implying the need for a more drastic policy response.

The scientists’ achievement was rhetorical as well as substantive. Song and Li took advantage of their superior mathematical skills and the larger culture of scientism – a widespread belief in modern science as a totalistic body of thought, the prime source of truth and an all-powerful solution to China’s problems – to create a powerful dichotomy separating their own modern, precise and useful “models method” from the old-fashioned, fuzzy, largely useless “statistics method” of the social sciences.⁵⁵ Linked to this modern science of population was an essential modern technology: the electronic computer. Modern computers, they argued, would allow researchers to analyse, calculate, model, project and control population development – in short, all the crucial tasks required to solve China’s population problems.⁵⁶ In the absence of discussion of the limitations of mathematics and computers as tools for addressing social problems, this scientific rhetoric must have left a powerful impression of the unquestionable superiority of the scientists’ models.

The substantive centrepiece of the article was the six-curve figure showing future population growth under different fertility regimes (Figure 1, above). The authors refrained from offering specific policy

53. *Sichuan daxue xuebao, zhexue shehui kexue ban (Journal of Sichuan University, Philosophy and Social Science Edition)*, No. 1, 1979.

54. Song Jian and Li Guangyuan, “Renkou fazhan wenti de dingliang yanjiu” (“Quantitative research on the problem of population development”), *Jingji yanjiu (Economy Research)*, No. 2, pp. 60–67.

55. Song and Li, “Quantitative research,” p. 61. Hua Shiping, *Scientism and Humanism: Two Cultures in Post-Mao China (1978–1989)* (Albany: State University of New York Press, 1995).

56. Song and Li, “Quantitative research,” pp. 60–62.

proposals (at least in the written work), but this figure and the accompanying text conveyed the unmistakable message that only the most restrictive policy on births would save the nation from being overwhelmed by human numbers.

Though publicly appreciative, in private the social scientists were largely hostile to the natural science takeover of their domain.⁵⁷ The most outspoken, Liang Zhongtang of the Shanxi provincial Party school, warned of the coercion that would be required to enforce one-childization among the peasantry and the social costs that programme would entail, from labour shortages to rapid ageing to fractured family economies and social support systems.⁵⁸ China's population officials, by contrast, were very impressed. According to those present, Li Xiuzhen, the number two in command at the Leading Group, was very excited about the projections.⁵⁹ Chen Muhua publicly endorsed the Song work. She also rebuked Liang and dismissed his concerns about damaging social consequences, sending a chill throughout the social science community.⁶⁰ With the top population official on board, the stage was set for Song to promote his ideas more widely.

Building networks to the top. Within a month Song had taken decisive steps to publicize his group's findings and get them into the hands of the nation's top population and political leaders. In late January Song, Yu and Li published a paper in the journal *Shijie jingji diaoyan* (*World Economy Research*).⁶¹ This article presented for first time the detailed results of the projections and their policy implications: to avert the crisis, it was imperative to institute a policy of rapid one-childization, resulting in one-child-per-family by 1985. Enforcing such a policy, they wrote, was an "extremely urgent strategic duty." In the wake of the social-consequences critique at Chengdu, the scientists sought to defend their policy choice by establishing that the projected ill effects would not materialize. They did so by presenting quantitative indices of ageing, dependency ratio and labour force over the next 50 years. As a treatment of the social consequences of a one-child policy, this approach left something to be desired, for it omitted analysis of the family-level dynamics through which such demographic changes would have to be socially and culturally produced. Left to speak for themselves, the numbers seemed to tell an unquestionable truth: there was nothing to worry about for at least 30 years.

57. Based on interviews with social scientists in several cities, 1985 and 1986.

58. Liang Zhongtang, "Dui woguo jinhou jishinian renkou fazhan zhanlüe de jidian yijian" ("Several opinions about the strategy for China's population development in the next few decades"), in Liang Zhongtang, *Lun woguo renkou fazhan zhanlüe* (*On China's Population Development Strategy*) (Taiyuan: Shanxi People's Press, 1985), pp. 1–16.

59. Interview with population specialist, 19 December 2003, Taiyuan; also Li, "The situation and duties," p. 3.

60. Interview with Chinese population specialist, 12 October 1987, Taiyuan, and discussions with Chinese demographers around the country in 1985 and 1986.

61. Song Jian, Yu Jingyuan and Li Guangyuan, "Guanyu wo guo renkou fazhan wenti de dingliang yanjiu baogao" ("A report on quantitative research on the question of China's population development"), *Shijie jingji diaoyan* (*World Economy Research*), No. 5, 31 January 1980; in Song Jian, *Selected Scientific Papers*, pp. 540–46.

Building on personal ties forged in the defence science community, Song then began creating networks to deliver the proposal into the hands of the people who would matter. He created two chains of ties, one connecting him to top population policy makers, the other linking him to top political leaders.⁶² In the first, Song sent the group's work to two of the nation's top scientists, one natural and one social. Qian Xuesen (mentioned above) was one of the most influential natural scientists in the country, while Xu Dixin was one of China's most eminent economists. Qian and Xu sent the materials on to Chen Muhua. Chen soon replied, writing that the projections were "very good" and "have great reference value" for policy-making, adding that she had "already prepared a special report for the Politburo."⁶³ In the second network, Song sent the materials to the secretary at the powerful National Defence Science Commission, who turned them over to Wang Zhen, vice-premier and member of the Politburo and Standing Committee of the Central Military Commission. Here Song seems to have been counting on his reputation as a leading missile expert, along with the prestige and political clout of defence scientists and policy-making bodies, to make his population policy the leading contender for adoption.

The strategy seems to have worked. In an interview, Song reported how Wang Zhen, upon receiving the research report, immediately picked up the phone and called to express his alarm.⁶⁴ In his written reply, Wang endorsed the work as "extremely important" and suggested that it be made known to Chen Yun, second only to Deng in prestige and influence, and Hu Yaobang, secretary-general of the CCP.⁶⁵ Many interviewees stressed that China's top leaders were awestruck by the mathematics, shocked by the projections and convinced that a one-child policy was the only option. Song himself emphasized the fears those numbers created in the minds of China's leaders. According to him, not only Wang Zhen but also Hu Qiaomu, Hu Yaobang and Hu Qili were shocked and persuaded by the report. Chen Muhua "decided on the one-child policy after reading the research report."⁶⁶ With only some exaggeration, another central actor maintained that "all the central leaders said the report was right."⁶⁷

Achieving victory: from the People's Daily to the open letter. In February, the State Council and Central Committee set the population target for the turn of the century at an extremely ambitious 1.2 billion.⁶⁸ On 7 March, Song and his collaborators published the results of their research in the *Renmin ribao* (*People's Daily*), suggesting its acceptance

62. *Ibid.* pp. 545–46.

63. *Ibid.* p. 546.

64. Interview, 24 December 2003, Beijing.

65. Song Jian, *Selected Scientific Papers*, p. 545. David M. Bachman, *Chen Yun and the Chinese Political System* (Berkeley, CA: Institute of East Asian Studies, University of California, Berkeley, 1985), p. viii.

66. Interview, 24 December 2003, Beijing.

67. Interview, 21 December 2003, Beijing.

68. Li Xiuzhen, "Bring about a rise in national economic construction, slow the speed of population growth," broadcast by Beijing Domestic Service, 12 February 1980; in *FBIS, PRC National Affairs*, 21 February 1980, pp. L5–L6.

by some at the highest reaches of the government in late February or early March.⁶⁹ Yet some top leaders, in particular Zhao Ziyang and to a lesser extent Hu Yaobang, still harboured reservations about the feasibility of a one-child policy in the countryside.⁷⁰ “Will it work? Will it work?” (“*xing buxing? xing buxing?*”), they kept asking. In April, Chen Muhua convened a series of high-level, top-secret discussion forums that brought together the relevant ministers, vice-ministers and a handful of leading specialists, 50 to 60 people in all, to discuss the pros and cons of a one-child policy. These meetings were held at Zhongnanhai. When the issues turned out to be too controversial to be rapidly settled, the meetings were moved across the street to the Great Hall of the People.⁷¹ The participants’ central task was to decide how tightly fertility had to be controlled to keep population within 1.2 billion. A number of the officials present harboured doubts about the workability of a one-child policy. Representatives of the mass organizations were especially unenthusiastic, fearing harm to the groups they represented. Song spoke out forcefully at the meeting, painting frightening scenarios of a nation with no food to eat, no water to drink and no land to till, and insisting that there was “no other way” to avert that disaster than a one-child-for-all policy.⁷² He was evidently a powerful and persuasive speaker. “When Song spoke,” one participant said, “everyone turned to listen.” Song’s ballooning numbers, frightening images and insistent rhetoric, combined with his sense of responsibility to his country, seem to have won people over to his cause. Although his projections had indicated that a TFR of 1.5 (or even 1.75) would keep the population under 1.2 billion, that policy was set aside in favour of a 1.0-child policy on the assumption that peasants asked to limit themselves to 1.5 children would press for two or more.

Over the long term, a policy of one child for all would create distortions throughout the society and economy. In the short term, enforcing such a rule would require the use of coercion and leave parents urgently needing a son little choice but to dispose of their baby girls. Those attending the spring meetings were well aware of these costs. Yet in the atmosphere of impending threat to China’s prosperity, global ambitions and even survival, the majority view – that all such costs were secondary concerns – prevailed.⁷³ By all accounts, these meetings had a huge impact.⁷⁴ By reaching collective agreement on the necessity of a universal one-child policy and settling the outstanding issues surround-

69. Song Jian *et al.*, “Guanyu renkou fazhan mubiao wenti (“Concerning the question of the target for population development”), *Renmin ribao* (*People’s Daily*), 7 March 1980, p. 5.

70. Interviews with top population scientists and birth planning officials, 15 and 21 December, 2003, Beijing.

71. Interviews with Chinese population specialists, 16 November 1999 and 21 December 2003, and with key staff member in Leading Group, 24 December 2003, all in Beijing.

72. The following is based on extended discussions with a well-placed birth planning official, 15 December 2003, Beijing.

73. Interviews with Chinese population specialists, 20 December 1986, Beijing; 16 November 1999, Beijing. In June 1980 Chen Yun articulated this same position in a letter to Chen Muhua (interview with key birth commission staff member, 24 December 2003).

74. Interviews with several scholarly and official participants in these meetings, 16 November 1999, 21 and 25 December 2003, all in Beijing.

ing its enforcement and consequences, they produced an urgent and feasible if unpleasant policy that China's leaders could hardly turn down.

On 26 June, the Secretariat of the Central Committee, then the highest decision-making body, met and endorsed Chen Muhua's report on the April meetings, effectively putting its seal of approval on a universal one-child policy to be implemented immediately.⁷⁵ With a big and difficult demand to make, the Party leadership decided that the new policy would be announced to the masses in an open letter from the Central Committee to the Party membership. Hu Yaobang asked Song Jian to draft the letter, but considered this version, as well as one requested later from Liu Zheng, too long and academic. Hu recruited some skilled government propagandists to write a shorter, more "massified" (*dazhonghua*) letter which, after multiple revisions during July and August, was finalized by Party ideologue Hu Qiaomu.⁷⁶

In September the third session of the Fifth National People's Congress gave its seal of approval to a new policy designed to keep the population within 1.2 billion at the century's end by advocating one child for all.⁷⁷ On 25 September, the policy was made public in an Open Letter from the Central Committee to all members of the Party and Communist Youth League.⁷⁸ Although policies encouraging one-child families had been carried out by many provinces since 1979, top birth planning officials stressed in interviews that the Open Letter marked the real beginning of China's one-child policy, for it was the first central-level "policy" advocating one child for all couples country-wide that bore the imprimatur of the nation's top decision-making body.⁷⁹ Incorporating the Song projections, the letter presented a frightening scenario of people proliferating out of control, giving rise to a "grave situation" in which, without drastic population control, the country's economy would never emerge from its poor and backward state. In both its contents and its tone of urgency, the official formulation of the problem reflected the strategic reframing of the population issue accomplished by the military scientists. The solution was a big-push campaign of 20 to 40 years in which every couple was to have but one child. Although couples with "real difficulties" would be allowed two (but never three), an internal document stipulated that the proportion of second children was not to exceed 5 per cent of births. This extremely strict policy was the "ideal" policy yielded by the optimization

75. Yang *et al.*, *Main Events*, p. 78, confirmed by interviews.

76. Interviews with person centrally involved in drafting the Open Letter, 15 and 24 December 2003.

77. "Diwu jie quanguo renmin daibiao dahui, disan ci huiyi zhengfu gongzuo baogao" ("Government Work Report of the Third Session of the Fifth National People's Congress"), in *Almanac of China's Population*, Editorial Committee (ed.), *Zhongguo renkou nianjian, 1985 (Almanac of China's Population, 1985)* (Beijing: Zhongguo shehui kexue chubanshe, 1985), p. 26. The ethnic minorities were exempted, at least initially.

78. "Zhonggong zhongyang, guanyu kongzhi woguo renkou zengzhang wenti zhi quanti gongchandang yuan, gongqingtuan yuan de gongkaixin" ("Open letter from the Central Committee to all Communist Party and Communist Youth League members on the question of controlling China's population growth"), in *Almanac of China's Population*, Editorial Committee (ed.), *Renkou nianjian (Population Almanac)*, pp. 27–29.

79. Interview with a leading birth planning official at the time, 25 December 2003, Beijing.

techniques of control theory. Following the priorities worked out in the April meetings, the social costs of a strict one-child policy were discounted. Although the policy it announced would require the use of force, the letter resolutely forbade the use of coercion, calling on cadres to enforce the policy through political and ideological means, backed by economic incentives for only children.

How much influence did Song have on the adoption of the strict one-child policy? Some Chinese scholars in the penumbra of the decision-making process acknowledge his extraordinary influence, but believe that he played a “supportive” or “facilitative” role in bringing to political fruition a universal one-child policy that would have been adopted anyway. Informants much closer to the centre – top government officials and Song himself – maintain that his role was much more fundamental. In the words of my most authoritative government informant, Yu Wang, deputy to Li Xiuzhen: “Song’s research persuaded China’s leaders to shift to a [universal] one-child policy.”⁸⁰ In this latter view, pieced together from numerous sources, China’s leaders clearly wanted fertility to fall as fast as possible, but doubted the feasibility of enforcing a one-child policy among the peasantry. Presented as an unquestionable truth of modern science by a highly articulate and self-confident protégé of Qian Xuesen, Song’s numbers and images created deep fears among China’s leaders that the nation was on the brink of demographic disaster. This gave supporters of a universal one-child policy (Chen Yun, Li Xiannian) the ammunition to persuade or simply silence the doubters (Zhao Ziyang, Hu Yaobang), yielding a collective decision to move ahead.

An Elite Scientist in the World of Population: Contributions and Dangers

In population, as in other domains of “scientific decision-making” in the early Deng era, the entry of a scientist had beneficial effects. After years of indecision on the population question, Song gave China’s leaders what appeared to be a firm basis for choosing one policy over another and an opportunity finally to correct the historic mistake made in silencing Ma Yinchu. Song’s solution, grounded in the now-supreme authority of modern science, broke the political logjam, enabling them to move ahead decisively with a strong policy to control population growth, widely considered a major obstacle to China’s modernization. More generally, the Song group’s work introduced new, data-based scientific rationalities and techniques that could be used to enhance the formulation and enforcement of public policies on population. These benefits are considerable. Yet the making of social policy by an elite scientist/engineer from the defence world also posed dangers for the Party and for China’s people. Two loom especially large.

The dangers of supreme self-confidence. From a technical standpoint, the models developed by the Song group were unproblematic; this is the

80. Interview, 25 December 2003, Beijing.

judgement of mathematical demographers who have reviewed the group's English-language work.⁸¹ But model-making is only one part of science; beyond the models are questions of data, limiting conditions and domain. Here the unshakeable self-confidence of the elite scientist led Song to take risks. It led him to build a large edifice of science and policy on flimsy empirical foundations. The same self-assurance allowed him to represent as international science a body of work that deviated from the European original in arbitrary, radical and highly significant ways. Song's certainty of his correctness also encouraged a scientific imperialism that led him to move into an unfamiliar social domain and apply models from physical science that, while offering technically efficient solutions, were inappropriate because they neglected the socio-cultural and political-economic context in which they would have to be carried out. In democratic systems the worst excesses of such technicist policy analyses are checked by the political process shaping decision-making. Yet China in the late 1970s lacked the procedures and multiple plays of interest that would allow a range of social and ethical values to blunt the policy initiative flowing from the analysis. China's social scientists protested, but they lacked the technical skills and cultural prestige to make a difference. China's leaders could neither understand the science nor challenge the scientific authority of its authors. Far from questioning, political leaders seem to have been in awe of the mathematics and the mathematicians. As a result, a brilliant, ambitious policy entrepreneur bearing an overly technicist solution was able to wield inordinate influence over China's population policy. Just as Qian Xuesen bamboozled Mao on several occasions, Song Jian seems to have beguiled Deng into believing that a one-child-for-all policy was not only "the optimal" but also "the only" way to save China from demographic disaster, and that the social consequences would be manageable.

The inappropriateness of the policy solution became painfully clear in 1983, when, in a changed environment, policy makers undertook a very big-push solution, a massive, nation-wide campaign aimed at jump-starting one-childization by sterilizing one member of all couples with two or more children and aborting all unauthorized pregnancies. Ordered to enforce this policy and reach targets no matter what, rural cadres had little choice but to use coercion against the people. The results were a record level of demographic achievements – 21 million sterilizations, 14 million abortions and fertility rates that dropped to just over 2.0 – and unexpected magnitudes of social suffering, as baby girls were killed, women's bodies were damaged, and village life was torn by violence and fear.⁸²

81. Joel E. Cohen, "Review of *Population System Control*, by Jian Song and Jingyuan Yu (1988)," *SIAM Review*, Vol. 32, No. 4 (1990), pp. 494–500; Geoffrey McNicoll, "Review of *Population Control in China: Theory and Applications*," *Population and Development Review*, Vol. 11, No. 3 (1985), pp. 556–57; John Bongaarts, personal communication (12 April 2004), Griffith Feeney, personal communication (15 May 2003), Zeng Yi, personal communication (28 November 2001).

82. On the social suffering, Greenhalgh and Winckler, *Governing China's Population*, ch. 8.

With sociopolitical stability threatened and the Party's reputation tarnished, in 1984 the leadership backed away from the strict approach of the Song team, while not abandoning advocacy of one child. The Central Committee's Document 7 added a few more conditions for second children, most importantly, a provision allowing rural couples with a girl to have two children. In 1988 that provision was formalized and enforcement severely tightened. In the 1990s, fertility fell to historic lows – between 1.55 and 1.8 children per woman – allowing the birth planning commission to eliminate big-push campaigns and initiate a series of major innovations in the birth programme that by the early 2000s had dramatically shifted population work in the directions of indirect regulation and social benefit.⁸³ Yet the policy itself has not changed. Meanwhile, its social costs have continued to mount. Today China faces a looming crisis of ageing/social security and a sex ratio at birth that, at 120 boys per 100 girls (in 1999), is the highest in the world.⁸⁴

Defence rationalities and population policy. The retention of a one-child-with-exceptions policy in the context of ultra-low fertility and perilously rising social costs can be understood by considering the second danger: the influence of defence thinking on population policy. Though Song's reformulations of the population issue drew heavily on the Club of Rome, in sinifying the Club's ideas for use in China, he unwittingly imported military rationalities into Chinese population work. Both the framing of the problem as a national security emergency and the big-push, top-down, total-leadership-commitment enforcement strategy bore traces of Chinese military logics. Today the big push is gone, but the central doctrine implanted by the scientists – that population growth remains a potential threat to the nation's well-being and global position that must be averted at almost any cost – remains in place. The 2000 Decision on population and the 2001 Population and Birth Planning Law reaffirmed population as a potential threat and reaffirmed the one-child policy as the way to avert it.⁸⁵ Today, leading Chinese demographers believe, the single greatest obstacle to abandoning the one-child policy is the fear of top leaders that if population tops 1.6 billion at mid-century, China will, in the words of one official, “expire” (*wanle*).⁸⁶

83. Zhang Guangyu, “China's far below replacement level fertility: a reality or illusion arising from underreporting of births?” PhD dissertation, Department of Demography, Australian National University, 2004. For 2000, 1.8 is the official figure, 1.55 the figure estimated by Zhang from meticulous analysis of all available data sets. On population work today, Greenhalgh and Winckler, *Governing China's Population*, chs. 5 and 6.

84. Sex ratio data from State Statistical Bureau, at www.chinapop.gov.cn, discussed in Greenhalgh and Winckler, *Governing China's Population*, ch. 8. On the social security crisis, Richard Jackson and Neil Howe, *The Graying of the Middle Kingdom: The Demographics and Economics of Retirement Policy in China* (Washington, DC: Center for Strategic and International Studies, 2004).

85. Edwin A. Winckler, “Chinese reproductive policy at the turn of the millennium: dynamic stability,” *Population and Development Review*, Vol. 28, No. 3 (2002), pp. 379–418. Article 18 of the Law advocates (*tichang*) that each couple have one child. See “PRC Law on Population and Birth Planning,” *Population and Development Review*, Vol. 28, No. 3 (2002), pp. 579–585.

86. Interview with Chinese population specialist, 22 December 2003, Beijing.