Global Water Management Dilemmas

Lessons from China

Baruch Boxer

Policies governing water quality and availability can be a powerful lens for looking at environmental protection as a whole. As China modernizes its water infrastructure, with some assistance from international development agencies, the opportunity arises to evaluate western approaches to water management in the context of China's much more integrated and detailed approach, which has evolved over the past two millennia.

What is "water management"? Can we measure its success or failure? And in whose terms and to what ends? What are the appropriate scales for evaluating management options and their effects in diverse settings around the world? China is a good example of a country seeking to apply international water management strategies and standards in the face of difficult demographic, economic, and physical circumstances. Much can be learned from a close look at China's experience in recent years, because that experience reflects policy adjustment processes and challenges in many developing countries.

Concern is growing worldwide over the social, ecological, and security implications of water shortages, along with a widespread decline in water quality. In recent years, several major global strategic planning efforts have been conducted by multilateral agencies, the United Nations (UN), nongovernmental organizations, and international scientific bodies to shape a global water policy agenda. Several of these initiatives over the past decade culminated in a December 2001 International Conference on Freshwater in Bonn, Germany, which sought to definitively clarify water issues and suggest solutions. The conference was convened specifically to help prepare an agenda for the August 2002 World Summit on Sustainable Development (Rio+10) to be held in Johannesburg.

Relating Global Experiences to Local Conditions

However, there is little evidence from all of these efforts that national and international bodies are in a position to effectively address water problems in an integrated manner at local, regional, national, and global levels. One problem is that it is difficult to develop commonly understood and generally applicable management policies, practices, and interventions at regional or global scale.

Responses to water problems in most countries mainly involve place-specific application of scientific, engineering, and institutional knowledge with limited transferability. A major challenge in achieving sustainable water resource development and management is relating global experience and understanding to the specific requirements of diverse countries and regions with

unique cultural and historical traditions, varied levels of social and economic development, and distinctive institutions.

China has embarked upon a vigorous campaign over the past decade to drastically reshape its water development and management policies in the context of ambitious market reforms and a major reassessment of the legal and ideological foundations of its water economy. The magnitude and complexity of this task are daunting. It represents a concerted effort to integrate long-standing policies defining government responsibility for judicious water development, protection, and use with newer perspectives on modern economic and legal strategies for realizing the long-term benefits of water sustainability.

China's water policy initiatives are of universal interest for several reasons. Most important, they test assumptions as to the efficacy of modern policy remedies for water conservation, hazard mitigation, and environmental protection in a society where assurance of adequate water supply and protection from flood and drought have been the hallmark of successful governance for over two millennia. Water mythology, water engineering, and water knowledge have been critical in shaping the distinctive forms, patterns, values, and cultural ecology of China's unique civilization. China's water policy experiments also provide insight into the potential benefits and limitations of foreign models for combining engineering interventions, economic incentives, and management strategies to achieve interrelated water quality, water supply, and water conservation goals.

Given the magnitude of China's water problems and its` long experience in dealing with them, these new ways of thinking and acting are being closely watched. The issue at stake is whether the rhetoric of water sustainability can be effectively translated into workable programs and policies under increasingly stressful conditions of imbalance in water supply, sharp variations in water surplus and water shortage over time and geographic distance, and the rapid deterioration of surface and groundwater quality.

Here I consider four dimensions of this transformation process, each of which illustrates some of the unique challenges and contradictions that Chinese water policymakers are addressing as they confront the task of developing and managing water resources in support of the country's economic and technological modernization. They are:

- building upon a 1988 Water Law to accommodate new water resource management concepts and challenges;
- implementing a dramatic policy shift in early 1999 from primary emphasis on planned structural engineering interventions to address water supply and control problems, to recognition of the need for a more comprehensive and diffuse notion of water as a resource (*ziyuanshuili*) to be developed and managed in response to changing market criteria;
- accommodating cultural/historical perspectives on water-state-society interactions, along with more recent and still-prominent Marxist theoretical frameworks, while simultaneously trying to adopt western market-oriented water policy instruments to improve the efficiency of water engineering, use, and control; and
- meeting the challenges of modifying indigenous water science and engineering theory and practice to facilitate the absorption of foreign technical and institutional approaches to water policy development.

Legal Issues

Key underlying assumptions of China's water program are that the landmark 1988 Water Law must: serve as the regulatory framework for a system that rationalizes and substantiates water and the water infrastructure as public economic goods in the transition to a market economy; and support a redefined, but still preeminent role for the Ministry of Water Resources (MWR) as the leading government body responsible for overall water planning, monitoring, research, and development. MWR also oversees national-level policymaking and interprovincial policy coordination, and flood and drought protection and control.

From its preliminary drafting stage in the early 1980s, the Water Law was assumed to be empowered through ancillary statutes drafted to address planning and regulatory issues associated with specific problem areas like water quality, soil erosion control, inland navigation, and groundwater protection. To this end, complementary laws have been promulgated. Currently, to facilitate basinwide water quality regulation and to improve coordination of water protection and development initiatives across administrative boundaries, there are strong appeals for a water basin law, to be implemented in the seven major river basin systems.

Since the late 1980s, however, efforts to establish a legal foundation and Water Law-based program to effectively address technical, institutional, regulatory, and environmental dimensions of the water economy in the context of socialist modernization have not come to fruition. There are several reasons for this which illustrate some of the fundamental challenges

China faces in trying to modify its supply-driven water system, a legacy of the earlier planned economy, to create a law-based, economically efficient, and ecologically sound water management regime.

A major difficulty is that economic, administrative, and social support dimensions of the Water Law still reflect a pervasive Ministry-promoted culture of active state and party social guidance and definition of responsibility for water management. The powerful authority of the Ministry on water protection and infrastructure development was seldom challenged prior to the late 1970s, and capital and labor support for key projects was usually made readily available.

Since then, however, modernization efforts have drawn attention to many previously neglected problems like nonpoint source pollution, hazardous waste management, wetland loss, biodiversity preservation, and adequate and safe urban water supply. The current practice of drafting supplementary water-related laws to address pressing issues is not well-suited in a situation where there is an urgent need to coordinate scientific and engineering research, and regulatory enforcement and adjudication, in the face of the overwhelming challenges of urban and rural water supply, pollution control, and environmental preservation.

Finally, China, along with many other countries and international bodies, gives lip service to the notion of sustainable water use as a key policy goal. The assumption is that the Water Law, with its complementary statutes, will help translate and integrate western management models and experience to accommodate alien concepts like demand management, market-responsive economic optimization, rational pricing, and institutional power-sharing.

The Engineering-to-Resource Transition

A dramatic shift in water policy thinking occurred in early 1999 with the introduction by the MWR of the resource water conservancy or *ziyuanshuili* concept as a major theoretical and methodological departure. This represents a distinctive Chinese perspective on water management. It aims to formally recast longstanding social and economic criteria for justifying and measuring the economic and social value of hydropower resources, as well as the infrastructure for water supply, treatment, control, protection, and distribution. More broadly, the focus shifted to the concept of "water resources" as it applies to the China of today.

Key Chinese Terms

Several key Chinese water policy terms are defined below. Evolving modern Chinese water policy concepts and methods can be understood only in the context of the specific technical associations of Chinese water-related terms that linguistically may have diverse meanings and connotations that reflect their long historical evolution. For a copy of the article with all of the Chinese water policy terms spelled out in either *pinyin* romanization or Chinese characters, contact the author at boxer@rff.org.

baohu—protect, safeguard
jieyue—economize (water use)
maodun—contradiction (a fundamental concept in Marxist dialectical philosophy)
peizhi—deployment (of water resources)
shuili—traditional water engineering knowledge, practice, and cultural values (literally, water benefits)
shuiziyuankaifaliyong—development and use of water resources
zhili—control, harness (river)
ziyuanshuili—resource policy-defined water management (in contrast to traditional engineering-focused shuili)

Wider focus on water as resource, moreover, clearly anticipates the need for new institutional mechanisms and policy instruments. Presumably these will ease the transition from longstanding reliance on plan-driven guidelines for meeting goals and evaluating performance to greater provincial and local autonomy in choosing appropriate market instruments.

This fundamental policy shift is an essential adjustment that demands new, non-Marxist theoretical perspectives on the historical benefits of traditional water engineering knowledge, practice, and cultural values (*shuili*). It also requires the reshaping of public attitudes and responsibilities toward water as a resource, thereby promoting new ethical values of protection, conservation, and improved scientific management to reform the *shuili* enterprise in support of the modern socialist market economy. Furthermore, new technical vocabulary and scientific rationales must extend definitions of *shuili* engineering benefits to include newly specified nonmaterial benefits, like ecological support, improved public health, and recreation, which are implicit in the *ziyuanshuili* agenda.

Three main theoretical areas must first be developed to facilitate and guide a smooth transition from engineering-dominated water management thinking to the new *ziyuanshuili* program. These include: first, systems thinking to probe the interrelated roles of water, as a distinct natural, human, and ecological resource; second, how to delimit and measure the connections between sustainable use ideas and the real-world physical, economic, and social processes that can formally substantiate the *ziyuanshuili* program through effective policies; and, finally, the need to recalculate the physical and social asset values of engineering facilities while incorporating new, largely intangible health, environmental, and welfare values implicit in the *ziyuanshuili* concept.

History, Dialectics, and Markets

China's ambitious efforts to confront water problems though the introduction of new laws and policies that seek to wean the water economy from its familiar planned orientation is a Herculean task that requires revolutionary policy measures. Given China's size, its variable and uncertain physical endowments, and the speed with which the economy is being modernized, it is not surprising that progress is slow.

The main 21st century water challenges and contradictions result from population growth, the expansion of industry and agriculture, growing disparity between water supply and demand in the north, rampant pollution, and fragmented administrative jurisdictions. Attempts to overcome them must acknowledge the historical legacy and cultural imprint of two millennia of traditional water engineering knowledge, practice, and values, as well as recognizing a still-present Marxist ideological framework.

This broad dialectical framework contributes in two important ways in China to the development of a "socialist market economy" that can support modern water management policies. There are contradictions that need to be addressed in undertaking the transition from a planned to a more realistic resource perspective on balancing water engineering and policy needs and priorities. Areas of contradiction (*maodun*) are clear and salient in the Chinese context, and include water resource development and use (*shuiziyuankaifaliyong*), governance (*zhili*), deployment (*peizhi*), economizing (*jieyue*), and protection (*baohu*).

Of these contradictions, deployment is the most crucial because it forces consideration of how governance can serve as a key policy link for resolving inherent contradictions in water development, use, and conservation alternatives while setting priorities for water projects primarily as sources of social and economic benefits (such as wastewater treatment plants, irrigation works, and reservoirs) or as protection against hazards (including sea walls, flood diversion and drainage works, and dikes).

The fundamental challenge of redefining the *shuili* enterprise in market terms is a second, more elusive task. Here, the main issues are: how to resolve contradictions in thinking about *shuili* primarily as a productive commodity in itself where value can be enhanced through private investment and the auctioning of land and facilities; or whether the *shuili* enterprise should primarily become a mechanism and vehicle for the spreading of benefits throughout the wider socialist market economy through public health improvement, increased energy generation capacity, cleaner water, and better ecological support.

Science, Technology, and Policy

Since the inception of China's environmental program in the early 1970s, indigenous environmental science research has supported the development of water-related environmental laws, policies, and regulations. Studies in marine and aquatic ecology, environmental chemistry, pollution biology, estuarine studies, soil science, epidemiology, and other fields contributed effectively to early monitoring, standard setting, and enforcement work that supported China's incipient environmental mission.

Prior to the flood of foreign contacts that began in the early 1980s, self-reliant Chinese investigators studied diverse aspects of water and other pollution. Their purpose was twofold: first, to describe, analyze, and recommend solutions for local and regional air, water, and solid waste pollution problems; and second, to use empirical work to explore, refine, and show the relevance of Marxist thinking about human-environment relations to policy development and problemsolving in specific problem areas. This kind of work was especially noteworthy in areas like fluvial (stream) dynamics and sediment transport, marine ecology and aquaculture, phytoremediation, and microbial degradation of pollutants in textile, petroleum, and other industries.

Self-reliant scientists had to develop their own theoretical perspectives and methodologies in response to local conditions, problems, and ideological directions. This resulted, in some problem areas, in creative insights, imaginative methodologies, and beneficial results for the environment and public health at local levels despite increasing pollution and environmental degradation on a national scale.

For example, to evaluate water quality and the distribution, movement, and effects of toxic elements in aquatic organisms and reservoir sediments, environmental chemists, aquatic biologists, and "chemical geographers" carried out extensive studies in the 1960s in the Yang and Sanggan watersheds of northern Shanxi and Hebei provinces. These studies were designed to support environmental standard setting and regulation in anticipation of intensified industrial and agricultural development.

The question now is whether Chinese environmental scientists and engineers will still be able to contribute to policy development imperatives that reflect distinctive Chinese social and environmental circumstances while employing state-of-the-art standardized foreign technologies and methodologies. One emerging problem is that Chinese scientific talent can't be most effectively used because many Chinese firms and municipalities cannot afford the technologies necessary for their application. Also, foreign investors in industrial plants and other enterprises introduce pollution control technologies that conform mainly to their own profit-making agendas. They are thus sometimes insensitive to the need to spend more to adapt the best modern technologies and processes to provide the most effective benefits in face of unusual environmental challenges in specific Chinese locales.

Conclusion

The challenges of water policy reform in China today can be thought of in two primary ways. On the one hand, there is the problem of assimilating a torrent of recent environmental economic theories and methods for achieving the greatest benefits, at least cost, in developing, using, conserving, and maintaining the quality of surface and groundwater resources. These ideas are being widely propagated by a new generation of economists and engineers, many foreign trained, who avidly seek to address China's water problems by applying internationally accepted strategies and methods.

On the other hand, these externally generated policy initiatives must make sense in Chinese terms. This means that they must be made workable in the context of an ongoing, self-directed, and spirited effort by the Chinese water engineering and science community to redefine conceptual, technological, and social rationales for environmentally significant water policies spawned by the economic, political, and ideological conflicts of the last half-century.

Baruch Boxer is professor emeritus of geography at Rutgers, the State University of New Jersey, and a visiting scholar at Resources for the Future.

For more information

This article is based on a longer, more technical article that appeared in *Water International*, Volume 26, Number 3 (September 2001): 335–341.

Allan S. 1997. *The Way of Water and the Sprouts of Virtue*. Albany: SUNY Press.

Boxer, Baruch 1987. "Environmental Research in China. Achievements and Challenges." China Exchange News 15, No.2 (June): 7–11.

Bray, F. 1994. *The Rice Economies: Technology and Development in Asian Societies*. Berkeley: University of California Press.

Johnson, Todd M., Liu Feng, and Richard Newfarmer. 1997. *Clear Water, Blue Skies: China's Environment in the New Century.* Washington, D.C.: The World Bank.
www-wds.worldbank.org/servlet/WDSServlet?pcont=details&eid=000009265_3980203115520 (Accessed Jan. 16, 2002).

Ke Lidan. 1998. *Zhongguo Shuifa yu Shuiguanli* (China's Water Law and Water Management). Beijing: Zhongguoshuilidianlichubanshe (China Water and Electric Power Press). (Note: this article is in Chinese.)

Needham, J. 1971. *Science and Civilisation in China*. Volume 4, Part 3. Cambridge: Cambridge University Press.

Wang Shucheng. 2000. *Shuiquanheshuishichang-tan shixian shuiziyuanyouhua peizhidejingjishouduan* (Water rights and water markets—a discussion of mechanisms for realizing the economic optimization of water resources). www.chinawater.net.cn/CWSnews/newshtm/w001026-2.htm. (Note: this article is in Chinese)