WATER AND SUSTAINABILITY IN ASIAN MEGALOPOLISES: THE CASE OF BEIJING

James E. Nickum
Tokyo Jogakkan College, Tokyo, Japan

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Summary

Water is a particularly salient issue in Asia, which has many of the world's largest cities and most of its irrigated area. As its cities continue to grow, projected water investment requirements are exploding, and use conflicts with agriculture and other problems would seem to threaten sustainable urban growth.

Using the example of Beijing, an evolutionary perspective is presented with the aid of a maturing water economy heuristic. This framework distinguishes between an expansion phase, which is characterized by a project culture, and a mature phase, in which more flexible institutions are called for. Such institutional changes may include increased reliance on demand management, opening up and decentralizing the decision-making process, and treating water as an economic good.

Beijing made its transition to a maturing water economy in the 1980s by claiming upstream rights, cutting farm uses, and reducing urban use rates. Despite lingering economic and institutional problems, including persistence of the project culture, Beijing's economy has grown spectacularly over the past two decades, apparently without any significant increase in available water. This indicates that there is some reason for optimism regarding the resilience of the water economy and consequently of the sustainability of urban growth in Asia despite increasingly severe limits on new supplies

of water.

1. Introduction

Will water, the emblematic natural resource linked closely with food security, urbanization, health and natural ecological systems, present a major limit to sustainable urban growth in the twenty-first century? It is certainly on the current agenda of international institutions and scholars: in 1998 alone, there were over 2000 conferences on the issue. If anything, the pace has picked up since then, punctuated by triennial World Water Forums under the World Water Council. At the second of these, in The Hague in March 2000, a World Water Vision was presented that called for a "behavioral change by all"—business as usual in the twentieth century is not likely to be sustainable in the twenty-first.

What to do about water is a particularly salient issue in Asia, which contains most of the world's population and therefore most of the people in the developing world. Asia, especially China and India, contains most of the world's irrigated farmland and the world's farmers, yet its largest cities are already among the most peopled. The limited available data on water quality indicate that the world's most polluted rivers and groundwater aquifers are also concentrated in the region.

Cities are often presented as both victim and villain in their relationship to adequate supplies of fresh water. Five-sixths of China's 61 largest cities are considered to be chronically short of water, because of lagging infrastructure or limited local sources. Whereas agriculture has tended to receive the largest funding for water use facilities in the past, it is quickly becoming dwarfed by the investment needs for providing adequate high quality water and sanitation to the cities and industries of developing countries. Indeed, the projected annual investment requirements are so astronomical—as much as $180 billion per year in the year 2025 (according to World Water Vision), not counting operations and maintenance or rehabilitation of aging systems—that few believe they can be met.

On the other side of the ledger, a popular vision of Asia's growing megalopolises is one where factories, houses, roads, and other factors gobble up vast areas devoted to grain and appropriate the water resources needed to feed millions of people. At the very least, countries fear losing control over their food supply, and its prices, to traders based in developed countries.

Certainly there is no doubt that urban water crises and conflicts between city and countryside are going to be a recurrent feature of coming years. Actually, this is not remarkable, as they have been a recurrent, but relatively localized and ephemeral, feature of the past. They change continuously in character, and often subside as institutional arrangements that enhance the relative supply of clean water evolve. The question is whether there is something about the future that will be qualitatively different, more universal, and more likely to affect the sustainability of cities.

For an answer, it is helpful to look at the past. Historically, many of the world's cities have repeatedly confronted and often overcome various water problems to grow and prosper.

The experience of water provision in cities may provide valuable lessons for the sustainable development problematic in general. The supply of fresh clean water has been a recurrent problem for most cities throughout their histories as they grew and expanded. In general, however, urban history demonstrates that the "rules" of water supply provision have changed dramatically, usually, but not linearly, away from isolated developments to a situation where tradeoffs between objectives, sectors and sources are negotiated. At the same time, there has been a complicated dynamic between subsidized engineering works ("supply management") and politically more difficult approaches such as demand management, integrated management and modifications in rights systems.
Before proceeding, it is important to note that each city is unique and nowhere more so than in where and how it gets and disposes of its water. Some lie by great rivers; others rest in arid highlands. Some have deep groundwater aquifers at their feet; others, especially those in deltas, almost float on salt water. In order to grasp some of the commonalities within this complexity, a simple heuristic stage model is presented here—that of the maturing water economy. This model, simplified as it is, allows us to sift through the complexity of details to focus on the dynamics of institutional change in the way water is developed and used. Following this is a brief case study of Beijing to demonstrate how this institutional perspective can shed light on a large city's urban water supply history and changing decision-making processes. Histories such as this demonstrate that underlying mechanisms are often quite resilient in responding to the existence and possibilities of often-extreme water emergencies. Cities grow, even in the face of water shortages. Sometimes water shortages disappear. Nonetheless, as water economies mature, solutions no longer focus on increasing water supply, but on changes in institutional structure. All this provides a clue to how or even whether water will limit the sustainability of growth of Asia's megalopolises.

2. A Conceptual Framework

2.1. The Maturing Water Economy

The histories of urban water supply development can be divided roughly into two kinds of phases, expansion and mature. In the expansion phase, water supply is elastic—it costs relatively little to get more. Subsidies supporting increased water use, for example, by providing water at low or no cost, are affordable and do not unduly deprive other, more valuable uses. There is little competition between different uses, mainly agricultural, industrial and domestic or municipal, but also environmental. In economic terms, the opportunity cost of water is low. Conflicts tend to be over land rather than water. Water facilities are new, in good physical condition, although tight budgets, overstaffed supply organizations, and low cost recovery may lead to "deferred maintenance," putting off routine upkeep. The environmental problem of greatest concern is often flooding and drainage.

In the mature phase, water supply is inelastic, and increasingly costly. Subsidies for water use entail a high social costs, as they privilege established users (usually agriculture) over competitive newer ones such as industry, who often can put the water to better economic use, or, ironically, whose subsistence needs are greater, as in the case of many migrants to the cities. Aging infrastructure demands higher maintenance or replacement and a growing amount of infrastructure development is geared towards relieving stress on the

system. Typical environmental problems are water pollution and the depletion of groundwater aquifers.

Concomitant with this framework, the history of urban public policy construction may be seen as the result of a combination of: 1) struggles among interests (social conditions); 2) the impacts of economic demands (economic conditions); and 3) dominant institutional arrangements of the period (responses). Institutional rigidities such as vested interests often resist change until a point of crisis is encountered, such as a major drought or pollution event. A study of the history of water supply policy is framed by the crises that punctuate and define particular policy periods. As new sets of arrangements are shaped, the solutions to problems more often than not bring new set of institutions and new sets of problems.

Technology makes the framework a bit more complex, often by allowing significant increases in the supply of water. In much of Asia, especially north China and the Punjab, the spread of deep pump tubewells allowed an unprecedented tapping of vast aquifers. Areas that formerly relied on the whims of weather to eke out low crop yields became irrigated grain baskets. In the cities, industries dug their own wells to provide for their own needs without having to rely on an outside supplier, such as the government.

Unlike humans, water economies can rejuvenate, by finding and developing new sources. The maturing water economy framework is not strictly unidirectional. New technologies can expand supply, but so can major projects such as reservoirs, diversions, or recycled water treatment facilities.

2.2. Project Culture

The expansion phase is associated with a particular kind of supply-oriented bureaucratic approach that can be summed up as a "project culture" style of decision making.

Project culture is characterized by 1) a dominance in planning of technological and political imperatives; 2) the dividing up of larger task into discrete units, each implemented by separate bodies with little adjustment or coordination after the plan is set; 3) institutional inflexibility in responding to new information or states of nature; and 4) the top-down involvement of the central government, using subsidies, regulations and revenue sharing that can overwhelm local social capital (defined as the capacity for self-organization of civil society). The rigid nature of institutions supporting the project culture, together with the specific nature of many of the assets they govern, helps explain why policy change often is slow in coming but dramatic when it does.

As a water economy matures, project culture becomes increasingly untenable. Conflicts arise more frequently and revolve largely around existing vested uses that often have poorly defined, and non-transferable legal rights. More flexible institutions become necessary to allow for participation of a wider number of stakeholders for each initiative, resulting in more incremental change driven by complex tradeoffs. Increasing priority is given to demand management and the primary focus of concern changes from increasing the amount delivered to protecting what is already available. Non-governmental decision making begins to play an ever greater role. Water comes to be treated as an economic

good. Prices, which have often been allowed to fall in real terms over time for political reasons, are adjusted upwards, with the goal of covering at least the cost of generation and delivery. Subsidies to water supply agencies are cut. Improved laws are enacted, sometimes even allowing trading among users.

3. The Case of Beijing: The Early Years

Beijing Municipality is quite large, covering 16 800 sq. km. Over three-quarters of its 12 million residents live in an urban core with just over one-quarter the land area (4660 sq. km.). The remaining four million reside in eight rural counties. Most employed "ruralites" (960 000 out of 1.61 million in 1997) are now engaged in activities other than farming. Beijing is the most favorably situated of north China cities in terms of its water resources, with an average annual precipitation of 625 mm, about 20% more than Denver. The natural groundwater supply is the most abundant on the north China plain.

Still, water has long been a major concern of governments of Beijing and its predecessor cities, due in large part to the wide variation in year-to-year precipitation (e.g. a low of 242 mm in 1869, and a peak of 1506 mm in 1959) and the concentration of rainfall in summer storms. The Mongols, who established their capital Dadu on the present site of Beijing in the thirteenth century, were concerned about water supply, flood prevention, and using the Grand Canal to bring in grain from richer agricultural areas in the south. The water plans of the relatively brief Mongol (Yuan) dynasty (1271 to 1368) have often provided the basis even for post-1949 works. Nonetheless, these traditional works were of limited effectiveness, especially in guaranteeing water to the rural areas and preventing floods. With agriculture relying on whatever water was provided by nature, yields were unstable. Sometimes there were famines. Water crises were a part of life.

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Biographical Sketch

James E. Nickum is currently professor in international relations and Chair of the Department of International Studies at Tokyo Jogakkan College. He has worked on various problems of governance of water resources in China for over three decades, beginning with his 1974 doctoral thesis in economics at the University of California, Berkeley on the role of the people's commune system in mobilizing labor for water works. He was a member of the pioneering U.S. Water Resources Delegation to China in 1974, and prepared the subsequent report of its findings. In 1980, he participated in a month-long United Nations University (UNU) study mission on the environmental effects of proposed south-to-north water transfers, intended to relieve growing water shortages in the cities of north China. With Zuo Dakang, Asit Biswas and Liu Changming, he co-edited the UNU book (*Long Distance Water Transfer in China* [Dublin: Tycooly International, 1983]) resulting from this mission and related seminars. He lived in Beijing in 1984 as a visiting researcher at the Chinese Academy of Sciences, and in 1986-1988 as country program officer for Winrock International Institute for Agricultural Development. From then until he moved to Japan in 1996, he was a senior fellow in the Program on Environment at the East-West Center in Honolulu, Hawaii, where he developed a project on problems of inter-sectoral water conflict in Asia due to urbanization. He has taught at a number of universities, including Cornell and the University of Tokyo. He has participated in numerous projects on China's water by United Nations organizations, the World Bank, and the Asian Development Bank.