

# REGIONAL DEVELOPMENT DIALOGUE

Vol.12 No.4 Winter 1991

THE APPLICATION OF TRANSACTION COST ECONOMICS TO  
ASIAN-PACIFIC METROPOLITAN WATER-USE ISSUES

JAMES E. NICKUM AND K. WILLIAM EASTER

APPLICATION OF TRANSACTION COST ECONOMICS TO THE  
ANALYSIS OF WATER-USE CONFLICTS IN  
SEOUL METROPOLITAN REGION

EUISOON SHIN

A TRANSACTION COST ECONOMICS APPROACH TO A STUDY OF  
INDUSTRIAL WATER IN SAMUT PRAKARN PROVINCE, THAILAND  
RUANGDEJ SRIVARDHANA

APPLYING THE TRANSACTION COST ECONOMICS APPROACH TO  
WATER-USE CONFLICTS IN OSAKA METROPOLITAN REGION

TOSIHIRO OKA

TRANSACTION COST AND INSTITUTIONAL APPROACHES TO  
WATER RESOURCES MANAGEMENT IN KUNMING MUNICIPALITY

JICHANG ZHANG



UNITED NATIONS CENTRE FOR REGIONAL DEVELOPMENT  
NAGOYA, JAPAN

276-91WA-14508

# DIALOGUE

An International Journal

Focusing on Third World Development Problems

---

*Regional Development Dialogue (RDD)* seeks to provide a forum for critical discussion of regional development problems, policies, and perspectives among academicians and practitioners. It is addressed particularly to policymakers, government officials, professional planners, and members of the academic community both in developed and developing countries.

---

EDITOR-IN-CHIEF:

Hidehiko Sazanami

GUEST EDITOR:

James E. Nickum

EDITORIAL BOARD:

Josefa S. Edralin  
Wilbert Gooneratne  
Hideaki Hoshina

Md. S. I. Khan  
Josefina M. Ramos  
Isao Tsukagoshi  
Toshihiro Yogo

EDITORIAL STAFF:

James F. Goater  
Aminta Lara-Peters

---

Appropriate articles appearing in *RDD* are indexed or abstracted in: *Asian-Pacific Economic Literature*; *Ekistic Index of Periodicals*; *Index to International Statistics*; *International Bibliography: Publications of Intergovernmental Organizations*; *International Labour Documentation*; *International Regional Science Review*; *Monthly Bibliography*, Part II, by the United Nations Library at Geneva; *PAIS Bulletin*; *Rural Development Abstracts*; *Sage Human Resources Abstracts*; *Social Planning, Policy and Development (SOPODA)*; and *Sociological Abstracts (SA)*.

---

Orders may be sent to:

Information Exchange Section  
United Nations Centre for  
Regional Development  
Nagano 1-47-1, Nakamura-ku  
Nagoya 450, Japan

Annual subscription (including  
postage by surface mail):

US\$50.00 - Developed countries  
US\$30.00 - Developing countries

---

Opinions expressed in signed contributions are those of the author(s) and do not necessarily reflect those of the United Nations Secretariat or of the United Nations Centre for Regional Development.

Designations employed and presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the United Nations Secretariat or of the United Nations Centre for Regional Development concerning the legal status of any country or territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

# REGIONAL DEVELOPMENT DIALOGUE

Vol.12 No.4 Winter 1991

---

## Water-Use Conflicts in Asian-Pacific Metropolises

James E. Nickum                      Editorial Introduction                      iii

### Background Articles

James E. Nickum and  
K. William Easter                      The Application of Transaction Cost  
Economics to Asian-Pacific Metropolitan  
Water-Use Issues                      3

K. William Easter                      An Application of Transaction Cost  
Economics to One Sector: Urban Water  
Supply and Sanitation                      15

### Case Studies

Euisoon Shin                      Application of Transaction Cost Economics  
to the Analysis of Water-Use Conflicts in  
Seoul Metropolitan Region                      21

Francisco P. Fellizar,  
Jr.                      Understanding Metropolitan Manila's Water  
Resources Management: A Transaction Cost  
Economics Approach                      38

K. Venugopal                      The Water Supply System of the Madras  
Metropolitan Area                      64

Ruangdej Srivardhana                      A Transaction Cost Economics Approach to a  
Study of Industrial Water in Samut Prakarn  
Province, Thailand                      73

Toshihiro Oka                      Applying the Transaction Cost Economics  
Approach to Water-Use Conflicts in  
Osaka Metropolitan Region                      82

LIBRARY IRC  
PO Box 93190, 2509 AD THE HAGUE

Tel.: +31 70 30 689 80

Fax: +31 70 35 899 64

BARCODE: 14508

LO: 071 011A

---

James E. T. Moncur	Transaction Cost, Efficiency, and Institutional Change: Water for Honolulu	94
Jichang Zhang	Transaction Cost and Institutional Approaches to Water Resources Management in Kunming Municipality	107

### Comments on Methodology

Regina Gregory		127
Lawrence J. MacDonnell		129
Toshihiro Oka		130
Responses to Oka's Comment		134
Euisoon Shin and James E. Nickum		
Euisoon Shin		137

### Transcripts

Exchange of Views on US and Asian Experience (Morning, 28 November 1990)(edited excerpts)		141
Discussion on Transaction Cost Economics (Afternoon, 28 November 1990)(edited excerpts)		156
Setting New Rules for Water Allocation in Hawaii and the American West: A Symposium held at the East-West Center, Honolulu, Hawaii, 26 November 1990 (Summary prepared by Regina Gregory)		174

Contributors		180
--------------	--	-----

# EDITORIAL INTRODUCTION

---

## INTRODUCTION TO THE WATER-USE CONFLICTS PROJECT

Water-use conflicts are increasing where growing cities compete with other users -- such as irrigated farmland -- for water of adequate quantity and quality. These conflicts are intensified by administrative and disciplinary fragmentation and delays in the development of institutional rules. Attempts to formulate policy to mitigate water-use conflicts are handicapped by the absence of satisfactory methods of analysis, especially in the area of institutional analysis.

With a view to addressing these issues, the East-West Center Environment and Policy Institute (EWC/EAPI), Honolulu, USA, and the United Nations Centre for Regional Development (UNCRD), Nagoya, Japan, initiated a project in 1989 on Water-Use Conflicts in Asian-Pacific Metropolises. The specific objectives of the project are: (a) To review the state of water resources management in selected Asian and Pacific metropolises, with a special focus on the conflicts between types of water use (e.g., agricultural, industrial, and domestic); and (b) to develop a practical approach, based on institutional analysis for understanding these conflicts, particularly from a transaction cost perspective.

Phase one, culminating in a workshop held in Otsu, Japan on 1-4 September 1989, aimed at the first objective. A concept paper by James E. Nickum and K. William Easter considered the problems of institutional choice in a maturing water economy, while case studies surveyed the metropolises of Bangkok, Beijing, Honolulu, Madras, Manila, Osaka, Seoul, and Nagoya (Yahagi River Basin). Phase two focused on developing a transaction cost economics (TCE) methodology and applying it to the analysis of issues concerning water-use conflicts in these metropolises, substituting Beijing with Kunming. The findings were presented and discussed at the Second Workshop on Water-Use Conflicts in Asian-Pacific Metropolises held at EWC on 26-30 November 1990. A symposium on changing the rules for water reallocation in Hawaii and the American West was held in conjunction with the workshop, with support from Ford Foundation.

The papers and discussions from these Phase two gatherings provide the basis for the present issue of *Regional Development Dialogue (RDD)*. From the workshop come two articles on methodology, followed by a number of case studies, a collection of discussions and statements on the merits and

## Editorial Introduction

demerits of a TCE approach, and an exchange of views on Asia and the West concerning water-use conflicts. The symposium provides supplemental materials on Hawaiian water-use issues and on water transactions in the western United States.

### TRANSACTION COST ECONOMICS

We begin with two background articles. The first article, by Nickum and Easter, describes TCE theory and sets out a structured set of questions for reference by the case study authors. Methodologically, we build on that variant of TCE developed by Oliver Williamson,<sup>1/</sup>

TCE, a component of the New Institutional Economics, attempts to apply economic reasoning to problems not conventionally addressed by standard neoclassical economics. For example, rather than assuming the existence of markets or, as in cost-benefit analysis, attempting to calculate surrogate market values (shadow prices) where none exist, TCE asks the more fundamental question of why some transactions take place in a market, while others are governed through other structures, notably a hierarchy (e.g., by the state or within a firm), or sometimes do not occur even though an exchange would be of mutual benefit to the transacting parties. In the context of water use, why are conflicts not resolved on the open market? Why, for example, is water poured on fields to produce surplus crops, while nearby urban users have to curtail water consumption and production activities? Or why do downstream water users have to bear the cost of treating water when it can often be done less expensively before discharge by upstream users? Why are municipal water utilities so often public or quasi-public bodies?

The article by Nickum and Easter begins with a simple but not always well understood question: How does water move from source to disposal? What internal as well as external transactions take place? Where do markets and market surrogates play a role? Where they do not, why not, and what are the implications for conflicts? We did not expect case study authors to answer all these questions definitively, but hoped that light would be shed on where conflicts occur and why, by phrasing the issue in terms of how the relevant section of the hydrological cycle is organized. This could then provide the basis for an analysis of options for resolving those conflicts.

While the basic idea of transaction costs goes back at least as far as Ronald H. Coase's famous article published in 1937,<sup>2/</sup> Williamson identified behavioural postulates (bounded rationality and opportunism) and characteristics of transactions (notably the role of asset specificity) that may affect the relative costs, especially risks involved in transactions under alternative "governance structures" (e.g., market, bilateral relationships, internalization within a firm, state allocation). He has also considered a wider range of governance structures that arise, in part, to reduce transaction costs. By more clearly specifying the factors involved in creating transaction costs and their organizational consequences than Coase did, Williamson's approach provides a useful and practical analytical tool.

## Editorial Introduction

Williamson developed his theory in the context of industrial organization. The question posed here is how well can the same concepts described by Nickum and Easter be used to analyse resource and environmental problems?

Easter first applies TCE reasoning to urban water supply problems. He focuses on the importance of asset specificity and its relationship to central control. A number of related subtopics are discussed, including small vendor alternatives, interagency relationships, and the problem of quality assurance.

## CASE STUDIES

Because of the experimental nature of the endeavour and the practical need to limit the selection of topics within each article, the resulting case studies highlight different features of the transactional flow and TCE analysis. They are divided here into four categories: Flow analyses, user-based (decentralized) alternatives, water rights, and the larger system context.

### Flow Analyses

The articles on Seoul (by Euisoon Shin), Manila (by Francisco P. Fellizar, Jr.), and Madras (by K. Venugopal) are structured around tracing the water as it moves through the metropolitan system. Particular focus is placed on the points where "transactions" take place, and how those transactions are governed. Williamson's definition is used, i.e., "A transaction occurs when a good or service is transferred across a technologically separable interface."<sup>3/</sup>

Shin identifies four major points of transaction in Seoul's surface water management system. He then analyses how different transactional governance structures have been adopted at each transfer point. Interestingly, he takes us inside the Korea Water Resource Corporation (KOWACO) to show us how the need for securing "credible commitments" is important in governing transactions even within a unified agency. Shin also considers some of the topics raised by Easter in describing how the current controversy over the quality of municipal tap water and the growth of a largely illegal private alternative, bottled water, may be described in terms of transaction costs and credible commitments.

Fellizar takes us on a detailed excursion through the Manila water system from watershed to sewage disposal. He is the only one to include the final stage, the return to the natural system. One of the more intriguing aspects of Fellizar's analysis from a TCE perspective is his description of the contractual instruments used at each stage. The diversity and complexity of those instruments is particularly striking. A potentially fruitful area for further research is why such diversity arises and persists, especially in light of their role in reducing transaction costs. Fellizar notes that while the identification of transaction instruments is relatively easy, it is more difficult to examine actual transactions and their dynamics, as these are microlevel problems. Yet these are

## Editorial Introduction

the most interesting components of TCE.

Venugopal provides a concise, careful delineation of the water supply system in Madras, one of the most water-short cities in Asia. While he includes allocation and charging principles in this demarcation, he finds it difficult to apply TCE in a situation where there is only one agency involved. Some interesting comparisons could be made here with the Seoul case, where a single agency also tends to dominate.

### User-Based Alternatives

Increasingly, state monopolies of decision-making power over resource use have come under challenge around the world. Privatization has been advocated as one alternative extending, in the case of England, as far as the water authorities. A related but not identical approach is to recognize or confer greater decision-making power on end users of a resource.

The article by Ruangdej Srivardhana on Samut Prakarn Province looks at the possibilities of a more decentralized approach to water supply rather than at extending an already overburdened Bangkok Water Authority (BWA). Currently, an extremely decentralized approach is followed, wherein industries rely largely on their own extraction of groundwater, but at considerable costs in land subsidence. It is quite likely that government policies will raise the transaction costs of this alternative, essentially by banning wells. An industry-sponsored effort to create an independent surface water supply organization for Samut Prakarn failed because of the underlying economics, e.g., the cost of land and uncertainty over the BWA's future course. Surface water treated and delivered to Samut Prakarn will be relatively expensive. By following its average cost pricing rule, the BWA could cross-subsidize deliveries to the province and undercut the profitability of a local supplier. Hence, lack of credible commitment may be one of the major factors in the adoption of a higher-cost alternative, BWA supply.

An additional study on the Yahagi River Basin, located near Nagoya, was presented by Kenji Oya at the workshop (but is not included in this RDD issue). This study looks at how the Yahagi Water Preservation Association (YWPA) has worked to represent the interests of downstream water users, especially farmers and aquatic products producers, in negotiating mutually acceptable rules over discharge with upstream users. The key mechanism has been for the YWPA to build up its credibility with the parties concerned.

### Water Rights

Toshihiro Oka and James E. T. Moncur consider nontransferable water rights in Osaka and Honolulu, respectively. In Japan, surface water flows belong to the state. For larger rivers, the Ministry of Construction allocates use rights, or *sutri-ken*, based on projected minimum flows. In the lower Yodo River, that level is encountered in a one-in-ten-year drought. When such a drought occurs, however, actual water-use rights are distributed on an *ad hoc* basis. Thus, in practice, the nontransferability of rights has not proven to be an obstacle to changes in sectoral water use in Osaka. It is even less likely to be so once a supplementary supply of up to 40 m<sup>3</sup>/s is available from Lake Biwa in the very near future. Oka con-



## Editorial Introduction

cludes that Williamsonian TCE does not offer any useful insights on *suiri-ken*. He elaborates on this point in a comment, which is followed by responses from Shin and Nickum.

In the case of Honolulu, the courts have declared surface water as state property, much to the surprise of all, including the state. A commission has been established to determine existing water rights and to adjudicate future transfers under extremely restrictive conditions. While Honolulu, like Osaka, is still for the most part relatively water-abundant, Moncur finds considerable inefficiency in the present system, where expensive desalination is being considered as an alternative to transfers from redundant sugar production.

### System Context

In his wide-ranging article, Jichang Zhang touches on a number of relevant themes on the application of TCE which go beyond the more narrowly defined topic of water-use conflicts *per se*. In particular, he notes the importance of the overall system context -- as in the case of China -- which is in transition from a hierarchy-dominant economy to a more market-driven one. When hierarchy becomes too dominant -- internalizing too many transactions -- it loses credibility. Hence, one might conclude that greater reliance on the market may actually strengthen the effectiveness of hierarchy in governing other activities. The problem is whether the credibility of hierarchical governance is so low that the market may be called on to operate where it is not most appropriate. Hence, system transitions themselves entail transaction costs.

Zhang further discusses the problems of forestry management and resettlement. He finds that a collective approach appears to provide the best governance structure for upland forests. In resettlement, government supply-side solutions are preferred to cash payments.

Zhang raises one water-use problem in Kunming. The relatively clean water from Songhuaba Reservoir, formerly used for irrigation, will be exchanged for the organically-rich water of Lake Dianchi. This is actually a win-win situation, as the lake's water is more desirable for agriculture. Conflict between farmers and city dwellers occurs because they do not deal directly with one another. Instead, they rely on direct government intervention in the form of subsidies and management of the pumps. This seems to indicate that less accountable approaches are likely to be adopted, unless the scarcity value of water is seen to be high enough to make transaction costs (such as monitoring and direct bargaining) less onerous than those internalized by the state.

### DISCUSSION OF TCE APPROACH

The merits, limitations, and possibilities of a TCE approach were discussed at length at the symposium. In keeping with the spirit, if not the conventional RDD format, extensive excerpts of these discussions and exchange of views are included in this issue, followed by written comments prepared subsequently by Regina Gregory and Lawrence J. MacDonnell, as well

## Editorial Introduction

as Nickum, Oka, and Shin.

The merits of TCE are seen mostly in terms of how it supplements more traditional economic approaches. By focusing more explicitly on transactions and actors, it allows one to look at relationships within an organizational network, e.g., the KOWACO or the US Bureau of Reclamation. When used as part of project appraisal, it could be analogous to technical feasibility, helping to rule out institutionally unrealistic alternatives. It is a useful interdisciplinary framework based on neoclassical economics, but more open to the insights of other disciplines like sociology, anthropology, and decision sciences. It helps one understand why certain institutional forms have arisen and the implications of those arrangements on externalities. Among those stressing these points are Maynard Hufschmidt, Susan Christopher Nunn, Easter, Nickum, and Shin.

TCE's limitations are seen in terms of the difficulties in measuring transaction costs and in how to apply the analysis in a way that can be used by policymakers. In addition to raising these concerns, Hidehiko Sazanami wondered how TCE could shed light on the larger, sometimes global, environmental issues of general concern today. Richard Cox, concurs that the problem of how to measure transaction costs, especially relative to other costs, would be of considerable concern to policymakers. Such costs are thought to be high, and current arrangements may make them unnecessarily higher; this is something that is difficult to determine. As Nunn notes, TCE itself throws into question all valuation, even standard economic analysis. Yok-shiu F. Lee adds that measurement problems themselves create transaction costs.

In general, discussants agreed that the verdict is still undecided on TCE as a practical policy tool. As summarized by Zhang, both its application and theoretical aspects need to be improved.

In his comment, Oka suggests that the results of the phase two exercise and methodological considerations indicate that Williamsonian TCE is not applicable to the study of metropolitan water-use conflicts. In reply, Shin disputes Oka's interpretation of the Seoul study and calls for more understanding on the difficulty of beginning a new analytical enterprise. Nickum notes, among other things, that neoclassical economics has been subject to similar methodological criticism, yet has proven its value in practice.

Gregory then outlines the areas in which Williamson's TCE concepts may be applied to water resource conflicts. Shin delineates a number of steps which can be taken to improve the applicability of TCE. Finally, MacDonnell points to the potential of transaction cost analysis in addressing wider issues, such as adaptation to global climate change.

## SYMPOSIUM MATERIALS

We conclude this volume with a summary by Gregory of the symposium presentations on creating new water allocation rules in Hawaii and the American West, and a subsequent exchange of views between the symposium speakers and the case study writers. These materials provide an interest-

## Editorial Introduction

ing dialogue between Asians and Westerners, focusing on water allocation issues, which to some extent is independent of the analytical methodology question.

In the presentations, Hufschmidt provides some general background on water supply and demand on Oahu, the most populous island in Hawaii. He notes some uncertainties in the estimated basic figure used in planning for water allocations from the aquifer system's sustainable yield. David Penn then discusses the problem of how to take values into account in determining water allocation. Cox provides an inside view of the very complex process of establishing rights and setting rules for water use.

MacDonnell presents the results of a survey of costs incurred in actual water-use transfer applications in several states in the western USA. Those costs, and other characteristics such as quantity involved per transaction, vary widely from state to state. Nunn finds that cities such as Los Angeles have been very adept at acquiring new water sources as they need them, in spite of the formal structure of rules.

Protection for third parties is still a problem. In the American West, the issue is how to develop efficient water markets which also take into account their effects on third parties. To be efficient, transaction costs must be low; and to be fair, they may need to be selectively high. There has been a trend away from the market in Hawaii with the court's adjudication of water ownership by the state. Increases in demand, sectoral shifts, and third-party interests must be accounted for through administrative methods.

Other topics covered were the pervasiveness of the allocation problem in all cases, the possibilities for using demand management as an alternative to the present supply-side management, the need to understand the underlying physical system, possibilities for citizen involvement and collective options, the value of the Tennessee Valley Authority (TVA) as a role model, the advantages of privatization, and the linkage between land-use plans and water use.

The discussants in general, especially those from the USA, found more similarities than differences in the water-use problems of the East and the West. Asian discussants, while noting the commonalities, expressed concern over the differences between systems; notably, the applicability to their countries of the market allocation mechanisms found in the American West was questioned.

## CONCLUDING REMARK

Water-use conflicts of various kinds are sharpening in and around metropolitan areas throughout Asia and the USA. While the specific nature of those conflicts differs from locality to locality, they exhibit at least two common features: Few can be resolved in the traditional way by developing new unclaimed water supplies; and the nature of the conflicts is as much institutional in origin as it is technical. We hope that the materials presented here, with assistance from the Ford Foundation and the US National Committee of the International Hydrological Programme, will pro-

## Editorial Introduction

vide a basis for sharing experiences and devising operational means for analysing and improving the institutional mechanisms governing water allocation.

### NOTES

- 1/ Oliver Williamson, *The Economic Institutions of Capitalism* (New York: Free Press, 1985).
- 2/ Ronald Coase, "The Problem of Social Cost," *Journal of Law and Economics* (1960):1-44.
- 3/ Williamson, *The Economic Institutions of Capitalism*, p. 1.

A handwritten signature in black ink, appearing to read 'James E. Nickum', with a long horizontal flourish extending to the right.

James E. Nickum

## ***Background Articles***



## THE APPLICATION OF TRANSACTION COST ECONOMICS TO ASIAN-PACIFIC METROPOLITAN WATER-USE ISSUES

James E. Nickum and K. William Easter

---

### INTRODUCTION

This article discusses ways in which transaction cost concepts may be made operational for analysing metropolitan water-use conflicts in the Asian-Pacific region. The purposes of our study are:

- (1) To provide policy analysts with a more sophisticated view of water-use conflicts, both by comparing the experiences of a number of major metropolitan areas in different countries, hopefully, by developing a new analytical approach;
- (2) To test the applicability of that approach -- transaction cost economics (TCE) -- to a major and growing arena of resource use.

### RESEARCH QUESTION

We are seeking to address two major research questions: What are the implications of a maturing metropolitan water economy on the institutions governing water use; and what is the underlying logic of existing institutional arrangements governing water use and water-use conflicts?

#### The Maturing Water Economy

At this stage, our work is focused on megalopolises, some of which are among the world's largest urban areas -- Seoul, Osaka, Los Angeles, Manila, Beijing, Hong Kong, Bangkok, Madras, and Nagoya. Similar types of contention over a local water supply may be found where a city is large relative to its watershed and where adjacent agriculture is irrigated. Honolulu and Tuscon fall into this category.

Typically, in the past, these metropolises have relied on expanding supplies to meet their growing demands for water. They have pumped more groundwater, built reservoirs upstream, and even transferred water from other river basins. Where they shared a common source with other users, there was enough to go round. But unclaimed, or inadequately defended,

## Application of TCE to Asian-Pacific Metropolitan Water-Use Issues

water has become increasingly scarce, while metropolitan governments are straining under tight budgets. Aging delivery and drainage systems and degradation of water further complicate the problem by adding to the demand for funds. To put it simply, water systems are moving from an "expansion phase" to a "mature phase."<sup>1/</sup> (see table 1)

**TABLE 1. CHARACTERISTICS OF EXPANSION AND MATURE PHASES OF METROPOLITAN WATER SYSTEMS**

Characteristics	Expansion Phases	Mature Phases
1. Supply of water	Elastic	Inelastic
2. Demand for water	Expanding rapidly, mostly quantity	Expanding; more slowly (quantity demands increase)
3. Physical condition of water system	New	Many old facilities
4. Competition for water with other uses	Low	High
5. Externality problems	Drainage	Over drafting of ground water and pollution of water sources
6. Social cost of subsidy for increased water use	Low	Rising
7. Life-style	Low water use per capita	High water use per capita

Source: Adapted from Alan Randall, "Property Entitlements and Pricing Policies for a Maturing Water Economy," *Australian Journal of Agricultural Economics* 25 (3:1981):196.

We are reaching a stage where water use cannot be taken as a given right. Increasingly, altering patterns and levels of water use -- "demand management" -- is viewed as a necessary alternative, or at least a supplement, to supply expansion. Important mechanisms used in demand management are water pricing,<sup>2/</sup> leakage control, and water markets.

Furthermore, the growing maturity and the consequent increase in complexity of water systems have given rise to demands both for increased planning and coordination by the government and for greater reliance on the market mechanism. A practical example of both, in the area of water resource management, is the Thames Water Authority in the United Kingdom, which brought disparate water management functions under one governmental body. Having proven its effectiveness and economic viability, the authority is now being divided and privatized. In this example, government and market have been regarded as mutually exclusive alternatives, but they are not necessarily so. The challenge of the next decade is to find appropriate mixes of public and private, plan and market, which meet social needs such as improvements in the environment while taking advantage of the greater incentive and accountability aspects of private and market orderings. This will require a more systematic approach to evaluating and comparing institutions.



## Application of TCE to Asian-Pacific Metropolitan Water-Use Issues

Water management strategies and conflict resolution should place the costs and benefits of supply and demand management on an equal footing. Once the principle is established that water should be used economically, the possibility arises of establishing, promoting, or recognizing water markets. Markets entail a decentralization of some decision making, especially over the allocation of water. Other forms of demand management, such as volumetric pricing, may lead to greater centralization. These changes in the locus of decision making usually require changes in the institutional framework -- the rules of the game, including, prominently, the structure of rights (and obligations) over water.

### Underlying Logic of Institutional Arrangements

In order to develop new ideas for future application, present conditions and practices must be understood. Existing approaches to metropolitan water use tend to be incomplete. Either they focus on one aspect of conflict, for example, quantity or quality, or on one sector, such as irrigation, industrial effluents, or domestic water supply and sanitation. Methodologically, they have been limited as well, for example, by focusing on technical options, on top-down planning models, or on relatively narrowly defined economic calculations, such as project-based benefit-cost analyses. Yet institutions and organizational arrangements themselves have costs and benefits, although they are not always as easily measured.

Williamson identifies the costs of making and enforcing transactions as a critical factor in institutional choice at the firm or industry level.<sup>3/</sup> Bromley reverses this, arguing that the choice of institutions affects transaction costs in a given economy.<sup>4/</sup> We feel that it is a useful exercise to explore the use of TCE in the somewhat different context of metropolitan water management, with its typically complex mixture of public and private controls and pervasive quality, as well as other environmental problems.

## THE TRANSACTION COST ECONOMICS APPROACH

There are several different approaches to TCE. Williamson, Bromley, Coase, and North are among those who discuss transaction costs as an important aspect of economic activity. Since Williamson has elaborated in the greatest detail the nature of TCE and its applicability to economic activity, we will use his approach as our basis.

### Williamson's Approach

The complexity of Williamson's theory is compounded by the specialized vocabulary it uses. For example, one of its central propositions is that "Transaction costs are economized by assigning transactions...to governance structures...in a discriminating way."<sup>5/</sup> Hence a brief digression is necessary to review the basic concepts used by Williamson.

The fundamental unit of analysis is the transaction, defined as something that "occurs when...one stage of activity terminates and another

## Application of TCE to Asian-Pacific Metropolitan Water-Use Issues

begins."<sup>6/</sup> Market transfers usually represent only a very small proportion of "transactions." Most transactions occur within a hierarchical organization, such as a factory. An assembly line consists of an organized and repetitive sequence of transactions. Each time a memorandum changes hands, a transaction takes place. Whenever water is moved from one place to another (including, presumably, when it evaporates or seeps away), is treated, or has wastes dumped in it, a transaction occurs. Of principal interest to Williamson are repetitive transactions between a limited number of transactors. Water, with its recurring nature and site-specific uses, has these characteristics.

Transaction costs are the "costs of running the economic system,"<sup>7/</sup> analogous to friction in a physical system.<sup>8/</sup> While they are just as real as production costs (the other major form of economic costs), they are not always as directly measurable. They may be incurred before a transaction occurs (*ex ante*) or afterwards (*ex post*).

*Ex ante* transaction costs include "the costs of drafting, negotiating, and safeguarding an agreement."<sup>9/</sup> *Ex post* transaction costs include the costs of "misalignment" of transactions during the period of an agreement, haggling over costs to correct misalignments, the costs of setting up and operating "governance structures" for handling disputes, and "the bonding costs of effecting secure commitments."<sup>10/</sup> In practice, the two kinds of transaction costs are interrelated. For example, the nature of *ex ante* safeguards depends on the *ex post* dispute resolution mechanisms which can be called upon.

Williamson argues that economic institutions which arise through the free choice of the parties directly concerned, as in a market economy, "have the main purpose and effect of economizing on transactions costs." Lowering transaction costs basically involves reducing the risk of economic loss to one or both of the contracting parties.<sup>11/</sup> Of particular interest are the losses which stem from "bounded rationality" and "opportunism," as these losses are likely to affect one party more than the other. Bounded rationality, defined by Herbert Simon as "behavior that is intendedly rational, but only limitedly so,"<sup>12/</sup> accepts the premise that people try to be rational in their economic lives, but recognizes that information is imperfect and that our mental abilities to assimilate and act on information are limited. Thus, other things being equal, the most preferred institutional arrangement will be that which makes the least demands on "cognitive competence."<sup>13/</sup> Clearly, changes in the availability of information, the way it is presented, and the ability of decision makers to process it will affect the way transactions are organized, although it is not clear to us in what way. This may be a useful avenue to explore in our case studies.

Information is made more imperfect by the existence of opportunism. This is defined by Williamson as "self-interest seeking with guile," or, more generally, as "the incomplete or distorted disclosure of information, especially...calculated efforts to mislead, distort, disguise, obfuscate, or otherwise confuse."<sup>14/</sup>

Bounded rationality and opportunism mean that exclusive reliance cannot be placed on contracts to govern transactions. "Given bounded rationality, all complex contracts are unavoidably incomplete. Given opportunism, contract-as-promise unsupported by credible commitments is hopelessly naive."<sup>15/</sup> Yet resort to the courts to settle disputes is a

## Application of TCE to Asian-Pacific Metropolitan Water-Use Issues

risky business and usually undesirable, even in litigious systems such as that of the United States. Williamson does grant, however, that private orderings operate in the "shadow of the law"; that is, that legal rights and rules may be part of the bargaining and dispute processes, even when a third party such as a court is not involved.<sup>16/</sup>

There are two forms of safeguards. One is to internalize the transaction through placing both parties under a common ownership and internal "governance structure" such as a firm or government agency, thereby avoiding the market. This entails some loss in the incentives of decision makers to act in an economically efficient manner. The other form of safeguard, not requiring organizational restructuring, is to establish "credible commitments" between the parties through "nonstandard" contracts and modes of organizing the transaction. Examples from the business sector of such nonstandard modes are customer and territorial restrictions, tie-in sales, block booking, franchising,<sup>17/</sup> and the *kanban* (just-in-time) production system which relies on fixed "upstream-downstream" relationships to make customized adjustments in production schedules while reducing inventory.<sup>18/</sup>

In the mainstream "neoclassical" economic theory which has provided the basis for antitrust activities in the United States, these sorts of nonstandard arrangements have been regarded as monopolistic and therefore inefficient. Williamson contends, however, that they may actually be more efficient: By reducing transaction costs, they allow a more intense level of economic activity. By extrapolation, then, public (state or collective), nonmarket governance of resources may be more efficient than private, market modes -- under some circumstances.

The governance structure (e.g., competitive market, "relational" -- bilateral -- market, firm, or government) adopted will tend to be that which minimizes the sum of production costs and governance costs (such as loss of economic incentive). These costs depend in turn on the nature of the technology employed. Where that technology is "general-purpose" and easily redeployable, there is little risk involved and a competitive market will almost always prove to be the most efficient. But general-purpose technology is usually more expensive than "specific-purpose" technology. Thus "asset specificity" plays a crucial role in transaction cost economics. The value of a transaction-specific asset (including human capital) depends on the continuation of the arrangement on preset terms.

Williamson points to the "fundamental transformation" that accompanies the transition from *ex ante* to *ex post* under conditions of asset specificity.<sup>19/</sup> In the fundamental transformation, a multilateral, competitive bargaining situation changes into a situation of bilateral dependency. Under these circumstances, the securing of credible commitments becomes particularly important in order to ensure against substantial losses in the value of assets which are not easily transferred to other uses.

An additional condition suggested by Baumol that will necessitate transaction cost analysis is "the presence of externalities and in particular, free riders." Although Williamson and others do not extend their analysis to environmental issues, Baumol's remark confirms our sense that transaction cost analysis is quite relevant to our present work.

## Application of TCE to Asian-Pacific Metropolitan Water-Use Issues

### Implications for Our Analysis: A Suggested Strategy

Williamson's theory suggests a research strategy such as the following:

- (1) Map out the disposition of water from its sources to where it leaves the urban system, delineating the major transactions if possible, including those to and from a common or an open access body. If it is not possible to delineate major transactions, many of which are internalized within one organization or the other, it may be necessary to limit the description to major transfers into and out of different organizations (including households);
- (2) Describe the organizational structures of the parties involved in water-related transactions. Delineate as much as possible the incentives and objectives of those parties, including at different levels within a given organization;
- (3) Identify the formal structure of rules governing transactions (such as customs, rights, pricing policies, and priorities of use);
- (4) Analyse the transactions in terms of their transaction cost attributes. These attributes include the reliance of transactions on fixed assets and information, the possibility for opportunism, and the use or nonuse of markets, allocation rules, and pricing; and
- (5) Determine where transactions do not take place even though there would be a clear economic advantage (such as between irrigated agriculture and high-value urban-industrial uses); and why they do not occur.

A complementary, and more comprehensive, checklist of desirable information is presented in appendix 1.

### Qualifications Regarding the Use of Transaction Cost Analysis

Transaction cost economics is, to use Williamson's term, more "micro-analytic" than other approaches to the study of economic organization.<sup>20/</sup> In particular, the focus on the transaction as the unit of analysis and on the role of private orderings in attempting a detailed, direct analysis could prove virtually impossible because of the sheer volume of data required. The two behavioural hypotheses of transaction cost economics, bounded rationality and opportunism, themselves indicate the impossibility of fully delineating the system or answering all questions precisely or absolutely. For example, much relevant information, where it exists at all, may be proprietary, not for divulging to outside parties.

A further question arises as to whether one can fruitfully attempt to apply a microanalytic approach to a "macro" problem such as water-use conflicts in an extended metropolis. Furthermore, in seeking a more holistic view of the situation, can the trap of explaining nothing by describing everything be avoided? The view of the authors on both questions is that we can.

## Application of TCE to Asian-Pacific Metropolitan Water-Use Issues

Firstly, the central problem of TCE and water-use conflicts is the same: What determines the institutional rules and organizational forms which are involved and how adequate are they to the current and projected situations? In particular, what are the relative present and potential roles of competitive market, bilateral market, and nonmarket mechanisms, and of organized behaviour by different sets of final water users?

Secondly, the attempt to apply TCE to a resource-use problem of this nature or scale will require some ingenuity. While keeping the entirety in view, it will be necessary to focus on a limited number of critical, hopefully representative, issues, transactors, and transactions. Where direct methods are not possible, it will be necessary to use indirect ones, such as secondary literature and analogical reasoning. Indeed, one important item is likely to be what information is not available, or how information availability varies across the system.

We may be consoled and encouraged in our pursuit of knowledge by Williamson:21/

A complicating factor in all of this is that the *ex ante* and *ex post* costs of contract are interdependent....Also, costs of both types are often difficult to quantify. The difficulty, however, is mitigated by the fact that transaction costs are always assessed in a comparative institutional way, in which one mode of contracting is compared with another. Accordingly, it is the difference between rather than the absolute magnitude of transaction cost that matters....Empirical research on transaction cost matters almost never attempts to measure such costs directly. Indeed, the question is whether organizational relations (contracting practices; governance structure) line up with the attributes of transactions as predicted by transaction cost reasoning or not.

## Application of TCE to Asian-Pacific Metropolitan Water-Use Issues

### APPENDIX 1: STRUCTURED QUESTIONS FOR APPROACHING AN ANALYSIS OF TRANSACTION COSTS IN A METROPOLITAN WATER SYSTEM

#### Warning

Do not be daunted by this list. It is intended to cover as many relevant areas as possible, but it also recognizes that the time and accessibility of researchers is limited, in addition to the limitations mentioned in the final section. The checklist of questions is presented in two parts. The first consists of baseline information on metropolitan water use and water-use conflicts which we believe would be important to bring together, no matter what approach is adopted to analyse them. The second part focuses more specifically on information which would be of use in a transaction cost analysis.

#### Baseline Information

1. What water is within the municipal span?
  - (a) Within basin
    - includes irrigation water which could be transferred to other uses at reasonable cost;
    - also includes instream, flushing uses; and
    - groundwater as well as surface water.
  - (b) From other basins
2. What is the organizational "water budget"? How does water (including groundwater) "flow" through the metropolis from source to disposal? What are the potential points of "transactions"? Who operates the different parts of the water system, e.g., irrigation facilities, treatment plants, wells, reservoirs, fee collection?
3. What are the uses of water? How does this vary geographically and according to income class?
4. Who are the users?
  - (a) "Wholesale" and "retail."
  - (b) State, corporate, cooperative, private: What are the organizational forms?
  - (c) What are their objectives? Where do they conflict?
  - (d) What is the incentive structure of members of the organizations at different levels?
5. How is water transferred from user to user?
  - (a) Allocation principles:

## Application of TCE to Asian-Pacific Metropolitan Water-Use Issues

- Sectoral priorities;
  - Markets (if any);
  - Pricing systems;
  - Quotas;
  - Queues;
  - Customs and laws; and
  - Role and effect of special interest groups.
- (b) Regulations (e.g., of private wells).
- (c) Quality changes in transfers.
- (d) What transfers to and from open access water?
- (e) Extent of own-use, of untransferred water (e.g., wells).
- (f) Where are free riders, unauthorized withdrawals, etc.?
- (g) How is sewage/drainage dealt with, if at all?
6. Who pays the financial (capital and operating) costs of water transfer and processing?
- (a) How adequate is cost recovery from users, where appropriate? What percentage of fees assessed are collected? Does the rate of collection vary according to type of user?
- (b) What use is made of general revenue, external funds, etc.?
- (c) What mechanisms are used to ensure accountability of water agency to provider of funds?
- (d) What is the consumers' willingness to pay (are there existing surveys)?
7. What role do private vendors have in supplying water?
- (a) What are their sources of supply, means of supplying consumers, and prices?
- (b) What, if any, is the role of collective forms of organization?
8. How does the metropolitan water system expand its services to meet the demands of growing peri-urban areas?
9. What is the larger context of transaction cost economizing?
- (a) Trade-offs between production and transaction costs.
- (b) System design.

## Application of TCE to Asian-Pacific Metropolitan Water-Use Issues

- (c) Social, institutional, and organizational context within which transactions are embedded.
- (d) Evolutionary history: Does the system seem to be moving towards efficiency?
- (e) Private vs. social costs and benefits.

### Information Useful for Transaction Cost Analysis

1. What assets (physical and human) are special-purpose; which ones are general-purpose? What differences does this make in terms of the organizational forms and institutional rules, including privately ordered "governance structures"? How can flexibility be built into fixed assets in terms of use rates and use? At what economic cost?
2. What sort of mediation and arbitration system is there?
  - (a) General public -- costs, government mediators, etc. How often are they used and for what purposes?
  - (b) Private orderings:
    - What kind of formal contracts are there? How well do they spell out contingencies?
    - What "nonstandard" modes of organization are present? -- Customer and territorial restrictions, vertical integration, and others.
  - (c) What are the structures of liability? Are governmental bodies financially or otherwise liable for the consequences of their acts?
  - (d) How do consumers report problems of water shortage or pollution? How do complaints vary in different parts of the water system?
3. What is the nature of information?
  - (a) What kind of information is collected?
    - "Hard" data on quantity and quality; and
    - Information on perceptions, including user satisfaction.
  - (b) What is its quality?
  - (c) Who has access to it?
4. Application to specific problems, sectors. Where do transaction costs appear to account for "distortions"?



## Application of TCE to Asian-Pacific Metropolitan Water-Use Issues

### NOTES

- 1/ Because of the "lumpiness" of supply shifts and major institutional changes, the historical development of most water systems shows a sort of cyclical movement from an expansion phase to a mature phase and on to a new expansion phase. What seems to be unique to the present is the relatively universal difficulty of moving beyond the present mature stage through supply expansion.
- 2/ J. Gordon Milliken and Graham C. Taylor, *Metropolitan Water Management* (Water Resources Monograph; no. 6) (Washington, DC: American Geophysical Union, 1981).
- 3/ Oliver Williamson, *The Economic Institutions of Capitalism* (New York: Free Press; London: Collier Macmillan, 1985).
- 4/ Daniel W. Bromley, *Economic Interests and Institutions: The Conceptual Foundations of Public Policy* (New York: Blackwell, 1989).
- 5/ Williamson, *The Economic Institutions of Capitalism*, p. 18.
- 6/ *Ibid.*, p. 1.
- 7/ Kenneth Arrow, "The Organization of Economic Activity: Issues Pertinent to the Choice of Market versus Nonmarket Allocation" in *The Analysis and Evaluation of Public Expenditure: The PPB System*, vol. 1 (US Joint Economic Committee, Ninety-First Congress, First Session) (Washington, DC: US Government Printing Office, 1969), p. 48.
- 8/ Williamson, *The Economic Institutions of Capitalism*, p. 19.
- 9/ *Ibid.*, p. 20.
- 10/ *Ibid.*, p. 21.
- 11/ It may, however, increase the risk of economic or other losses to a noncontracting third party.
- 12/ Herbert Simon, *Administrative Behavior*, 2nd ed. (New York: Macmillan, 1961), p. xxiv.
- 13/ Williamson, *The Economic Institutions of Capitalism*, p. 46.
- 14/ *Ibid.*, p. 47.
- 15/ Oliver Williamson, "Operationalizing the New Institutional Economics: The Transaction Cost Perspective" (Paper presented at the meetings of the American Economic Association, December 1988) (Nashville, TN, 1989), pp. 12-3.
- 16/ Williamson, *The Economic Institutions of Capitalism*, pp. 166; 168.
- 17/ *Ibid.*, p. 19.

## Application of TCE to Asian-Pacific Metropolitan Water-Use Issues

- 18/ For example, see Masahiko Aoki, *Information, Incentives, and Bargaining in the Japanese Economy* (Cambridge: Cambridge University, 1988), chapter 2.
- 19/ Williamson, *The Economic Institutions of Capitalism*, pp. 61-3.
- 20/ For further discussion on externalities, see William J. Baumol and Wallace E. Oates, *The Theory of Environmental Policy: Externalities, Public Outlays, and the Quality of Life* (Englewood Cliffs, NJ: Prentice-Hall, 1975); on transaction costs, see William J. Baumol, *Economic Theory and Operations Analysis*, 4th ed. (Englewood Cliffs, NJ: Prentice-Hall, 1977).
- 21/ Williamson, *The Economic Institutions of Capitalism*, p. 18.
- 22/ *Ibid.*, pp. 21-2.

## AN APPLICATION OF TRANSACTION COST ECONOMICS TO ONE SECTOR: URBAN WATER SUPPLY AND SANITATION

K. William Easter

---

Most metropolitan water systems require a large investment in relatively specific assets ranging from water mains (pipelines) to storage and treatment facilities. The degree of asset specificity varies, and is not necessarily associated with the size of fixed assets. Large multipurpose storage facilities might have alternative uses that would allow relatively low-cost reallocation to other uses, such as irrigation, hydropower, or flood control. In other cases, it may be very difficult to redeploy many similar facilities and some of the technical staff operating them. Careful attention needs to be paid to the level of asset specificity in terms of the difficulty of shifting a physical or human asset to alternative uses.

A high level of asset specificity has a number of important implications. Because it requires reliance on a nonmarket governance structure, large government agencies or public utilities are generally in charge of supplying water for metropolitan areas. In addition, suppliers of capital (for example, the World Bank) for metropolitan water systems require assurances that their loans will be repaid. Therefore, they want some control over the investment, which means they will favour centralized management to reduce monitoring costs.

In the case studies we need to determine if alternative ways have been used to provide assurance of capital repayment and if asset specificity precludes decentralized management. Do water users provide credible commitments concerning payments for water? What is the record for water fee collection and enforcement?

Another important aspect of asset specificity is the huge difference in costs between installing a water main and having one more consumer connected to the main. Assuming that water users pay for water and there is an adequate supply, it is in the best interest of suppliers to have all potential users along the main line connected. The fixed cost of installing a water main is high but the cost of another user connecting to the line is low, particularly if the individual households or enterprises are required to pay for the connection. The question is, how do metropolitan systems induce users to connect to the existing system? Should users pay for the connection? What incentives or legal requirements are there?

Extending the water main to new users is a different question since it involves added fixed costs plus the possibility of reducing hydraulic pressure in the rest of the system. Consequently, any extension of the exist-

## An Application of TCE to One Sector

ing system should be analysed differently. Do the new users pay for the cost of the main line extension; if not, who does? Who makes the decision whether or not to extend the system? What community pressures are important in these decisions?

Although asset specificity appears to favour centralized control of metropolitan water systems, several alternatives may exist. First, centralized planning of the metropolitan-wide water system could be combined with decentralized management. However, to do this, a credible commitment would have to be made by water users. This might be done by turning over major management responsibility to ward-level user groups (WUGS). They could take responsibility for installing water mains, allocating water, and collecting user fees within the ward. They might also be responsible for connecting users and installing water meters. Finally, water users, through WUGS, would pay the centralized unit for water storage and distribution. It is necessary to determine what credible commitments have been developed to reduce the risk of installing large capital-intensive metropolitan water systems and then have users not pay for the service.

A second alternative would be a system of small water vendors, with negligible fixed assets, to supplement the metropolitan water system. There are at least three selected areas of water demand which small vendors could serve: Firstly, areas and groups not served by the main system; secondly, during times when the main system service is interrupted (water delivered only a few hours a day or on alternative days); and thirdly, for higher water quality requirements or demands (bottled water). In fact, during the early stages of a water system's development, private provision of selected metropolitan water demands may be necessary and should be encouraged provided that this does not create unwanted externalities, such as groundwater depletion or reduced pressure in water lines. It is necessary to determine to what extent such private vendors exist and what specific demands they are meeting. Also, what are their costs and sales prices? How do they keep asset specificity low? What are their sources of water and means of delivery?

Most of the water supply within an urban area is usually managed by some organization such as a government agency or a public utility. In analysing the transaction costs of a metropolitan water system, it is critical to know how such organizations operate to allocate water and manage conflicts. Have water-use conflicts been mainly addressed by expanding the supply? How does the metropolitan water management work with or accommodate government agencies (metropolitan, state, or national) that influence metropolitan water supply or demand, such as departments of agriculture, construction, or industrial development? Do some of these agencies and/or their rules raise the transaction costs of supplying metropolitan water? If so, how? How might these agencies react if there were a need to conserve water and higher water fees were imposed? Can the metropolitan water organization change the way it allocates water, e.g., by imposing higher water fees? What transaction costs prevent or, at least, make it more costly to make the necessary changes to conserve water? It is more difficult to make such changes if the metropolitan area is accustomed to water abundance?

Another important aspect of urban water supplies which make them more expensive than irrigation water is the cost of providing high quality water. Irrigation water does not have to be as clean. Many urban areas do

## An Application of TCE to One Sector

not have access to water of drinkable quality. As a result, water must be boiled before use, at a significant cost in both time and energy. Even if water is clean most of the time, the risk of not boiling water is too high and users cannot check water quality given the current costs of testing. This situation results from at least two factors: The consumer has scant knowledge of the water supply system because of its size and specialization; and the number of pollutants that can enter the water supply has expanded and become increasingly difficult and costly to detect. Thus, for both reasons, transaction costs have increased. Consumers in large systems cannot confirm the quality of water through personal knowledge of the system and the cost of measuring water quality has become prohibitive. But do small private systems fare any better in accountability to the end user?

This suggests that one should consider the cost of boiling water as one consequence, or cost, of not providing an assured high quality water supply. Furthermore, one would expect the costs involved in measuring water quality to be important in evaluating an urban water system. We would also expect these costs to rise, due to the growing number of potential pollutants, and the higher information dissemination costs due to the growth in size of urban water systems.



## ***Case Studies***





## APPLICATION OF TRANSACTION COST ECONOMICS TO THE ANALYSIS OF WATER-USE CONFLICTS IN SEOUL METROPOLITAN REGION

Euisoon Shin

---

### INTRODUCTION

Concentration of population and industries in Seoul Metropolitan Region has given rise to an increasing scarcity of potable water sources. The introduction of areawide waterworks was mainly aimed at solving this problem, but the degradation of the raw water source has made people suspicious of tap water quality and an illegal natural water market has provided an alternative to public waterworks.

While the 1970s and 1980s were a water supply expansion period in Seoul Metropolitan Region, the next decade will be a period when the demand for quality becomes the major concern. Thus, the water system of Seoul Metropolitan Region is transforming from an "expansion phase" to a "mature phase."

As neoclassical economics is based on market analysis, it fails to answer why some transactions take place in bilateral markets, others in competitive markets, and in some cases are internalized. According to Williamson,<sup>1/</sup> transaction costs, both *ex ante* and *ex post*, which are the costs of running the economic system, constitute a major factor in institutional choice.

The objective of this article is to apply the transaction cost approach to the analysis of the water management system developed in Seoul Metropolitan Region. The format of analysis is as follows: First, the water management system of Seoul Metropolitan Region is introduced briefly and four stages of transactions are explained. Then in each stage, the different types of transactions are analysed and potential conflicts identified. Then, various institutions developed for conflict resolution and transaction cost minimization are investigated. The last part contains a summary and concluding remarks.

### WATER MANAGEMENT SYSTEM IN SEOUL METROPOLITAN REGION

The Han River system is made up of the North Han, South Han, and Lower Han Rivers. The Soyanggang Multipurpose Dam was constructed on the North

## Seoul Metropolitan Region

Han River and the Choongju Multipurpose Dam on the South Han River. The North and South Han converge at Paldang Reservoir, where the Lower Han River begins and flows through Seoul Metropolitan Region. The Seoul Metropolitan Region is composed of Seoul Special City, Incheon Directly-Governed City, and Kyunggi Province.

Along the water management system from multipurpose dam to final water users, there are four major points of transaction. There are single or multiple sellers and buyers at each transaction stage. Our major interest is to investigate what kind of governance structure was developed at each transaction stage and to explain the reason, where possible, in terms of transaction cost minimizing behaviour.

The first transaction occurs between the Ministry of Construction -- constructor of multipurpose dams -- and the parties who establish dam-use rights. The second takes place between dam-use rights holders and wholesalers. The third is between wholesaler and areawide waterworks. In the final stage, local governments produce tap water and sell it to the final users through local waterworks. Figure 1 is a schematic diagram showing the four stages of transaction along the surface water management system.

### STAGE I: CONSTRUCTION OF MULTIPURPOSE DAM AND COST SHARING

#### Financing of Construction Capital

A multipurpose dam is constructed by the Ministry of Construction to secure two or more kinds of benefit from flood control, irrigation water, domestic/industrial water, and hydropower generation. According to the *Specific Multipurpose Dam Act (SMDA)*, the parties who establish dam-use rights should share the construction cost based on the benefits they receive.

The Choongju Multipurpose Dam was financed through various sources such as government funds, domestic and foreign loans, and internal funds of the Korea Water Resources Corporation (KOWACO), as shown in table 1. The KOWACO provided 32.4 per cent and the government financed 20.1 per cent. A loan from the World Bank and Japan Overseas Economic Cooperation Fund (OECF) supplied 20.2 per cent and 10.5 per cent, respectively, a loan from the Korea Development Bank (KDB) supplied another 10.7 per cent, and 6.1 per cent was borrowed from the Petroleum Business Fund.

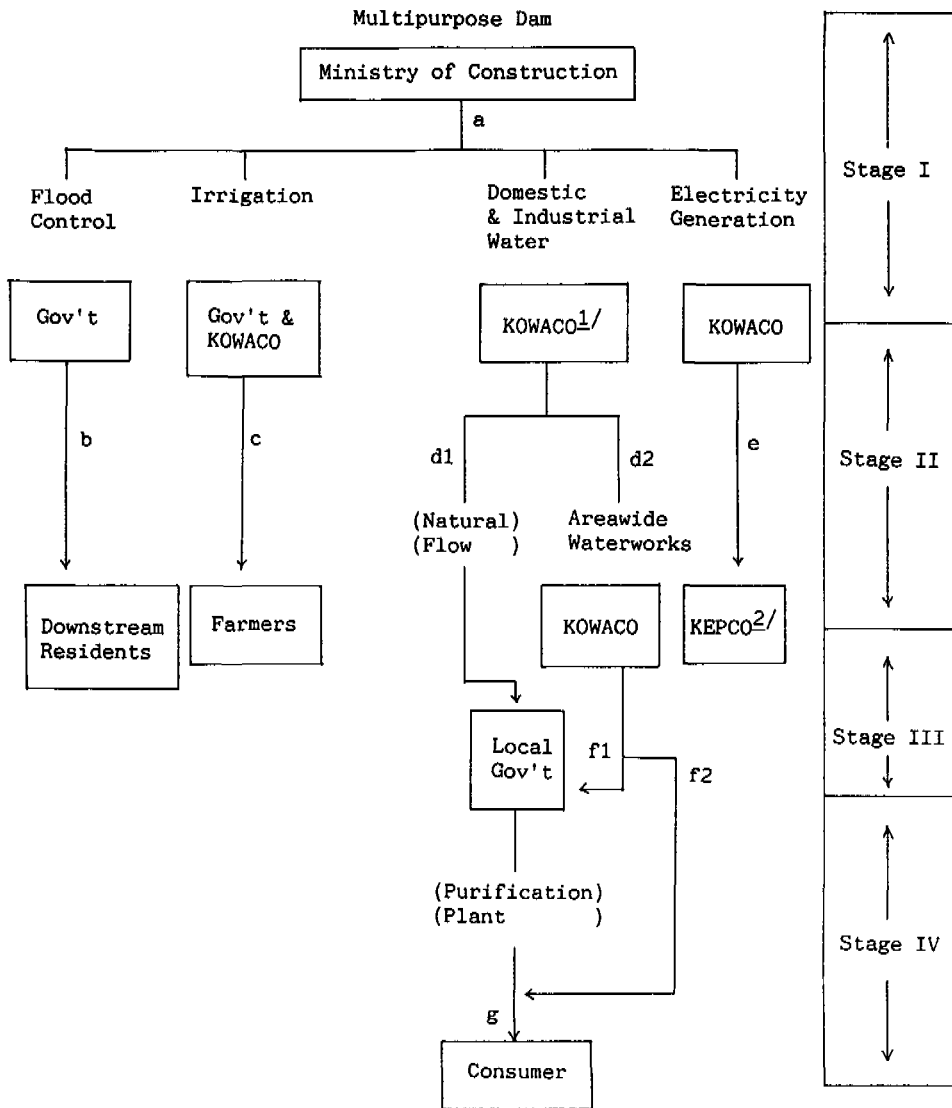
#### Cost Sharing

Cost sharing is based on the expected benefit from the use of a dam. There are two kinds of costs to be allocated: Exclusive facility cost and common facility cost. First, the exclusive facility cost is attributed to each benefit and then facility costs common to all four purposes are allocated according to their expected benefits.

Table 2 shows the final cost share schedule for the construction of Choongju Multipurpose Dam.

Seoul Metropolitan Region

Figure 1. Surface Water Management System



Notes: 1/ KOWACO -- Korea Water Resources Corporation  
2/ KEPCO -- Korea Electric Power Corporation

Seoul Metropolitan Region

TABLE 1. FINANCING OF CONSTRUCTION CAPITAL FOR CHOONGJU MULTIPURPOSE DAM

Classification		Won (million)	Share (%)	Annual Interest Rate(%)
Domestic Fund	Government Fund	111,558.2	20.1	
	KOWACO Fund	179,962.7	32.4	
	Subtotal	291,520.9	52.5	
	Petroleum Business Fund	33,900.0	6.1	10
	KDB <sub>2</sub> / Loan	8,670.9	1.6	10.5
	Subtotal	42,570.9	7.7	
	Total	334,091.8	60.2	
Foreign Fund	IBRD Loan	112,149.8	20.2	7
	OECF <sub>1</sub> / Loan	58,368.6	10.5	3.5
	KDB Loan	50,437.1	9.1	flexible (10.5)
	Total	220,955.5	39.8	
Total		555,047.3	100.0	

Source: KOWACO, *Analysis of Waterworks and Sewerage Projects and Rate Structure Rationalization Plan* (1989)(in Korean).

Notes: 1/ OECF -- Overseas Economic Cooperation Fund

2/ KDB -- Korea Development Bank

TABLE 2. COST SHARE FOR THE CONSTRUCTION OF CHOONGJU MULTIPURPOSE DAM

Purpose Classification	Flood Control	Irrigation	Domestic/ Industrial Water	Hydropower Generation	Total
Common Facility Cost Share(%)	20.4	3.5	17.4	58.7	100
Total Construction Cost Share(%)	16.8	2.9	14.4	65.9	100
Total Construction Cost (million won)	93,107	15,952	79,501	363,857	552,417

Source: KOWACO, *Analysis of Waterworks and Sewerage Projects and Rate Structure Rationalization Plan* (1989)(in Korean).

## Seoul Metropolitan Region

Among the four benefits, hydropower generation took the greatest share of total construction costs with 65.9 per cent. Next was flood control with 16.9 per cent, followed by domestic and industrial water supply with 14.4 per cent and irrigation at 2.9 per cent.

The cost sharing arrangement is internal as it is made between the Ministry of Construction and the dam-use rights holders, who are the Ministry itself and the KOWACO, a government-invested organization.

### Cost Recovery

The allocation of property rights for respective purposes is based on the *SMDA*, *River Act*, and *Farm Village Modernization Promotion Act (FVMPA)*. For flood control, the government covers full costs and the dam-use right is assigned to the government (Ministry of Construction). For irrigation, 70 per cent is paid by the government and 30 per cent is the responsibility of the KOWACO. For this purpose, dam-use rights are retained by the KOWACO. For domestic and industrial water supply, the KOWACO assumes the responsibility for construction costs and retains the dam-use right. The KOWACO also pays the full capital cost for electricity generation and retains the dam-use right.

### Analysis

"The governance structure (e.g. competitive market, bilateral market, firm, or government) adopted will tend to be that which minimizes the sum of product costs and governance costs."<sup>2/</sup> Asset specificity plays a crucial role in transaction cost economics (TCE). If the transaction requires the use of fixed assets, the value of which is not easily transferred to other uses, the securing of "credible commitments" becomes particularly important and bilateral dependency prevails.

We find a case of credible commitments through the *ex ante* cost sharing arrangement in the construction of a multipurpose dam. Such nonstandard contracts are formulated to govern the transactions of service from a dam, which is a transaction-specific asset. The value of the dam also depends on the continuation of the present arrangements.

The costs of constructing a multipurpose dam are very high. If the constructor does not secure credible commitments from the users in advance, there is a risk that the construction costs cannot be fully recovered. This is one reason why such dams tend to be constructed by the state. As a way of preventing various kinds of *ex post* transaction costs, *ex ante* cost sharing and long-term contracts were developed for the construction of the multipurpose dam.

## Seoul Metropolitan Region

### STAGE II: STRUCTURAL CHANGE IN COST RECOVERY SYSTEM

#### Contracting

The KOWACO, as the property-rights owner of dam water as well as administrator of the multipurpose dam, enters into water intake contracts directly with actual users and collects a water fee based on the amount of water withdrawn. There are three types of transactions.

First, the KOWACO makes a contract with local governments who take water from the Han River to treat and sell through waterworks to end users. This contract entails a potential conflict between the KOWACO and the local governments because they withdrew raw water directly from the river long before the completion of the dam. If a dispute develops, the river management agency intervenes to determine the amount of water to which the local government has a vested right. However, not enough information is available on vested water-use rights. There is no separate water code in the Republic of Korea, and the provision on water-use rights specified in the *SMDA* is too ambiguous to be applied to conflict resolution.

Second, the KOWACO generates hydroelectricity and sells it to the Korean Electric Power Corporation (KEPCO), thereby recovering the construction and operation/maintenance costs of the multipurpose dam for electricity generation purposes.

Third, the KOWACO made irrigation water supply contracts with thirty-four different farmland improvement cooperatives. However, confronted by strong protests by farmers against the so-called irrigation water tax, the government decided not to collect fees; consequently, the share of construction costs for irrigation will be paid entirely by the government.

#### Structural Change in Dam Water Rates

The water rate structure has undergone several changes since the completion of the Soyanggang Multipurpose Dam in 1973. Up to the end of the 1970s, the KOWACO operated at a loss because the demand for dam water was far below supply capacity and the users were reluctant to pay for river water which, historically, they had used free of charge.

From 1980 to 1984, dam-use rights holders made charge contracts with actual users based on the cost sharing principle to recover construction as well as maintenance and operation costs. However, the revised *SMDA* of May 1984 added a provision which allowed dam-use rights holders to collect a user's fee from actual and potential users of dam water. This transformed the water rate system from the previous cost sharing contract to a government-backed user's fee system, breaking the direct relationship between costs and benefits.

Another problem developed at the end of 1985 when water demand for Soyanggang Multipurpose Dam reached full capacity and Choongju Multipurpose Dam was completed. Due to the high construction cost of this dam, its water rate was set at 8.75 won/m<sup>3</sup>; more than twice that of Soyanggang Dam. Naturally, users were reluctant to enter into a contract with Choongju Dam Authorities. To solve this problem of different prices for water from the

## Seoul Metropolitan Region

same system, two types of unified rate structure were proposed -- one within the same river system and the other nationwide. The government chose the latter option, sacrificing efficiency to solve a distributional problem, thereby reducing conflict.

In December 1986, the government approved a unified national rate of 5.94 won/m<sup>3</sup> for domestic and industrial water. If local governments were to be responsible for constructing a multipurpose dam, the relative scarcity of water would be revealed by different water rates charged by local governments and more efficient allocation through water transfer, for example, could be secured.

A multipurpose dam is constructed through an *ex ante* cost sharing contract between the constructor and dam-use rights establishers. An *ex ante* cost sharing contract and the allocation of dam-use rights are ways to secure credible commitments. The essence of this system can be preserved only if the holder of a dam-use right can transfer costs to water users. However, confronted by protests and boycotts from dam water users, the KOWACO was forced to rely on a fee-paying system rather than on the cost sharing contracts, as initially planned. Even after the change in cost recovery methods, the conflict between the KOWACO and dam water users persists.

To minimize *ex post* transaction costs, such as the cost of resolving legal conflicts over vested water-use rights and costs involved in fee-setting or fee-collection procedures, the KOWACO developed an alternative way to sell dam water. The idea was that rather than depending on fluctuating demand by uncertain users, the KOWACO would set up reliable bilateral contracts with customers to sell them water through exclusive water pipelines. Through the development of a bilateral market as a substitute for cost-sharing contracts, the KOWACO could avoid various problems in selling dam water. The first stage of this system is the transaction of dam water between the KOWACO and the areawide waterworks which purchase dam water from the KOWACO and sell it to local governments through pipelines. The operator of the areawide waterworks is the KOWACO itself, so the transaction between the KOWACO and the areawide waterworks is internalized and the transaction costs incurred due to opportunism and bounded rationality are avoided.

### STAGE III: AREAWIDE WATERWORKS

#### Rationale of Areawide Waterworks

The establishment of areawide waterworks is a way to reduce the transaction costs involved in selling dam water to actual users. This is because the internalization of transactions and the imposition of bilateral dependency through specific assets greatly reduce transaction costs.

However, the construction of areawide waterworks is a public project so that if it does not satisfy the public, it cannot be implemented. The following are reasons presented by the advocates of areawide waterworks:

## Seoul Metropolitan Region

- (a) Local governments face growing difficulties in securing sufficient raw water of potable quality to use for local waterworks. In particular, Seoul Metropolitan Region should construct new water intake stations upstream to secure better quality raw water.
- (b) Areawide waterworks can provide good quality raw water at lower cost than several small-scale water transmitting pipelines, thanks to planned investment and economies of scale.
- (c) Water transfers among the network of areawide waterworks are possible and water will be allocated more efficiently throughout the nation.
- (d) The national unified rate structure will mitigate different tap water rates among local governments.
- (e) If each local government constructs its own raw water transportation pipelines to the water source, conflict will arise between upstream and downstream users and between large and small cities.

In summary, the construction of areawide waterworks not only reduces the transaction cost of the KOWACO in selling dam water, but is also a way of securing better quality raw water at low cost. However, because of the unique character of bilateral dependency and the KOWACO's role as a sole supplier, an unequal transaction might take place. Therefore, the water rate structure of areawide waterworks needs to be studied to investigate the real reason for the development of the system.

### Rate Structure

The KOWACO sells raw and purified water to local governments through areawide waterworks. The monthly charge is based on the following formula. The rate structure is shown in table 3. Monthly charge = (basic use rate x monthly contracted amount) + (measured use rate x monthly actual used amount) + (excess use rate x quantity exceeding contracted amount).

The areawide waterworks charge system is analogous to an average cost pricing scheme where the basic use charge covers average fixed costs and the measured use charge covers average variable costs. The excess use charge is a kind of penalty charged for the quantity in excess of the initially contracted amount. Overuse by one user means that some other users might not receive what they initially contracted for.

The KOWACO requests a revision of the water rate structure when necessary. The Ministry of Construction is authorized to approve the revision after consultation with the Economic Planning Board. This rate-making system of areawide waterworks is analogous to that of local waterworks.

Table 4 shows the composition of raw water sources for waterworks in Seoul Metropolitan Region. In 1988, the City of Seoul secured 66 per cent of its raw water from the Lower Han River. The remaining 34 per cent was supplied by the metropolitan areawide waterworks. In the City of Incheon which is located by the Yellow Sea, 76 per cent came from the Paldang Reservoir through metropolitan areawide waterworks and the rest was pumped



## Seoul Metropolitan Region

from the Lower Han River. Kyunggi Province consists of many cities and towns located far from the Han River, so it depends on areawide waterworks for 75 per cent of its raw water.

**TABLE 3. RAW AND PURIFIED WATER RATE IN 1990**

(unit: won/m<sup>3</sup>)

	Basic Use Rate	Measured Use Rate	Excess Use Rate
Raw Water	21.55	16.48	69.14
Purified water	67.49	9.65	92.04

Source: KOWACO, *Analysis of Waterworks and Sewerage Projects and Rate Structure Rationalization Plan* (1989) (in Korean).

**TABLE 4. SEOUL METROPOLITAN REGION WATERWORKS CAPACITY BY RAW WATER SOURCE IN 1988**

(unit: 1,000 m<sup>3</sup>/day)

Area	Water Purification Plant	Capacity	Raw Water Source			
			Surface Water	Areawide Waterworks	Riverbed	Ground-Water
Seoul	9	4,970 (100)	3,290 (66)	1,680 (34)		
Inchon	2	1,060 (100)	250 (24)	810 (76)		
Kyunggi-do	54	1,331 (100)	101 (7.5)	993 (75)	216 (16.2)	21 (1.3)
Total	65	7,361 (100)	3,641 (49.5)	3,483 (47.3)	216 (3)	21 (0.2)

Source: E. Shin, "Water Use Conflicts in the Seoul Metropolitan Region" (1989)(mimeo).

Note: Figures in parentheses are percentages.

### STAGE IV: PUBLIC WATER SUPPLY IN THE CITY OF SEOUL

#### Water Supply and Demand in Seoul

Water demand in Seoul has been growing continuously due to population growth and improved living standards. In 1989, 4.97 million m<sup>3</sup> per day were supplied to Seoul. Out of 10.6 million residents, 99.3 per cent received waterworks service, with a per capita daily supply of 427 litres.

There are nine water purification plants in Seoul. As noted above, out of a total daily capacity of 4.97 million m<sup>3</sup>, 66 per cent of raw water

## Seoul Metropolitan Region

is taken from the surface flow of the Lower Han River and the rest is delivered from the Paldang Reservoir through metropolitan areawide waterworks. Seoul pays a fee to the KOWACO for the raw water taken from the Lower Han River and for the raw and purified water delivered through pipelines (see table 5).

**TABLE 5. WATER PURIFICATION CAPACITIES IN THE CITY OF SEOUL IN 1989**

(unit: 1,000 m<sup>3</sup>/day)

Purification Plant	Capacities by Raw Water Source		
	Paldang Reservoir (Areawide Waterworks)	Han River (Surface Flow)	Total
Paldang	1,000	-	1,000
Amsa	-	1,000	1,000
Kuui	-	1,130	1,130
Ttukdo	-	500	500
Bokwangdong	-	300	300
Noryangjin	160	140	300
Sonyu	180	220	400
Yongdungpo	240	-	240
Kimpo	100	-	100
<b>Total</b>	<b>1,680</b>	<b>3,290</b>	<b>4,970</b>

Source: Seoul Waterworks Authority.

### Water Rate Structure in Seoul

As local waterworks are operated by local governments, water rate structures vary. Table 6 shows the water rate structure in Seoul, where water users are classified into nine categories. The monthly water bill is composed of a basic charge and an additional charge. As shown in table 6, first class commercial users pay 4.6 times as much as households for the first 10 m<sup>3</sup>. Households consume almost 90 per cent of total supply but contribute only 35 per cent of total revenue, thus they are highly subsidized.

Presently, the water rate is lower than production costs in Seoul, so the waterworks authority borrows approximately 80 billion won every year. Local loans are spent on construction of additional purification plants and on the improvement of water quality through rehabilitation of old pipes.

### Growing Distrust in Tap Water Quality

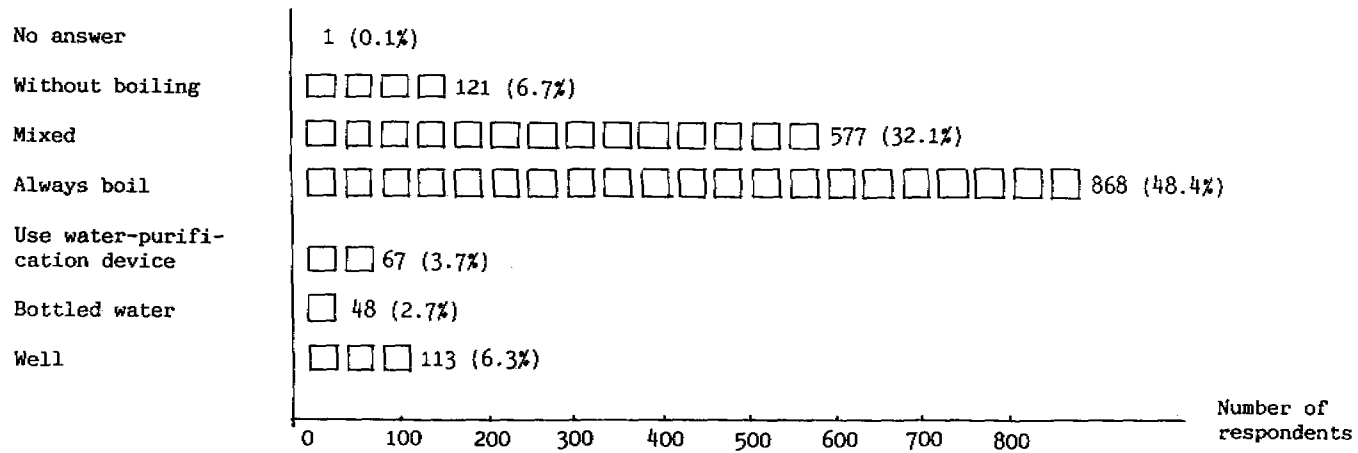
According to a survey conducted by the Office of the Environment in 1987, 3/ 48.4 per cent of respondents said they boil tap water before drinking, 32.1 per cent said they drink sometimes without boiling and sometimes after boiling, and 6.7 per cent said they always drink without boiling (see figure 2).

TABLE 6. WATER RATE STRUCTURE IN SEOUL (1990)

Classification	Type of Industry	Number of Taps	Basic Rates		Additional Rates	
			Usage Volume	Value	Usage Volume	Unit cost/m <sup>3</sup> (won)
First Class	Commercial	95,334	30	8,270	31-200 201-300 301+	410 550 700
Second Class	Commercial	60,558	20	2,100	301+	260
Third Class	Household	1,238,186	10	600	11- 30 31- 50 51+	79 174 230
Fourth Class	Luxury public baths	77	500	273,000	501+	880
Fifth Class	Public baths	2,117	500	54,000	501+	140
Sixth Class	Public institutions	4,501	170 won per m <sup>3</sup>			
Seventh Class	Public waterworks	671	100	5,000	101+	50
Eighth Class	Temporary supply	295	410 won per m <sup>3</sup>			

Source: Seoul Waterworks Authority.

Figure 2. Patterns of Tap Water Drinking Habits



Source: Office of the Environment, *A Survey on People's Opinion Concerning Environmental Preservation* (1987).

## Seoul Metropolitan Region

By income level, the poorest are most likely to take their drinking water from wells. As expected, the highest income group has a dominant share in the category of using a water purification device at home. By region, residents of cities and industrial complexes prefer drinking after boiling, while people living in farming or fishing villages often drink tap water without boiling.

The Waterworks Association conducted a separate survey in 1989 on people's attitudes towards local waterworks, covering 2,500 households in fourteen cities. The survey results, presented in table 7, show that 78.7 per cent of people thought that the sanitary condition of tap water was bad, and most respondents had negative experiences with water such as a high rust content, sediment, or disagreeable odour. As the main cause, 42.2 per cent of people indicated a polluted raw water source while the rest mentioned old facilities or insufficient purification.

TABLE 7. NATIONAL SURVEY ON WATER QUALITY BY THE WATERWORKS ASSOCIATION

Survey Contents	Evaluation	
Sanitary Condition	Bad: 78.7%	Average: 12.5%
	Good: 3.4%	Others: 5.4%
Uncomfortable Experiences	Rust: 34.4%	Sediment: 34.4%
	Odour: 17.8%	Combined: 13.4%
Causes of Unsatisfactory Water Service	Polluted raw water: 42.2%	
	Old facilities: 23.5%	
	Insufficient purification: 23.5%	
	Others: 13.3%	
Tap Water Drinking Habits	Boil: 79.9%	
	Water purification device: 7.7%	
	Natural water: 6.6%	
	Tap water, as is: 5.8%	

Source: Waterworks Association (1989).

Consequently, 79.9 per cent responded that they always, or at least sometimes, boil tap water before drinking. This result is very close to the one obtained from the survey by the Office of the Environment.

## WATER CRISIS AND THE GROWING PRIVATE WATER MARKET

### Development of a Natural Water Market in the Republic of Korea

The *Food Sanitation Act* prohibits the sale of natural water to Koreans living in the Republic of Korea. However, the Ministry of Health can authorize the establishment of a natural water company on condition that the product be either exported or sold only to foreigners in the Republic of

## Seoul Metropolitan Region

Korea.

Fourteen manufacturers produced 109,900 tons of natural water and earned 20 billion won in 1989. More than 95 per cent of these earnings were from sales in the domestic market. The sales volume has been growing at an explosive rate since 1986 but the per capita consumption is still very small compared to the developed nations shown in table 8. The low per capita consumption of natural water in Japan might be the result of a difference in life-style between East and West, because of water quality differences, or simply because the Japanese have great confidence in the government water supply.

TABLE 8. PRIVATE WATER MARKET

	Total (1,000 kl)			Per capita (litre)		
	1985	1986	1987	1985	1986	1987
Republic of Korea	-	-	36.7	-	-	0.9
Japan	82.4	82.5	89.6	0.7	0.7	0.7
USA	4,743	5,203	5,566	19.6	21.5	23
Germany (West)	3,520	4,087	4,148	57.7	67	68
France	3,373	4,009	4,396	61	72.5	79.5
Italy	3,375	3,774	4,180	59.1	66.1	73.2
Belgium	569	628	680	57.5	63.4	68.7
Switzerland	325	339	360	50.8	53	56.2

Source: Anonymous Company.

Natural water is sold in 18.9 litres, 1.8 litres, and 0.9 litres bottles directly to large-scale consumers or is delivered to households through sales agents. Seoul takes 90 per cent of its sales volume through agents. Principal consumers are households, which consume 87 per cent, with the remainder consumed by the business sector.

Up to 1986, foreign residents and the upper-income groups were major customers. However, the demand for bottled natural water has extended to the middle-income groups during the past five years. Now each household consumes four 18.9 litres bottles a month, on average.

Table 9 shows that agents' margins from the sale of bottled water are quite high, more than 30 per cent. The price per ton is 184,210 won in the case of the 18.9 litres bottle. As a Seoul resident pays 600 won for up to 30 tons of city water, the average price of city water per ton is 20 won. Thus, the price of bottled water is 9,210 times more than tap water. This is an indication that people are willing to pay much more to get better quality drinking water.

### Conflicts between the Government and Natural Water Producers

In 1990, eleven of fourteen natural water companies were charged with breaking the *Food Sanitation Act's* prohibition on the sales of natural

## Seoul Metropolitan Region

water to Koreans. One company was ordered to suspend business for five months. That company later filed an administrative appeal to the Seoul High Court of Justice for the removal of the suspension order.

**TABLE 9. PRICES AND SELLING AGENTS' MARGINS**

	Consumer Price(won)	Agent Price(won)	Margin(%)
18.9 litres 1/Box	3,500	2,100	40.0
1.8 litres 12/Box	6,000	4,000	33.3
0.9 litres 15/Box	6,000	4,000	33.3

Source: Natural Water Manufacturers' Association.

The Ministry of Health has fined those natural water companies which violate the law more than three times and has strengthened the penalty after learning that sales of natural water to domestic consumers are still increasing.

The government and producers have different opinions on the issue of legitimating natural water sales to domestic consumers. The government worries that the legitimization of domestic natural water will increase people's distrust in public water and will trigger a protest from the low-income groups which cannot afford to buy better quality bottled water. Additionally, the government worries that mushrooming natural water production could deplete groundwater sources, against which there is no present legal constraints. On the other hand, producers assert that people should have the freedom to choose better quality water and that it is unfair to differentiate natives from foreigners. They also insist that the legitimization of the natural water market is a good way to improve efficiency through open competition. But more than anything else, they contend that the natural water market can serve as a complement to the existing system of public waterworks.

### Analysis

Deteriorating water quality and the growing distrust of public waterworks recently became an important social issue in the Republic of Korea, especially in the summer of 1989 when it nearly developed into a water crisis. People questioned whether there might be harmful new chemicals which are not included in evaluating the quality of tap water and whether existing water purification plants are adequate to treat these harmful materials. They also wondered whether purified water could be polluted en route to households due to rusted or leaking pipelines and unsanitary water tanks.

According to tests performed by the City of Seoul and other research institutions, the quality of tap water is safe for drinking. But most people do not believe these results. The problem is how to assure people that the quality of tap water is truly safe. This dilemma, which cannot be solved through neoclassical marginal analysis, may be amenable to a transaction cost approach.

## Seoul Metropolitan Region

A waterworks system operates through fixed asset and bilateral dependency. The supplier uses a metering device to measure the quantity consumed and can secure a steady demand. The supplier does not have to incur high *ex post* costs to monitor water theft even though water loss in the process of transportation is quite high due to deteriorating pipelines and mismanagement.

However, a large degree of bounded rationality is involved in city waterworks transactions. As pointed out by Williamson,<sup>4/</sup> "given bounded rationality, all complex contracts are unavoidably incomplete." The monthly rate is charged according to volume used but the quality dimension is not included in the contract.

As there are no clear provisions on the quality of tap water sold and no compensation or penalty is guaranteed in cases of violation, consumers must depend on their own information sources to judge the quality of water. However, it is costly to test the water quality of all users and because there are many ways for the water to be polluted, it is impossible to find evidence to charge the waterworks authority with intentional quality deterioration. Instead, people resort to the available risk minimizing options of boiling water, utilizing private water purification devices, or purchasing natural water, depending on their income levels.

### CONCLUDING REMARKS

This investigation of the stages of transactions in the Seoul water management system and of the current controversy over bottled water shows that, at the very least, framing the problems in a Williamsonian transaction cost framework yields important insights into water-use conflicts. For example, it allows us to look inside an organization such as the KOWACO to see how it arranges transfers of water, and to understand better the logic of internalization. It also shows how vested rights and the political process can increase transaction costs of new development, in particular through the avoidance of cost sharing by riverine cities and agriculture.

The controversy over drinking water can also be looked at through a transactional approach. Credibility is important in maintaining a bilateral relationship. The state's loss of credibility in the quality of its water supply, whether deserved or not, has led consumers to expand their sources, even at high cost. Attempts by the state to use the police to impose high transaction costs on alternative transactions appear to be less successful.

Clearly, there is much work to be done before TCE becomes fully operational in policy applications. Nonetheless, the results obtained here are encouraging for continued efforts to that end.



## Seoul Metropolitan Region

### NOTES

- 1/ Oliver E. Williamson, *The Economic Institution of Capitalism* (New York: Free Press; London: Collier Macmillan, 1985).
- 2/ James Nickum and K. William Easter, "The Application of Transaction Cost Economics to Asian-Pacific Metropolitan Water-Use Issues" in this issue of *RDD*.
- 3/ Office of the Environment, *A Survey of People's Opinion Concerning Environmental Preservation* (1987) (in Korean).
- 4/ Oliver E. Williamson, "Operationalizing the New Industrial Economics: The Transaction Cost Economics Perspective" (1989)(mimeo).

### REFERENCES

- Industrial Site Development Corporation, *A Study on the Allocation of Property Rights of Choongju Multipurpose Dam and Management Plan* (1985)(in Korean).
- Korea Water Resources Corporation (KOWACO), *Analysis of Waterworks and Sewerage Projects and Rate Structure Rationalization Plan* (1989)(in Korean).
- Ministry of Construction, *Waterworks* (1989).
- Seoul Metropolitan Government Waterworks Headquarters, *'90 Waterworks in Seoul* (1990).
- Shin, Euisoon, "Water Use Conflicts in the Seoul Metropolitan Region." Rev. ed. (1990)(mimeo).
- Williamson, Oliver E., *Economic Organization* (New York: New York University Press, 1986).
- \_\_\_\_\_ "Transaction Cost Economics: The Governance of Law and Economics" (1979).

## UNDERSTANDING METROPOLITAN MANILA'S WATER RESOURCES MANAGEMENT: A TRANSACTION COST ECONOMICS APPROACH

Francisco P. Fellizar, Jr.

---

### INTRODUCTION

As the population grows, the demand for water to serve the needs of individual households, government entities, and industries increases. Together with the desire for more and adequate water, there is a preference for suitable quality. This creates immense difficulties for water agencies, considering that water supply is becoming increasingly limited and delivery costs more prohibitive.

These conditions result in a maze of interacting institutional arrangements involved in the various aspects of water resources development, allocation, conservation, and utilization. Understanding the roles and relationships of these institutions is essential as an initial step to improving such arrangements to effect sustainable water resources management, particularly in metropolitan areas. In Metropolitan Manila, for instance, mixes of organizations, related policy instruments, and informal arrangements exist as components of water resources management. This article attempts to describe the nature of the interplay of these institutions and to further analyse the inherent relationships with the aid of transaction cost economics (TCE), as an approach. At its best, this work is exploratory with respect to the application of TCE to water management issues, and it may be improved upon, given additional data.

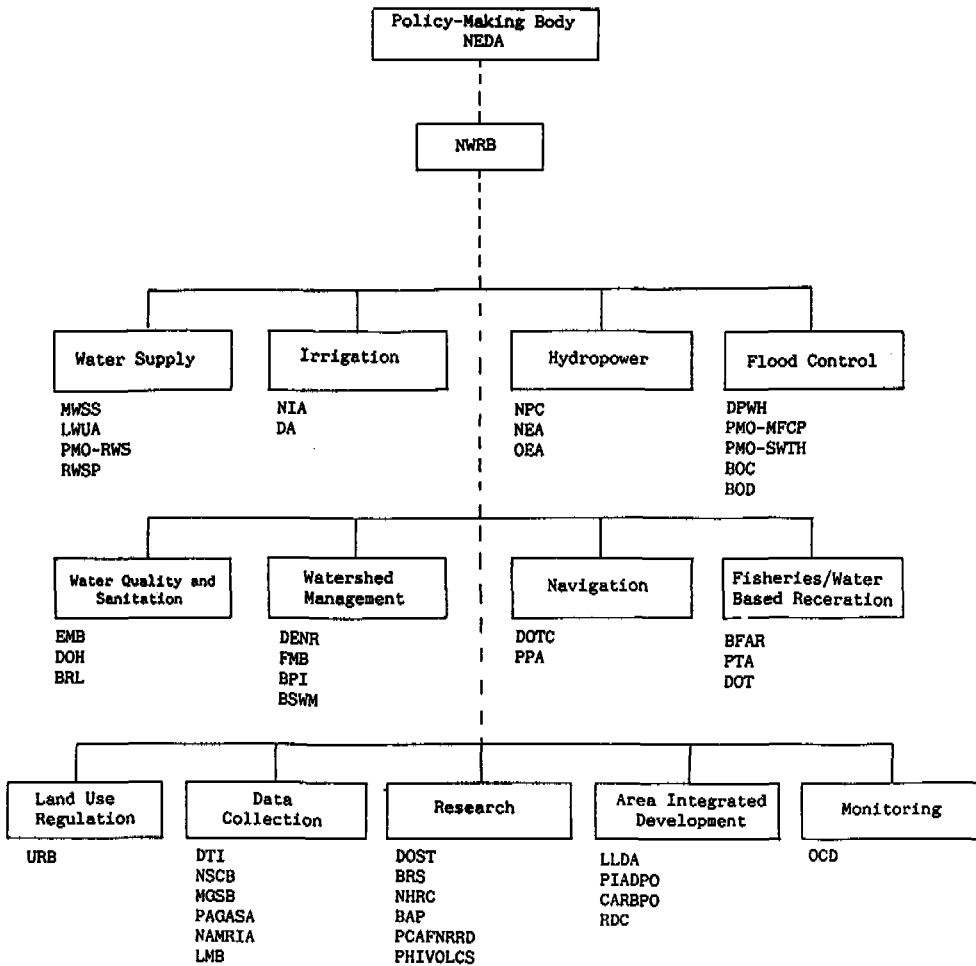
### NATIONAL WATER RESOURCES MANAGEMENT

#### Institutional Framework

The development and management of the country's water and related land resources is the concern of many government as well as private agencies. These agencies undertake programmes and projects within their own sectoral fields of responsibility. Thus, there are separate agencies mainly dealing with particular sectors such as water supply, irrigation, hydropower, flood control, navigation, pollution, and watershed management. These agencies are under the administrative supervision of thirteen national government departments (figure 1).

Metropolitan Manila

Figure 1. Agencies Concerned with Water-Related Activities



## Metropolitan Manila

The water resources activities of these agencies are coordinated by the National Water Resources Board (NWRB),<sup>1/</sup> formerly, the National Water Resources Council (NWRC).<sup>2/</sup> The NWRB is composed of the heads of the departments and line agencies most concerned with water resources. At present there are ten members consisting of the Secretaries of Public Works and Highways, Agriculture, Environment and Natural Resources, the National Economic and Development Authority (NEDA), Trade and Industry, and Health, and the heads of the Metropolitan Waterworks and Sewerage System (MWSS), the National Irrigation Administration (NIA), the Local Water Utilities Administration (LWUA), and the National Power Corporation (NPC).

Presided over by the Secretary of Public Works and Highways as chairman, the board meets twice a month to resolve all issues and conflicts in water resources development and management. The board is supported by full-time specialists in different aspects of water resources, as well as administrative support personnel, headed by an executive director.

### Water Supply Situation

The government provides three levels of water service, depending on what is feasible for a given area. These service area levels are Level I, Level II, and Level III. Level I service essentially consists of point sources of water, such as open wells and hand pumps designed to serve an average of fifty households. Level II service consists of a point source from which water is pumped and distributed to communal faucets, each system serving an average of 100 households. Level III service is a waterworks system which draws water from one or more sources, treats it according to need, and distributes it through a pipe network directly into the user homes. At the end of 1987, around 63 per cent of the total population had access to public water supply systems. The service area coverage included 86 per cent in Metropolitan Manila and its adjoining areas, 55 per cent in other urban areas, and 62 per cent in the rural areas. Out of 86 per cent covered in Metropolitan Manila, however, only 57 per cent were directly served by the MWSS, 16 per cent were served indirectly by the MWSS through ambulant vendors, and the remainder acquired water through private wells and other sources. The rest of the population, approximately 37 per cent, still depended on water from open dugout wells, rainwater cisterns, lakes, and streams.

Under the service coverage of the LWUA, a total of 476 water districts has been formed as of January 1990. According to a 1987 nationwide water sources and facilities survey, 15.32 million people were adequately served by the existing Level I facilities, and around 9.04 million were either inadequately served or their water sources were of doubtful quality.

The nation as a whole has adequate water resources to meet projected demands. Surface water emanating from rivers and streams, measured at around 90 per cent availability, is about two-and-a-half times the estimated withdrawals (figure 2).

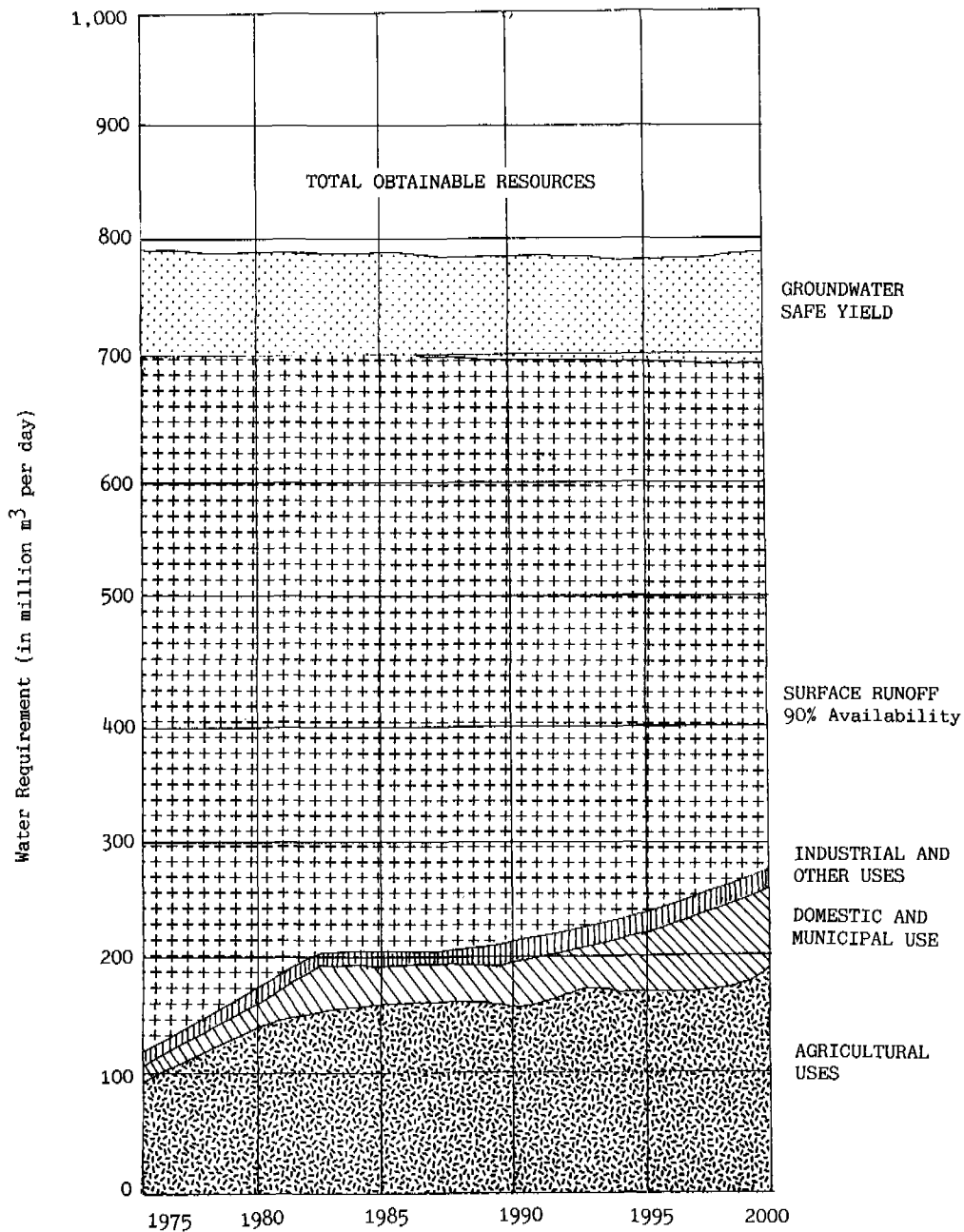
### Irrigation Development

Irrigated land in the country covers an aggregate area of just over 1.5 million ha, which is approximately 50 per cent of the total potential

## Metropolitan Manila

irrigable area. Of this, about 607,546 ha is utilized by communal systems and 226,039 ha is utilized by individual systems. The goal is to extend the irrigated land coverage to 1.7 million ha so as to sustain the growing population's cereal needs.

**Figure 2. National Water Picture, 1975-2000**



## Metropolitan Manila

### Hydropower Development

The hydropower component from the power industry sector accounts for 37 per cent of the country's power demand. Thirty-nine per cent of the total power production comes from oil- and diesel-fired power generating plants, with the remaining 24 per cent supplied by geothermal and coal power plants. The national power programme calls for the acceleration of hydropower development in order to reduce the country's dependence on fuel oil in power production. Feasibility studies have been conducted for designing sixteen hydropower projects to meet these needs.

### Water-Use Regulations

To rationalize the utilization, development, conservation, and protection of the nation's water resources, water-use regulation is pursued within the context of the *Philippine Water Code*.<sup>3/</sup> This is essentially effected through the issuance of water permits to all water appropriators from surface and groundwater sources for all purposes, except single-family domestic use.

## METROPOLITAN MANILA WATER RESOURCES MANAGEMENT

The MWSS, a government-owned and controlled corporation, was created on 19 June 1971 (this replaced the National Waterworks and Sewerage Authority (NWSA)),<sup>4/</sup> to continue supplying potable water and providing sewerage services to Metropolitan Manila and its environs. The service area covered five cities and twenty-three municipalities, totalling about 148,700 ha. The coverage was later expanded under *Batas Pambansa 799*, to include an additional nine towns in Rizal Province (figure 3). The system's initial capitalization was ₱3 billion, and this was increased to ₱8 billion in 1985.

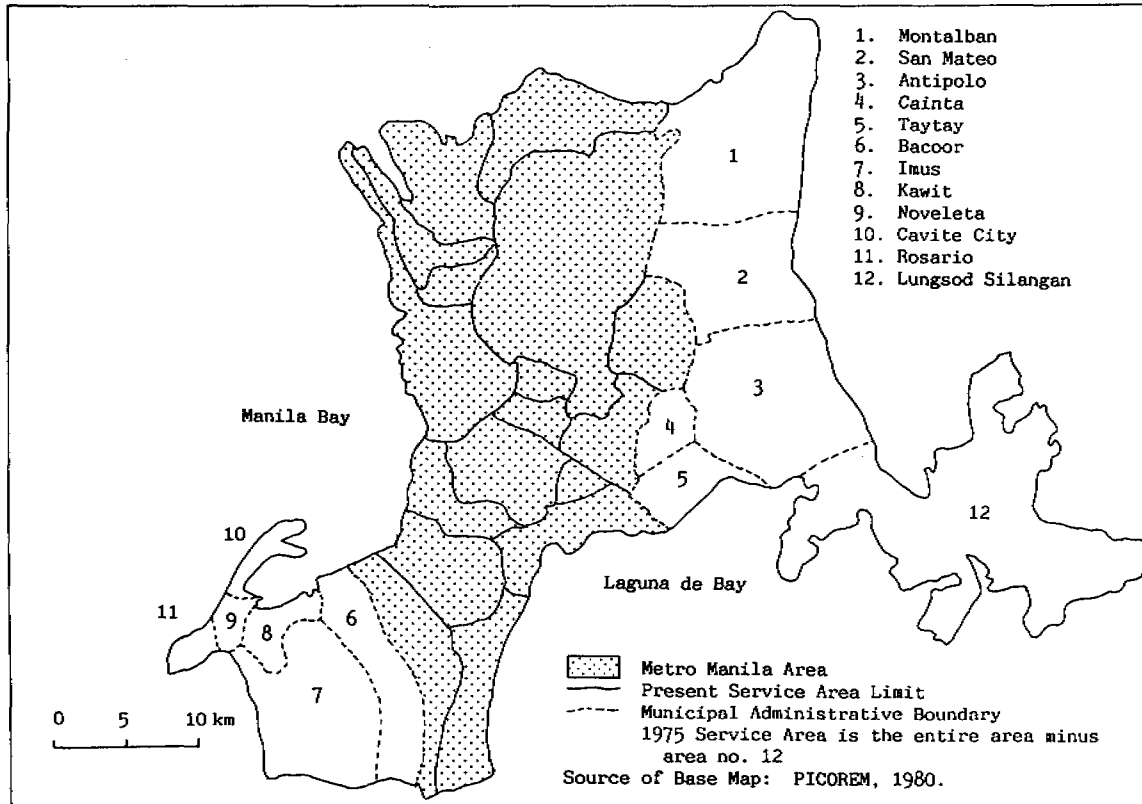
In 1981, the service area population was about 6.79 million; in 1985, it was 7.5 million, and growing at a rate of 3 per cent per year. It is estimated that the area's population will reach 11 million by the year 2000.

### Water Supply Sources

Metropolitan Manila relies mostly on surface water sources to supply its population's needs. The major water sources are three big river systems, namely, the Angat, Ipo, and Novaliches Rivers (table 1).

The biggest source of raw water is the Angat-Ipo Stream Reservoir System. Other sources include the Alat-Novaliches Reservoir and a number of wells. Water from Angat Reservoir is released and diverted to Ipo Dam, where it converges with water from the Ipo River. The water is then conveyed by tunnel and pipe aqueduct to Novaliches Reservoir, where it is temporarily stored before it goes to two treatment plants: Balara in Quezon City and La Mesa in Novaliches. From these two dams, treated water enters the central distribution system (figure 4). Water is then supplied

Figure 3. Map of the MWSS Service Area



Metropolitan Manila

## Metropolitan Manila

to customers through metered service connections, which as of 1989 totalled 688,118, serving a population of 7.98 million. There are also about 1,364 public standpipes, mainly in poor areas.

TABLE 1. AVERAGE YIELD OF WATER SOURCES IN 1985

(unit: mld)

Sources	Average Yield
Angat/Ipo Stream Reservoir System	2,350
Alat-Novaliches Reservoir	184
Deep Well	85
<b>Total</b>	<b>2,619</b>

Source: MWSS (1985).

### Water Quality

To ensure that the water supplied is safe for consumers' health and well-being, the MWSS regularly monitors water quality through sampling and analysis of water from river sources, treatment plants, points in the distribution system, artesian wells, and water samples submitted by both government and private establishments. Bacteriological examination is done in coordination with the Department of Health and local health laboratories.

Most significantly, the effective operation of the two treatment plants is in large measure the insurance for quality water. Balara and La Mesa Treatment Plants have a capacity of 1,600 mld and 1,500 mld, respectively.

It has been claimed that the water harnessed from the Angat, Ipo, and La Mesa Dams is treated and transformed into one of the purest, cleanest, and safest in the world, surpassing even international health standards.

### Water Distribution

From Angat Dam as source, 22 m<sup>3</sup> of water is diverted to two smaller dams/reservoirs and then to two treatment plants. After treatment, the water is stored in reservoirs, from where it then goes to the distribution system, and finally to the consumers (figure 4).

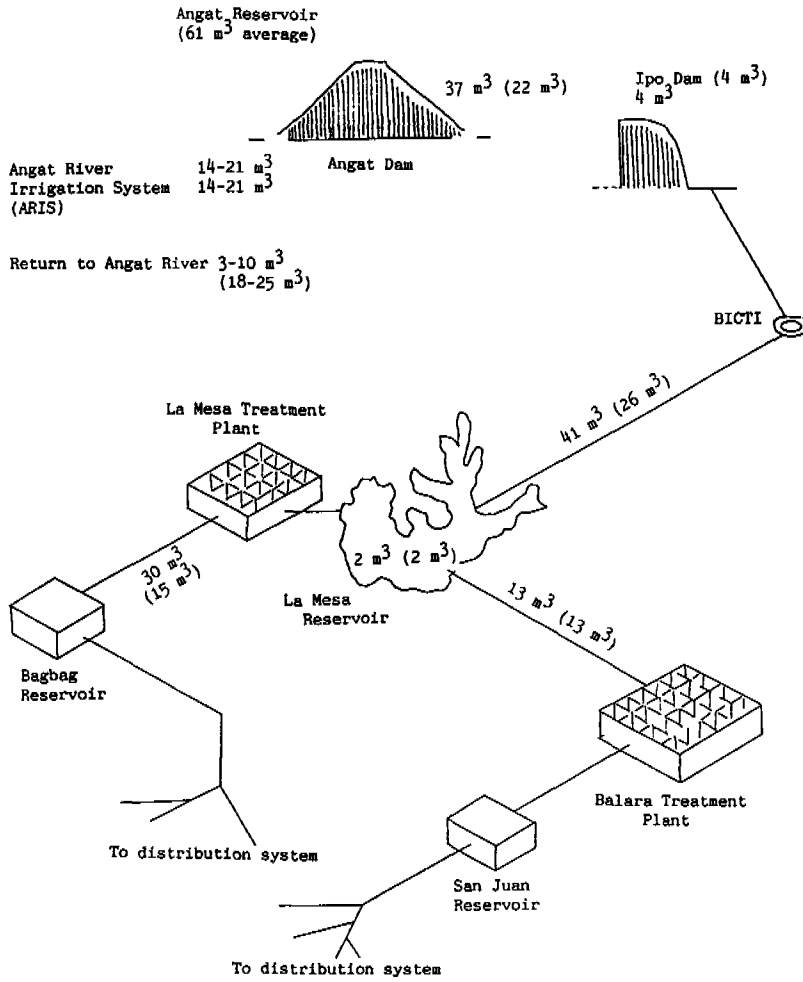
## WATER DEMAND SITUATION

Components of water consumption in Metropolitan Manila are domestic, industrial, commercial, and institutional. About 60 to 90 per cent of the total water consumption is for domestic use. Domestic consumption ranges from 170 to 780 litres per capita per day (lcpd).



# Metropolitan Manila

Figure 4. Water Supply System



## Metropolitan Manila

The demand for water is expected to increase steadily. The MWSS projections for water demand from 1987 to the year 2000 are shown in table 2. For 1989, it appears that the demand of 2,333.51 mld is more than adequately met by the water volume produced by the MWSS, which is about 2,400 mld. This, however, depends on the premise that there is 100 per cent efficiency in water distribution and use. Unfortunately, this is hardly the case. In 1985, for instance, the water demand of the estimated 7.7 million people residing within MWSS's jurisdiction was approximately 2,079 mld lower than the total 2,617 mld capacity for all sources. Due to the distribution losses, the actual water supplied averages only about 1,575 mld, or approximately 76 per cent of consumption requirements.

TABLE 2. PROJECTED DEMAND FOR WATER

Year	Estimated Population	Water Demand (mld)
1987	8,159.30	2,170.98
1988	8,396.34	2,248.75
1989	8,640.50	2,333.51
1990	8,891.92	2,421.12
1991	9,112.74	2,494.95
1992	9,339.18	2,571.59
1993	9,571.51	2,639.74
1994	9,809.84	2,708.78
1995	10,054.39	2,779.53
1996	10,263.55	2,851.86
1997	10,477.32	2,926.29
1998	10,695.77	3,003.92
1999	10,919.01	3,086.16
2000	11,147.23	3,174.55

Source: MWSS (1986).

Past and projected water supply figures are shown in table 3. A steady increase in population has been projected and is expected to continue to rise, given additional water supply sources. Table 4 shows the nature of water consumption for the month of July 1989, and the cost per capita of water, which is about ₱17.77 per month or approximately US\$0.67.

### **WATER MANAGEMENT TRANSACTIONS: AN EXPLORATORY DISCUSSION**

A transaction has been defined as that which "occurs when one stage of activity terminates and another begins."<sup>5/</sup> The objective of a transaction is to minimize the costs among transactors. In actuality, however, transactions occur with transactors either "losing" or "gaining" due to opportunism and unavailability of accurate information upon which decisions can be based. It is important that adequate knowledge by parties on a particular subject or issue be gained prior to any transactions. Moreover, the parties involved must be aware of the consequences of the nature of the transaction. In effect, the consequences could benefit one and cost

TABLE 3. HISTORICALLY PROJECTED WATER SUPPLY

Year	Population <sup>1/</sup>	Water Supply (mld)	Number of Connections <sup>2/</sup>	Population Served <sup>3/</sup>			Percentage Served
				Directly	Indirectly	Total	
1882	-	15	-	-	-	-	-
1898	-	30	-	-	-	-	-
1909	-	87	-	-	-	-	-
1939	910,000	300	-	-	-	-	-
1946	1,450,000	360	73,323	645,747	209,643	855,390	59
1948	1,600,000	380	77,301	681,622	221,290	902,912	56
1960	2,500,000	760	154,603	1,363,243	442,580	1,805,823	72
1976	5,657,588	1,284	261,197	2,303,164	747,728	3,050,891	54
1982	7,015,586	1,530	303,244	2,846,331	1,028,864	3,875,195	55
1983	7,236,753	1,685	327,521	3,069,625	1,177,733	4,247,358	59
1984	7,466,653	1,830	371,641	3,417,062	1,491,870	4,908,932	66
1985	7,705,704	2,156	438,288	3,990,411	2,165,217	6,155,628	80
1986	7,926,105	2,583	501,225	4,617,913	3,036,680	7,654,593	96
1987	8,154,562	2,576	534,337	5,085,292	2,756,919	7,842,211	96
1988	8,391,436	2,581	566,506	5,338,278	2,670,224	8,008,502	95
1989	8,637,110	2,579	627,310	5,531,378	1,696,423	7,227,801	84
1990	8,891,986	2,620	687,310	5,899,728	1,671,084	7,570,812	85
1992	9,833,543	4,475	959,044	6,770,487	1,612,974	8,383,460	85
1995	11,270,562	4,904	1,378,477	8,718,948	1,813,785	10,532,733	93
1997	11,742,077	5,704	1,551,802	9,296,175	1,883,141	11,179,315	95
2000	12,505,358	6,061	1,787,909	9,743,749	1,975,671	11,719,420	94

Notes: <sup>1/</sup> All the fourteen municipalities of Rizal and twelve urban municipalities of Bulacan.

<sup>2/</sup> Nonrevenue water constitutes 25 per cent of unbilled consumption.

<sup>3/</sup> Angat project operational in 1992; Umiray project, which will be operational in 1997; and MSWSP I, II, and III, which will be operational in 1992, 1993, and 1999, respectively.

Metropolitan Manila

TABLE 4. WATER CONSUMPTION IN JULY 1989

	Volume (m <sup>3</sup> )	Percentage Share
Domestic	19,141,424	63.64
Commercial	6,212,972	20.66
Industrial	2,017,497	6.71
Government	2,703,692	8.99
<b>Total</b>	<b>30,075,585</b>	<b>100.00</b>
	Value (₱)	Percentage Share
Domestic	60,257,466	47.42
Commercial	35,559,099	27.98
Industrial	15,346,699	12.08
Government	15,910,415	12.52
<b>Total</b>	<b>127,073,679</b>	<b>100.00</b>
Per Capita Consumption		
Volume: Total	4.2 m <sup>3</sup> per month	
Domestic	2.7 m <sup>3</sup> per month	
Value: Total	₱17.77 per month	
Domestic	₱8.42 per month	
Cost of Water Leakage per m <sup>3</sup> :	₱4.03	

another. The importance of TCE lies in minimizing costs and maximizing benefits.

In this article, the TCE approach -- as applied to water resources problems -- is used, taking into account the above-mentioned transaction elements, namely, the transactors, the theme or subject of transaction, transaction instruments, and the consequences. These elements are discussed with reference to the various phases in the flow of water: From the source, to the pipelines, to storage or reservoir, to treatment plant, to the distribution lines, to the users, and finally to water destination after use. More specifically, the idea is to identify the transactors, subject of transaction, instruments involved, and the consequences, given limited information and the subtractability of transaction dynamics. Table 5 summarizes these elements at the same time as providing the organizational framework for the discussions.

### Water Source

#### Watershed areas

Angat River Watershed is under the jurisdiction of the NPC, a government-owned entity responsible for power generation and development. Like-

**TABLE 5. SUMMARY OF TRANSACTION AND ITS ELEMENTS RELEVANT TO WATER RESOURCES MANAGEMENT IN METROPOLITAN MANILA**

Flow of Water	Organization Involved (Transactors)	Subject/Theme	Instruments	Consequences
<u>Underground Source</u>				
Watershed/River System	MWSS/NWRB/NPC/DENR	Extraction, Protection, and Maintenance	- Water Point - Proclamation/ Memorandum of Agreement	- Availability and Sustained Supply
Reservoir/Dam (Angat Dam)	NPC, EMB	Water Quality	- Legal/Policy Framework	- Safety to Users
	NPC, NIA, MWSS, NWRB	Water Allocation "Water Crisis"	- Codal Provi- sion - Water Permit Committee	- Water Avail- ability/ Adequacy
Distribution Channels/ Pipelines	MWSS Individual Landowner Local Government	Right-of-Way/Use of Land	- Right-of-Way - Purchase	- Cost of Opera- tion - Access to Metropolis
Water Treatment	MWSS, DOH, Consumers	Water Quality	- Memorandum of Agreement	- Health and Safety of People
Distribution	MWSS, Users, Local Government	Pipe Laying	- Permits	- Access to Users
	MWSS, Users	Water Connection	- Contract - Standpipe	- Water Avail- ability

Metropolitan Manila

TABLE 5. (Continued)

Flow of Water	Organization Involved (Transactors)	Subject/Theme	Instruments	Consequences
Use and Maintenance	MWSS, Users	Billing	- Water Meter - Tariff Rates	- Efficient Use
	MWSS/Users MWSS Client Users, MWSS	Delinquency in Payment Water Vending	- Disconnection - Fees	- Revenue - Available Water
<u>After Use</u>	EMB, NWRB MWSS Citizens	Disposal/Water Pollution	- Policy/Codal Provisions - Water Treat- ment	- Quality Water

## Metropolitan Manila

wise the Angat Dam, under its administration and control, is mainly designed to generate a total of 928 megawatts of electricity. Originally, the watershed area was under the jurisdiction of the Department of Environment and Natural Resources (DENR).<sup>6/</sup> However, administration and responsibility for development was transferred to the NPC. At present, collaboration exists between the two agencies with regard to the basin's protection and further development, with the DENR providing the necessary technical expertise in forest protection and management.

### Angat Dam

Angat Dam has an average discharge capacity of approximately 61 m<sup>3</sup>, mainly for power generation. Dam maintenance is the responsibility of the NPC, but water allocation is the responsibility of the NWRB. There are two other water-use management agencies, namely, the NIA and the MWSS; both are government corporations.

### Underground water

Another source of water for Metropolitan Manila is deep wells. In 1981, underground water distributed 28,966,506 ml of water to the total volume produced. Jurisdiction over these water resources lies with the heads of the NWRB. As with surface water, appropriation of underground water is through a water permit. The MWSS has secured such a permit from the NWRB. Individuals have dug wells without permits, however, and the level and volume of extraction has yet to be determined.

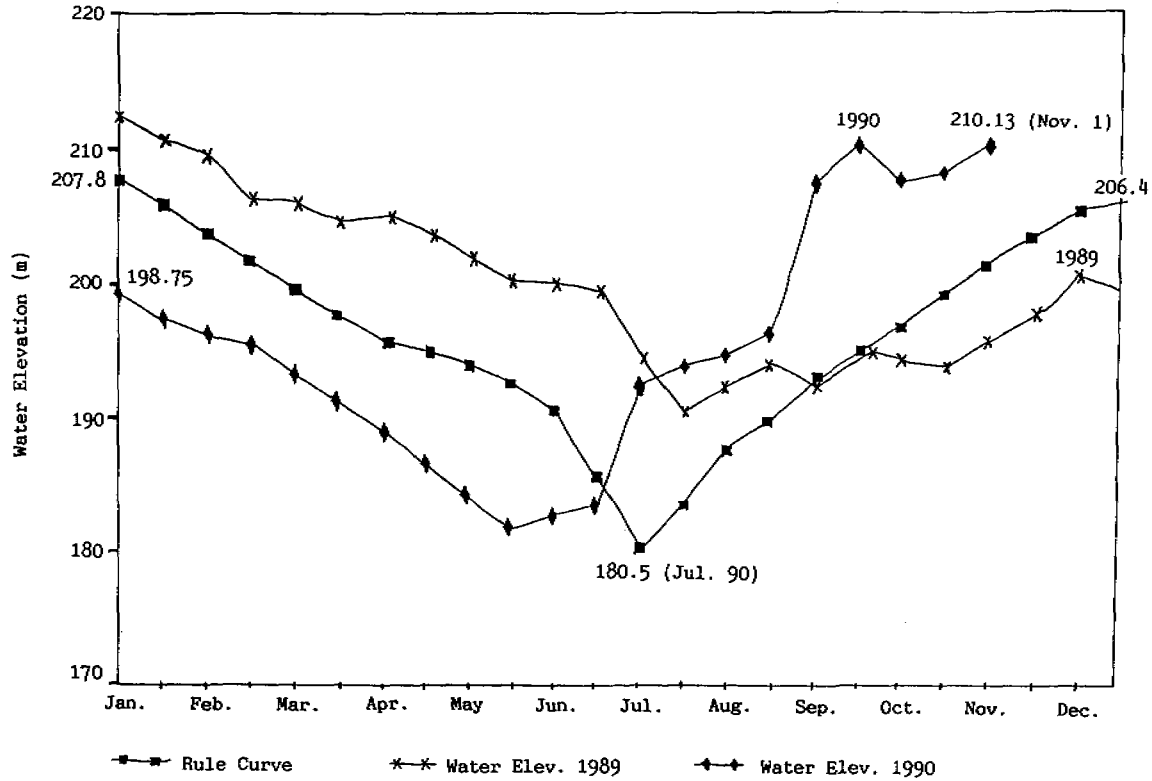
Water for power, irrigation, and domestic purposes is allocated through the NWRB in accordance with the provisions of the *Philippine Water Code*. The *Water Code* stipulates that water must be appropriated by means of a "water right," which shall be evidenced by a document known as a "water permit."<sup>7/</sup> Furthermore,

...between two or more appropriators of water from the same source of supply, priority in time of appropriation shall give the better right, except that in time of emergency the use of water for domestic and municipal purposes shall have a better right over all other uses; provided, that where water shortage is recurrent and the appropriator for municipal use has lower priority in time of appropriation, then, it shall be his duty to find an alternative source of supply in accordance with conditions prescribed by the council.<sup>8/</sup>

Aside from the actions or decisions of the NWRB -- which is usually involved in terms of allocation problems -- there are at least three factors that minimize problems or conflicts that may arise from water allocation for different uses. At a more technical level there is a rule curve which has been established as a more objective basis for allocation (figure 5). Any point below the curve indicates water shortage and may require readjustments in all three uses. A situation of abundance is indicated by points above the curve.

For organizational purposes, an Interagency Committee on Water Crisis Management has been created composed of different water-related agencies.

Figure 5. Angat Rule Curve





## Metropolitan Manila

This committee is chaired by the MWSS Administrator, with members coming from the NWRB, the NIA, the NPC, the Department of Public Works and Highways (DPWH), the LWUA, and the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA). The NWRB serves as the secretariat of this committee. The committee meets every two months and as often as necessary during times of crisis. The status of water-related projects is reported at these meetings and solutions are explored for problems arising from water management. Water allocation in times of emergency situations as in the case of droughts is the committee's paramount concern for deliberation and action.

It should be further noted that water for irrigation and domestic purposes is for secondary uses. That is, after power generation, water is diverted to intakes that lead to different reservoirs, each for the NIA and the MWSS. This means that out of the total  $61 \text{ m}^3$ ,  $22 \text{ m}^3$  and  $21 \text{ m}^3$  are being used for domestic and irrigation purposes, respectively. The remaining volume is discharged into the river systems below Angat Dam. The MWSS is undertaking an optimization project which will utilize an additional  $15 \text{ m}^3$  from this otherwise untapped water source. Given this system of usage, allocation conflicts are avoided, except in times of extreme water shortage where the water level falls below the "rule curve." In this case, the NIA and the MWSS will have to tap other sources and give priority to the NPC. This is because the NPC has "seniority," so to speak, over both the NIA and the MWSS, as water rights were granted earlier to the NPC.<sup>9</sup> Finally, from the point of view of different water agencies, transaction costs are minimized through their functional relationship with the DPWH. While by nature, the NIA and the MWSS are government corporations which operate as private (revenue-generating) entities, their functions are tied to those of the DPWH. This is made more significant by the membership of the DPWH Secretary on the boards of these corporations. Likewise, the secretary serves as the chairman of the NWRB. In effect, these arrangements internalize the cost of transactions among agencies with regard to water-use allocation and development, which provides for greater efficiency.

### Pipeline and Tunnel Construction

Transactions during pipelaying and tunnel construction, carried out to transfer water from the dam to the intermediate reservoirs and treatment plant, involve the MWSS, the local people, and local governments. Specifically, transactions revolve around land acquisition and acquiring right-of-way from private individuals and the government.

Land acquisition through direct purchase and by securing easements and right-of-way is covered by public laws and give special concessions for public utilities which serve general interests. Expropriations are also resorted to in some cases. So far, no problems have been encountered in this particular phase of water resources management, mainly due to the presence of a legal framework governing public utilities.

### Water Treatment

Maintaining water quality is an important concern for the MWSS and its customers. For this reason, four organizations, two of which are private,

## Metropolitan Manila

coordinate to guarantee safe and potable water to the public at all times. The organizations are the Bureau of Research and the Laboratory of the Department of Health (DOH), the Manila Laboratory, the Central Laboratory, and the Process Quality Laboratory of the MWSS.

A Memorandum of Agreement has been signed by these organizations to provide continuity in their coordinated efforts. There are, of course, certain costs involved in securing the services of these entities.

In December 1989, for instance, the cost of treatment and purification per m<sup>3</sup> of water was recorded at ₱0.5610. In terms of water processed and sold, this amounts to roughly ₱1.3458.10/

There have been no serious complaints concerning the quality of water provided to clients by the MWSS. In fact, it has been mentioned that, compared to other countries, Metropolitan Manila has a high percentage of consumers drinking the water directly from the tap without boiling or additional treatment. The estimate has been placed at about 95 per cent.11/

### Water Distribution

Ensuring that water reaches the consumers at acceptable levels of quantity and quality is the ultimate concern of water resources management. This particular phase involves varied activities and multiple transactions and actors.

#### **Laying of water mains**

Providing water mains is the responsibility of the MWSS. It has, however, to deal with various local government rules and ordinances governing excavation and pipelaying. For instance, there are municipalities in the metropolitan area which have passed ordinances requiring the MWSS to secure excavation permits. The fees for the permits are used for the rehabilitation of excavated land surfaces. This is an important area of interaction between the local government and the water agency.

#### **Application for service connection**

The MWSS has established a branch office within the metropolis to provide easy access to applicants and consumers.

Application for a service connection involves certain requirements on the part of the applicant. These include the following: (a) Building permit; (b) plumbing permit or certification by a licensed sanitary engineer; (c) branch office clearance or account; (d) excavation permit; (e) right-of-way or easement from owner of private property -- if the water service connection should pass through a private property; and (f) a receipt accounting for the ₱50 filing fee. These requirements constitute the bulk of the transaction costs to the applicant for water service; they involve costs in terms of both time and money.

## Metropolitan Manila

### Billing and collection

Increasing billing and collection efficiency minimizes the transaction cost to the MWSS with regard to providing water to more customers. The level of collection as against billing has gone up remarkably from 1986 to 1989 (figures 6 and 7). This indicates a marked increase in the efficiency of the collection system, as well as the customers' growing sense of commitment and responsibility in meeting their obligations. At times, discontinued service is resorted to as a penalty for nonpayment of water fees.

### Production and billing

Transaction costs for providing water to more customers can be increased through nonrevenue water (NRW). This is indicated by the gap between production and billing. NRW can result from leakage, unmetered systems, illegal and unauthorized use, and public or free use. Monthly comparisons between water production and nonrevenue water for 1989 are shown in figure 8. From 1986 to 1989, there was a declining trend in the level of the NRW (figure 9). This indicates greater efforts on part of the MWSS to curb losses from NRW through such measures as upgrading meter systems, thorough inspection, imposing penalties, repairs and rehabilitation of degraded pipes, and detection of illegal connections.

### Alternative distribution schemes

- (1) **Bulk-buying.** This is resorted to, usually by big housing subdivisions, where the developer has constructed a water system as part of the development package. The developer and/or the homeowner associations are issued one general meter. The homeowners in turn pay the developer or the designated officer of the association. This arrangement has high governance costs to developers and/or associations due to leakage of the system and other uses. On the other hand, this minimizes the costs to the MWSS in terms of billing and collection. There is now a growing tendency to give to the MWSS the responsibility of individual connection among developers and associations.
- (2) **Standpipes.** In poor areas and in low pressure areas, communal standpipes are provided. These standpipes have meters and are charged by the MWSS at a high subsidized cost. Under this scheme, the community manages the collection of fees among members. Associations are also formed to facilitate and regulate the use of water. The associations are registered with the MWSS. The water charges by the association to its members are affordable, yet enable the association to earn some profit. The association charges ₱4.00 per m<sup>3</sup> of water.
- (3) **Water tankers.** Delivery of water through tankers is provided by the MWSS to address the water shortage in low pressure areas. Water is sold at a wholesale cost of ₱5 m<sup>3</sup>, or at a retail price of ₱0.25 per 20-litre container on a cash-and-carry basis. This scheme is highly dependent on the availability of tanker trucks, however, and on the price of gasoline.

### Metropolitan Manila

Figure 6. Billing, Collection, and Collection Efficiency, 1986-89

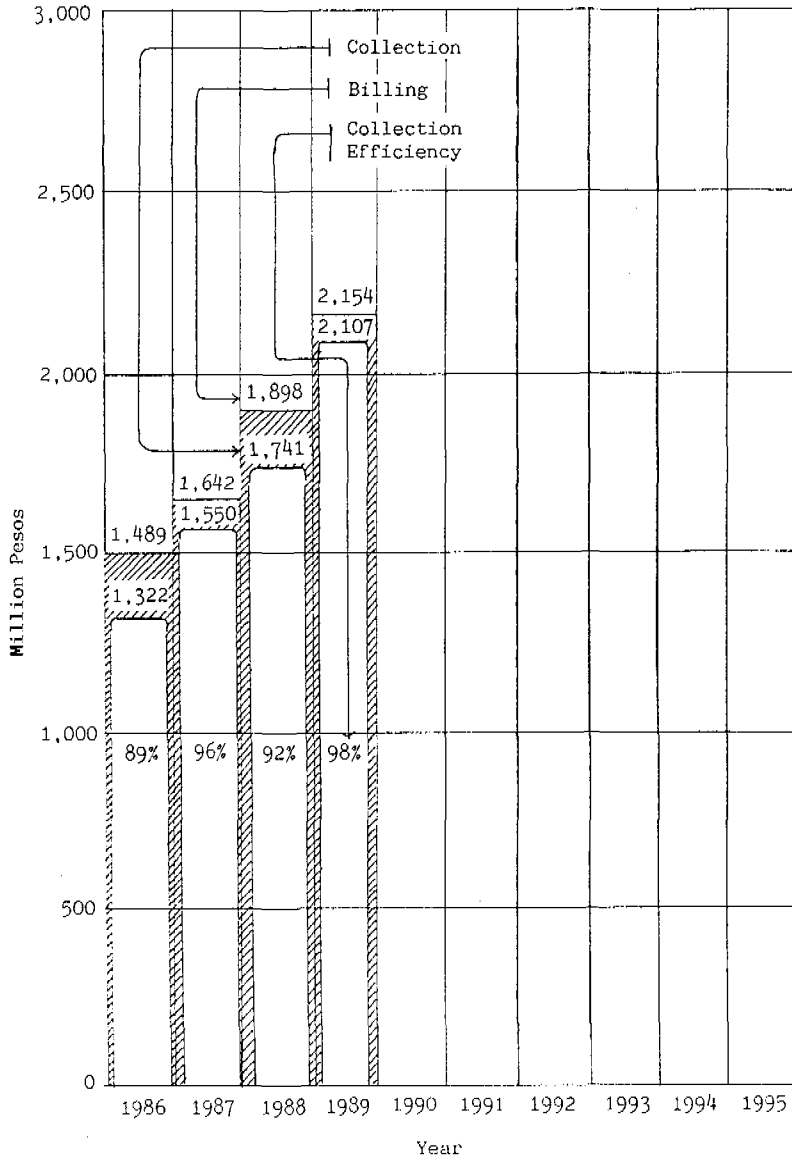
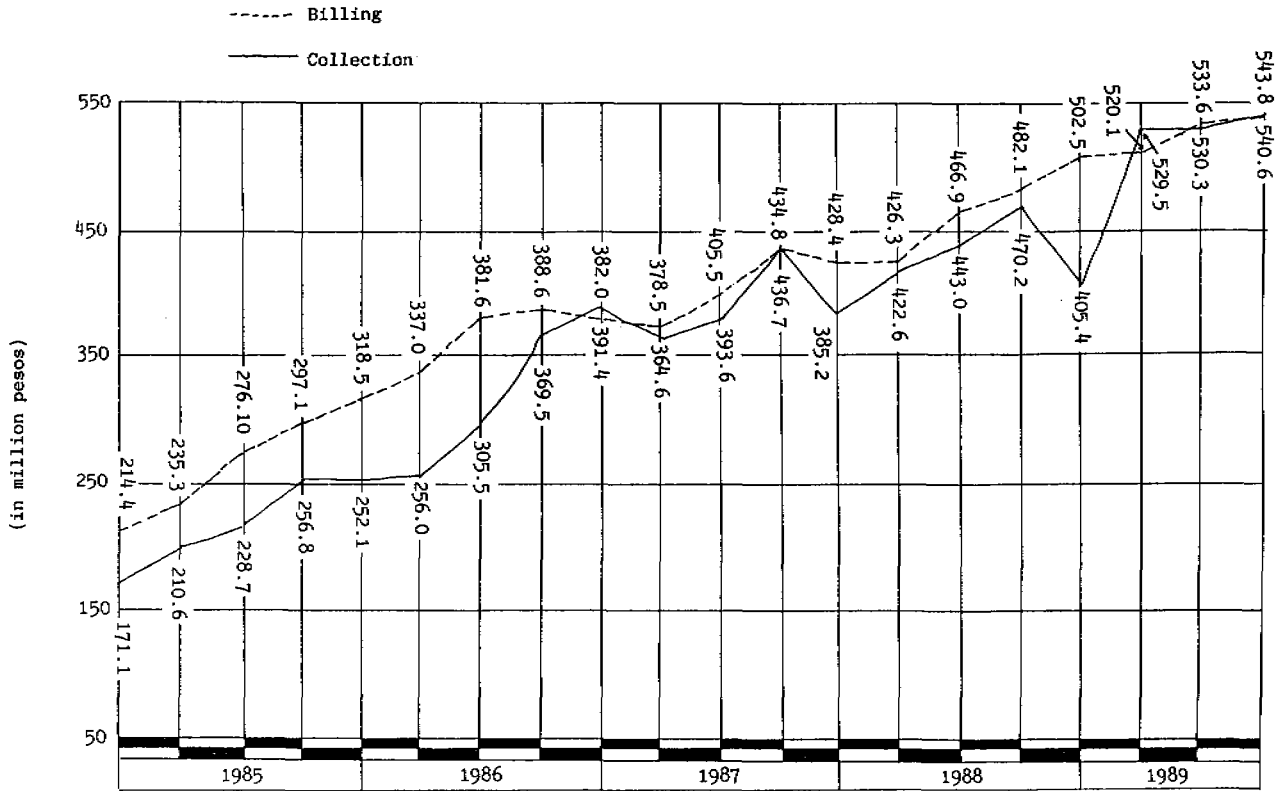


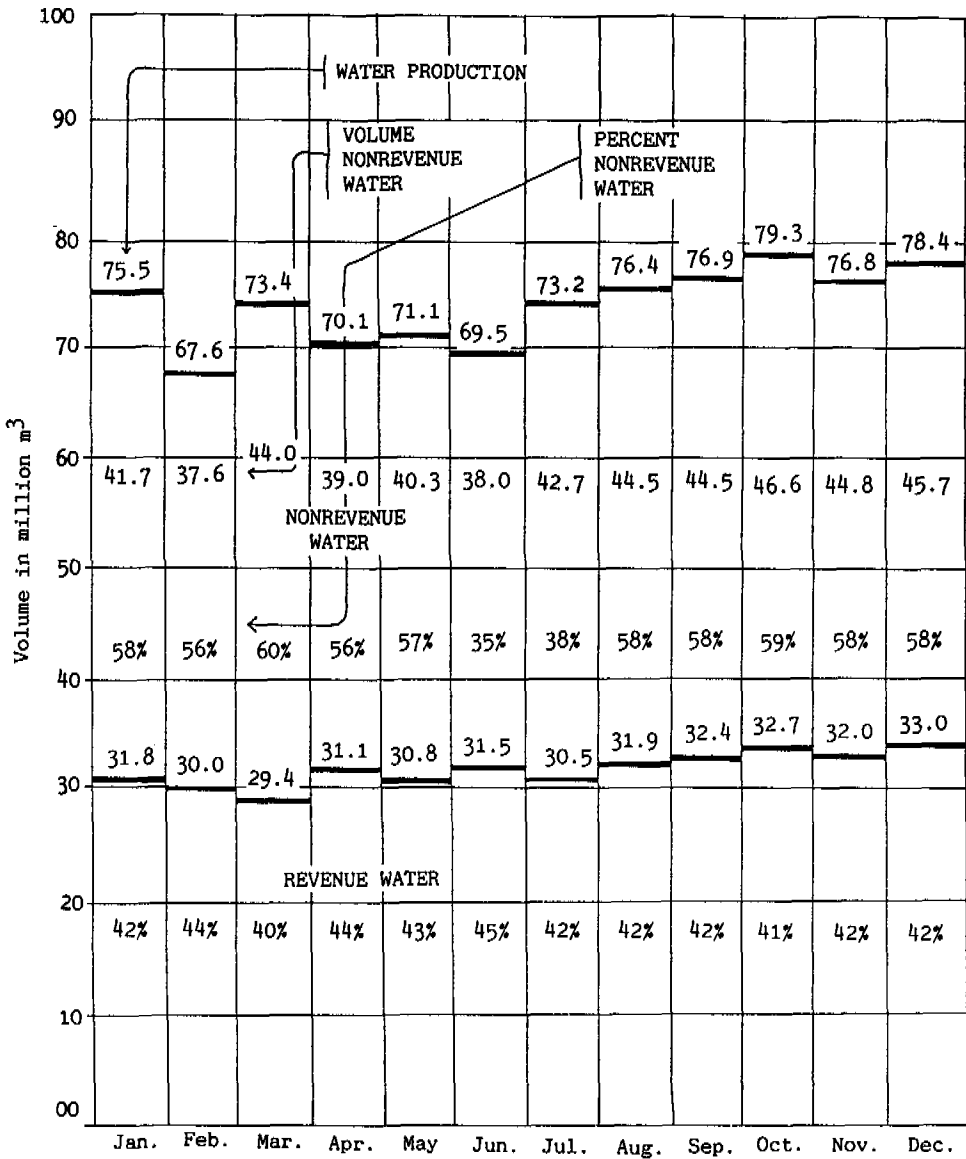
Figure 7. Billing and Collection Levels, 1986-89



Metropolitan Manila

Metropolitan Manila

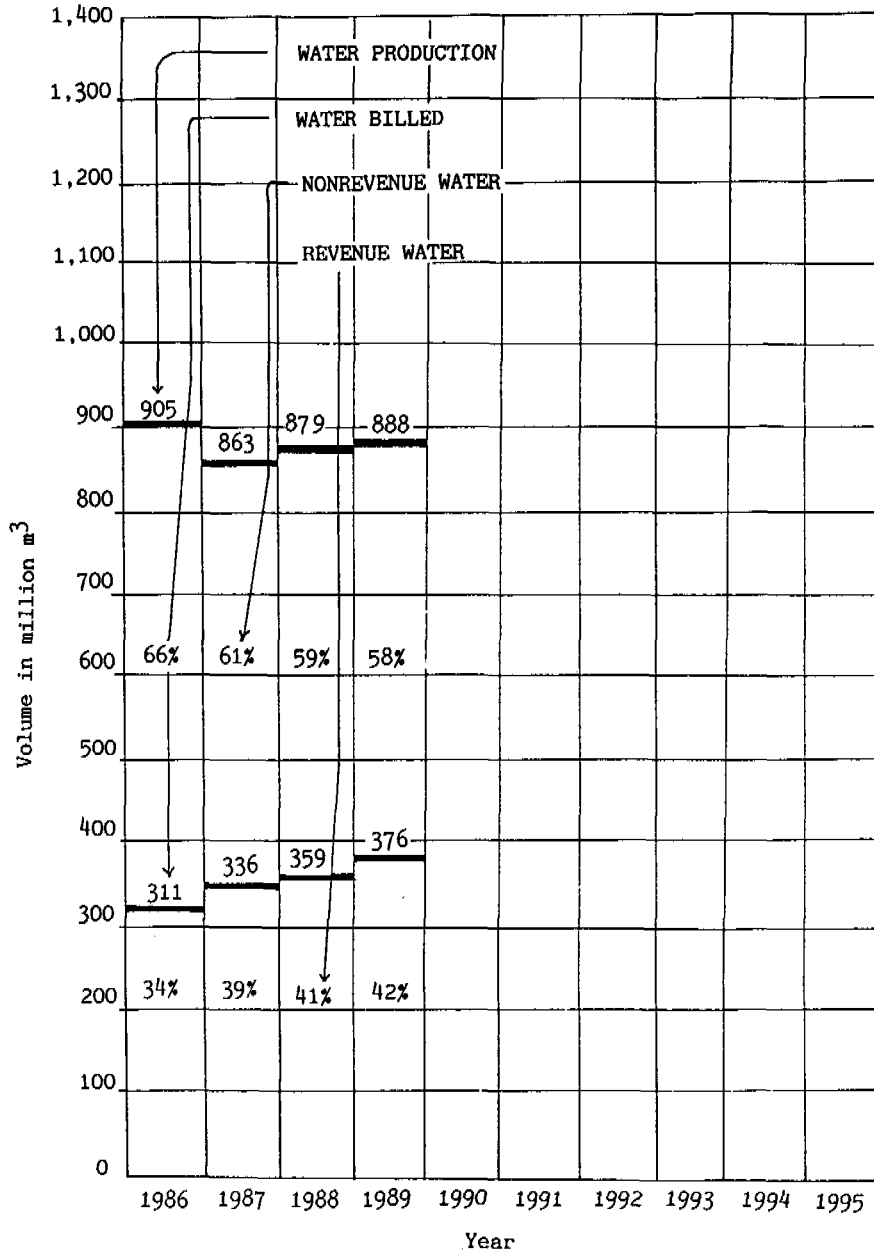
Figure 8. Production-Billing Levels in 1989



1989

Metropolitan Manila

Figure 9. Production-Billing Levels, 1986-95



## Metropolitan Manila

- (4) **Water vendors.** Private homeowners who have either deep wells or cisterns, and who are situated in low pressure areas engage in water vending. The cost per m<sup>3</sup> of water is about ₱10.00. This arrangement is profitable for the vendors. For the consumers, the scheme is expensive, while moreover there is no assurance as to the water quality. Nevertheless, the consumers are at the mercy of the vendors. This type of market will also eventually result in excessive water extraction and in the lowering of the groundwater level.

Still, private water vending might continue for a long time, since only 83 per cent of Metropolitan Manila is served by the MWSS.<sup>12/</sup>

### Disposal After Use

Sewage disposal is the responsibility of the MWSS. Presently, however, only 12 per cent of the population of Manila and Quezon City have adequate sewerage systems. The rest have septic tanks, while the majority in impacted areas dispose of used water through small canals and drains.

Waste water is a major pollutant of nearby water bodies and groundwater. Protection of water bodies is the responsibility of the NWRB, while pollution control is the responsibility of the Environmental Management Bureau (EMB). Coordination between these two agencies exists, but greater efforts are needed in water treatment and recycling. A sewerage infrastructure requires huge expenditures and may not be affordable at the moment. While 50 per cent of water tariffs is for sewerage development, the revenue is not enough to defray the cost of sewerage infrastructure.

## SYNTHESIS OF OBSERVATIONS AND SUGGESTED ACTION

A TCE approach of the sort adopted here aims at identifying critical points in water resources management. By analysing conflicts it may help to minimize them, and thereby enhance the economical operation of water agencies, as well as secure adequate and safe water for a variety of uses.

In water allocation, the government has sought to internalize transaction costs by creating interagency boards and committees. These committees and agencies are guided in their actions and decisions by the *Water Code* provisions. Specifically, water appropriation is through water rights as defined by a water permit.

The cost of infrastructure development for water treatment and distribution is borne by the MWSS. With the assistance of other agencies via Memoranda of Agreement, the MWSS is able to economize on its transactions. For instance, it no longer has to develop its own water source with water provided by the NPC. As proof of its economic viability, the MWSS in 1989 was able to earn a total net income of ₱495 million, notwithstanding its debt servicing.<sup>13/</sup>

The cost per capita of water to consumers serviced by the MWSS as of July 1989 was ₱17.77 a month per m<sup>3</sup>, and the domestic per capita cost was



**Metropolitan Manila**

only ₱8.42 per month. As a whole, basic water charges remain relatively affordable for all consumer categories (table 6).

**TABLE 6. SCHEDULE OF BASIC WATER CHARGES BY CONSUMER CATEGORY**

Types of Services/Consumption Range (m <sup>3</sup> )	Water Rate/m <sup>3</sup> (₱)
<b>Domestic Users</b>	
Up to 15	16.85/connection
16 to 20	28.15/connection
21 to 25	41.75/connection
26 to 30	60.15/connection
31 to 50	2.4875
51 to 70	3.0425
71 to 100	3.7430
101 and above	4.6500
<b>Commercial Users</b>	
Up to 25	117.70/connection
26 to 1,000	4.7075
1,000 and above	5.6105
<b>Industrial Users</b>	
Up to 25	154.15/connection
26 to 1,000	6.1655
1,001 and above	7.2010

Source: MWSS (1989).

For consumers located in low pressure areas, water tanks are provided at subsidized rates. In impacted areas, standpipes are also made available at low rates. In areas where water service from the MWSS is not accessible, water vending proves to be a lucrative business for owners of deep wells and cisterns, who charge more than the MWSS.

Local government and community associations figure as actors in water management. The transaction cost of water connection is made higher by the imposition of excavation permit fees by local governments. On the other hand, community water associations are able to derive a certain profit margin from their operations.

It is apparent that, on the whole, the transaction mechanisms or instruments employed serve to economize on transaction costs, from the point of view of both the MWSS and the consumers.

One limitation to the use of a TCE approach is the difficulty of capturing the dynamics of transactions among parties. While instruments are easily identifiable, the behaviour during transactions is not.

## Metropolitan Manila

The approach enabled identification of actors as well as hierarchies of levels in the transaction. Understanding the intricacies of microlevel transactions demands more time and resources on the part of the researcher. For instance, transactions involving water vendors and clients among members of water associations and local governments need thorough analysis.

A framework like the one presented in this article proved useful. Further refinements are necessary, however, particularly in standardizing nomenclature or terms for the elements of transactions. Finally, more structured research must be conducted based on a unified framework, but this could only be accomplished with adequate support.

### NOTES

- 1/ *Executive Order 124 and 124a.*
- 2/ *Presidential Decree 424 (28 March 1974).*
- 3/ "Philippine Water Code and the Implementing Rules and Regulations" (11 June 1979), 50 p.
- 4/ *Act Creating the Metropolitan Waterworks and Sewerage System (19 June 1971).*
- 5/ Oliver Williamson, *The Economic Institutions of Capitalism* (London: Collier Macmillan, 1985), as cited in James E. Nickum and K. William Easter, "The Application of Transaction Cost Economics to Asian-Pacific Metropolitan Water-Use Issues" in this issue of *RDD*.
- 6/ "Presidential Proclamation" (*Presidential Decree 1515*).
- 7/ "Philippine Water Code," Article 13.
- 8/ *Ibid.*, Article 22.
- 9/ *Ibid.*
- 10/ MWSS Accounting Division, Official Records (1990).
- 11/ Discussion with MWSS staff.
- 12/ *Ibid.*
- 13/ MWSS, *Annual Report, 1989*, p. 6.

## Metropolitan Manila

### ADDITIONAL REFERENCES

Interagency Committee on Water Crisis Management, "Report" (Sixty-ninth meeting, 3 September 1990).

Metropolitan Waterworks and Sewerage System (MWSS), "Guidelines in the Delivery of Water Through Water Tankers and the Collection of Corresponding Bills" (Memorandum Circular 919, 30 April 1990), 6 p.

\_\_\_\_\_, "Inclusion of All Check Meters in the Customer Master File and Correct Assignment of Meter Type Coder" (Memorandum Circular 891, 27 September 1989), 2 p.

\_\_\_\_\_, "Water Service Connection Policies and Guidelines as Amended by Board Resolution 59-89 and Other Amendments to MC 718" (Memorandum Circular 718 D, 19 May 1989), 7 p.

National Water Resources Board, "Situational Report on Water Resources" (1989), 11 p.

\_\_\_\_\_, *Primer* (1990), 10 p.

## THE WATER SUPPLY SYSTEM OF THE MADRAS METROPOLITAN AREA

K. Venugopal

---

### INTRODUCTION

Madras, the capital of Tamil Nadu and the fourth largest city in India, is located in the northeastern corner of the state (figure 1), covering an area of 174 km<sup>2</sup>. The land is flat with a coastal alluvium top cover not more than 50 m deep. Madras gets rainfall from the southwest monsoon from June to September, and from the northeast monsoon from October to December. The average annual rainfall is around 1,200 mm and average temperature ranges from 25 to 37 degrees centigrade. The average humidity varies from 59 to 80 per cent. The population is around 4 million and the per capita water consumption is approximately 70 litres per day (lpcd). Among the principal cities in India, Madras has the lowest per capita consumption of drinking water. A good sewerage disposal system serves much of the city.

### WATER SOURCES

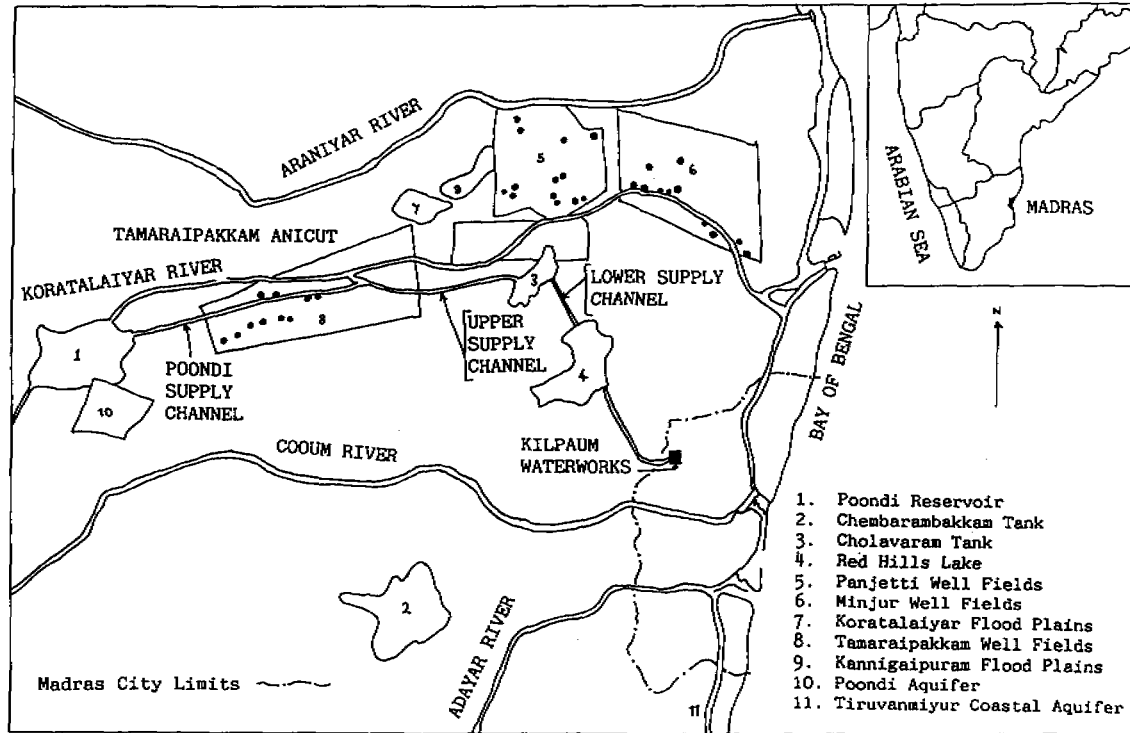
#### Surface Water

Four river basins, namely, Araniyar, Koratalaiyar, Cooum, and Adyaru Rivers, and appurtenant reservoirs and tanks constitute the surface water potential. Araniyar River has a total catchment area of 1,450 km<sup>2</sup> out of which 700 km<sup>2</sup> lies in Andhra Pradesh and the rest in Tamil Nadu. The normal yield from the catchment area in Andhra Pradesh is used by the state itself. On average about 50 million m<sup>3</sup> flows down into Tamil Nadu annually and is mostly used for irrigation.

The total catchment area of Koratalaiyar River is 3,225 km<sup>2</sup>, of which 790 km<sup>2</sup> lies in Andhra Pradesh. The average annual yield of the basin is estimated at 580 million m<sup>3</sup>, of which about 57 million m<sup>3</sup> is contributed by the catchment in Andhra Pradesh. Poondi Reservoir is constructed on this river. It has a storage capacity of 77.20 million m<sup>3</sup>. This storage is used to supply water to Madras.

Adyaru River has a catchment area of 860 km<sup>2</sup>. The average annual yield is 140 million m<sup>3</sup>. Chembarambakkam Tank, the largest of the old

Figure 1. Index Plan of Water Sources of Madras Metropolitan Area



Madras Metropolitan Area

## Madras Metropolitan Area

irrigation tanks in Tamil Nadu, with a catchment area of 358 km<sup>2</sup>, lies in this basin. This is primarily an irrigation tank having a storage capacity of 87.70 million m<sup>3</sup> with a registered *ayacut* of 5,269 ha. The yield from Cooum River is of no significance in the context of city water supply.

The safe yield figures from surface sources in million litres per day (mld) -- estimated on the basis of a thirty-six-year record of dependability -- are as given in table 1.

TABLE 1. MADRAS WATER SOURCES: DEPENDABILITY

Dependability (per cent)	Safe Yield (in mld)
95	142
90	150
80	162
50	190

Note: 1,000 litres = 1 m<sup>3</sup>

Oggian Madagu is a small swamp area situated south of Madras. Its maximum length varies from about 5 km immediately after the monsoon to about 1 km in the summer. The water in Oggian Madagu is saline because it is connected to the sea. As this is located close to the city it can be considered a source both for the city water supply and for recharging the southern coastal aquifers.

### Groundwater

Groundwater development started with Minjur, Panjetti, and Tamaraipakkam Well Fields in Arani-Koratalaiyar Basin, with a safe yield of 125 mld. Subsequently, the coastal aquifer from south of Tiruvanmiyur to Kovalam was used. The safe yield was assessed as 1.15 mld per km. Later, three new well fields were developed in Poondi, the flood plains, and Kannigaipuram, with a safe yield of 60 mld. About 500 mld of groundwater from private wells is used for irrigation.

### Other Basins

The Krishna water supply scheme envisages a supply of 340 million m<sup>3</sup> of water on an annual basis at the Tamil Nadu border. This contribution is from Maharashtra, Karnataka, and Andhra Pradesh. The annual flow of the river at 75 per cent dependability has been assessed as 58,340 million m<sup>3</sup>. The average annual quantity draining into the sea in the past sixteen years is calculated to be 22,650 million m<sup>3</sup>. The project is expected to deliver 400 mld to Madras by 1993.

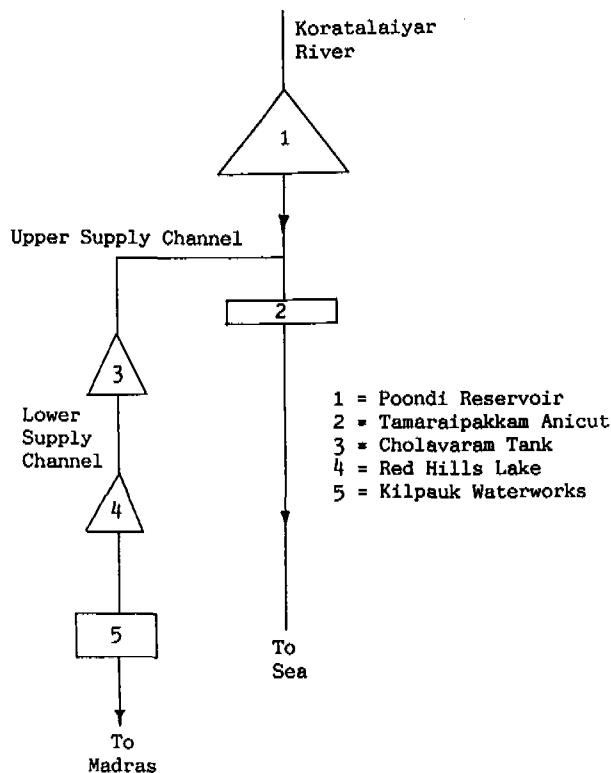
The groundwater potential available from Palar Basin close to Adyaru Basin is estimated to be 135 mld, of which the present use by the municipalities and towns in that area accounts for 45 mld.

## Madras Metropolitan Area

### WATER SUPPLY SYSTEM

The river systems in the area are not perennial. Adyar and Cooum Rivers have no dependable yield and are acting as local drainage systems. Hence, Koratalaiyar and Araniyar Rivers were chosen to supply water for the City of Madras. In order to utilize the flood surpluses of Araniyar River, a diversion channel was constructed linking Araniyar River with Koratalaiyar River. Downstream from Poondi Reservoir on Koratalaiyar River, Tamaraiykkam Anicut was constructed in order to divert water to the existing Cholavaram Tank which has a capacity of 22.97 million m<sup>3</sup>. The diversion channel is known as the upper supply channel. A lower supply channel was constructed to link Cholavaram Tank to Red Hills Lake with a capacity of 80.65 million m<sup>3</sup>. All three reservoirs, namely, Poondi Reservoir, Cholavaram Tank, and Red Hills Lake are meant to exclusively supply water to Madras. An intake tower called Jones Tower was erected in Red Hills Lake and a closed conduit was constructed to convey water to Kilpauk Waterworks. Water is treated at Kilpauk Waterworks, and after treatment is supplied to Madras through the distribution network. Figure 2 shows the network of the water supply system to Madras.

Figure 2. Water Supply System to Madras



## Madras Metropolitan Area

The distribution network has a length of about 1,560 km. The water is supplied to users through service connections and public standpipes. The service connections are either metered or unmetered, depending upon the pressure in the distribution system. The areas not covered by the distribution network are provided with tanks. These tanks are filled by conveying water in trucks.

The well fields are scattered, as can be seen in figure 1. Industrial requirements to a large extent are met by diverting water from the well fields. After meeting industrial demands, the excess water is used to supplement the surface water supply. A portion of the quantity diverted from groundwater goes through the treatment plant and the balance is pumped directly into the distribution mains; before being pumped directly into the distribution mains, spot chlorination is carried out.

During one of the severe droughts, a number of hand bore wells were provided in public places under the drought relief programme. Some of these hand bore wells have been used continuously. Most of the houses and flats in Madras have their own wells. Well water is used to supplement the city water supply.

### PRESENT DEMAND AND SUPPLY DETAILS

Studies show the basic water requirements for domestic consumption in the Indian context to be about 107 lpcd. Indian standards prescribe 135 lpcd for urban areas. In view of the large number of wells in Madras, a supply of 100 lpcd is said to be adequate. The present population of Madras consists of 1.86 million people living in prime residential areas, 0.22 million in commercial areas, 1.1 million in mixed residential areas, and the remaining 0.82 million in slums. The water consumption figure for prime residential and commercial areas is set at 100 lpcd; for the mixed residential areas it is 80 lpcd; and the per capita consumption for slum dwellers is 40 lpcd, as water is drawn from public standpipes.

The domestic water demand for each category, namely, prime residential, commercial, mixed residential, and slum areas comes to 186 mld, 22 mld, 88 mld, and 32.8 mld, respectively; the total demand is 328.8 mld.

The present industrial requirements, both inside and outside the city are presented in table 2.

Surface sources supply 200 mld every two years, and groundwater supplies 150 to 165 mld annually. The extent of supply for domestic consumption from private wells is estimated to be 30 to 35 per cent of the demand. Irrigation demand is met from private wells.

### OPERATION AND MAINTENANCE OF THE WATER SUPPLY SYSTEM

Red Hills Lake, Poondi Reservoir, and Cholavaram Tank are maintained by the Public Works Department of Tamil Nadu State. The conveyance system



**Madras Metropolitan Area**

**TABLE 2. DETAILS OF PRESENT INDUSTRIAL REQUIREMENTS**

Name of Industry	Quantity actually supplied (mld)
<b>INSIDE THE CITY</b>	
1. Madras Port Trust	2.5
2. Southern Railway	1.8
3. Basin Bridge	0.6
4. B & C Mills	1.0
5. Others	1.1
	7.0
<b>OUTSIDE THE CITY</b>	
1. Madras Refineries Limited	16.10
2. Southern Railway (Ennore)	4.60
3. Ennore Thermal Power Station	11.70
4. Madras Fertilizers Limited	19.60
5. Indian Organic Chemicals Limited	1.70
6. Central Reserve Police Force	1.40
7. Kothari (Madras) Limited	1.30
8. Linear Alkyl Benzene	6.80
9. Others	2.40
10. Dunlop India Limited*	1.80
11. Shaw Wallace & Company Limited*	4.00
12. Compound Fertilizer Factory*	3.30
13. Others	1.70
	76.40

Note: \* Supplied by own/other agencies.

from reservoirs and tanks, the treatment plant and well fields, and fee collection, i.e., water tax, water charges, and sewerage surcharge, are under the control of the Madras Metropolitan Water Supply and Sewerage Board (MMWSSB).

Allocation of water is based on availability from the consumers' own source, the nature of the industry (that is, whether it is labour-intensive), and the severity of the situation. The MMWSSB maintains more than 525 trucks for supplying water to tanks in the areas not covered by the distribution system. They also serve the areas within the distribution system when supply is unavailable due to inadequate pressure. The private agencies cater to the needs of major consumers, such as central government establishments, railways, telephone companies, the port and berthing ships, hospitals, hotels, industrial establishments, and some private houses. The supply from private agencies is 12 mld. In order to control the excessive pumping of groundwater in the southern coastal belt, in 1987 the Government of Tamil Nadu introduced licensing for the bores, wells, and trucks transporting water. The wells designated for irrigation were all accounted for by 1 February 1990, and the government announced that no new areas could be brought under irrigation after that deadline.

## Madras Metropolitan Area

The cost of hooking up the service connections to the supply main is paid by the users. If the mainline is extended to provide a service connection, the department extends the main and the user has to wait until the mainline is laid. The MMWSSB decides on the areas for laying new mains. Apart from political will, this is based on the availability of water and the extent of development in the area.

Citizens' complaints concerning the quantity of water are considered by that area's MMWSSB office of the Assistant Engineer. Necessary steps are taken to look into and rectify the defects. Complaints usually relate to water pollution and inadequate supply. The locations where the water becomes polluted are identified and if necessary the pipe itself is replaced. A separate cell functions to monitor the quality of water distributed at various points. Depending upon the results of the observations, remedial measures are taken.

The domestic consumer is charged at the rate of Rs1 to Rs5 per 1,000 litres, depending on the type of accommodation and on the amount of water consumed. The industrial units have to pay Rs7 per 1,000 litres. These consumers are subjected to a minimum rate of Rs10 and Rs50 per month, respectively. A flat rate is charged for unmetered connections. In the case of buildings with sewerage connections, 20 per cent of the water charges collected consist of sewerage surcharges; the MMWSSB charges Rs125 for a truckload of up to about 6,400 litres of water. Private trucks charge Rs150 per 12,000 litres of groundwater obtained from the southern coastal belt.

The cost recovery meets mainly operation and maintenance expenses. Assistance is sought for special projects and developmental activities from external agencies. The Government of Tamil Nadu sanctions 50 per cent in grants and 50 per cent in loans for special projects. Public loans are also floated with the approval of the state government.

### KRISHNA WATER SUPPLY PROJECT

Water from the Tamil Nadu border to Poondi Reservoir is conveyed via a 24 km canal. In order to increase the storage of Poondi Reservoir by 20 million  $m^3$ , the full reservoir level will be raised by 0.60 m. Upstream from Poondi Reservoir, Ramanjeri Reservoir is proposed with a storage capacity of 33.40 million  $m^3$ . Downstream from Poondi Reservoir, Thirukkondalam Reservoir is also proposed, with a 28.30 million  $m^3$  storage capacity. Aside from raising the full reservoir level of Poondi Reservoir, the full reservoir levels of Red Hills Lake and Chembarambakkam Tank will also be raised. By raising the full reservoir level in both tanks by 0.6 m, additional storage of 12.75 million  $m^3$  in Red Hills Lake and 14.85 million  $m^3$  in Chembarambakkam Tank will be made available. Poondi Reservoir is to be connected to Chembarambakkam Tank which will, in turn, be connected to Red Hills Lake (see figure 2).

The *ayacut* area under Chembarambakkam Tank is in the process of gradually being converted into housing plots. The state government is waiting for a suitable time to acquire the irrigation rights of the *ayacut* under Chembarambakkam Tank. Provision of about Rs130 million has been made

## Madras Metropolitan Area

towards purchase of the irrigation rights.

The above projects are to be carried out by the Public Works Department and the estimated cost is Rs1 billion. The state government has agreed to share the cost of the work in Andhra Pradesh in proportion to the total utilizable water. The Krishna water supply scheme envisages the water supply to urban agglomerations with semiurban and rural areas as coming under the control of the Madras Metropolitan Authority, an area which covers 1,170 km<sup>2</sup> (extending to a radius of 27 km from the city centre). A World Bank loan of Rs5 billion is being sought for improving the water supply and sewerage system in the Madras Metropolitan Area. In order to repay the World Bank loan it is proposed to increase the tariff by 20 to 30 per cent for domestic consumption and seven times for industrial consumption.

### CONCLUDING REMARKS

The focus here has been on delineating the Madras Metropolitan Area's water supply system. One problem encountered in applying transaction cost analysis was that data requirements were not clearly specified, as only one agency (the MMWSSB) is involved in the case of Madras, and demand is mainly from the domestic and industrial sectors.

### REFERENCES

- Daivamani, S., "Long-Term Strategies for Madras Water Supply" (Paper presented at the Workshop on Water Problems of Madras City, India).
- Dattatri, G., "Madras: Projected Demographic and Physical Structure" (Paper presented at the Workshop on Water Problems of Madras City, India).
- Elango, L. and Manickam, S., "Hydrogeochemistry of the Madras Aquifer, India: Spatial and Temporal Variation in Chemical Quality of Ground Water" in *The Role of Geology in Urban Development* (Bulletin, no. 3) (Hong Kong: Geological Society of Hong Kong, 1987).
- Janakiraman, S., Venugopal, K., and Sakthivadivel, R., "Stochastic Simulation of Daily Rainfall in Madras Basin, Tamilnadu" (Proceedings of the Fiftieth Annual Research and Development Session, Central Board of Irrigation and Power, held in Simla, India, March 1983).
- Mohanakrishnan, A., "Selected Papers on Irrigation" (Irrigation Management Training Institute Publication; no. 9) (Trichi, Tamil Nadu, 1990).
- Panchanathan, S., "Madras City Water Problems, Strategies, and Augmentation Scheme: An Overview" (Paper presented at the Workshop on Water Problems of Madras City, India).

## Madras Metropolitan Area

Srinivasan, S., "Water Demand" (Paper presented at the Workshop on Water Problems in Madras City, India).

Thirunavukkarasu, A. S., "Groundwater Availability" (Paper presented at the Workshop on Water Problems of Madras City, India).

## A TRANSACTION COST ECONOMICS APPROACH TO A STUDY OF INDUSTRIAL WATER IN SAMUT PRAKARN PROVINCE, THAILAND

Ruangdej Srivardhana

---

### INTRODUCTION

The Bangkok Metropolitan Region (BMR), which consists of Bangkok Metropolis and parts of the five adjacent provinces of Nonthaburi, Samut Prakarn, Nakhon Pathom, Pathum Thani, and Samut Sakhon (figure 1), is the growth centre of Thailand where all important economic activities such as trades, services, and industries are concentrated. The BMR covers an area of approximately 6,000 km<sup>2</sup> in the lower part of central Thailand. With a subtropical and humid climate, its average annual rainfall is 1,200 mm per year. The region lies on flat land, with an elevation of between 0.1 m and 2.0 m above mean sea level. The average elevation is 1.5 m. As the country's growth centre where half of the national economic growth between 1970 and 1986 originated<sup>1</sup> and more than 16 per cent of the country's total population reside, the BMR is forced to continually update and expand its infrastructure.

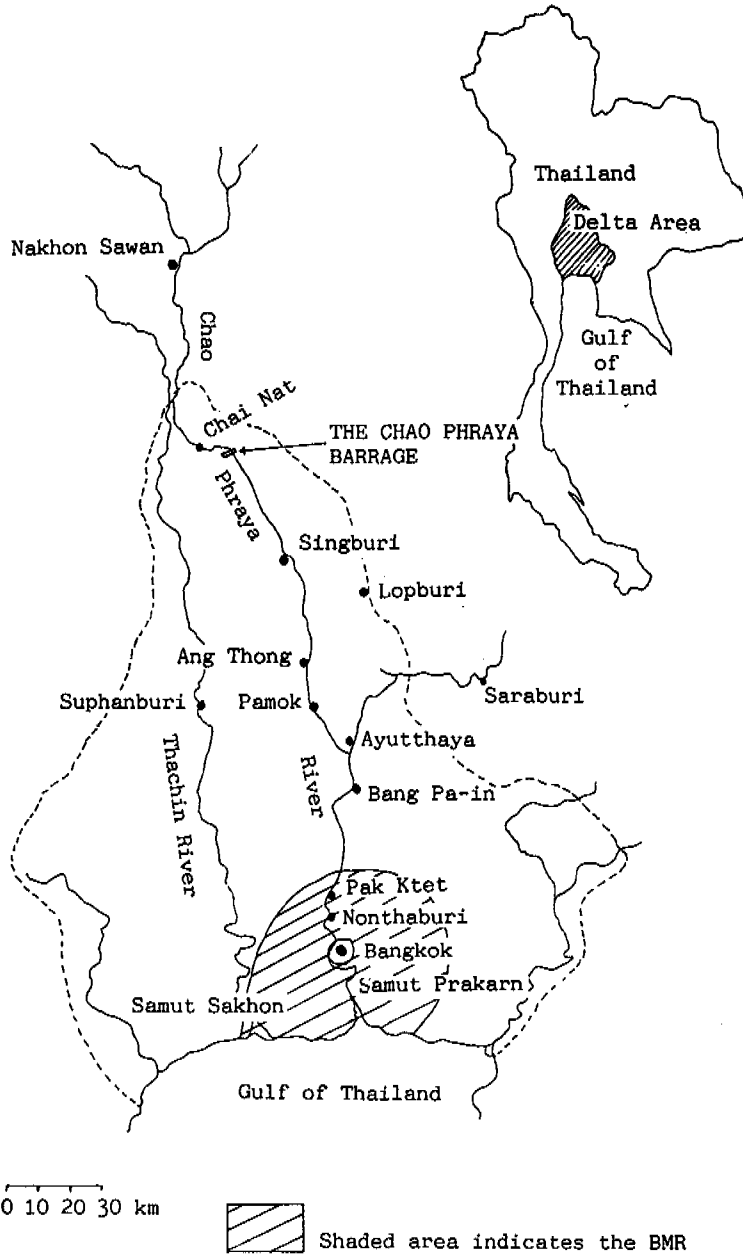
Water supply, a necessary public utility, is in a critical situation in serving the BMR's needs. With the Chao Phraya River as the only surface source and because of groundwater deterioration, the prospects of the BMR coping with a rapid increase in demand are gloomy.

Insufficient water supply in the BMR has already been reflected in various types of conflict such as deteriorating water quality in the Chao Phraya River, a shortage of water for agricultural production, and over-exploitation of groundwater with resultant land subsidence. These problems are not dealt with seriously because the majority of people tend to ignore them. Shortage of irrigation water, for example, is considered by farmers as a fact that must be accepted rather than as a result of poor management. Hence, no serious action has been taken to improve water supply management. For example, the BMR's water has been delivered at an unrealistically low price that makes it impossible to upgrade and expand services to meet demand.

The industrial sector requires a great deal of water for production. In the past the industrial sector in the BMR relied on water from the river and groundwater, although some establishments have obtained water from the BMR water supply system. But with water pollution in the Chao Phraya River and land subsidence resulting from excessive withdrawal of groundwater, the industrial sector in the BMR faces a water supply problem.

Samut Prakarn Province

Figure 1. Lower Central Basin of Thailand Showing the Chao Phraya River



## Samut Prakarn Province

By looking at industrial water supply issues in Samut Prakarn, this article uses some principles of transaction cost economics (TCE) to consider problems which may arise with alternative institutional approaches. It also attempts to identify some important factors which are crucial in setting up a viable "credible commitment" which is indispensable for a centralized nonmarket type institution.

### Description of the Study Area

Samut Prakarn is situated directly to the southeast of the Bangkok Metropolis. It is included within the BMR for planning and managing public infrastructure such as highways, electricity, telephones, and water supply. Samut Prakarn has an area of 1,004.1 km<sup>2</sup>, approximately one-sixth the total of the BMR (figure 1). As shown in figure 2, the province straddles the Chao Phraya River at the rivermouth. Major land-use categories include residential, commercial, industrial, and agricultural. Although agriculture still dominates land use, industrial land comprises a significant portion of the provincial total, and an even higher share of net value added.

Because of its locational advantage, the province has attracted considerable industrial investment. In fact, it has been the fastest growing province industrially. The 3,466 industrial establishments employ 266,403 workers, a significant portion of the total provincial population of 854,029. In 1988, the per capita income of Samut Prakarn was 85,525 baht per annum (25 baht = US\$1). Of this, 56.86 per cent came from the industrial sector.<sup>2/</sup>

### Industrial Water Demand

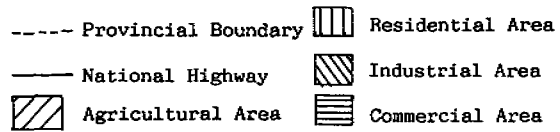
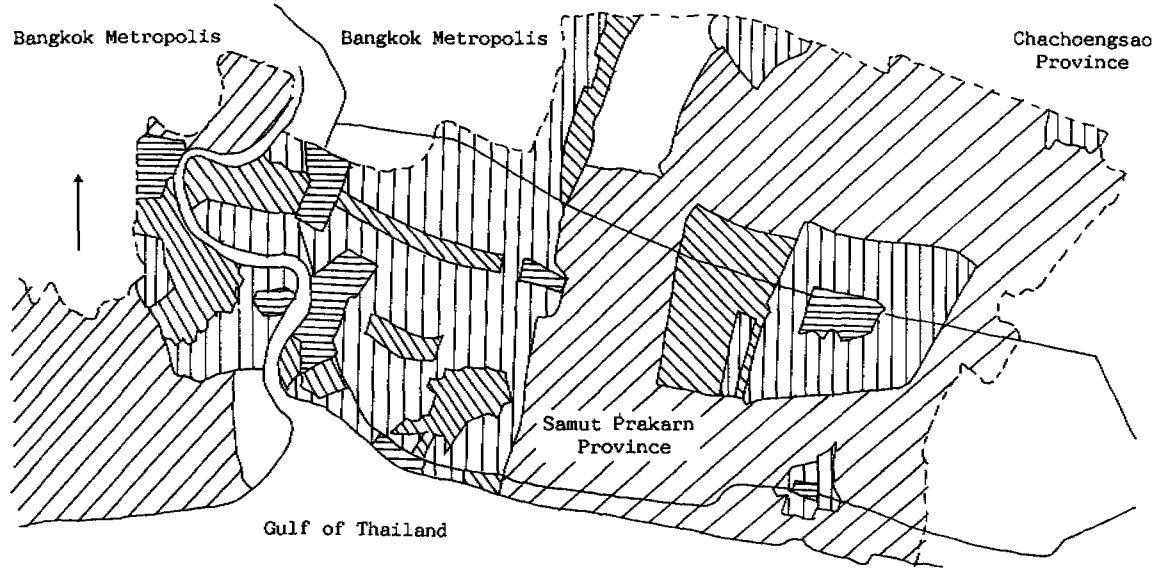
Although there is no official study of industrial water demand for Samut Prakarn, it is obvious that it is considerable. About 350,000 m<sup>3</sup>/day of groundwater is presently withdrawn for industrial use. Most of the water is tapped at a depth of 100-150 m. At the present withdrawal rate it is anticipated that even deeper aquifers will be overexploited, leading to serious land subsidence and higher costs of water withdrawal. At present, the groundwater withdrawal costs, which include a groundwater fee in compliance with the *Groundwater Act* of 1977,<sup>3/</sup> average 4 baht per m<sup>3</sup>.

Although groundwater has been the main source of industrial water, it will not be dependable in the near future. As a result of excessive withdrawal, much of the BMR is sinking at a rate of 5-10 cm per year. Samut Prakarn, which adjoins the Gulf of Thailand, is sinking at about the same rate. All agree that groundwater withdrawal must be halted as soon as possible; and that every party must comply with the *Groundwater Act*. But to do this, alternative sources must be provided.

### The Groundwater Act of 1977

The *Groundwater Act* was enacted to help alleviate the land subsidence problem of the BMR. This law established a groundwater zone which includes Bangkok Metropolis and the provinces of Nonthaburi, Samut Prakarn, Patum Thani, Samut Sakhon, and Ayutthaya. Within this zone, the withdrawal

Figure 2. Samut Prakarn Province





## Samut Prakarn Province

rate is to be reduced to a sustainable level.

The law stipulates that any party within the proclaimed zone must have a permit for either digging a well or making use of the obtained groundwater. In addition, users in each locality are to pay a price close to that of the available surface water supply. The law recognizes the vital importance of groundwater to those who reside outside the water supply service area and exempts them from the water surcharge if they use the water for domestic or agricultural purposes. They are required to obtain permits for digging wells and using water, however, so that authorities can monitor the resource situation. Industrial establishments of Samut Prakarn are required to have groundwater wells and use permits.

Also, to help reduce the withdrawal rate as soon as possible, the government, by cabinet resolution in 1983, set a guideline for permitting groundwater use. It provides for the establishment of a "water supply service area" where a complete city water system is provided. Such an area will be proclaimed by the Minister of Industry when a locality has been provided with an adequate city water supply. To date, about 832 km<sup>2</sup> of the BMR have been declared within the service area. Without acceptable reasons, such as damage to production due to chlorine in the water supply, households and establishments in this proclaimed area are required to use the city water supply, and cease groundwater withdrawals.

Prior to September 1990, no area of Samut Prakarn was proclaimed in the water supply service area. Hence, most industrial establishments of Samut Prakarn relied on groundwater. Under the *Groundwater Act*, these establishments need to have use permits which are effective for ten years from the issuance date. The majority of industrial establishments in Samut Prakarn still have five or six more years before their permits expire. After expiration, each permit can be extended by one year at a time, with acceptable reasons. Thus, even without the extension of the urban water supply into Samut Prakarn, the *Groundwater Act* may facilitate restricted use of groundwater.

### PROVISION OF URBAN WATER SUPPLY TO SAMUT PRAKARN

To implement the provisions of the *Groundwater Act* and the cabinet resolution to reduce groundwater withdrawal, the Bangkok Water Authority (BWA) extended its investment in pumping stations and distribution lines into Samut Prakarn. Beginning in June 1990, the system can supply up to 600,000 m<sup>3</sup> of water per day to Samut Prakarn households and business establishments. Because the distribution system does not meet acceptable standards, however, only a small portion of the established piped area has been declared a water supply service zone. More than 70 per cent of industrial land is still outside the compulsory zone and not subject to the cabinet resolution requirement that they cease dependence on groundwater. So the most important limiting factor on groundwater use is not the availability of urban water supply, but the provisions of the *Groundwater Act*, including the permits which will expire within five or six years.

## Samut Prakarn Province

### Problems in Phasing Out Groundwater

The importance of moving from groundwater to the urban water supply system is quite clear. The BWA has a master plan to expand its network into Samut Prakarn. Five to ten years from now the BMR water system will cover most of the built-up and industrial areas of Samut Prakarn. By that time, all of the use-permits will have expired and, to comply with the cabinet resolution passed in 1983, no extension will be made unless proven necessary. A large number of industrial establishments will have their applications for permit extension turned down. The question is how is the transition likely to take place? Will industrial establishments comply without resistance? Are there any mechanisms to help smooth the transition?

An additional factor was a collaborative movement of industrial organizations, such as the Industrial Council of Thailand, the Samut Prakarn Chamber of Commerce, the Department of Industrial Works, and local industrialists, to push for a separate industrial water project. They initiated this project to provide a non-BWA alternative to groundwater. Major arguments in favour of this approach were water quality and relative pricing. Since water for industrial use can be of lower quality than that for municipal purposes, it can be acquired at a lower cost. The proposal passed the scrutiny of the Ministry of Industry and was approved in principle by the cabinet, which provided for a contractor to invest in the project. At least one firm considered undertaking the investment but it withdrew when it found that the land for water storage was so expensive that the project was not economically viable. Other factors, discussed in the following transaction cost analysis, also put the project's profitability in doubt. Since then, no other investors have wanted to undertake the project.

### Transaction Cost Analysis

#### The connecting rate to the BWA water supply system

Only about 15 per cent of industrial establishments use BWA water supply in their production. It is easy to understand why factories are not enthusiastic about making use of the BWA water supply. They are still eligible to make use of inexpensive groundwater for some years to come. The average price of urban water is 6.12 baht/m<sup>3</sup> while the cost per m<sup>3</sup> of groundwater is approximately 3.50 baht (including the fee). Hence, there is no economic incentive for the industrial establishments to shift from groundwater to the urban water system. Differences in quality are insufficient to induce producers to make the change. The BWA is only going to be able to recover the very expensive investment costs of the distribution system if, and when, groundwater withdrawal is effectively banned, raising the transaction costs of self-supply.

#### The unrealized industrial water project

Besides the land price for water storage facilities, other factors made the project impossible. The distribution system, installed separately from that of the urban water supply, would also have been quite expensive. In addition, the private developer could not use low-cost public land for

## Samut Prakarn Province

pipe-laying and other pumping facilities. A new management structure would have been required to take care of water distribution, maintenance and repairs, and collection of water charges. This would have involved people at different levels. It would also have taken time and effort to negotiate with industrial water users. All these factors can be interpreted as huge transaction costs confronting a newly established system. The resultant price of water would not be cheaper than that of conventional BWA water supply and the new system would be in constant competition with the urban water supply system. It is not certain that the system could obtain credible commitments from its customers if the urban water supply system could provide better quality water at only a marginally higher price. The possibility of undersubscription would always undermine the new organization's stability and, in fact, was a major reason the ambitious scheme failed.

### Enforcement

It is still possible that a transfer from groundwater to the urban water system can be accomplished when a comprehensive water supply system is fully extended into Samut Prakarn and the authorities do not extend permits to groundwater users. With strict enforcement of the *Groundwater Act* backed by the cabinet resolution, every party must abandon groundwater exploitation. They would have to turn to the only available alternative -- the urban water supply. Effective enforcement is expensive, however, and includes costs of monitoring, policing, and penalizing those who violate the law. These are part of the overall transaction costs.

### Pricing strategies

One way to encourage the use of the urban water supply is to make the price comparable to that of groundwater. The water price could be reduced to 5.34 baht/m<sup>3</sup> -- the present production cost.<sup>4/</sup> If necessary, water can be charged at below the production cost, at least in the early stages of transition. The price can be adjusted later to cover the production cost. Consideration should also be given to the household consumer who uses the same kind of water but pays a higher price.

### Social consciousness

Publicity and good understanding between the water supply organization and industrial users are also key factors in a successful transformation. To get good cooperation and credible commitments from water users, they must understand the need to make some sacrifice for the general good of society.

### CONCLUSION

The case of Samut Prakarn's industrial water suggests the possibility of setting up a new, local organization for water management, rather than depending on the conventional, huge, and very centralized system of the BWA. Industrial establishments clearly understand the difference between

## Samut Prakarn Province

the low cost of extracting groundwater and the price they will have to pay for urban water supply. Hence, they might be unwilling to shift to the surface water supply system.

With an inadequate monitoring system and a lack of qualified personnel for effective enforcement, groundwater users could avoid complying with the law. They could continue to pump groundwater, or misappropriate the city's water. These possibilities are not encouraging for the city's water supply since, as the transaction cost theory notes, a huge, centralized system with a high level of asset specificity such as the BWA needs a strong credible commitment to remain profitable.

The BWA is not the type of organization that can easily induce its customers to observe its regulations and rules. It is so huge that its top administration is quite distant from water users. Views on water management issues of these two parties are therefore different. Moreover, a centralized, national organization like the BWA cannot afford to give special attention to a particular region or segment of its water supply system. Samut Prakarn is a subregion of the BMR and its industrial sector represents only a small proportion of metropolitan water users. Hence, from an organizational viewpoint, no special treatment can be given to Samut Prakarn's industrial sector. As pointed out earlier, the high price of water supply affects the decision to move from the original groundwater resource to the city's water supply system. A new organizational and institutional structure may perhaps ease this problem. Since, from the locational viewpoint Samut Prakarn's industrial sector can be separated from the rest of the urban water supply system, it should be beneficial for the province's industrial establishments to have a small, independent water management organization to manage the water supply system of this area. Apart from water procurement this new organization could be responsible for all activities of water supply management, including construction of a distribution system, delivering water to all users, setting the water price according to provincial conditions, maintenance of the pipe and delivery system, collecting water charges, and creating good relations with all water users.

Since the procurement of water through the construction of a new storage reservoir is too expensive and since it is difficult to get natural water, it is more convenient and economical to get it from the BWA which is already in charge of procuring water for the whole BMR. The established provincial organization could obtain a sufficiently low-priced water supply of standard quality from the BWA, with its scale economies and a high degree of asset specificity. Moreover, it is hoped that a small corporation, like the one suggested, would be more efficient than the BWA, and hence could reduce the operational costs of the provincial water supply. All these factors seem to justify a lower price of water supply for the Samut Prakarn industrial sector, a key to inducing groundwater users to turn to the city's water supply system.

More benefit could be expected from such a scheme. Being small and local, the organization would tend to be more closely associated with local water users. More information could be exchanged more easily between the two parties, with better understanding and more cooperation. Such credible commitments are indispensable for the organization to survive.

## Samut Prakarn Province

Credible commitments would guarantee the viability of the local organization, which in turn would reinforce the strength of the BWA at a higher level. This multilevel approach has not been implemented in Thailand's water management but it has proven to be successful in the management of the country's power system. The Electricity Generating Authority of Thailand, the Metropolitan Electricity Authority, and the Provincial Electricity Authority work closely in an efficient and acceptable manner at the present time. Though the scales may be different, the roles of efficiency, decentralization, and credible commitments are constant. Water supply authorities should follow the successful example set by the electrical power sector.

### NOTES

- 1/ National Economic and Social Development Board (NESDB), "Bangkok Metropolitan Regional Development Proposals: Recommended Development Strategies and Investment Programs for the Sixth Plan (1987-1991)" (Joint NESDB/IBRD/USAID/ADAB Metropolitan Planning Project)(Bangkok, 1986).
- 2/ Province of Samut Prakarn, "Figures for Samut Prakarn Province" (1990)(in Thai).
- 3/ The *Groundwater Act* of 1977.
- 4/ Metropolitan Waterworks Authority, *Annual Report* (1988)(in Thai).

## APPLYING THE TRANSACTION COST ECONOMICS APPROACH TO WATER-USE CONFLICTS IN OSAKA METROPOLITAN REGION

Toshiro Oka

---

### INTRODUCTION

Both the amount and the composition of water demand in Osaka Metropolitan Region have changed greatly since the Second World War. This article analyses how water has been allocated in response to these changes, and why it has been done in this way. It also shows that transaction cost analysis can explain this process to some extent but that both the transaction cost approach in general and its application to water allocation have their limitations.

### CHANGES IN WATER DEMAND AND THE ALLOCATION OF WATER RIGHTS

#### The Allocation of Water and *Suiri-ken*

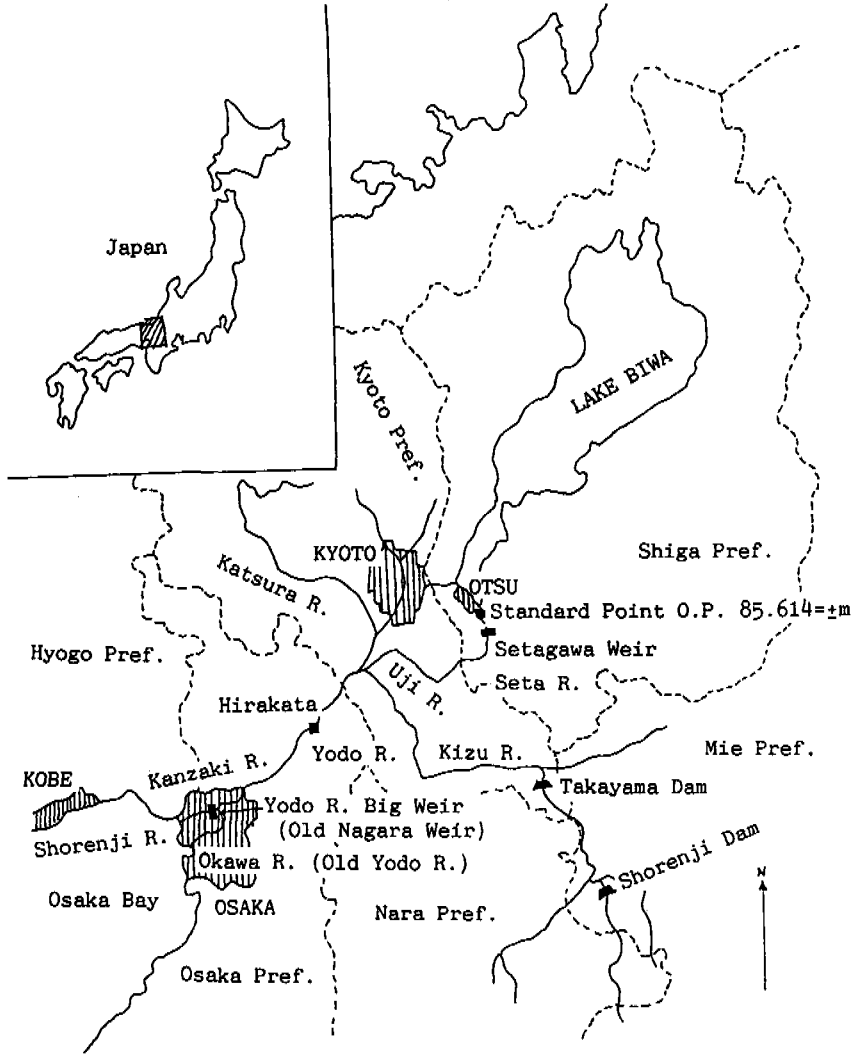
The users of water of the Yodo River in Osaka Metropolitan Region (figure 1) and their relations to one another are described below.

Land improvement districts (which manage irrigation), some municipal water supply systems, the regional water supply systems, the industrial water supply systems, and some private industrial corporations all get water directly from the Yodo River. The private industrial corporations are final users; the regional water supply systems sell water wholesale to municipal water supply systems. The others retail water to final users -- the land improvement districts to farms, the municipal water supply systems to households and corporations, and the industrial water supply systems to private industrial corporations.

The municipal water supply systems are managed as municipal enterprises. Some of them get water directly from the Yodo River, some from the two regional water supply systems, and the remainder from both. The regional water supply systems are the Osaka Prefectural Water Supply System and the Hanshin Water Supply System. There are seven industrial water supply systems, i.e., Osaka Prefectural System, Osaka Municipal System, Osaka Rinkai System, Kobe Municipal System, Amagasaki Municipal System, Nishinomiya Municipal System, and Itami Municipal System.

Osaka Metropolitan Region

Figure 1. Lake Biwa and the Yodo River Region



## Osaka Metropolitan Region

Water is allocated in accordance with water rights. Different water rights pertain to different stages of water transaction. Among them, the right to get water directly from a river is called *suiriken*. The other stages involve rights to water supply for a fee. The *suiriken* is the most important right for the allocation of water as a resource, since it alone is directly constrained by the given amount of water. The other water rights are limited only indirectly through the amount of *suiriken* possessed by water suppliers, or constrained by other factors, such as the capacity of supply facilities, rather than by the water resource.

The *River Law* says that a *suiriken* is authorized by the manager of the river,<sup>1/</sup> the manager being the Minister of Construction or the prefectural governor. Historical agricultural water rights are regarded as permitted.<sup>2/</sup>

The maximum *suiriken* of a river is the minimum estimated flow at a reference location (Hirakata in the case of Yodo River) every ten years, minus the amount needed to maintain the river. The present *suiriken* of the Yodo River, amounting to 73.97 m<sup>3</sup>/s, is allocated to irrigation (16.80 m<sup>3</sup>/s), to tap water (42.32 m<sup>3</sup>/s), and to industrial water (14.85 m<sup>3</sup>/s, which includes 10.688 m<sup>3</sup>/s to the industrial water supply systems and 4.159 m<sup>3</sup>/s to the private corporations). The maintenance flow is 70 m<sup>3</sup>/s.

The next section views how the *suiriken* has been allocated in response to the changes in water demand in Osaka Metropolitan Region.

### Changes in Water Demand and the Amounts of the *Suiriken* since 1955

The total *suiriken* of the lower reaches of the Yodo River was determined for the first time at the completion of the first stage of the Yodo River water control project in 1952. It was allocated as follows:<sup>3/</sup> 16.802 m<sup>3</sup>/s -- for agriculture; 23.248 m<sup>3</sup>/s -- for tap water (the municipal and prefectural water supply systems); 8.120 m<sup>3</sup>/s -- for industry (the industrial water supply systems and private industrial corporations); and 88.500 m<sup>3</sup>/s -- for flow augmentation.

Let us view the changes in water demand and the concomitant reallocation of the *suiriken*.

#### Tap water

Figure 2 shows a rapid growth of demand for tap water from the Yodo River until the early 1970s. The daily maximum supply of tap water from the Yodo River, 1.4 million m<sup>3</sup>/day (16.4 m<sup>3</sup>/s) in 1955, increased to 4.6 million m<sup>3</sup>/day (53.1 m<sup>3</sup>/s) in 1970.

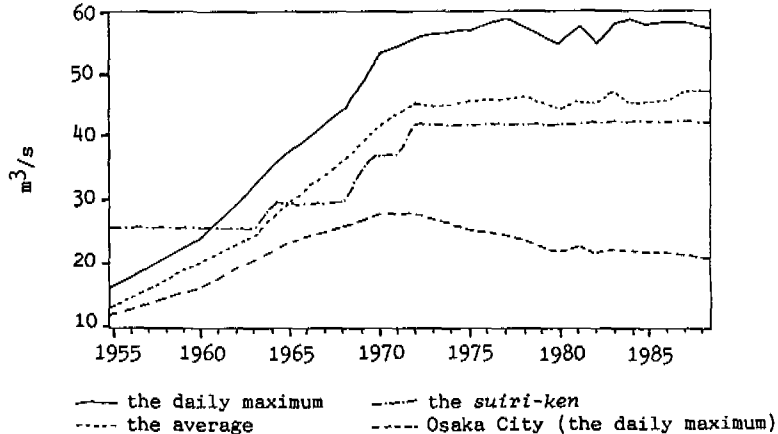
The municipal and prefectural water supply systems obtained the 2.6 m<sup>3</sup>/s of *suiriken* from the Osaka prefectural industrial water supply system directly after the completion of the first stage of the Yodo River water control project. The total *suiriken* possessed by the municipal and prefectural water supply systems increased to 29.809 m<sup>3</sup>/s in 1964 (through the improvement of the Nagara Weir), to 37.109 m<sup>3</sup>/s in 1970 (through construction of the Takayama and Shorenji dams), to 41.971 m<sup>3</sup>/s in 1972 (by the Shorenji River water development project), and to 42.321 m<sup>3</sup>/s in 1982



## Osaka Metropolitan Region

(transferred from industrial water).4/

Figure 2. Tap Water Use from the Yodo River



Source: *Statistics of Waterworks; Annual Statistics of the Department of Waterworks of Osaka Prefecture; Records of the Prefectural Water Supply System for the Last Thirty Years* (in Japanese).

Since 1965, the amount of water taken from the Yodo River for tap water, on average, has been more than permissible, although the rapid growth of water use came to a halt in 1972. In future, 27.21 m<sup>3</sup>/s of the additional *suiri-ken* of 40 m<sup>3</sup>/s, which is to be created by the comprehensive development of Lake Biwa, are to be allocated to tap water. This *suiri-ken* is considered as provisional. Therefore, the total present and provisional *suiri-ken* for tap water amounts to 69.531 m<sup>3</sup>/s.

The demand structure for tap water has also changed. Since 1972, the amount of water taken from the Yodo River by Osaka City has decreased (figure 2). (However, the total demand in the Osaka Metropolitan Region has remained roughly constant.) This means that the tap water demand in the surrounding cities has increased. Recently, water demand in Osaka has been within the formally permitted *suiri-ken*, although in future it is expected to get 7.49 m<sup>3</sup>/s of the additional *suiri-ken* from the comprehensive development of Lake Biwa.

### Industrial water

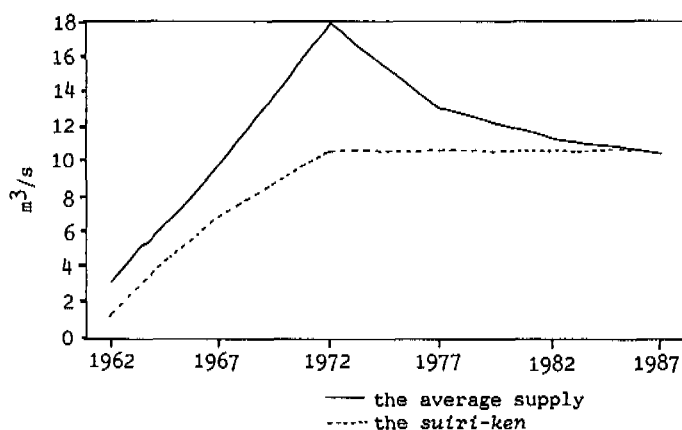
As shown in figure 3, the average water supply from the industrial water supply systems in Osaka Prefecture and Hanshin District steadily increased from 1962 (3.1 m<sup>3</sup>/s) to 1972 (17.9 m<sup>3</sup>/s). The *suiri-ken* for the industrial water supply systems, which amounted to 1.2 m<sup>3</sup>/s just after the completion of the first stage of the Yodo River water control project, was expanded to 7.05 m<sup>3</sup>/s by the improvement of the Nagara Weir in 1964 and to 10.688 m<sup>3</sup>/s by the Shorenji River water development project in 1972.<sup>5</sup>/

## Osaka Metropolitan Region

Figure 3 shows a reduction in industrial water use after 1972. But  $12.8 \text{ m}^3/\text{s}$  of the additional *suiri-ken* of the comprehensive development of Lake Biwa is to be allocated to the industrial water supply systems. This raises the total present and provisional *suiri-ken* of the industrial water supply systems to  $23.488 \text{ m}^3/\text{s}$ .

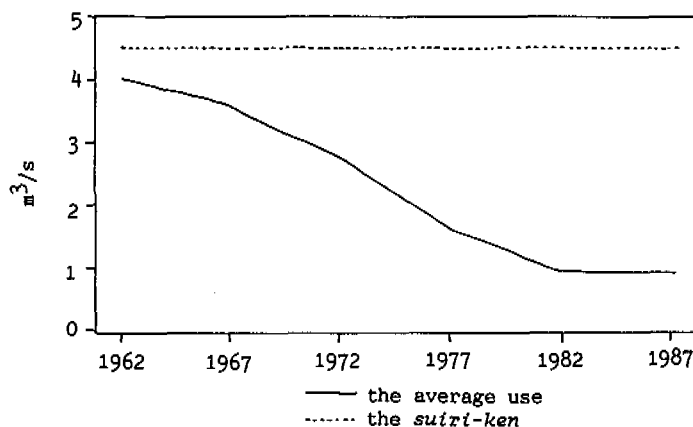
The *suiri-ken* possessed by private corporations was maintained at  $4.509 \text{ m}^3/\text{s}$  until 1982, when some was transferred to Suita City. Since then it has remained at  $4.159 \text{ m}^3/\text{s}$ . The amount of water taken directly from surface flows or underground sources by factories in the metropolitan region has continued to decrease, as shown in figure 4.

Figure 3. Water Supplied by the Industrial Supply Systems



Source: *Kogyo tokei [Census of Manufacturers]*, vol. 3.

Figure 4. The Amount of Water Taken Directly by Factories



Source: *Kogyo tokei [Census of Manufacturers]*, vol. 3.

## Osaka Metropolitan Region

### Irrigation water

The *suiri-ken* for irrigation use has remained the same (16.80 m<sup>3</sup>/s) since 1952. But the area of irrigation in the lower reaches of the Yodo River has decreased from a 1948 area of 9,694 ha to 1,465 ha, today.

### Nontransferability of the *Suiri-ken*

Increases in demand have been met mainly by the creation of additional *suiri-ken* through water resource developments, especially storage facilities which increase the minimum base flow. Practically no reallocation of existing *suiri-ken* has occurred. Yet water resource development has involved not only direct economic costs but also intangible social costs. The most likely reasons why the *suiri-ken* is not transferred are the provisions in the *River Law* which state that streams cannot be objects of private rights,<sup>6/</sup> and that the *suiri-ken* cannot be transferred without permission from the river manager.<sup>7/</sup> The river managers do not easily allow the transfer of *suiri-ken*. But the coexistence of shortages of *suiri-ken* in some sectors and surpluses in others is likely to cause pressure for transfers. Hanayama and Huse<sup>8/</sup> proposed that the *suiri-ken* should be a private right and that the Government should allow transfers in exchange for appropriate compensation.

In fact, *suiri-ken* has been transferred in other parts of Japan. But in the Osaka Metropolitan Region, there have only been the two cases mentioned above in which negligible amounts of *suiri-ken* were transferred from industrial water supply systems to municipal water supply systems without any compensatory payments. Why not? Let me now attempt to provide an explanation by applying the transaction cost analysis.

### AN APPLICATION OF THE TRANSACTION COST ANALYSIS

Let us hypothesize that the transfer of *suiri-ken* does not take place because its transaction cost/benefit ratio is too high.

If the transaction cost/benefit ratio of transferring *suiri-ken* is high, then some structural adjustments for responding to the changes in water demand and for governing transactions of water without transferring the *suiri-ken* would be expected to develop. This has, in fact, happened.

### Having water reserves

If the transaction cost/benefit ratio of transferring the *suiri-ken* is high, then the growth of water demand in some sectors tends to stimulate further water resource development. Because of their "lumpiness," these activities themselves become a means to respond to further demand changes. That is to say, because the increments in the base flow of rivers create excess capacity, sectors with growing demand can get more water than is permitted by their *suiri-ken* without any problem. In addition, since the amount of *suiri-ken* is based on the estimated flow in dry years, which occur on average once a decade, getting more water than is permitted by

## Osaka Metropolitan Region

*suiri-ken* causes no problem in nine years out of ten.

In addition, a flow augmentation amounting to 70 m<sup>3</sup>/s has been secured in the Yodo River. This amount was once thought necessary for navigation and for direct irrigation along the river.<sup>9/</sup> It is more significant now as a buffer for easing short-term water shortages and for diluting the pollution in dry years.

This flow of 70 m<sup>3</sup>/s must be discharged into the Kanzaki River (10m<sup>3</sup>/s) and to the Old Yodo River (60 m<sup>3</sup>/s). A portion of this flow can be diverted for consumption uses in dry years. So far, this has had practically no adverse impact. But in extremely dry years, this may cause saltwater intrusion from Osaka Bay into the Okawa River (see figure 1), resulting in damage to manufacturing processes in factories using the water.<sup>10/</sup>

### The regional water supply systems

In the Osaka Metropolitan Region, the rapid growth of water demand in cities surrounding Osaka has been met mainly by expanding the Osaka Prefectural Water Supply System.<sup>11/</sup> This regionalization provides a structure that can allocate water and govern transactions without transferring *suiri-ken*.

The main reason why the surrounding cities have depended on the prefectural system has been the difficulty in securing their own water sources.<sup>12/</sup> The most reliable source for most of them was, and still is, the Yodo River. But the transaction costs for them to get *suiri-ken* individually are high. So they have chosen to leave the acquisition of *suiri-ken* to the prefectural system and to receive water from it for a fee.

A city which wants to receive water from the prefectural supply system applies to the prefectural system for an annual amount. If the application is accepted, the city pays a set minimum fee based on the allotment agreed upon, even if it actually receives less.<sup>13/</sup> This means that the municipal water supply systems bear the risk of unforeseen reductions in demand within the year.

The prefectural water supply system is responsible for maintaining the quality of water. It should also cope with long-term changes in demand by acquiring or surrendering *suiri-ken*. But when the change of demand involves regional shifts within the area to which the prefectural system supplies water, the total amount of *suiri-ken* needed by the prefectural system remains the same. In that case, water can be reallocated by altering the contracts between the prefectural systems and the municipal water supply systems.

### Allocation of water during serious droughts

As mentioned above, the *suiri-ken* does not play a crucial part in the allocation of water in ordinary years. Similarly, the actual right to use water during more serious droughts than the ones that come once a decade is not governed by the *suiri-ken*.

## Osaka Metropolitan Region

For example, in the dry winter of 1984-85, the amount that each user could take from the Yodo River was uniformly restricted to 80 per cent (for tap water) or 78 per cent (for industrial water) of the maximum amount used in October and November in the preceding three years, irrespective of how much *suiri-ken* was owned. These levels were decided by a council composed of the water users of the Yodo River.<sup>14/</sup>

"An old farm should have prior rights over the new ones," was once a widely accepted rule of water allocation at times of serious droughts. In more recent years, the rule that tap water should have priority is gaining ground.

As illustrated above, *ad hoc* agreements rather than *suiri-ken* determine the actual allocation of water. Within this context, the actual amount of water used becomes a determining factor rather than the amount of *suiri-ken*.

In addition, the operating rules of man-made structures such as dams and weirs have considerable control over the flow of a river. *Suiri-ken* is created by their development. However, depending upon how these structures are operated, the amount of water used can, in some circumstances, exceed the amount determined by *suiri-ken*.

For example, the project for the comprehensive development of Lake Biwa aims to facilitate additional water withdrawal of up to 40 m<sup>3</sup>/s by lowering the water level of the lake by 1.5 m. This arrangement has resulted from a compromise between the upstream and the downstream local governments. The prospective water consumers in the lower reaches of the Yodo River had originally asked for creation of an additional flow of 40 m<sup>3</sup>/s by allowing the Lake Biwa water level to be lowered by 2 m. The Shiga prefectural government insisted that the level should not be lowered more than 1.5 m, which would create an additional water flow of only 30 m<sup>3</sup>/s. The finally-agreed upon plan was a compromise, i.e., creation of up to 40 m<sup>3</sup>/s of incremental water flow, by lowering the water level by 1.5 m, but taking measures to counter the damage which might affect the people in Shiga Prefecture if the water level declined by up to 2 m.<sup>15/</sup>

There are no rules governing the operation of the Setagawa Weir, controlling the outlet of Lake Biwa, when the Yodo River does not have sufficient flow to satisfy the *suiri-ken* even if the water level of Lake Biwa is lowered more than 1.5 m. Rather than definite operating rules for the weir or specified quantitative *suiri-ken*, *ad hoc* agreements among the concerned parties are the most likely means which will be chosen to manage the allocation of water.

### Application of the Concepts of Transaction Cost Analysis

Transaction cost economics (TCE) assumes "bounded rationality" and "opportunism" as characteristics of human behaviour. It views transactions from three dimensions: "Uncertainty," "asset specificity," and "frequency." The governing structure of transactions is determined by the combination of the two behavioural assumptions and three dimensions. In particular, nonmarket governing structures tend to be superior when the three dimensions are large.

## Osaka Metropolitan Region

If the two behavioural assumptions are valid for human behaviour in general, they naturally apply to the agents concerned with the allocation of water. Also, there are uncertainties in water allocation. Long-term changes in demand are not predictable. And climatic uncertainties are also important.

When uncertainty and bounded rationality are combined, "it is very costly or impossible to identify future contingencies and specify, *ex ante*, appropriate adaptations thereto."<sup>16/</sup> For example, *suiri-ken* does not take into account the possibility of serious droughts.

The frequency of transactions is also considerable in the case of water. But, in the case of water transactions, specificity is not present except in the transactions between the regional water supply system and the municipal water supply systems. Here, long-term investments are necessary on both sides based on reliable contracts.

In transaction cost analyses of firms or of relations between firms, guidelines of internal organization arise when the asset specificity, the uncertainty, and the frequency are combined with opportunism. That is not the case in the analysis of water allocation. One reason is that uncertainty is not so severe in the sense that a certain amount of water is always necessary for daily life and industrial activities, and, over a short period, the amount is more stable when compared with that of other candidates.

Also, opportunism may be weak because most agents concerned are public enterprises. More important, "the internal incentive and control machinery is much more extensive and refined in the case of private firms than that which is obtained in market exchanges."<sup>17/</sup> Integration of public enterprises does not give rise to such extension or refinement of the incentive and control machinery.

### EVALUATING THE TRANSACTION COST APPROACH TO WATER USE

As shown above, a high transaction cost/benefit ratio can be a cause of the development of governance structures to cope with changes in demand and to determine allocations without transfer of *suiri-ken*. In this sense, it can be said that transaction costs can explain the existing practices of water allocation in the lower reaches of the Yodo River; and the concept of TCE is applicable to some extent to water use in this region.

The transaction cost approach has been successful in the analyses of firms and their relations to each other. Firstly, the approach has produced general propositions applicable to any firms and their relations in general. Secondly, it has implied that internal organization is rational, that the market is not almighty, and that monopoly or oligopoly is not necessarily bad.

When applied to water use, does the transaction cost approach produce such general propositions and does it have any implications?

## Osaka Metropolitan Region

### What Implications Does the Transaction Cost Approach Have in Explaining Water Use?

To make clear the implications of the transaction cost approach on water use, let us consider what causes the high transaction cost/benefit ratio.

A prime reason for the high transaction cost is already cited in the provisions of the *River Law* and the government regulations based on them. The *suiri-ken* is not regarded as a private right. When *suiri-ken* is needed it can only be given by the river manager and when it is no longer needed by the user it can only be returned to the river manager. Not only is there no incentive to return it, but the authorities overseeing the activity do not readily allow *suiri-ken* to be returned. For example, the Ministry of Agriculture tends to prevent land improvement districts from returning their *suiri-ken*, for fear of being criticized that it has subsidized wasteful investments in irrigation.

As long as high transaction costs arise for this reason, the Williamsonian approach does not have the implications that it has had in the analyses of firms. The existing structures of water allocation cannot be justified on efficiency grounds. These transaction costs, political in origin, can be altered politically, and the alteration is not likely to require a high transaction cost. Besides, the ministries concerned do not seem to be influenced by cost-saving considerations.

A second reason for the high transaction costs is uncertainty of the supply and demand of water. To cope with uncertain and frequent changes of the supply and demand of water by reallocating well-defined *suiri-ken*, either the *suiri-ken* must be redefined every time the change takes place or it must be comprehensive enough to take into account all possible contingencies. In either case, the cost is very high -- which has led to the development of alternative governance structures.

As long as the high transaction costs arise for this second reason, the implications of the Williamsonian transaction cost approach are the same as they are in the analyses of firms.

One reason for the small amount of transfer of *suiri-ken* is unique to the Yodo River. The transfers of *suiri-ken* in other regions in Japan were mainly from agricultural uses to city uses. But in the Yodo River the agricultural sector originally had very little *suiri-ken*. The growing urban demand for water up to 1972 would not have been met even if all the *suiri-ken* possessed by the agricultural sector had been transferred.

A second reason that raises the transaction cost/benefit ratio of the transfer of *suiri-ken*, is the nontransferability of *suiri-ken* itself. Even if the difference between the transaction cost/benefit ratio of the transfer of *suiri-ken* and that of the creation of *suiri-ken* by water resource development is initially small, the benefit of the transfer of *suiri-ken* is reduced once new *suiri-ken* is created, or the transaction costs remain high if transfer never occurs. The existing governance structures may be explained by high transaction costs. But in turn, the high transaction costs may be a result of the existing structures. The existing structures may be duplicating themselves through transaction costs. Therefore, it seems difficult to justify the existing governance structure in terms of transac-

## Osaka Metropolitan Region

tion cost minimization.

### Does the Transaction Cost Approach Produce Any General Propositions in the Analysis of Water Use?

In the analyses of firms, the transaction cost approach produced general propositions applicable to all firms and their relations in general. Does it produce any general propositions in the analysis of water use; for example, the ones applicable to any public enterprises or to any relations of government agencies? It does not seem so.

### CONCLUDING REMARKS

The possibility of applying TCE to water allocation in the lower reaches of the Yodo River has been examined. The transaction costs can explain the existing method of allocation. But, the application is not as successful as it is in the analyses of firms and their relations.

In the Yodo River, the transfer of water from agricultural use to urban uses has been of negligible importance. But, reallocation within the area of urban usage has been and will continue to be important. TCE is unable to give a definite answer to the question of whether we should rely more on transferring the *suiri-ken*, although it does show us that we should bear in mind that every transaction requires costs.

### NOTES

- 1/ Government of Japan, *River Law*, Article 26 (1896).
- 2/ *Ibid.*, Article 87.
- 3/ Kinki Regional Construction Bureau, Ministry of Construction, *Yodogawa hyakunen-shi [The Yodo River in the Past 100 Years]* (1974), p. 928 (in Japanese).
- 4/ *Ibid.*, p. 942.
- 5/ *Ibid.*, p. 960.
- 6/ *River Law*, Article 2.
- 7/ *Ibid.*, Article 34.
- 8/ Y. Hanayama and T. Huse, *Toshi to mizu-shigen: Mizu no seiji-keizai-gaku [Cities and Water Resources: A Political Economy of Water]* (Tokyo: Kashima Shuppan-kai, 1977), p. 65 (in Japanese).
- 9/ Kinki Regional Construction Bureau, *Yodogawa hyakunen-shi*, p. 1,652.



Osaka Metropolitan Region

- 10/ Osaka Municipal Waterworks Bureau, *Showa goju-ku-nendo kasui no kekkai to taisaku* [The Drought of 1984/85 and the Measures to Counter it] (Osaka: Municipal Waterworks Bureau, 1985), p. 112 (in Japanese).
- 11/ M. Akiyama, "Toshiken no hendo to josui no junkankozo [Urban Development and Changes in Water Supply Systems]" in Y. Taguchi and K. Narita, eds., *Toshiken takakuka no tenbo* [Perspectives for Multi-Level Development of Urban Areas] (Tokyo: Tokyo University Press, 1986) (in Japanese).
- 12/ *Ibid.*, p. 227.
- 13/ *Ibid.*, p. 235.
- 14/ Osaka Municipal Waterworks Bureau, *Showa goju-ku-nendo kasui no kekkai to taisaku*.
- 15/ Kinki Regional Construction Bureau, *Yodo-gawa hyakunen-shi*, pp. 1,122-3.
- 16/ Oliver E. Williamson, *Markets and Hierarchies: Analysis and Antitrust Implications* (Boston, MA: Free Press, 1975).
- 17/ *Ibid.*, p. 10.

## TRANSACTION COST, EFFICIENCY, AND INSTITUTIONAL CHANGE: WATER FOR HONOLULU

James E. T. Moncur

---

### INTRODUCTION

Over the past century and a half, Hawaii's rapid population growth and economic change have sometimes caused profound and difficult transformations in water use and in the institutions controlling water. Water allocation transformed from a prerogative of the mid-nineteenth century monarchy and nobility to, by the 1920s, a market-based system providing strong incentives for efficient use of the water resource.<sup>1/</sup> The presumed rights to use water were readily tradeable with minimal transaction costs.

This is not to say that concerns over the adequacy of water supplies were absent. In spite of efforts to improve the physical efficiency of the water extraction system on the island, the Board of Water Supply has long foreseen a time when groundwater aquifers would be stressed to meet urban demands while agriculture continued its use, and speculated about finding new means of conserving and reordering water uses. Then, in 1973, the ability of Hawaii water users to transfer their allocations changed unexpectedly and dramatically. A judicial decision in that year (*McBryde v. Robinson*),<sup>2/</sup> along with subsequent legislation, replaced the market with state controlled decision-making apparatus. In the process, the steady flow of mostly small and unremarkable exchanges of water rights has ceased, and the way has been opened to rent-seeking activity on a scale not previously imagined. This change has increased enormously the transaction costs of bringing about any major change in water uses.

This article describes some of the institutional forces underlying changes in transfer costs for water rights in Hawaii, particularly in the state's major urban centre, Honolulu. Neither methodology nor data exist to determine the actual magnitude of these transfer costs, but an approach to determining bounds on these values if market transfers were to continue will be discussed. Some estimates of these limits will also be presented.

### ECONOMIC BASE AND WATER USE

Uniquely, among the fifty United States, Hawaii has no municipal governments *per se*, although the unit governing Oahu, an island of 1,600 km<sup>2</sup>

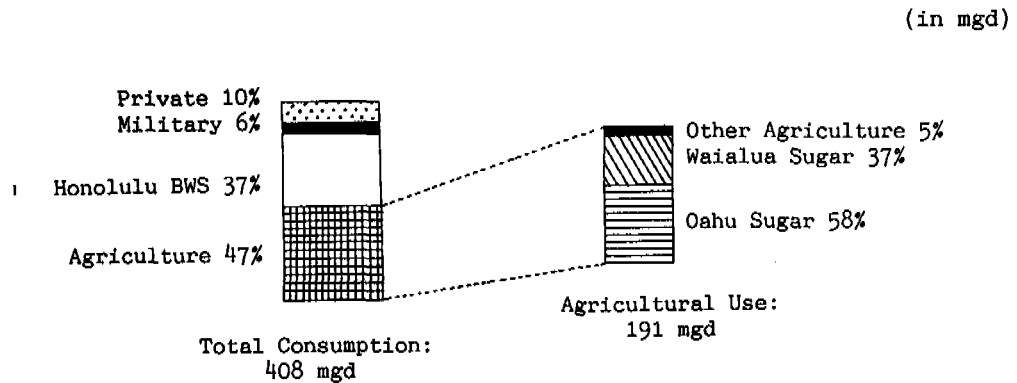
## Honolulu

and 836,000 people<sup>3/</sup> is called the City and County of Honolulu. Both state and county have major powers over the use and control of water resources. The state's economy, as well as that of Oahu, is dominated by the visitor industry, military activities, and, to a declining extent, agriculture, especially sugar and pineapple.

Water use on Oahu totaled approximately 408 million gallons per day (mgd) (or roughly 1.5 million m<sup>3</sup>/day) as of 1988, according to an estimate by Wilson Okamoto and Associates.<sup>4/</sup> Water use is dominated by two institutional forms: the Honolulu Board of Water Supply (BWS), about 37 per cent of total use, and two private sector sugarcane plantations, together accounting for about 44 per cent of the total. In addition, the United States military and nonsugar private parties together use about 16 per cent of the total (figure 1). These shares have shifted considerably over the years. As recently as 1980, the BWS reported that plantations accounted for 57 per cent of water withdrawal, while the Board itself used only 28 per cent.<sup>5/</sup> Going back even further, to 1961, figure 2 shows steadily rising pumpage through the mid-1970s, followed by a period of relatively stable consumption. The lack of growth in the past fifteen years, in the face of substantial population growth, presumably reflects the Board's conservation efforts in that period.

The BWS sources are almost entirely groundwater, including a system of 145 wells, five shafts, and twenty-two tunnels. Three springs and a stream contribute the 1 per cent derived from surface sources. The plantations' sources are about two-thirds groundwater, including natural dikes inside the porous volcanic mountains as well as slightly brackish groundwater taken from coastal areas. Most of the known water sources on Oahu are already exploited, the exceptions being portions of the rainy windward coast and the island's North Shore.<sup>6/</sup>

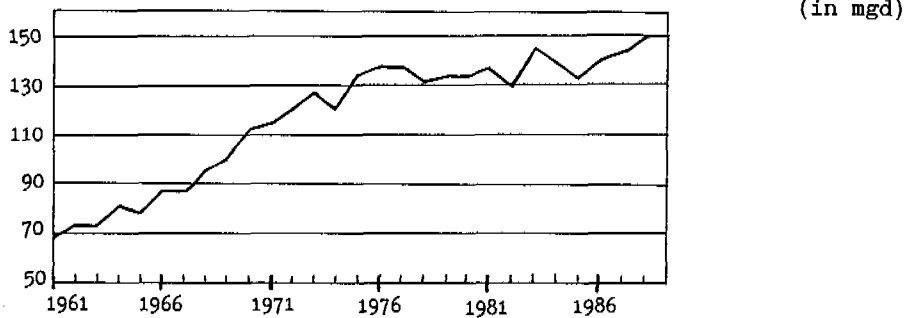
Figure 1. Oahu Water Use, 1988



Source: City and County of Honolulu, *Oahu Water Management Plan* (March 1990).

## Honolulu

Figure 2. Mean Daily Pumpage, Honolulu BWS, 1961-89



Source: Honolulu Board of Water Supply, *Annual Report and Statistical Summary*, 1961-89 (Honolulu).

### THE FRAMEWORK OF WATER RIGHTS

Hawaii's economy has undergone at least two major transformations over the past century and a half, each time bringing up major water problems. The first change, beginning in the mid-nineteenth century, saw the expansion of taro cultivation and then the establishment of sugarcane. The large investments required to grow and process cane were accommodated by an entirely new system of landownership and associated water rights. The more recent transformation, basically since Hawaii's statehood in 1959, has witnessed the secular decline of sugar and other large-scale agriculture, replaced gradually by the now dominant visitor industry as well as continuing United States government military expenditures.

Traditional Hawaiians shared the available supplies, an allocation principle presumably adequate for the agricultural and domestic purposes of their times.<sup>7/</sup> The expansion of taro cultivation and rise of sugar in the first half of the nineteenth century, however, greatly increased the demand for water and created conflicts which could not be resolved by the traditional institutions. These conflicts were resolved initially by the Great Mahele in 1848, in which the king alienated lands to the citizenry, and subsequently by a series of court decisions stretching well into the twentieth century.<sup>8/</sup> With the security of tenure in water rights thus established, long-term commitments of substantial capital seemed safe, minimizing the transaction costs arising from risk of loss of entitlements. Thus, large-scale plantation agriculture arose and eventually water could be provided to a growing population. These water rights, it should be noted, owed little or nothing to any legislative direction,<sup>9/</sup> yet they were well defined and readily transferable.

### Groundwater

Groundwater exploitation on Oahu began with the drilling of a well by pioneer sugar planter James Campbell in 1879.<sup>10/</sup> This well proved highly productive, and many other water users followed Campbell's lead by drilling

## Honolulu

in the same aquifer. With no mechanism to prevent third-party effects, the predictable overdraft soon occurred. A declining water table and consequent saline intrusion forced abandonment of many coastal wells. Various commissions studied the problem, culminating in a 1929 recommendation to establish the Honolulu BWS to operate the city water system and regulate the island's water wells.

The BWS charter gave it broad authority over water development for the entire island. It set standards, monitored well drilling and operation, repaired leaking wells, and generally improved the efficiency of water extraction.<sup>11/</sup> The resulting betterment of the water system's physical efficiency provided the island with supplies adequate to handle the growing residential and military demand without major transfers from agricultural uses. In terms of competing demands for contemporary use, at least, raw water remained essentially a free good until recent years.

Also in 1929, in *City Mill v. Honolulu Sewer and Water Commission*,<sup>12/</sup> the Hawaii Supreme Court pronounced the correlative doctrine for artesian water, more or less a groundwater analogue of riparianism in which adjacent landowners share in using an aquifer. While this doctrine provided something of a basis for market exchange, hydrological uncertainties plus third-party encroachments, not well-handled by the "riparian" paradigm, continued to arise. A groundwater management act in 1979 gave the state considerable control over groundwater allocation.

### Surface Water

In the late 1940s, Gay and Robinson, a sugar plantation on the island of Kauai, replaced an old and very leaky diversion channel with a new tunnel, thus reducing water available to McBryde Sugar Company. After a decade of unsatisfactory negotiations, and facing expiration of the statute of limitations, McBryde filed suit in 1959 to clarify the water right. Eventually, in 1973, the State Supreme Court "flabbergasted everybody involved"<sup>13/</sup> by ruling that while both companies had appurtenant or riparian rights to use "surplus" water, neither had a property right in it. Instead, in its *McBryde v. Robinson* decision, the court declared the state to be the owner.

Gay and Robinson responded by suing the State of Hawaii in federal court, claiming its property had been taken without compensation in violation of the United States constitution. This case proceeded through federal courts for sixteen more years, until a 1989 ruling settled the suit, if not the substantive question of who controls water allocation. That decision, *Robinson v. Ariyoshi*,<sup>14/</sup> upheld the earlier decision by ruling in favour of the state, declaring that the state had not actually deprived the plantations of use of their water, but had only declared that they did not "own" it. Thus, the court declared that since no "taking" had occurred, the issue was not "ripe" for adjudication.

When McBryde Sugar Company originally filed suit in 1959, both parties anticipated a simple judicial declaration with limited legal costs. The ensuing thirty years of legal conflict generated costs well into the millions of dollars.<sup>15/</sup> Legal fees alone have been enormous; yet the question of water rights remains unsettled, with transaction costs, in the form of uncertainty, apparently prohibitive to new transfers.

## Honolulu

It is important to remember that *McBryde* dealt directly only with surface water. If the decision had an impact on groundwater, it was only through the influence of *McBryde* on discussions leading up to passage of the *State Water Code*.

### The State Water Code

The *McBryde* decision and ensuing controversy, along with emerging public concerns over the sustainability of aquifer yields and with water quality, led the 1978 Hawaii Constitutional Convention to propose an amendment directing the state legislature to establish an agency to set policy on water conservation, quality, and use in order to protect the state's water resources and to regulate water use.<sup>16/</sup> Voters approved the amendment in 1978. There followed almost a decade of studies, proposals, hearings, and discussion. Major proposals from official study commissions<sup>17/</sup> would have required all users to obtain permits of limited duration from a state authority with power to deny renewal and to disapprove any transfers. The Advisory Study Commission denounced market institutions: "Indeed, the commission strongly feels that water and the right to use it should not be the subject of purchase and sale on the open market".<sup>18/</sup> This sentiment carried over into early drafts of the legislative act creating the code.

The resulting *State Water Code*,<sup>19/</sup> which deals with both ground and surface water sources, has been called a "masterpiece of compromise."<sup>20/</sup> What remains unclear is whether the compromise melded the best or the worst of competing paradigms. Under the code, existing uses are granted perpetual permits; hence the administrative body established by the code, the Commission on Water Resource Management, has little authority to reallocate water on its own volition. On the other hand, transfers are strictly limited and subject to Commission approval, so the market cannot be expected to perform the allocation function. At best, the water rights question remains unsettled. Presumably, the Commission will eventually take some action, such as denying a permit or transfer, which will provoke another suit on the grounds of unconstitutional taking of property.

It has been observed that the 1987 *Water Code* gives to the state an additional form of zoning authority. Land use changes require approval from the State Land Use Commission as well as the City Zoning Board. Now attendant water transfers must obtain approval from the State Water Management Commission as well. The Commission includes two *ex-officio* members of the Governor's cabinet as well as others appointed by the Governor. Present appointees include representatives of plantation management and the workers' union, as well as a former state legislator closely allied to small farmers. The sugar workers' union has a clear interest in exerting power over water allocation, in hopes of maintaining the viability of sugarcane and thus sustaining union membership and jobs. Many of the small farmers cultivate leased land with no presumptive transferable water rights. Cabinet members can bolster the dominant political group by controlling resources, such as water, outside the discipline of market forces. Hence, in its implementation, the code provides additional power to vested interests over those which may arise from growth and economic change in the state.

## TRANSACTIONS IN WATER RIGHTS

### Agriculture

By and large, the sugar plantations on Oahu developed their own sources of water beginning with Campbell's 1879 artesian well and now including dozens of wells and an extensive system of tunnels and dikes bringing water to central Oahu from the windward side of the island through the Koolau mountains. Prior to the 1973 *McBryde* decision, the plantations would have presumed themselves to hold solid property rights over the water, defined to include the right to use, to exclude others from using, and to transport the water, as well as the right to sell these rights. In the post-*McBryde* world, operating under the 1987 *Water Code*, their rights to carry on such transactions, especially sales, are quite unclear.

Continued use of water for sugarcane production on Oahu is uncertain for reasons largely unrelated to the tenure of water rights. Sugarcane almost surely would shut down if United States sugar import quotas were abolished or eased significantly. Demand for urban residential land threatens the existence of at least one of the two plantations, Oahu Sugar Company, whose cultivated lands are all leased. While continued marginal reductions in sugarcane acreage are still possible, at some point Oahu Sugar will lose the economies of scale necessary for profitable operation.

Shrestha<sup>21/</sup> estimates the value of the marginal product of water in sugarcane at US\$108.66 million gal if applied with drip irrigation technology, but only US\$9.06 million gal using standard furrow techniques. Even the higher figure falls substantially short of the value in residential uses. By switching to drip irrigation, growers have significantly improved the efficiency of water use, in spite of the relatively high capital requirement. Drip irrigation not only saves significant labour time, but has permitted irrigation of acreage previously rainfed, thus increasing crop yield for those lands. None of the water savings were transferred to the urban sector.<sup>22/</sup>

Sugar plantations and other large landholders have a clear interest in bringing about an allocation system permitting the sale of water rights to developers as housing gradually takes over land currently devoted to cane. Likewise, the union representing sugar workers has exerted strong efforts to gain influence over water uses. Without irrigation, much of the sugar land would not be sufficiently productive to justify continued cane growing. In spite of an intensive research effort, alternate crops with less demand for water do not seem to offer great hope. Cane processing mills are old and will not find alternative uses. Much of the sugar acreage is leased, and while short-term extensions are possible after the mid-1990s, housing seems to be the principal land use of the future. Even unleased fee-simple acreage is obviously much less attractive without clearly transferable water rights. In short, there is much highly specific capital, human and otherwise, involved with sugar growing.

The picture of water transactions associated with Oahu's other major crop, pineapple, is much the same, although pineapple uses only a fraction of the water necessary for sugar.<sup>23/</sup> Efficient drip irrigation techniques cover about 80 per cent of the 5,263.15 ha on Oahu planted in pineapple.

## Honolulu

Small farms on the island also produce fruits and vegetables, meat, poultry and other agricultural commodities, notably flowers. However, these enterprises use less than one-half of 1 per cent of total water withdrawals from private wells, plus about 2 per cent of BWS pumpage. Continuing urbanization of farmland will increase the difficulty of maintaining such operations. Some may transfer to sections of defunct sugar plantations, but by and large, land retired from sugar has only partially found alternative agricultural uses and has remained fallow if not urbanized. To whatever extent alternative crops do take over cane acreage, water usage is likely to decline since sugar is a highly water-intensive crop.

### Municipal Water

As already noted, the Honolulu BWS historically has performed a somewhat unusual dual function as both the sole "retailer" of water on Oahu and the principal regulator of water rights. Although the latter role may diminish somewhat under the new *Water Code*, as the Water Resource Management Commission exercises its regulatory powers, heretofore the BWS has been able, by and large, to obtain new sources of supply simply by finding a promising location, drilling wells, and installing the necessary pumps and mains. BWS has controlled large "watershed reserve" land areas in the mountains and has rationalized and improved the efficiency of existing wells. Water sources, until quite recently, have been more or less readily available. The Board has rarely even attempted to purchase water rights.

An exception to this pattern is instructive in the light of transaction cost analysis. In the late 1960s, the Board purchased land and associated water rights in a windward Oahu valley, intending to develop its groundwater and transport it for use elsewhere on the island. However, several small taro farmers filed suit (*Reppun v. Board of Water Supply*)<sup>24/</sup> to stop this project, asserting that the water the Board wanted to export was a significant contributor to streamflows from which they drew large amounts of the cool, free-flowing water necessary for traditional taro cultivation. Citing in part the 1973 *McBryde* decision and its implications for market transactions in water, the court ruled in favour of the farmers. While this ruling has been praised as ensuring water quality in the form of minimum streamflow standards,<sup>25/</sup> it effectively stopped the BWS from completing its planned transbasin diversion. The Board has not since attempted to purchase water rights.

As the sole urban water retailer, BWS serves a wide variety of customers, including residential, commercial, industrial, hotels, government units, and small-scale agriculture. Transactions between the Board and its customers follow a simple, nearly uniform pricing policy. Rates are based on a standard average-cost pricing structure intended to recoup costs. At present, the rate includes a flat charge of US\$3.70 per billing period (two months), to recoup general administration costs, plus a quantity charge of US\$1.34 per thousand gallons used.<sup>26/</sup> Single family dwellings on Oahu, which account for some 85 per cent of service connections but only about 40 per cent of consumption, are universally metered. With long-run demand elasticity in the range of 0.3 to 0.6,<sup>27/</sup> single family customers appear to have considerable potential for conservation if faced with the right price incentives. Most apartment units, however, are master metered, with water bills paid as an undifferentiated part of maintenance fees or rent.



## Honolulu

Published financial data give only recorded accounting costs, which fall significantly short of full economic costs. First, the book value of infrastructure has never been adjusted to reflect inflation. Second, certain contributed items never enter the cost base, including developer-installed distribution systems and associated development charges intended to recoup off-site costs. Third, marginal costs almost certainly exceed average cost, so the average-cost-based water rates are inefficiently low. Finally, historical accounting records completely overlook the scarcity rents attached to existing BWS water sources as the marginal cost of source supplies has risen over the years.<sup>28/</sup>

Under the authority of the *Groundwater Control Act of 1979*, which was largely incorporated into the *1987 Water Code*, the State in 1985 cited nonuse of some 20 mgd of Oahu Sugar Company water and transferred most of that amount to the BWS and the military. The plantation argued, unsuccessfully, that it had left the groundwater unused only because of unusually high flows from its less costly surface water sources during the preceding two-year period.<sup>29/</sup> This reallocation allowed the BWS and military users to continue augmenting supply sources without compensation for any value of the *in situ* resource, compounding its failure to factor in the scarcity value of its inframarginal sources.

In addition, BWS rates are uniform for customers whose delivery costs vary extensively. Many customers live at elevations of several hundred feet above water sources. In spite of substantial pumping costs, they pay the same water rate as customers living near sea level.

For all these reasons, the Board's rates have fallen short of marginal cost and thus fail to generate user incentives for conservation in accordance with the true economic value of water. The BWS, as a governmental entity, has no way of capturing any profit on water and in fact is proscribed by its charter from earning even a cash-basis profit. Hence, the Board and its managers have no incentive to raise prices to efficient levels, and have every incentive to continue supply augmentation to the neglect of demand management.

### THE MAGNITUDE OF TRANSACTION COSTS

With no market-based water transfers in recent years, no data exist to enable a direct estimate of transaction costs. However, if transfers from irrigation to urban uses are to occur, these costs could not exceed potential rents arising from the water right. Any higher transaction costs would induce the buyer to either forego entirely the activity for which water was sought or turn to a "backstop" alternative such as desalination. Hence, an estimate of potential rents provides a limit, albeit perhaps only a very distant one, on potential transfer costs.

Under the counterfactual assumption that rights to irrigation sources are well defined and transferable, Bowen, Pollock, and Moncur<sup>30/</sup> estimated potential rents on water currently used for irrigating sugarcane by Oahu Sugar Company. This water comes from a system of mountain tunnels and dikes and from freshwater wells, together with some moderately brackish "caprock" wells. These water sources are used on land near an area of

Honolulu

major urban expansion in the southwest portion of the island, and are therefore prime candidates for transfer. The model simulates willingness to pay (WTP) and willingness to accept (WTA) for the transfer of water rights, net of both extraction and transfer costs.

The WTP estimate is based on the discounted difference between costs for conventional sources such as irrigation wells and the cost of the next cheapest source, in this case desalination. A potential buyer such as the BWS would be willing to pay an amount no greater than the (discounted) extra cost of the desalination which it could avoid by using transferred irrigation water. WTA depends on the potential seller's perception of the scarcity value of its irrigation water sources.<sup>31/</sup> These values may diverge substantially, and a final transfer price probably lies somewhere in between, depending on the bargaining strength of sellers versus buyers. Clearly, however, no exchange will occur if transaction costs exceed the WTP measure; in that case, desalination would be cheaper.

Clearly, if WTA exceeds WTP, there will be no exchange, whatever the transfer costs. The water will remain in its agricultural use. On the other hand, suppose  $WTA=0$  while  $WTP>0$ . A bargain can be struck at any price below WTP. For a third case, suppose the relationship is  $0<WTA<WTP$ . Here, the settlement price must exceed WTA plus seller's transaction costs, while not exceeding WTP. Finally, if (total) transaction costs exceed WTP, no exchange will occur; it will be cheaper for the potential buyer to switch immediately to desalination to meet growth in demand. Hence, WTP imposes an upper limit on transfer costs, if exchange is to occur.

Projected increases in municipal demands for the study area total some 112 mgd stretching over the next forty years. Transfers from irrigation wells could supply about 76 mgd, with additional amounts derived from desalination. Table 1 shows estimates of WTP and WTA. Two estimates appear for each valuation concept, according to the cost of desalination, which serves as the backstop source of potable water and is a sensitive parameter of the model. Estimated WTP lies in the range of US\$100 million to US\$200 million. For perspective, these limits imply an addition to the cost of each housing unit planned for the area of roughly US\$1,200 to US\$2,500, respectively.

TABLE 1. WILLINGNESS TO PAY AND TO ACCEPT FOR WATER IN THE STUDY AREA

Desalination Cost (\$/mgd)	Willingness to Pay (\$million)	Willingness to Accept (\$million)
1,825,000	98.6	56.6
3,650,000	203.6	115.7

Note: Values discounted to 1990 at  $r = 3$  per cent. See R. L. Bowen, J. E. T. Moncur, and R. L. Pollock, "Seeking Wealth Transfers and Water Rights: The Hawaii Case," *Natural Resources Journal* (1991).

Any rents not absorbed by transaction costs could be dissipated in a variety of ways. For example, suppose the BWS, as buyer, were to arrive at a price close to WTA. With the BWS's average costs, island-wide uniform

## Honolulu

pricing policy, the rent would be dispersed into lower user charges and excessive water consumption. If the (sugar plantation) sellers extract a large part of the WTP, then the sellers would capture the rents.

As noted earlier, however, the assumption of well-defined and transferable water rights is counterfactual. In this situation, sellers have no incentive to sell the water and rents are dissipated by continuing its use in low-value agricultural applications. Potential buyers effectively face prohibitive transaction costs, (e.g., lawyers' fees, lobbying expenses, "buying" the agreement of powerful interest groups, and so on).

In the event, a coalition of housing developers and landowners, who might otherwise have bought high quality irrigation water, has agreed to invest in brackish groundwater for golf courses, parks, and other applications in which higher salinity poses no overwhelming obstacle, thus reserving scant potable water for residential uses. This enterprise will also develop and transport what little potable water is available and will participate in construction of facilities for desalination of brackish groundwater. Presumably, these agreements will be validated by the Water Commission. The bulk of freshwater rights included in the estimates above will remain, for the time being, in sugarcane.

### SUMMARY

Transaction costs clearly play a large role in determining the course of action of Honolulu's water users in their efforts to meet projected water demands. The institutional problems of effecting such transactions mean that the BWS underpays, undercosts, and underprices water, leaving ultimate consumers with reduced incentives to conserve the resource in accordance with its true scarcity. Likewise, sugar planters cannot sell their water-use rights and so will continue to apply it to sugarcane in spite of its low marginal value.

In its naive form, at least, transaction cost theory would suggest that rising transaction costs will generate a demand for institutional change to articulate or clarify property rights so as to ameliorate these costs.<sup>32/</sup> The institutional framework is, so to speak, an endogenous variable, not just a parameter standing above the influence of economic incentives and pressures. Being subject to economic incentives, institutions can be expected to evolve over time so as to encourage increasing efficiency in the use of resources, including a reduction of transaction costs.

This seemed an appealing explanation for institutional change in Hawaii water institutions until the judicial, constitutional, and legislative changes of the 1970s and 1980s described above. The 1973 *McBryde* decision, however, was an entirely unexpected shock to the system and cannot be viewed as an evolutionary step towards greater efficiency. Its effect was to raise, not lower, transaction costs in water resources -- indeed almost to prohibit transfers based on market agreements. Seen in this light, the transaction costs erected by *McBryde* seem to have opened up water to new rent-seeking activity, with subsequent judicial, constitutional, and legislative milestones designed to enable favoured groups to

## Honolulu

capture those rents.

### NOTES

- 1/ T. L. Anderson, "The Market Alternative for Hawaiian Water," *Natural Resources Journal*, 25 (1985):904.
- 2/ "McBryde Sugar Co. v. Robinson," 55 *Hawaii* 260, 517, P.2d 26 (1973).
- 3/ Oahu's population accounts for 63 per cent of the state's total. Non-residents, mostly visitors, make up about 8 per cent of the total population on average (Department of Business and Economic Development, *The State of Hawaii Data Book* (1989), p. 128; and First Hawaiian Bank, *Economic Indicators* (September/October 1990):2, 5.
- 4/ Wilson Okamoto and Associates, Inc., *Oahu Water Management Plan: Technical Reference Document* (Paper prepared for Department of General Planning, City and County of Honolulu, 1990), p. 80.
- 5/ Board of Water Supply (BWS), *Oahu Water Plan* (City and County of Honolulu, 1982), p. 24.
- 6/ Okamoto and Associates, Inc., *Oahu Water Management Plan*, pp. 84, 94.
- 7/ The following paragraph draws from the accounts of Anderson, "The Market Alternative for Hawaiian Water," pp. 901-6 and D. C. Cox, "A Century of Water in Hawaii" in F. N. Fujimura and W. B. C. Chang, eds., *Groundwater in Hawaii: A Century of Progress* (Honolulu, HW: University Press of Hawaii, 1981).
- 8/ Cox, "A Century of Water in Hawaii."
- 9/ Anderson, "The Market Alternative for Hawaiian Water," p. 903.
- 10/ Cox, "A Century of Water in Hawaii."
- 11/ *Ibid.*, pp. 64-6.
- 12/ "City Mill v. Honolulu Sewer and Water Commission," 30 *Hawaii* 912 (1929).
- 13/ A. A. Smyser, *Honolulu Star-Bulletin* (17 October 1980):A14.
- 14/ "Robinson v. Ariyoshi," 887 F.2d 215 (9th Cir. 1989).
- 15/ A January 1989 ruling of Hawaii-based federal Judge Martin Pence had reaffirmed the plantations' water rights, reversing the State Supreme Court's surprising 1973 decision assigning ownership to the state. Later that year, Judge Pence awarded the plaintiffs some US\$2 million from the state as compensation for legal costs incurred since the 1973 ruling (*Honolulu Star-Bulletin*, 1989).

Honolulu

16/ The Hawaii State Constitution, Article XI, section 7:

The State has an obligation to protect, control, and regulate the use of Hawaii's water resources for the benefit of its people.

The legislature shall provide for a water resources agency which, as provided by law, shall set overall water conservation, quality, and use policies; define beneficial and reasonable uses; protect ground and surface water resources, watersheds, and natural stream environments, establish existing correlative and riparian uses and establish procedures for regulating all uses of Hawaii's water resources.

- 17/ Governor's Advisory Commission, *Hawaii's Water Resources: Directions for the Future* (Honolulu, 1979); and Legislative Reference Bureau, *Advisory Commission on Water Resources*, thirteenth Legislature (1986).
- 18/ Legislative Reference Bureau, *Advisory Commission on Water Resources*, p. 21.
- 19/ *Hawaii Revised Statutes*, chapter 174c.
- 20/ L. S. Lau, "State Water Code -- A Masterpiece of Compromise," *Wiliki o Hawaii* (1988) Part I, 23(8):1-3; and Part II, 23(9):2.
- 21/ R. B. Shrestha, "An Econometric Analysis of the Choice of Adoption and Diffusion of Irrigation Technologies in Hawaii's Sugar Industry" (Ph.D. diss., University of Hawaii, Honolulu, 1988).
- 22/ H. Yamauchi, "Economics of Groundwater Resource Conservation on Oahu" in Fujimura and Chang, eds., *Groundwater in Hawaii*.
- 23/ Okamoto and Associates, Inc., *Oahu Water Management Plan*, p. 109, reports that pineapple irrigation used about 7 mgd in 1987 compared to 181 mgd for sugarcane.
- 24/ "Reppun v. Board of Water Supply," 65 *Hawaii* 531 (1982).
- 25/ W. B. C. Chang, "Reppun v. Board of Water Supply: Use of Riparian Rights to Ensure Minimum Streamflow" in W. B. C. Chang and J. E. T. Moncur, *Reppun v. Board of Water Supply: Property Rights, Economic Efficiency and Ensuring Minimum Streamflow Standards* (Technical report no. 165) (Honolulu: Water Resources Research Center, University of Hawaii at Manoa, 1984).
- 26/ Prior to July 1977, the Board used a declining block pricing structure. Since then, in spite of consultant recommendations for an increasing block rate schedule, it has set a uniform quantity charge designed to equal average cost. The only exception is for agricultural customers, who continue to pay on a reduced, declining-block rate schedule for the 2 per cent of BWS water they use.
- 27/ James E. T. Moncur, "Urban Water Pricing and Drought Management," *Water Resources Research*, 23 (March 1987):393-8.

Honolulu

- 28/ James E. T. Moncur and R. L. Pollock, "Scarcity Rents for Water: A Valuation and Pricing Model," *Land Economics* 64 (February 1988):62-72.
- 29/ W. D. Balfour, Jr., "Testimony to State Water Commission on Proposed Administrative Rules" (Honolulu, 1988), p. 2.
- 30/ R. L. Bowen, James E. T. Moncur, and R. L. Pollock, "Rent Seeking, Wealth Transfers, and Water Rights: The Hawaii Case," *Natural Resources Journal* (1991).
- 31/ Moncur and Pollock, "Scarcity Rents for Water."
- 32/ See for example, H. Demsetz, "Towards a Theory of Property Rights," *American Economic Review, Papers and Proceedings* 57 (May 1967):347-59; and C. M. Rose, "Energy and Efficiency in the Realignment of Common-Law Water Rights," *Journal of Legal Studies* 19 (June 1990).

## TRANSACTION COST AND INSTITUTIONAL APPROACHES TO WATER RESOURCES MANAGEMENT IN KUNMING MUNICIPALITY

Jichang Zhang

---

### INTRODUCTION

Water supply capacity in the People's Republic of China (hereafter China) has expanded enormously since 1949. For example, over 86,000 reservoirs have been built with a total capacity of 350 billion m<sup>3</sup>. This achievement, however, has not kept pace with the increasing demand for water. On the contrary, water shortages have become a major constraint to economic development, especially in the cities. The situation is most acute in metropolises like Beijing, Tianjin, Shanghai, and many of the provincial capitals such as Kunming. These cities traditionally relied on groundwater supply. In recent years, however, all of them, to a great extent, have turned to reservoirs, rivers, or lake water because the groundwater is either totally depleted or the water table is rapidly sinking. The development potential of new water resources is limited, especially adjacent to major metropolises. Projects such as long-distance diversion and "soft" nonstructural management alternatives are necessary to satisfy the increasing excess demand for water in these metropolises. Kunming and adjacent Lake Dianchi were chosen as the site for demonstration case studies on management solutions by the Chinese Environmental Protection Agency. There are two reasons: First, most of the problems associated with water resources can be found here; second, the city and the entire water system of Lake Dianchi including the catchment, tributaries, and upstream reservoirs, are located within the jurisdiction of Kunming Municipality, so transregional problems can be avoided. For the same reasons, Kunming is taken as the site of this case study.

China is a developing country with a centralized socialist economy. The economic system has, to a certain extent, been altered by reform. Hierarchy and market interact, struggle against, and sometimes mix with each other in economic operations. This article attempts to provide an insight into these mixed mechanisms through institutional analysis by transaction cost economics on a few problem issues and the countermeasures applied in water-use conflicts. The output of this work may, hopefully, indicate complex problem issues for further in-depth studies.

## Kunming Municipality

### BACKGROUND INFORMATION

#### Water Resources

Kunming is the capital of Yunnan Province in southwest China. Lake Dianchi, to the southwest of the city proper, is the largest lake in the province and one of the largest tectonic lakes in China. The entire water system of Lake Dianchi is relatively isolated from other water systems (figure 1). The lake has a surface area of 307 km<sup>2</sup> and a volume of 1.29 billion m<sup>3</sup>. It is fed by more than twenty rivers. The major contribution of inflow water comes from Songhuaba Reservoir through Panlong Jiang River. The lake water, reservoir water, and groundwater constitute the water resources of Kunming Municipality.

Kunming Municipality, with eight districts and counties, had a population of only 1.4 million in 1949. It has developed into a metropolis with intensive agriculture and industries since then. The total population reached 3.3 million in 1985, increasing by as much as 2.41 per cent per year (agricultural population, 1.8 per cent and nonagricultural, 3.0 per cent). The population density was 439 persons per km<sup>2</sup> in 1985, about five times the average of Yunnan Province. Kunming's development may also be shown by its industrialization. In 1949, the municipality had approximately forty factories and some 400 family workshops with a total gross value of industrial output of 47 million yuan (RMB), while in 1985 it rose to 2,162 factories and enterprises with gross output value of 5.3 billion yuan. The gross value of industrial output accounted for 42.7 per cent of total output in 1949 and 86 per cent in 1985.<sup>1/</sup>

The water environment in the Lake Dianchi Basin has been strongly affected by human activities. The slash-and-burn farming, sloped-farming, deforestation by excessive logging for construction and firewood, and government-organized land reclamation from the lake, have all resulted in soil erosion and siltation, which have reduced the water storage capacity. Table 1 shows the change in Lake Dianchi's surface area and storage capacity between 1957 and 1983.

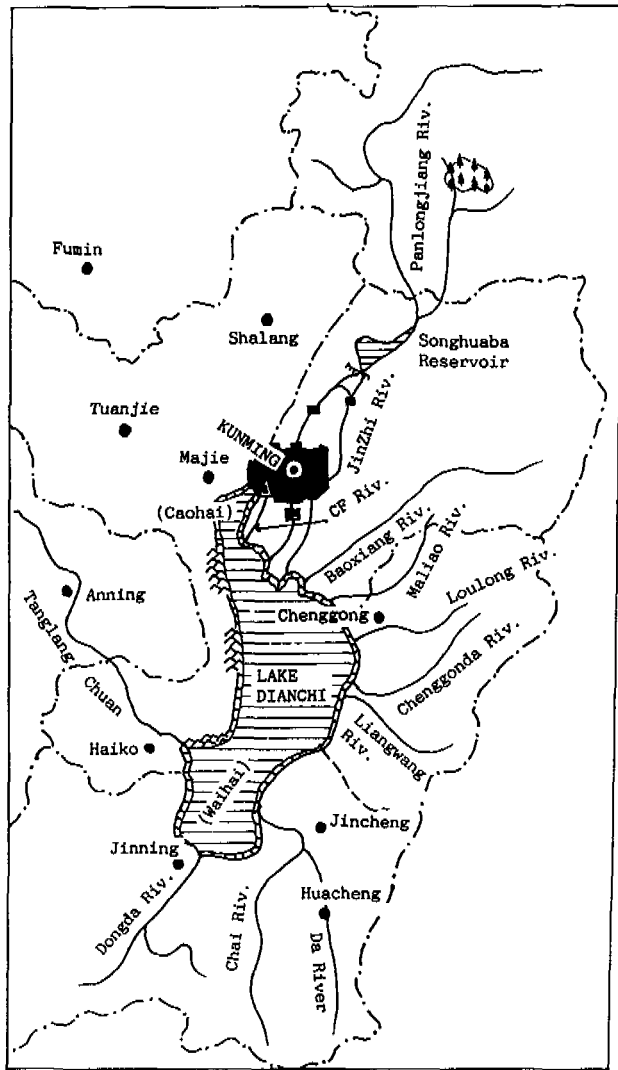
The disruptive exploitation of Kunming's water resources and environment forced the metropolis to rely heavily on expanding supplies to meet the growing demand for water. In the past thirty years, 489 middle- and small-scale reservoirs and 3,304 small dams and ponds have been built with a total capacity of 1.12 billion m<sup>3</sup>.<sup>2/</sup> Of these, Songhuaba Reservoir is most important. Songhuaba was built in 1958 for power generation, flood control, and irrigation. The average flow from the reservoir has fallen from 210 million m<sup>3</sup>/annum to 199 million m<sup>3</sup>/annum due to the destruction of the forest cover. Part of the reservoir's water was transferred to urban use due to the shortage of groundwater and deterioration of the water quality of Lake Dianchi. The reservoir irrigates 1,800 ha of farmland and supplies 90 per cent of the tap water (62.05 million m<sup>3</sup>/annum)<sup>3/</sup> for Kunming City.<sup>4/</sup> Songhuaba also provides 42 per cent of Lake Dianchi's replenishment.






The groundwater resources amount to 210,000 m<sup>3</sup>/day (76 million m<sup>3</sup>/annum) in Kunming Municipality, of which 170,000 m<sup>3</sup>/day (62 million m<sup>3</sup>/annum) is exploited for industrial and domestic use.<sup>5/</sup> The large-scale development of groundwater started in 1974. According to a survey carried



# Kunming Municipality

Figure 1. Proposed and Ongoing Projects for the Water Conservation of Lake Dianchi Basin



-  Water Diversion Works
-  Afforestation Area
-  Lanhuagou Sewage Treatment Plant
-  Dam Reinforcement of Songhuaba Res.
-  Lake Dianchi Bank Revetment

## Kunming Municipality

**TABLE 1. THE CHANGE IN SURFACE AREA, DEPTH, AND CAPACITY OF LAKE DIANCHI**

	Area (km <sup>2</sup> )	Maximum depth (m)	Average depth (m)	Capacity (billion m <sup>3</sup> )
1957	330	6.0	4.6	1.37
1983	305	5.7	4.1	1.20
Difference	-25	-0.3	-0.5	-0.17

Source: Adapted from Zhang Jingfang *et al.*, "The Comprehensive Ecological Consequence of Irrational Development and Utilization of Natural Reservoirs in Dianchi Basin" in Shi Qing and Shan Peirao, eds., *The Ecological Problems and Consequences of the Four Lakes in Yunnan Plateau* (Kunming: Yunnan Science and Technology Press, 1987).

Note: Data are calculated according to a water level of 1,886.2 m above sea level.

out in 1983, ten of the fourteen major water-rich areas which have been developed are suffering from a lowering of the water table of up to 50 cm per year, maximum 30.7 m, due to overpumping.<sup>6/</sup> The same report estimated that 90 per cent of the usable groundwater has been exploited; therefore, little further potential exists.

At present, the total water resources (mostly from Songhuaba Reservoir and Lake Dianchi, plus a small portion from groundwater) are barely sufficient to match demand during the once-in-four-year drought (P=75 per cent) (see table 2). Increases in demand from population growth, industrialization, and agricultural use will pose a key problem for planners. In the past, conflict over the allocation of water resources between competing users (agriculture, industrial, and domestic users) has happened only in the drought years (once every five or seven years), and only for a short period, normally in April or May. The problem was traditionally solved at the expense of government-owned industry. However, in the long-term, water shortages will no longer be treated as periodic inconveniences, but as a basic problem which has to be solved. The Kunming Municipal Government is therefore reconsidering its development plan with a strong emphasis on water resources conservation.

### Water Pollution

Not only water quantity, but also water quality, has deeply affected the development and public welfare of this area. Forty enterprises around the lake constitute the main industrial pollution sources which discharge wastewater at a rate of 95,400 tons/day. Untreated domestic wastewater accounts for 70,000 tons/day. Agricultural run-off has not been calculated. All wastewater flows into the lake through six inflow rivers, namely, the Yunliang, Xin, Wang Jiadui, Daqing, Chuan Fang, and Dagan rivers. Including the dilution water, the total loading rate of wastewater is 0.48 million tons/day and 176.6 million tons/year, which accounts for 25.6 per cent of the total surface run-off. Among these six rivers, all except the Daqing flow into Caohai (see figure 2). Therefore, Caohai receives 73 per cent of the total wastewater discharge. The pollution status of different parts of the lake is summarized in table 3. Pollutants are highly concen-

TABLE 2. THE PRESENT AND PROSPECTIVE SITUATION OF WATER DEMAND AND SUPPLY IN KUNMING MUNICIPALITY<sup>1/</sup>

(in million m<sup>3</sup>)

	p <sup>2/</sup>	Supply		Demand				Balance	
		Total resource	Available supply	Industrial	Domestic	Agricultural	Total	Amount	Percentage
Present	23 per cent	1,174	540	146	22	312	480	+60	+13
	50 per cent	978	531					+51	+11
	75 per cent	736	480					0	0
	95 per cent	604	352					-127	-26
Prospect (Year 2000)	20 per cent	1,174	562	271	50	360	681	-119	-17
	50 per cent	978	553					-128	-18
	75 per cent	736	502					-179	-26
	95 per cent	604	352					-328	-48

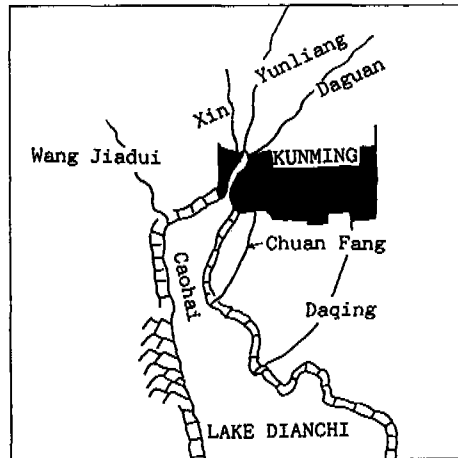
Notes: <sup>1/</sup> Based on statistics from 1960 to 1970, data provided by Water Resources Office of Yunnan Province, summarized by Zhang Jingfang *et al.*, "The Comprehensive Ecological Consequence of Irrational Development and Utilization of Natural Resources in Dianchi Basin."

<sup>2/</sup> Hydrological probability. P=50 per cent stands for average (median) years; P<50 per cent, wet years; and P>50 per cent, dry years.

## Kunming Municipality

trated in the sediment of the lake. Nutrients in the wastewater and agricultural run-off have caused Lake Dianchi to be generally eutrophied. Pollution in groundwater is also found, but to a lesser extent.

Figure 2. Lake Dianchi: Inflow Rivers



### Reclamation and Deforestation

Reclamation of farmland from the lake and deforestation in the catchment area can, to a great extent, be blamed on erroneous policies of the government from the late 1950s to the 1970s. Borrowing the Stalinist big-push development strategy from the Soviet Union, the central planners overemphasized heavy industry and grain production, ignoring environmental capacity for recovery and the sustainability of natural resources. During this period, economic development was considered a political and ideological principle rather than a strategy. In part out of ignorance, the local government promoted and organized citizens and peasants to reclaim the land from the lake and the surrounding marsh for grain farming. In the same period a large area of forest was also destroyed for heating, charcoal, house building and, in some cases, for farming on slopes. The land reclamation resulted not only in the decrease of the lake area as shown in table 1, but also in a significantly changed balance of aquatic organisms. In addition, many famous natural scenic places disappeared.

Deforestation resulted in decreasing total forest coverage from 50 per cent to 37.6 per cent between 1950 and the 1960s. By 1981, only 16.5 per cent was left. With the reduction of vegetation and with farming on slopes, soil erosion in the region has increased alarmingly. The silt loading from the upper reaches into the lake is about 855,000 m<sup>3</sup>/annum. Accumulated silt deposition (to 1983) contributed about 68 per cent of the total reduction in lake capacity, while land reclamation accounted for 32 per cent. Soil erosion also caused serious contamination in the rivers and

TABLE 3. THE MEAN VALUE OF WATER QUALITY IN DIFFERENT PARTS OF LAKE DIANCHI

	Caohai	Waihai North	Waihai Middle	Waihai South
Water level (m)	1,887.0	/	1,886.24	/
Depth (m)	1.80	4.00	4.2	5.2
Temperature ( C)	16.8	16.8	17.7	17.7
Transparency (m)	0.35	1.0	0.99	0.97
PH	8.92	8.86	8.88	8.84
Hardness	10.7	7.58	7.51	7.44
Suspended matter	40	15	18	19
DO	4.59	5.31	5.37	5.95
COD	58.84	30.87	39.54	40.59
BOD	9.02	2.41	2.81	3.15
NH <sub>4</sub> <sup>+</sup>	0.33	0.032	0.076	0.036
NO <sub>2</sub> <sup>-</sup>	0.0043	0.0020	0.0061	0.0039
NO <sub>3</sub> <sup>-</sup>	0.068	0.098	0.049	0.036
Total N	2.908	0.68	0.58	0.695
Total P	0.14	0.030	0.031	0.035
Hg	0.0001	0.0001	0.0001	0.0001
As	0.147	0.0136	0.0164	0.022
Cr	0.0054	0.0030	0.0030	0.0035
Cd	0.0136	0.0016	0.0017	0.0021
Pb	0.025	0.0097	0.0086	0.0104
F	0.494	0.453	0.462	0.468

Notes: The mean value was arranged over the monitored data collected from September 1982 through April 1983. All data are in mg/l except when otherwise mentioned. Data provided by Zhang Jingfang *et al.*, "The Comprehensive Ecological Consequence of Irrational Development and Utilization of Natural Resources in Dianchi Basin."

## Kunming Municipality

the lake itself, bringing with it large amounts of nutrients as well as organic chemicals and pesticides.

### Remarks

It is beyond the scope of this work to discuss in detail the socio-economic institutions of China's Mao era (1949-76). A few remarks, however, are given below as a hint for an improved understanding of the institutional evolution.

- (1) Until the late 1970s, remarkably little attention was paid to environmental policy. Social development was, on the whole, guided more by the necessity of satisfying basic economic needs than by higher values.
- (2) Classical Marxist thinkers assigned the blame for environmental disruption to short-sighted profit-seeking by capitalists.
- (3) Overly ambitious economic goals were shifted from their original economic purpose to become purely political instruments.
- (4) Ecological principles were not well understood.
- (5) Implementation was by politically and ideologically marked campaigns enforced through coercion.
- (6) There was a monopoly on resource rights and decision making.

Reviewing the overall situation, one may conclude that the mistakes of the past years have formed a vicious circle in the ecosystem which requires high investment for even a very slow recovery. This cost entails a reform of institutions in addition to the large amount of investment. Since the late 1970s, with the establishment of environmental protection agencies in the central, provincial, and municipal governments, corresponding research institutes, monitoring centres, and stations have been built. Environmental surveys and research projects have focused on the key problems. After more than ten years of research and pollution control management, awareness of the significance of the environment in economic development has slowly increased, notably by Kunming's local authorities, who have come to realize that an overall management strategy based on legislation is necessary. Although belatedly, these new steps finally turn to China's ancient philosophical traditions which stress the need for man to live in harmony with nature.

## **AN INSTITUTIONAL APPROACH TO DEMAND AND SUPPLY CONFLICTS**

### Present Approach to Demand and Supply Conflicts -- Supply-Side Management

Reform in the past ten years, mostly in economic policies, has provided possibilities for alternative institutions in water resources management. The accumulation of knowledge through research and survey provided better information for decision makers to reflect on the salient lessons

## Kunming Municipality

of the last generation and to seek better solutions in water resources management through a slightly wider choice of institutions. Among many, the *Ordinance for Lake Dianchi Protection*<sup>7/</sup> and the *Outline of Comprehensive Plan for the Renovation of Lake Dianchi*<sup>8/</sup> best reflect the present approach to the water resources context. Since the present article is limited to considering a few cases involving transactions -- namely, the resettlement compensation, afforestation barter, and irrigation barter -- to demonstrate some of the institutional mechanisms in a hierarchic socialist regime, only the relevant contents of the ordinance and outline are introduced and discussed below.

The *Ordinance for Lake Dianchi Protection* was approved in March 1988 and has been in effect since July 1988. It is a result of the joint effort of managers, lawyers, and scholars from the municipal government and different sectors. Most remarkably, it is a policy approach characterized by a basinwide management strategy, with a legal base. It properly covers the problem issues of Lake Dianchi conservation in terms of comprehensiveness and integration of the ecosystem.

The formulation of the outline is the most important step in the implementation of the ordinance. The outline was enacted as a governmental decree<sup>9/</sup> which requires all related government sectors to formulate relevant plans according to the objectives set by the outline.

Zhang Zheng, the deputy commissioner of the Standing Commission of Kunming People's Congress, provided a guide to the ordinance in his paper.<sup>10/</sup> He noted five key points of the ordinance: (a) it identifies the function of the lake; (b) it determines the operating water level; (c) it specifies a strategy for protection and development; (d) it ensures the protection and use of aquatic organisms; and (e) it identifies the area to be protected. He further elaborated on how the ordinance may lead to a solution to water shortage problems. In short: The operating water level of Lake Dianchi is to be raised to solve the water shortage problem. Originally, the water levels were determined at an upper limit of 1,887.2 m elevation and a lower limit of 1,885.5 m. In the ordinance, operating water levels are set for different situations: The upper limit which was set at the maximum level reached during flooding which occurs, on average, once every twenty years, i.e., 1,887.5 m; the flood control level, 1,887.1 m; and the lowest limit in major drought years, 1,885.2 m. The new setting of operating water levels from the upper limit to the lowest limit provides a total buffer capacity of 570 million m<sup>3</sup>, 61 million m<sup>3</sup> more than at present. The average water supply is then increased from 202 million m<sup>3</sup> to 302 million m<sup>3</sup>, a net gain of 100 million m<sup>3</sup>. In extreme droughts, an additional 90 million m<sup>3</sup> may be supplied when the lowest limit is in effect.

The new operating water level required bank revetting to protect adjacent farmland from flooding. This construction was finished at the end of 1989 (see figure 1). Another follow-up engineering project is the reconstruction of Tanlangchuan River banks in order to increase the flow capacity. This is currently at the planning stage.

In order to implement these provisions, besides the above-mentioned engineering works, two other projects proclaimed in the outline are being carried out which are closely related to resettlement compensation and irrigation barter. One is the Songhuaba Reservoir Dam Reconstruction Proj-

## Kunming Municipality

ect which will ensure an increase in water storage capacity of 30 million  $m^3$ . Another project is a pumping system which will draw water from Lake Dianchi up to the farmland that used to be irrigated by the reservoir through the Panlongjiang River. This project is aimed at saving clean reservoir water for urban use, while pumping eutrophic water from the lake for irrigation. This is a barter involving water of different quality, each more suited to the new use.

As shown in table 2, the total water demand is adequately covered by the supply at present consumption levels for average years with a frequency of P=50 per cent. In three years out of four (P=75 per cent), the water budget is still in balance. In extreme drought years with P=95 per cent, the water supply will be 127 million  $m^3$  short, or 26 per cent of demand. The same table predicts the situation for the year 2000 according to the economic and population growth rate. Water supply will be 128 million  $m^3$  short in average years and 179 million  $m^3$  short in drought years of P=75 per cent. As noted above, the ongoing water resources projects will provide 100 million  $m^3$  in addition to the present supply for normal years, while, when special drought occurs, another 90 million  $m^3$  can be supplied. Songhuaba Reservoir will increase its supply by 30 million  $m^3$  a year and the pumping works will save another 15 million  $m^3$  of reservoir water for urban use (by pumping the same amount of water from the lake to irrigate 3,300 ha of farmland). This estimate shows that the water resources may be sufficient to meet demand at present consumption levels and for the predicted future (the year 2000) when the waterworks are accomplished. The entire programme also indicates that water resources will be exploited fully. There will be no more room for further resource development or to counter a twenty-year drought.

### Demand-Side Management -- A Supplementary Instrument

A quota system is mentioned in the ordinance. But it does not specify when it will be imposed or how to allocate quotas to users. The ordinance also calls for a reform of the water pricing system and the adoption of more efficient water use by increasing the water recycling rate and employing water-saving technologies. The same document also intends to impose a water resources tax on water-related industries such as tourism, fishing, and navigation. A metered water fee system has been imposed for domestic and industrial users. To a far lesser extent, volume-based water fees are imposed on agricultural users by measuring the electricity consumption of their pumping systems. For gravity irrigators, a flat rate is applied.

As mentioned above, these projects will fully exploit Kunming's water resources. This, together with the severe pollution problems and the increasing demand both in quality and quantity, means the metropolitan water systems of Kunming Municipality are moving from an "expansion phase" to a "mature phase."<sup>11/</sup> The current approach, however, still favours expansion, although demand management is utilized. Centralized bureaucratic-authoritative (administrative) implementation has precedence over market-exchange measures. Questions are raised: How much water can demand management provide; why does decentralization not proceed smoothly; what are the obstacles and are there any solutions?

The first question is easy to answer. Demand management provides two opportunities: The first is in water use. The average water consumption



## Kunming Municipality

level in Kunming is 113 m<sup>3</sup> per 1,000 yuan output value -- double the national average, 2.5 times the Beijing level, 3.3 times that of Tianjin, 3.1 times that of Suzhou, and double that of Nanjing. Since only 5 per cent of the total consumption is for domestic use in the countryside and 17.5 per cent in the urban area, about half of the water consumption could be saved, accounting for more than 200 million m<sup>3</sup> per year, more than all the engineering projects could provide. Considering that the engineering projects (including five wastewater treatment plants) require 1.2 billion yuan of capital investment, the application of water-saving technologies may be quite cost-effective. In addition, water pricing may not only give incentives to efficiency, but also provide revenue for conservation projects.

Another opportunity is in reallocation among water users: For example, 1 ha of wet rice land needs 15,000 m<sup>3</sup> of water a year, while for dry rice farming, this number is halved. If demand management allows tradeable water-use rights, the rice farmer will have the choice of trading both rice and water. Water may then be transferred to higher value uses.

### Administrative and/or Market Approaches -- Institutional Choices

Many authors have elaborated on the inefficiency of centralized administrative approaches to water resource management, especially in water allocation.<sup>12/</sup> Young<sup>13/</sup> described some of the characteristics of water that make it difficult to develop institutional arrangements for market management: The pervasive interdependency among users; high resource mobility; "public good" nature of rain; economies of scale in large water projects; the low economic but high social value of water used in agriculture; variability in supply and demand; and conflicting social values concerning water. Nickum<sup>14/</sup> added two more attributes -- the high cost of making transactions, particularly when a large number of water users are involved, and communications and information problems in water allocation for large systems.

In the Kunming case, however, other attributes are found which may be indicative of the nature of centrally planned economies.

The institutional choice is sometimes shifted from its original economic purpose to political instruments as ammunition to attack the opposition. This obstacle was clearly demonstrated in the "Great Leap Forward" movement in China in the late 1950s. Most reforms from the centralized hierarchic system into a market economy confront this problem.

Another difficulty for the market approach comes from the high transaction cost of creating a market. Under a nonmarket governance structure, governmental subsidies are commonly applied. Subsidies are capitalized into values of products and properties. "Market value" does not reflect the actual production cost. The market system is balanced by adding more subsidies and price controls. After years of cumulation, it is integrated into an artificially distorted economic system, characterized by exclusiveness and weakness in self-regulation. Under reform, any decentralization and changes in pricing system will cause economic turbulence such as inflation, speculation, and profiteering. An attempt has been made to reduce the impact on China's reform by releasing control on end products. Little has been tried with resources, especially scarce resources, to avoid possible turmoil. Weakness of self-regulation causes the imperceptibility of

## Kunming Municipality

impact from releasing control. "Bounded rationality" is hence unavoidable. In other words, the transaction cost is high due to the high demand on "cognitive competence"<sup>15/</sup> and information. It is, however, impossible to simulate an objectively controlled market system, since the necessary information is usually unavailable. Water pricing, for example, is a long-standing problem in Kunming (as well as in the rest of China). Except for the water supply company, nearly all sector leaders oppose the idea of raising the water price to cover a larger portion of the operation costs for purification plants. This is not a problem of willingness to pay, but the result of a complicated situation.

The existing economic system may be best understood by the example of water use for rice farming. Ideally, irrigated rice farmers in the area surrounding Kunming Municipality may turn to other crops such as vegetables which are more profitable and could save valuable clean reservoir water for urban use. The grain market, however, is under strict control. Trade between provinces requires the permission of higher authorities. This situation may be traced back to the self-reliance policy before the late 1970s. The water allocation principle was then set in the order of domestic -- agricultural -- industrial uses. The high transaction cost associated with the inadequacy of external market trading prohibits the water transfer from low-value to high-value uses. Instead, the government invested in a large pumping system to convey irrigation water from Lake Dianchi in order to save the reservoir water for urban use. The barter proceeded smoothly since the lake water is more suitable and less expensive. The warmer and eutrophic lake water is better than reservoir water for irrigation. This example demonstrates that the high transaction costs of grain trading necessitated a capital investment for a large pumping system and led to a water exchange with lower transaction costs. The low transaction costs are not only due to the suitability of lake water but also to the government-owned pumping systems. In this transaction, the hierarchy played a positive role in lowering transaction costs by reducing the numbers of transactors, providing credibility, and funding the project.

The obstruction of applying a decentralized market approach also stems from *ex post* dispute resolution mechanisms. In the Kunming case, the litigation system is imperfect. Resorting to the courts to settle disputes is mostly undesirable and traditionally avoided.

The nonmarket failure in water resource management has forced the governments at different levels to solicit market discipline to economize on water use. The complexity of the existing economic system in socialist countries adds difficulties to the solution of conflicts over demand and supply, as well as uses and users. Attempts have been made by reformers through careful and progressive steps. This may explain why the water-use tax, the quota system, and water repricing have not been implemented although they are stipulated in the ordinance. Economic incentives, *quasi-market* approaches, together with enhanced information analysis for realignment, have been applied allowing a more effective management. Two examples are discussed below.

## TWO CASES OF TRANSACTIONS -- A MIXED ADMINISTRATIVE-MARKET APPROACH

Although privatization of water resources is prohibited by the constitution and tradeable property rights such as water-use rights do not seem to be likely in the near future, some cautious measures of decentralization have been adopted to improve the effectiveness of the hierarchical system. Two cases of transaction are described below to demonstrate the mixed approach of both traditional administrative measures and market incentives.

### A Mixed Governance Structure in Reforestation Management

#### Decentralization in reforestation management

Part of the water resource management efforts include the rehabilitation of water catchment ecosystems. The forest coverage in Lake Dianchi Basin has decreased dramatically, as noted above. The total forested area is 34,000 ha (17,000 ha is forest and 9,300 ha shrub, and 10,000 ha is barren mountains feasible for afforestation).

Although afforestation has been a nationwide campaign involving nearly every individual, deforestation has been continuing. In Lake Dianchi Basin, more than 13,000 ha are afforested annually, with a survival rate of more than 80 per cent during the past ten years. Afforestation is carried out by nearly every sector of the government, especially by the forestry, hydrological, and environmental agencies. Deforestation is, however, a complex socioeconomic issue.

The rapid population growth in the rural areas results in unemployment and poverty. Per capita annual incomes of less than 300 yuan in some districts are common. Primitive farming, such as through the slash-and-burn technique, still exists. A bonus is offered for using coal instead of firewood, although firewood is a free resource and labour costs little. Nonextinguished open fires are still a traditional way of living. Roasted tobacco is the most important economic crop for the livelihood of the local people. One kg of roasted tobacco consumes 3-5 kg of firewood. The annual productivity of wood in the entire basin area is 400,000 m<sup>3</sup>, while the consumption is 1.2 million m<sup>3</sup>, of which 55 to 60 per cent is used for firewood. The upper stream forestry area has a total population of 70,000. The average consumption is 1 m<sup>3</sup>/annum/person, while the productivity of wood in the same area is less than 50,000 m<sup>3</sup>.

Forest management is difficult because of the remoteness and the expansive area. A decentralized market approach has been applied in some places according to the *Forest Law*. In the case of Lake Dianchi Basin, especially in the mountainous area, this approach has not shown a positive effect. The collective (community) forest lands have been allocated to households by long-term contract. This policy, however, has not motivated afforestation nor prevented illegal logging. Part of the reason may be fear of policy instability. Another reason may be the economic risks involved. Forestry is a long-term investment. Disasters, insect plagues, and forest fires threaten the producers' capital investments as well as threatening the results of ten to twenty years labour. Individual households have limited financial capability against such risks. One example illus-

## Kunming Municipality

brates the feelings of the contractors: A young farmer contracted a piece of mountain land, obtained a soft loan of some 20,000 yuan, and planted trees. The trees died due to early frost. He was then unable to repay the loan. Many farmers in the Lake Dianchi Basin area prefer resorting to collective operations, and some have already done so. Another problem is the difficulty of administration. A household has limited manpower to protect its woods from unlawful logging. In the present situation, illegal logging may be more effectively stopped by collective operations. Experience from one village reveals the sociocultural mechanisms: The village had very few cases of unlawful logging before the allocation of forest lands to households. The village custom stipulated that the illegal logger had to plead his guilt and beg forgiveness by inviting all villagers for dinner. It is customs of this kind, found in many villages, that have a strong binding force on the villagers, not the *Forest Law*. People establish their identity through their own culture rather than under authority. The law can only be effective when it is merged with the traditional culture, but this takes time, unless coercive measures or mandatory sanctions are applied. This is difficult in remote locations, however. A better solution is collective forest farms with some capital and technical support from the government.

Economic incentive is still a powerful method for afforestation. Generally, the government has paid 30 yuan for one mu (1/15 ha) of tree planting. This amount, however, has not increased over time, so although it was very effective in 1980, it was of no interest to farmers by 1987. The Municipal Environmental Planning Agency (EPA) initiated a programme of reforestation on the farmland in Songhuaba Basin. Planters could receive 12.5 kg of rice per year over ten years for one mu of reforested farmland. About 2,700 ha of poor quality farmland has been reforested since 1985. Trees have grown to more than 1 m in height and are in good condition. Farmers in this area are competing for new contracts.

### Some coherent mechanisms

The institutional improvement for the implementation of reforestation programmes is a step towards market measures and privatization in order to have the advantage of greater incentives and accountability. It is clear that the administrative approach using stringent controls does not work effectively because the transaction costs in terms of inspections and monitoring, are very high. However, privatization does not always ensure effective management because of enforcement costs, as in the case of forest rights in remote areas. Alternatively, collective ownership reduces the operational costs of forest management and provides more credibility, and is therefore more feasible.

The latter case is a barter with land-use rights and labour for forest rights and credible goods (rice). The 12.5 kg of rice actually is not worth 30 yuan which is generally paid by the government for 1 mu of tree planting. But rice is more viable especially under a long-term contract. The contractor can live on the rice and have supplementary interests from the forest farming.

Comparing the two cases, one may realize that credibility is a very important factor of transaction costs. Transaction costs may be reduced by measures such as collective ownership and suitable payment (rice). The

## Kunming Municipality

limits of bounded rationality are then avoided by releasing the farmer from fear of risk and devaluation.

### Resettlement Compensation in Songhuaba Reservoir Dam Reconstruction Project -- A Nonmarket Approach

In order to have an additional 300 million m<sup>3</sup> of water supply for urban use, the dam at Songhuaba Reservoir has been under reconstruction since 1988. The project will be completed by the end of 1992. The inundated area includes 2,700 mu of farmland, houses, trees, and public facilities such as roads, bridges, and waterworks. More than 1,000 people are to be resettled nearby. The compensation, estimated to be more than half of the construction costs, is to make up for the losses of public and private properties in the surrounding villages. Estimates of losses are based on a detailed inventory made by a joint mission composed of representatives of governmental agencies, officials of municipalities, counties and districts, and representatives of resettlers. The compensation measures are to be implemented in terms of constructing new roads, bridges, and houses; opening up new land, and establishing new fruit ranches and forest farms. Resettlers can be hired for these projects and paid by the compensation budget. Cash payment is also a way of compensation but is limited to some special cases. Disagreement between the government and the resettlers is mostly over detailed arrangements such as subsidies to old people and the estimates of inundated building areas. In general, compensation covers the property losses adequately. (A detailed inventory is deemed unnecessary.) Two points are of major interest: The concept of compensation and the method of implementation.

*Ex post* resettlement disputes have long been a social problem in China. The above-mentioned construction of 86,000 reservoirs resulted in the resettlement of more than 10 million people. From these, about two-thirds are satisfactorily resettled, but the other one-third are confronted with various problems. Appealing to higher authorities for help (it may take years to solve the problem), petition, and unlawful actions are common expressions of their losses. Resettlement failure is chiefly to be blamed on the Maoist social value system which promoted sacrificing personal interests for a vague "communism."

In the case of the Songhuaba project, "sacrifice" is replaced by "compensation," which is specified "to cover all losses of the state, collectively and privately owned properties in order to ensure that income of the resettlers is no less than that of a normal year's harvest." Under this principle, in the best case when the estimate of property losses is adequate, the resettlers will be fully compensated. In the case of underestimation, which often happens, the compensation is inadequate. Considering transactions as a form of trading, both sides, the water users and the upstream farmers, should benefit. The development of upstream water supplies should, in return, advance the economy of the upper reaches. The principle of equality and mutual benefit is difficult to apply under a nonmarket governance structure.

Under a nonmarket structure, the transaction costs associated with bounded rationality in resettlement compensation is high. An attempt was made by the Mid-South Hydraulic Design Institute. A draft specification for reservoir project planning and design was carried out in January 1990.

## Kunming Municipality

The specification takes resettlement as a part of the project; a system plan for the development of the resettlement area should be carried out together with the dam construction planning. The planning involves goal-setting for development, investigation programme, impact assessment, environmental carrying capacity of the new settlement area, investment planning, and socioeconomic planning. Large amounts of data and models are required. This is a top-down planning approach. No report on the application of this specification has been published.

Successful cases of a mixed administrative-market approach are reported,<sup>16/</sup> such as the Xinan Jiang Reservoir Project. The essence of the approach is: Rules of the game (principles) -- development (instead of compensation) measures -- banking and market. Resettlement was taken as a development project. Various economic activities such as privately- or collectively-owned handicrafts manufacture, tourism, fruit orchards, milk production, and vegetable farms, were promoted by favourable tax policies (three to five years tax free or low tax). At the same time, banking systems were built up using part of the compensation budget for financial capital. Financial assistance in the form of loan contracts, loan capital, or soft loans was provided. Technical assistance training was organized by local governments. A similar approach was implemented in Dan Jiang Reservoir and Panjiakou Reservoir projects. The average income of resettlers in Panjiakou Reservoir increased by five times between 1984 and 1988. On the governmental side, about 70 per cent of the capital investment for compensation is reimbursed. Effectiveness and efficiency of market ordering largely reduced the transaction cost.

### CONCLUDING REMARKS

After forty years of socioeconomic development, Kunming's available water resources have been exploited to the limit. The development strategy changed from pure productivity-seeking to sustainability with strong consideration of resources conservation. A good strategy, however, does not ensure success unless the institutional setting for implementation is effective. Transaction cost economics is a useful tool to gain insight into the mechanism of the economic system.

Institutional analysis of water-use conflicts by means of transaction cost economics revealed that the water economy in Kunming has grown from an expansion phase into a mature phase. Under a centralized hierarchic system, water use is not always effective and economically efficient. Irrigation water for rice, for example, could have been minimized if a free grain market were open to all. The situation is quite the contrary in Kunming due to the high transaction costs of grain trading. Alternatively, a barter with lake water for reservoir water is made. The exchange was facilitated by a government-financed pumping system.

The decentralization process faces many difficulties. Attributes of these are largely due to the characteristics of water as concluded by Young<sup>17/</sup> and Nickum.<sup>18/</sup> Other attributes are added in the case of Kunming which may also be relevant to other similar situations: Political factors, an objectively distorted pricing system, an inadequate external market system, and imperfect litigation system.

## Kunming Municipality

Cautious *quasi*-market measures have been adopted in China to improve efficiency. The example of the afforestation programme demonstrates the power of economic incentives made possible by barter with credible products -- rice, forest rights for land-use rights, and afforestation labour. Another example shows the limitation of privatization in forest conservation.

The last case analysis illustrates the effectiveness of the mixed governance structure of administration and market economy in comparison with the nonmarket approach.

This study does not intend to conclude anything, but rather intends to, "throw out a minnow to catch a whale," or in Chinese terms: To cast a brick to attract jade.

### NOTES

- 1/ Yang Shuquan *et al.*, eds., "Conditions in Kunming Municipality" (*Kunming Shi Qing*) (internal publication) (Kunming: Economic Research Centre, Kunming Municipal Government and Economic Research Institute of Kunming, 1987).
- 2/ Zhang Jingfang *et al.*, "The Comprehensive Ecological Consequence of Irrational Development and Utilization of Natural Resources in Dianchi Basin" in Shi Qing and Shan Peirao, eds., *The Ecological Problems and Consequences of the Four Lakes in Yunnan Plateau* (Publication; no. 13466.7) (Kunming: Yunnan Science and Technology Press, 1987), p. 21.
- 3/ Xiong Yue, "Preliminary Exploration of Main Functions of Dianchi Lake" (Paper presented at the Symposium on Environmentally Sound Management of Lakes, Kunming, September 1990), p. 5.
- 4/ Kunming Environmental Protection Agency (EPA), "Summary Report of the Multi-disciplinary Survey and Study on Songhuaba Water Resource Conservation Area in Kunming Municipality" (*Kunming shi Songhuaba Shuitiyuan Baohuqu Duo Xueke Zonghe Kaocha Yu Yanjiu Zongbaogao*) (internal publication) (Kunming: EPA, 1989).
- 5/ Li Zuohong, "Development and Utilization of Dianchi Lake Water Resources" (Paper submitted to Symposium on Environmentally Sound Management of Lakes, Kunming, September 1990), p. 3.
- 6/ Survey Study Group, "Report on the Comprehensive Survey on the Eco-Environment and Economy in Lake Dianchi Area" (*Dianchi Diqiu Shengtai; Huanjing Yu Jingji Zonghe Kaocha Baogao*) (Kunming: Yunnan Science and Technology Press, 1988).
- 7/ "Ordinance for Lake Dianchi Protection," *Kunming Environment* (Special issue on the Ordinance for Lake Dianchi Protection) (1988):4-12.

## Kunming Municipality

- 8/ Circular on the "Outline of Comprehensive Plan for the Renovation of Lake Dianchi" (*Yin Fa "Dianchi Zonghe Zhengzhi Dagang" di Tongzhi*) (Document of Kunming Municipal Government, *Kun Zheng Fa* (No. 16) (1989)).
- 9/ *Ibid.*
- 10/ Zhang Zheng, "Directive on the Ordinance for Lake Dianchi Protection," *Kunming Environment* (Special issue on the Ordinance for Lake Dianchi Protection) (1988):13-17.
- 11/ Alan Randall, "Property Entitlements and Pricing Policies for a Maturing Water Economy," *Australian Journal of Agricultural Economics* 25 (3:1981):196.
- 12/ James E. Nickum and K. William Easter, "Water-Use Conflicts in Asian-Pacific Metropolises: Institutional Concepts" (Paper presented at the East-West Center-UNCRD Joint Workshop on Water-Use Conflicts in Asian Metropolises, Otsu, Japan, 1-4 September 1989). See also Lester Ross, *Environmental Policy in China* (Bloomington: Indiana University Press, 1988), and Charles Wolf, Jr., "A Theory of Non-Market Failure: Framework for Implementation Analysis," *Journal of Law and Economics* 22 (1979):107-39.
- 13/ Robert A. Young, "Market Versus Non-Market Management of Irrigation Water: A Review of the Issues" (Paper presented at the Conference on Water and Water Policy in World Food Supplies, Texas A&M University, 1985), p. 25.
- 14/ Nickum and Easter, "Water-Use Conflicts in Asian-Pacific Metropolises."
- 15/ Herbert Simon, *Administrative Behavior* (2nd ed.) (New York: Macmillan, 1961).
- 16/ Niu Maoshen, "Concluding Speech" (Delivered at the Conference on Exchange of Experiences on Resettlement and Assistance to the Poor, May 1989).
- 17/ Young, "Market Versus Non-Market Management of Irrigation Water."
- 18/ Nickum and Easter, "Water-Use Conflicts in Asian-Pacific Metropolises."



## ***Comments on Methodology***



## COMMENT

Regina Gregory

---

### THE APPLICABILITY OF TRANSACTION COST ECONOMICS TO WATER RESOURCES ISSUES

Not all of Oliver Williamson's tools for analysing transaction costs were applied in the case studies; in particular, the implications of "bounded rationality" and "opportunism" were neglected. But this does not mean -- as Toshihiro Oka concludes -- that these tools are unsuitable for analysing water-use conflicts. The following are a few suggestions on how Williamson's two behavioural assumptions and three dimensions of transactions could be useful.

Bounded rationality could be used to analyse any situation where information is lacking, for example, as in the following cases:

- Where upstream water users are unaware of their effect on downstream users;
- Where technical information for problem solving is lacking;
- Where farmers with surplus water are unaware of water scarcities elsewhere; and
- Where overcentralization taxes the abilities of a government agency to deliver water of desired quantities and quality to end users.

Opportunism could be used to analyse the self-interest behaviour of any entity, including government agencies. Examples arising in water-use conflicts include:

- A government employee's or rival government agency's self-interests, which lead to goals other than that of maximizing the public welfare;
- Private companies exploiting gaps in pollution laws and/or the monitoring capability of enforcement agencies;
- Other overexploitation of public goods; and

## Comment

- Persons selling water rights without considering the effects on downstream users.

Asset specificity can be applied anywhere there is a lack of perfect competition and/or perfect mobility of resources, for instance, in most water-related infrastructure (dams, irrigation channels, water supply pipes, and sewerage lines); where there are physical obstacles to transfers among different water uses; and where there is a choice of institutional arrangements for water supply.

Frequency implies efforts to minimize the number of transactions needed, and might be fruitfully applied when there is a tendency towards bilateral relationships, even when this involves an extra "middle man" layer and additional financial costs; and when the need for affected citizens exists to form a single organization in order to demand resolution of conflicts.

Uncertainty is a characteristic of water availability, quality, and demand.

While Williamson's analytical tools are useful, they cannot be thought of as replacing the need for Coasian analysis in water-use conflicts as well. Many such conflicts in the USA and Asia persist, for example, because of the high costs of negotiating, metering and monitoring, enforcing laws, and obtaining external assistance.

Even taken together, Coasian and Williamsonian transaction cost economics (TCE) do not cover all institutional aspects of water-use conflicts. Nevertheless, they are useful analytical tools for pinpointing certain types of problems, and they provide useful clues for appropriate approaches to conflict resolution.

## COMMENT

Lawrence J. MacDonnell

---

The general concept of transaction cost analysis seems potentially useful in considering responses to change. I saw it as a potential methodology to apply to the factors that are most likely to affect decision making where circumstances have changed. At the National Center for Atmospheric Research, we are working on a methodology for analysing institutional change; we are interested in the idea of adaptation to global climate change. We have been developing our ideas in connection with the adaptation that appears to be taking place in the metropolitan Denver area with regard to the veto of the Two-Forks project. A kind of systems analysis is being considered, in which the transaction points could be identified and the friction or lack of friction could be roughly analysed. From such an analysis, a blueprint of the direction of movements of different choices could be drawn that would point to some of the likely choices. If there should be a preferred outcome in terms of policy implications, then policymakers might look at ways to reduce transaction costs to encourage movement in that direction.

## COMMENT

Toshihiro Oka

---

### IS TRANSACTION COST ANALYSIS APPLICABLE TO WATER-USE CONFLICTS?

One of the main themes of the second workshop on water-use conflicts in Asian-Pacific metropolises was whether or not a transaction cost approach would be useful in analysing water-use conflicts. To address this question, transaction cost economics (TCE) was applied to water-use conflicts in Asian metropolises selected as case studies.

Two kinds of TCE may be usefully distinguished here. One is that of R. H. Coase, which I will call "primitive" TCE; the other is that of O. E. Williamson, a more "advanced" TCE.

In 1937, Coase presented the idea that a firm would emerge when the cost of transactions within the firm was smaller than the cost of transactions between individual economic agents in a market.<sup>1/</sup> That was the beginning of TCE. In 1960, he presented the idea that externalities might exist because of the high transaction costs of removing them through negotiation between the generators and those affected.<sup>2/</sup> This implied a way in which the concept of transaction costs could be applied to the problem of externalities.

A Coasian transaction cost approach can be applied to any institutional problem. This approach usually only makes the proposition that the present institutions have emerged and currently exist because the transaction costs for sustaining them are relatively small. Whether they are in fact small is not usually questioned because it is difficult to prove that the existing institution incurs lower transaction costs than its alternatives.

Williamson extends this analysis to identify the factors which might affect the transaction costs of different types of institutions.<sup>3/</sup> He has thereby succeeded in presenting some general propositions regarding the choice of institutions.

Williamson analysed the relative competitiveness of institutions from the perspective of transaction cost savings, by combining two hypotheses on human behaviour -- "bounded rationality" and "opportunism" -- and three dimensions of transactions -- "asset specificity," "frequency," and "uncer-

## Comment

tainty." But he was able to refine TCE only at the cost of limiting the objects of analysis to the choices of industrial organization between the market, the firm's internal organization, and a combination of the two.

The case studies presented at the workshop analysed water-use conflicts, using the "primitive" Coasian transaction cost approach. In all cases it was proposed that the present institutions governing water transactions had been chosen and continued to exist because their transaction costs are relatively low. In only a few cases were some reasons proposed for the lower transaction costs.

The application of "advanced" Williamsonian concepts -- i.e., the two behavioural hypotheses and the three dimensions of transaction, as suggested by Nickum and Easter -- was attempted in each case study. But in all cases the concepts were only referred to, applied in an irrelevant way, or misapplied.

My analysis of the Osaka metropolitan water supply<sup>4/</sup> is no exception. I attempted to examine the extent to which TCE would explain the absence of the transfer of water rights in the lower reaches of the Yodo River. Such an explanation is only that of "primitive" TCE. I referred to opportunism, asset specificity, and uncertainty, and examined whether or not they were identifiable in the transactions of water, but I did not use them in any analytically meaningful way.

Shin<sup>5/</sup> distinguished four stages of water supply in the Seoul Metropolitan Region, and tried to apply the transaction cost approach to each stage.

The first stage is the transaction between the Ministry of Construction -- the constructor of multipurpose dams -- and the parties who established (*ex ante*) multipurpose dam-use rights. The latter include the Korea Water Resource Corporation (KOWACO) and the government itself. The KOWACO was the dam-use rights holder of water for domestic and industrial uses and for electric power generation.

The second stage is the transaction between the dam-use rights holders and actual beneficiaries. The beneficiaries of flood control, irrigation, and electric power generation were respectively: Downstream residents, farmers, and the Korea Electric Power Company (KEPCO). Water for domestic and industrial purposes is sold to areawide waterworks, which are, in fact part of KOWACO.

In the third stage, water owned by areawide waterworks is sold to local governments.

The fourth stage is the transaction between the local governments in charge of production of municipal water and the final domestic and industrial consumers.

Shin stated that the transaction of the first stage needed "credible commitment" because it had asset specificity, and that the *ex ante* cost-sharing contract secured this credible commitment. Certainly the transaction of the first stage has asset specificity, but the frequency of the transaction is very low -- only once. According to Williamson, a transaction of low frequency does not need a credible commitment. Thus, this

## Comment

application of Williamsonian concepts was inappropriate.

The transactions of the second stage are high in frequency, but they are one-to-many, not one-to-one, transactions, which means the absence of asset specificity. So this stage does not require credible commitments either.

As for the third stage, Shin stated that the areawide waterworks were created to reduce transaction costs by establishing a dependable bilateral market. This is similar to the case of Osaka.

As for the final stage, he stated that the development of an illegal bottled water market reflected the transaction cost minimizing behaviour of the people for securing safe drinking water.

The statements for the third and the final stages are propositions of "primitive" TCE.

Srivardhana<sup>6/</sup> stated in his case study that what hindered a smooth transition from groundwater to urban water supply systems were the high transaction costs associated with the transition. The high transaction costs consisted, according to him, of the high cost of making the new system, contracting with users, collecting charges, and strictly enforcing the *Groundwater Act* which was intended to regulate the withdrawal of groundwater in the Bangkok Metropolitan Region. This proposition comes solely from "primitive" TCE.

He also referred to a credible commitment -- one of the Williamsonian concepts. In his case, it was the credible commitment of users to suppliers of water. This application of the concept is inappropriate because the transaction is of the one-to-many type.

Zhang<sup>7/</sup> referred to transaction costs in stating that both market costs and the costs of administrative control are high. Again, this is an application of Coasian TCE.

Thus, in the case studies presented at the workshop, the Williamsonian analytical tools were not really applied. I would suggest that this shows that Williamson's analytical tools are only suitable for the special institutional problem identified by him, i.e., the choice of industrial organization. Institutional problems specific to water-use conflicts are different.

Therefore, it may be necessary to abandon attempts to apply Williamsonian concepts and develop analytical tools suitable to the special institutional problems of water-use conflicts. Otherwise, all we will do is make inappropriate propositions resulting from attempting an impossible application, or come up with "primitive" and almost tautological propositions which cannot be called analysis.



## Comment

### NOTES

- 1/ R. H. Coase, "The Nature of the Firm," *Economica* 4 (1937).
- 2/ R. H. Coase, "The Problem of Social Cost," *Journal of Law and Economics* 3 (1960):1-44.
- 3/ Oliver E. Williamson, *Markets and Hierarchies: Analysis and Antitrust Implications* (New York: Free Press, 1975); and *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting* (New York: Free Press, 1985).
- 4/ Toshihiro Oka, "Applying the Transaction Cost Economics Approach to Water-Use Conflicts in the Osaka Metropolitan Region" in this issue of *RDD*.
- 5/ Euisoon Shin, "Application of Transaction Cost Economics to the Analysis of Water Use Conflicts in Seoul Metropolitan Region" in this issue of *RDD*.
- 6/ Ruangdej Srivardhana, "An Application of Transaction Cost Economics Approach to a Study of Industrial Water Demand of Samut Prakarn Province, Thailand" in this issue of *RDD*.
- 7/ Jichang Zhang, "The Progress of Institutional Approach for Water Resources Management in Kunming City: A Case Study by Transaction Cost Analysis" in this issue of *RDD*.

## Responses to Oka's Comment

### Euisoon Shin and James E. Nickum

---

#### Response from Euisoon Shin

First, a couple of comments on Toshihiro Oka's interpretation of my case study on Seoul:

- (1) During the first stage, there is indeed a low frequency of transactions, but this is due to the effect of the cost-sharing contract on lowering transaction costs. Without cost-sharing, the government and the dam users would have to be in frequent, almost constant contact. The contract reduces the frequency of required transactions.
- (2) During the second stage, the transactions are not one-to-many arrangements, as stated by Oka. The usage of water is predetermined according to *ex ante* cost-sharing. Hence, the water used for one purpose cannot be transferred to another use *ex post*.

What we have been trying to determine for the past two years is whether the transaction cost approach can be applied to analyse the choice of institutions allocating water resources. The Williamsonian approach, which is part of the "New Institutional Economics" does not have to be the only approach to follow. It is necessary to understand that methods for applying this framework to natural resources and environmental services are still being developed. Our task at this point is to test their applicability step-by-step. Eventually, it might indeed prove wiser to go back to the basics of Coasian analysis, but at this stage constructive suggestions would be more advisable than premature calls to abandon this endeavour.

#### Response from James E. Nickum

It is useful to do continuous "reality checking" when you are trying something new. Oka reminds us of the Coasian roots of our endeavour and asks whether Oliver Williamson's more "advanced" (i.e., highly articulated and perhaps more faddist) theory contributes anything new to the analysis of water-use conflicts. This is a good question. Put another way, Ronald H. Coase advanced the concept of transaction costs in 1937 to explain industrial organization, and twenty-three years later applied it to environmental issues. Williamson also developed his theory within the context of business organization. Can that theory be expanded to analyse environ-

## Responses to Oka's Comment

mental and resource use problems as well, or is it too specialized to apply to other fields?

Oka states that our attempts to apply Williamsonian concepts have been reduced to a Coasian approach. In addition, he says that all transaction cost economics (TCE), "primitive" as well as "advanced," is "almost tautological" and cannot be used in an "analytically meaningful way." Why is this? For one thing, it is Panglossian: It posits that what is, is good, in the sense that present institutions are presumed to minimize transaction costs. Yet this is difficult to prove.

Economists have long been subjected to the criticism that their analytical approach assumes away the problem and has intrinsic problems of measurement and proof. For example, neoclassical economics assumes that equilibrium prices are obtained through profit and utility maximization. But how do we know if an observed price is in equilibrium? If we are in equilibrium, are we at a global (Pareto) optimum or a local one? Yet neoclassical economics has provided a rich basis for the analysis of real-world phenomena, which most assuredly are never in equilibrium, and which casual observation indicates are far from optimal. In particular, it gives us a basis for understanding the underlying processes which determine observable phenomena. If TCE can follow in the path of its neoclassical parent, it should prove to be of considerable value in practical policy analysis.

One way TCE could follow neoclassical economics is by providing a normative standard for assessing clearly observable deviations from that norm. For example, where do transaction costs persist at what seems to be a high level because free choice of institutional form by the potential transactors is not allowed? This is a problem that was raised directly in the Honolulu and Kunming cases, and to some extent in the Bangkok case as well.

Oka asserts that all our case studies hypothesize transaction cost minimization. In some instances, such as the establishment of area-wide systems in Osaka and Seoul, reduction in transaction costs was clearly a factor, but the Bangkok, Honolulu, and Kunming cases focus on the reasons for the persistence of high transaction costs. Others, such as Madras, Manila, and Osaka -- in keeping with the checklist -- concentrate on the identification of transactions (or nontransactions) and the properties of their governance structures. Analysis of transaction cost properties in those cases may be a little premature; we did not expect it to be too elaborate at this stage.

Oka notes that he did not use TCE concepts "in any analytically meaningful way" in his article on Osaka. There are a number of possible explanations for that, only one of which is defects in the theory. Others include flaws in the analytical approach, improper choice of topic, or the analyst's lack of incentive. Whereas Oka seemed eager to "disprove" Williamson, greater efforts to apply innovative thinking could have yielded more interesting hypotheses about the possible application of TCE to water issues in the lower Yodo River. For example, it is clear from the case study that the reason *suiri-ken* (water rights) have not been transferred in the Osaka region is because there have been no binding constraints to transactions. Since there are upper bounds, set on the basis of a one-in-ten-year drought, they are not binding 90 per cent of the time. As long as

## Responses to Oka's Comment

some enterprises, particularly in agriculture, underutilize their entitlements, others such as industry or households, can use more water.

When binding shortage occurs, *suiri-ken* are suspended in favour of *ad hoc* allocations. It would seem that opportunism, uncertainty, and asset specificity all come into play, yet the rules are determined in a political, albeit needs-based spot market. Is it because of infrequency that no abiding governance structure is set up? Or does an informal governance structure arise, based on the experience of previous droughts?

It should be noted that Williamson himself does not put much stress on frequency or uncertainty in his analysis, considering asset specificity by far the most important dimension of a transaction. K. William Easter and I also stressed asset specificity in our guidelines. Hence, Oka's reference to frequency as a necessary condition seems misplaced. Similarly, the insistence on strict bilateral (one-to-one) *ex post* conditions may be overly rigid. Many apparently one-to-many arrangements could be broken down into many one-to-one ones, as Shin indicates.

In my view, the case studies used a Williamsonian perspective more than Oka indicates. They did not necessarily use all of Williamson's concepts, or apply them in the same way he did, or as Easter and I outlined in our article. Even if many of us left the second year exercise and the workshop feeling that we had not fully mastered the applicability of TCE to water-use conflicts, that does not mean that the tools are useless. We may need to further refine the concepts and framework before we can apply them comfortably. It may be necessary to expand our horizons to include methodologies unfamiliar to us, for example, those used in anthropology. It may be that data needs are too great to work conclusively in some areas -- such as exploring the full effect of bounded rationality -- but sufficient to allow other types of analysis.

I agree with Shin that we should not be wedded to Williamsonian concepts in our pursuit of analytical approaches to solving institutional problems in water-use conflicts. But at the same time, we should not consider those problems to be so special or unique that they cannot be analysed by adapting frameworks developed in other domains.

## COMMENT

Euisoon Shin

---

### STEPS TO IMPROVE THE APPLICABILITY OF TRANSACTION COST ECONOMICS

#### (1) Clarify Goals

What is the objective of economic choice: Efficiency, equity, supply security, or welfare maximization? Do transaction costs hinder or assist the attainment of such objective?

#### (2) Apply the Discriminating Alignment Hypothesis

This hypothesis asserts that the governance structures (market, bilateral relations, state allocation, and internalization within a firm) are chosen in such a way that the sum of production costs and transaction costs is minimized. For the time being, we should apply this hypothesis to explain why a specific governance structure was chosen in a particular country or region.

#### (3) Develop Analytical Tools

Uncertainty, asset specificity, and frequency of transactions are analytical tools suggested by Oliver Williamson. His analysis of "non-standard contracts," such as *ex-ante* credible commitments, is mostly based on asset specificity. It is necessary to first clarify the definition and classification of transaction costs, further study the role of analytical tools, and develop ways to measure or compare aspects which affect transaction costs.

#### (4) Aim at a Unifying Theory of Policy Intervention

Up to this point, a diagnosis of institutions adopted in specific countries or regions has been made. The next question is whether the choice of institution is appropriate for obtaining social goals, rather than serving an individual agent's needs.

## Comment

To help decision makers evaluate the present system objectively, all conceivable factors which could affect transaction costs need to be specified, such as lack of information, incomplete contracts, rent-seeking activities, moral hazards, uncertainty, inappropriate legal systems, lack of policy, or government failure; additional factors should emerge from actual transaction-relevant cases.

If those factors which increase transaction costs are identified, policymakers could choose relevant governance structures as policy mechanisms through data building efforts by establishing new rules or laws for changing the incentive system and adopting user group mediation. That is, expertise is needed on legal, institutional, economic, and all related matters based on other countries' experiences.

### (5) Comparison with Neoclassical Economics

Neoclassical economics is based on the premise that the market is the most efficient governance structure in allocating scarce resources. Transaction cost economics (TCE) challenges this idea and contends that state intervention or a nonmarket solution could be justified in some cases, and the development of nonstandard contracts could also be explained on efficiency grounds. Terms used in neoclassical economics, such as government or market failure, are a manifestation of its inability to explain the development of nonstandard market forms or government intervention.

## ***Transcripts***





## Exchange of Views on US and Asian Experience (Morning, 28 November 1990) (Edited excerpts)

---

**Nickum:** This morning we will first discuss US views of Asian experience and then have Asian views of US experience.

**Cox:** The differences in conditions -- from Madras, a very dry area, to Manila and Bangkok, which have abundant water -- were impressive. As a result, the infrastructure and the political/institutional arrangements needed in each of these cities are different. Oya noted that environmental improvements could be accomplished through an informal approach, in contrast with such areas as the US, where a more legalistic approach tends to be taken.

**Easter:** To what extent do you think that scarcity -- rather than cultural differences -- has been a driving force?

**Cox:** Certainly scarcity has affected Madras more than areas such as Japan, where a more culturally-oriented voluntary organization has protected water quality by regulating usage. When looking at the process of development, however, there are cultural differences between countries. They developed at different times and evolved different institutional arrangements.

**Penn:** Two studies with similarities to the Hawaiian situation were those on the Philippines, in terms of the bureaucratic structure, and on Japan, concerning the legal aspects of water rights. The Chinese example was also interesting. One consistent point was the emphasis on water quality in so many of the Asian cases and, to some extent, in the Western US, particularly the Colorado River. Dealing with water quality problems seems to be an area from which much could be learned in Hawaii, where such problems are not yet perceived as pressing.

Another interesting observation is the great difference in the water supply systems, both in their network structures and in the kinds of facilities themselves. In Manila, there is a multipurpose project but different lines service different sectors, while in Bangkok, only the industrial water-use sector is separated, whereas in other areas it is combined and serviced by a more central network.

**Nickum:** Do you think that all of this provides some lessons?

## Exchange of Views

**Penn:** I hope so, but I am still not sure how the lessons will help us with the central questions of water allocation or reallocation.

**Moncur:** It is important to recognize that given sufficiently disparate values, transfers will be made in spite of any formal framework. This bypasses the basic question posed here regarding the cost of all these transaction costs. It might be said that the transfers are being made in spite of the formal background, but the question is how to improve it?

**Nickum:** If the values are wide enough, this would overwhelm transaction costs as well.

**Hufschmidt:** There is one big difference between some of these cases and Honolulu. That is, in the Bangkok, Madras, and Manila cases we have large, rapidly growing cities without the capability of managing a Western-style urban water supply system. Madras is an excellent example where water is available only every other day and enough money cannot be collected even to operate and properly maintain the system, let alone expand it; people are just not willing to pay for unreliable service. Consequently, there is an infrastructure investment problem, which is not peculiar to water supply; it also includes sewage collection and treatment, transport, housing, and other aspects of the urban environment. This is in contrast to the situation, for example, in Osaka, and possibly in Seoul. I think Seoul is now at the development stage where investments can be made to provide water in the way it is in Honolulu, where most of the urbanized areas are covered by a central system. This is a big difference which must be examined with respect to transaction costs and the water allocation problems. In Manila, a system has been developed to provide water storage in a reservoir to transport the water to the treatment plant that provides potable water, and to distribute it, but its potability is undermined by the inflow of polluted water into the system's lines. In addition, there are substantial water losses in the distribution system -- as much as 50 to 60 per cent in some cases -- due to leakage and theft. In such cases, the crucial urban water management problem is to improve the system so that its potability is maintained, and unaccounted for water is reduced. An irrigator threatened with loss of water rights might argue that he was making beneficial use of water which, if taken for urban use would be substantially wasted.

The second point is that for various institutional reasons, there is an allocation problem even in humid tropical areas. Although Jakarta is not one of our cases, it is not easy for that city to get the water it wants because it is currently being used to supplement irrigation. While this is a humid tropical area, water is used for irrigation in the dry season.

Fellizar took the approach of looking at the entire management system and identifying the transaction costs within the system. That way of looking at the system avoids the possibility of considering transaction costs in the abstract.

**Nickum:** It also demonstrates the difficulty of gathering such information.

## Exchange of Views

**Hufschmidt:** That is correct. But unless you have a thorough understanding of the physical system, it is not possible to talk about policy or the economics of water. The issues cannot be dealt with in the abstract; it is essential to understand in detail where the water comes from, and how it is processed and used.

**Nickum:** Fellizar is saying, and we tried to point out here, that it is necessary to know who is managing the system, not just how it is being operated.

**Moncur:** For instance, how could managers of entities like the Board of Water Supply be encouraged to be more concerned about demand management? In most cases, their background is in engineering. Their expertise is mostly specific to supply augmentation solutions. In general, they have relatively little knowledge of basic economic principles and very little faith in the force of those principles. Other than privatizing the system, it is difficult to think of incentive systems that are as constant and unrelenting as market-imposed discipline.

**Nickum:** In several of these cases, including Honolulu, it is a restrictive requirement that the water authority cover its costs, but not make a profit. If, as in Osaka, there is declining demand, ways must be found to generate demand or approval for water rate increases has to be obtained, in order to meet costs.

**Moncur:** Yes. That has to go through the political system, where numerous politically sensitive issues arise. For example, in Hawaii, the small farmers make a huge issue of any proposed increases.

**Nickum:** The transaction costs involved in raising rates are very high.

**Moncur:** Yes.

**Hufschmidt:** I am a strong advocate of demand management, but I think in terms of some of these cases, the actual per capita water use is quite low. On the other hand, demand management was emphasized in China in the Beijing-Tianjin area, and demand management is obviously important for Honolulu, and also perhaps for Osaka. I think that the answer to your question is not easy, but it requires long-term education and training of water supply managers from the beginning. For developing countries, demand management is part of the overall management problem, where you have leakage and unaccounted for water. Also, lavish use of water should be avoided in catering to tourism, as in the case of Bangkok. Through plumbing codes and other technical means, use rates could be brought down. So demand management should be utilized, even in developing countries.

**Easter:** I think this also has to start early. The fact that they do not have a demand management problem right now means that this is the time to start the education process.

**Hufschmidt:** Right. I think engineers and planners in developing countries can do a lot better than the developed countries have done.

**Easter:** Yes, they do not have the same historical constraints.

## Exchange of Views

**Hufschmidt:** The problem is that developing countries often do not get consultant advice on demand management, as many consultants are still supply-oriented.

**Easter:** Would you not agree that, as in the Beijing case and a few other cases, one of the key factors that makes demand management more popular is extreme scarcity?

**Hufschmidt:** Oh, yes.

**Easter:** Alternatives for getting more water are very expensive. When governments realize that they do not have sufficient funds for water projects, they tend to be more receptive to demand management concepts. That is the case in Beijing.

**Hufschmidt:** That is right. The Chinese State Science and Technology Commission was very unhappy with the engineers' proposals for trans-basin diversions from the Yangtze River -- which are tremendously costly -- so they decided that there must be a better way of dealing with this problem. That was the motivation for exploring demand management. It was not necessary to convince them of the need for demand management, they had already adopted it, and had identified the demand management issues. What they wanted was a professional assurance that demand management is beneficial from an international point of view.

**MacDonnell:** For me it was a day of trying to understand the transaction cost framework. I am not sure that I have completely mastered that, but I do not think I am alone.

I have been considering the role of government in the activities described here. There is no question that government is the dominant -- almost sole -- agent involved in the provision of water. Acceptance of that principle is almost without exception. That might be because we were considering the provision of water supply for municipalities. In our country it is also primarily a function of government. We choose to use large government organizations almost exclusively to provide public water supply, because there are economies of scale as well as for other very good reasons. Is irrigation at the village level operated differently in other countries? Perhaps the manner in which that use is allocated is different. Comparisons would be interesting to understand if the reason the government's role was so predominant was due to the nature of the water supply question we were addressing.

I noticed some differences in priorities. For example, in China, it seemed quite important to keep the irrigation users whole. In the other studies, this seemed to be less significant. In Madras, it was clear that just providing for people's basic needs was the fundamental problem.

The case studies reflect the supply-side emphasis. We cannot expect water supply engineers to suddenly embrace these ideas. It will come through other concerns, such as conserving and protecting the resource and pressuring politicians to go to their water supply people and say, "Find other ways." My experience is that once good

## Exchange of Views

engineers are told to find another way, they are very capable of doing so quite quickly, but they often need some outside push.

The Japanese example of citizen involvement is without parallel. It is a unique system where citizens had the ability to affect government decision making. It deserves more recognition and should be drawn to the attention of others in our country.

Zhang's discussion of the problems in Kunming, conceptualized the concerns of individuals in the decision-making process. As opposed to simply creating and implementing a plan which appears to have all the right ingredients, the plan should be very sensitive to, and work with, local interests in order to ensure that there is an involvement of those interests in the solution. How to ensure that individual interests are directly connected with the decision-making process is a constant struggle. We think in our country that there is a high degree of citizen involvement in decision making, that there is a very open decision-making process, that there are processes that provide for a great deal of public and citizen involvement. But I am not convinced that we do a terribly good job of more than just listening to people. I am not sure that they are really understood or involved in decisions in a sense that they feel they can trust the outcome. Trust is an important issue. In Shin's discussion, he used the phrase "lack of trust" in the quality of Seoul's water supply, suggesting that the government is attempting to convince the people that it delivers potable water; but people do not believe so. This problem also exists in our system: How can people participate in a way that makes them believe that there is a fair and equitable outcome in which their voice has been heard and considered in the decision-making process? It is one of the things that concerns me most about a hierarchical decision-making process -- there is a tendency not to include the individual in that process in a way that (from my value standpoint) the individual ought to be included.

**Nunn:** The problems that motivated the case studies were more related to capital scarcity than water scarcity. I was looking for competition for water among sectors. However, we have not seen much agricultural/urban competition for water in those cases. I get the impression from many of the studies that the problems of making capital investments in urban water supply need priority attention, that water scarcity hardly figures as a factor. Either necessary capital is not available, or capital can be substituted for water, as in the case of Lake Biwa in Japan. That seemed a much more familiar kind of situation: If water is scarce, invest heavily in new projects. This relationship between water and capital scarcity is common to the American West in many ways. At this point we have begun to see actual competition among sectors for control over water. I do not think that the western US has been faced with water scarcity issues until very recently.

Federico Aguilera, an agricultural economist, visited Arizona from the Canary Islands a few years ago. Water is scarce in the Canary Islands; there is not very much water there and there are a lot of people. After two months of talking with people involved in the Arizona water system, he said: "I don't know what you people are talking about. What do you mean when you say 'scarce water'? You don't pay anything for your water; you don't separate out water of

## Exchange of Views

different qualities and charge different prices; you're not investing anything in water; what's scarce about it?"

Also of interest in these studies is how important and varied the water users' alternatives are. Alternative water supplies are very important in the Madras study in particular, but this seems to be an important feature in a number of the studies. Water users obtain water from the city water system, wells, delivery trucks, and a wide variety of sources, each of which presumably answers certain kinds of needs. Consumers are choosing among these alternatives in ways that minimize transaction costs. The other side of the question, of course, is how to manage a water supply system where consumers evade the system. In most US cities, the water consumer has no alternatives -- although my own city, Albuquerque, has a large population of water users with domestic wells. If the water system is not meeting consumer needs very well, consumers will get their needs met elsewhere; people will be provided with water somehow. Many people are minimizing their transaction costs. It is not one monolithic institution, but the operations of individuals, agencies, or the agricultural or consumer sectors. Minimizing transaction costs might maximize primary costs or losses. This is an extremely interesting feature of the studies.

Water users' associations were discussed in the Manila study, and the China study talked about associations for reducing leakage losses. In the Yahagi River Basin, the water users' association was a collective activist's dream. In response to the Yahagi River Basin cases, I began to think about where you would expect to see associations in the other cases. I am not sure what their relative absence means, but I was struck by it. Users' associations -- particularly agricultural associations -- are terribly important in the western US, but they rarely showed up as characters in the case studies.

The role of farmers in these case studies, is the same as the role of farmers in the American West. Agriculture is no longer an economic sector that needs to be satisfied; it is a stumbling block. Farmers can only be pushed so far, and then it is necessary to deal with them. Industry seems to be a sector that draws attention, capital, and water, but agriculture is a barrier to being able to do what you want. We are burdened with the existence of farmers in both Tucson and New Mexico.

With respect to demand management, it seems to me that water managers are not insensitive to demand; indeed, they are very sensitive to political demands. It is not that water supply personnel have neglected to notice that in fact there are ways to reduce demand, but they have noticed that when you reduce demand in those ways, people tend to remove you from your job. This implies that education about the consumer's role in water supply should be directed at the consumer.

Cox: You are right.

Nunn: The environmental movement has done some of the groundwork in raising consumers' awareness of their role in water supply operations. We could educate the engineers in what they usually already know. Engi-

## Exchange of Views

neers know that they are not going to work very long if they try to implement those approaches in some cases. Lester Snow, who was Director of the Tucson Active Management Area, used to say, "If Bill Martin wants marginal cost pricing, he can have my job any day, and I'll be glad to watch him implement it." He meant it; and Bill Martin never took his job.

**Hufschmidt:** It should be noted that the reason local water users' associations have not been mentioned in these cases is because they are urban case studies. There is some mention of it in Madras. But there are water users' associations in all of these countries. This is well documented in the vast irrigation water management literature.

**Nunn:** I was thinking of urban water users' associations.

**Nickum:** Let us move on to give our Asian case study people a chance to respond with their impressions of Hawaii and the experience in the American West, and where they think they might have something to learn.

**Zhang:** In the beginning, I was not clear on how to apply transaction cost analysis, especially in a case such as China. However, after hearing the presentations, my general impression is that this is a very useful tool, especially for comparing different institutional arrangements. Some common themes might be drawn from these case studies.

Demand management is extremely meaningful for the water shortage cases, but not for the others. Also, in the Indian case, where the consumption level is extremely low, I think that demand management has little meaning. Because they consume very little water on a daily basis, the problem is to provide more water. While demand management can play an important role in a general sense, particular cases require specific analysis.

In China, it is considered urgent to adopt demand management, because its application could save a lot of water that could be used more economically. We have found that demand management can save as much or more water as the expansion or development of waterworks.

It must first be ascertained how much water could be saved from demand management. If very little is to be gained, it is not expedient to concentrate efforts on such factors as water pricing, metering, and monitoring. But if a great amount of water could be made available for more useful purposes -- that could help resolve the water shortage problem -- then demand management would be very meaningful.

But demand management requires both administrative power and decentralized measures, such as a market approach or water pricing. In China the most serious problems facing demand management are the decentralization problems. To centralize something is easier than to decentralize it. Decentralization has very high transaction costs. So, when a decision maker confronts problems, the first inclination is to centralize, or let us say, to want to solve it through administrative power; this is so, especially when resources are scarce. One decision maker in Beijing said that the decentralization of market profits, for example, is only possible if supply exceeds demand. If

## Exchange of Views

resources (or products) are scarce, the market process will be very inequitable. Decision makers try to avoid that which might open the door to opportunism.

Something in-between seems necessary. Many of the papers presented here give a very strong impression that a mixed effort may be one of the solutions. In Asian countries, a collective response is sometimes much more powerful than an individual one. So in China, reformers go to opposite extremes. Those who want to decentralize the whole economic system always refer to the American or some European systems, and they overemphasize the individual response. In fact, individualism in China is less significant than in most Asian countries. The social structure or culture is different from Western countries, so things have to be treated in a different way. I learned a lot about such things from the Yunnan study, and was able to see that a collectively organized structure can sometimes play a very important role.

In Japan, the Yahagi River Association is a solid collective organization. On the one hand, it spreads out the transaction costs among many different users; on the other hand, it plays a strong role in politics as well as in the market. So they have a much louder bargaining voice. The same could be said of resettlement problems in China. In the past, the bargaining was always between the government and households. Now the district -- the lowest level of the government -- speaks on behalf of the households and resettlers in most cases, because officials at the local level have a lot of prestige among the households in spite of their very low salaries. Often they are themselves resettlers, so the bargaining is also a collective response. This organizational arrangement has improved the bargaining process and reduced the transaction costs, because it provides households with different ways of voicing their views and needs to the government.

I have gradually come to realize that the transaction cost concept could provide something especially useful in comparing different institutional arrangements.

**Nickum:** Just a couple of quick responses. There is a counterargument that centralized systems create shortages and, therefore, if you wait for shortages to disappear before decentralizing and bringing in the market, it will never happen. It is a self-perpetuating system.

**Nunn:** One of the things that was interesting in these comments is the distinction between a transaction cost under a system and a transaction cost of instituting a system; in other words, the capital aspect of transaction costs and the operation costs.

**Nickum:** Actually, that distinction is made within the broader transaction costs literature. Williamson tends to think that "whatever exists is rational," whereas North and others say that "what exists may not be rational, but the costs of changing it tend to be too high." There are transition costs that make up part of the transaction costs.

One of the things that specific assets do is to impose transaction costs as a way of getting out of a situation. While that in



## Exchange of Views

itself may initially serve efficiency purposes, if maintained over time, it may impose high transactions costs on those who want out of the situation, such as in the case of specific irrigation structures for sugar which are no longer profitable.

**Venugopal:** I would say that consumer awareness is very high in the US and other developed countries. And the legal means that goes with this is very powerful. These two factors are very much absent in a country like India. And even agencies and authorities of a public nature, such as the Tennessee Valley Authority (TVA), have been doing a very good job in distributing water to small cities, not limited necessarily for only domestic and industrial uses, but also for power. Maybe some information could be provided on how these organizations function.

It is unrealistic to talk about a market for water, because the supply varies greatly while the demand remains constant. Also, if only one agency is involved, it would tend to become a monopoly. But in this context, what is exactly the market mechanism which could be introduced? It is something which may need to be discussed in conjunction with the market as a means of understanding water distribution. Similarly, the centralized and decentralized systems were considered to be extremely complicated, but essential for effective management. The middle way is a concept that is being propagated and is better understood nowadays, but it still requires discussion. As for effective management, and the tools to see that water is managed effectively, I think more information needs to be provided on the advanced countries' experience in dealing with problems of this nature, e.g., the facts and figures on the American experience.

**Hufschmidt:** The TVA probably has a higher status overseas than it does in the US. Part of the problem was that the TVA started out as a very broad-gauged agency concerned with the social, economic, and natural resource development of an area, but it turned rather quickly into primarily a power management agency. When the TVA developed all the hydro feasible, it started to build thermal as well as nuclear plants. And then, when concern for the environment rose, the TVA, as a well-established bureaucracy, found it difficult to change rapidly. To environmentalists, the TVA had a bad reputation because it was polluting the environment with fossil fuel emissions and the building of nuclear power plants.

There is much in the American experience that is sobering in the sense that it should not be uncritically adopted by developing countries. Developing countries ought to be able to do better than the US has been doing. And they must, because they do not have the resources that we have had. In water management, the US seems to have a better reputation overseas than it deserves. So, those things which ought to be done in water management, but which have not been done very well, should be explained more fully. For example, demand management, which has been discussed here, is one thing that is not done very well in the US, although we are beginning to do better under the pressure of circumstances. But developing countries have so few resources available for capital-intensive programmes that they cannot afford to waste them in the way that they are unfortunately still wasted in the US.

## Exchange of Views

**Nickum:** The maturing water economy seems to be afflicting most of us, and some of the ideas and ways of responding to it are new to all of us. So it is not that we have a package to give to you; we need to find out what you are doing, and you need to find out what we are doing, and we need to work together to come up with solutions.

**Hufschmidt:** Of relevance to this discussion is the observation that while much of the urban water supply is in the public domain in developing countries and in the US, it is no longer so in the UK. Under the Thatcher government, the British water authorities came under privately-owned and operated municipal water systems.

**Moncur:** The point is that privatizing the water industry is not unthinkable.

**Hufschmidt:** That is correct.

**Zhang:** In 1986, Thames Water sent a large delegation to Beijing to hold a workshop on the experience of centralized management of water problems, and the many advantages of the Thames Water Authority. And now it is privatized. How do you use transaction costs to analyse this phenomenon?

**Nickum:** I would say that the political atmosphere affects the transaction costs and sometimes overwhelms them.

**Zhang:** I think Thames Water is a very good example to consider.

**Easter:** But this does not mean that it is setting up these individual semiprivate groups and that water is being sold on an open market. They probably just set a price and are operated much like they were previously operated.

**Hufschmidt:** That is correct.

**Easter:** So that even though we privatize, this may have no relationship to any kind of a market solution.

**Nickum:** In a study by Donohue that examined urban water supply systems, some systems were private and others were public. He found that some of the private ones were more efficient, but some of the public ones were also efficient. So, in the area of water supply, ownership may not really make much of a difference, compared to other factors.

One problem with British privatization was that it was hard to sell, even though it seemed to be successful; but they were not meeting the EEC standards for sewage discharge, and there were some potential litigation problems -- *ex post* transaction costs -- facing the buyers.

**Hufschmidt:** One of the reasons why Britain has been unwilling to join the EEC is that it does not want to abide by increasingly stricter environmental as well as trade regulations.

In a developed country with a good economic base, urban water could be provided at a profit, and essentially with payment of full

## Exchange of Views

direct costs.

If the full cost price, including third party effects, were to be included, maybe the private water companies could not operate at a profit. But it is at least possible to pay all direct costs. The conventional wisdom is that water supply has to be public, because it is important that everybody has water, and therefore it has to be subsidized. That is essentially the case in the developing world, where in most cases water supply investments are heavily subsidized. Manila is different because it has very carefully kept its water rates high. Whenever there is inflation, water rates are raised to reflect the inflation. In this respect, Manila appears to be unique.

**Nickum:** Let us turn to our expert from the Philippines, for his comments on the US experience.

**Fellizar:** I would like to start with what has been foremost in my mind: The role of values in transactions. Values are difficult to comprehend, i.e., the values of a person or a group of people. When we understand the value position of people we can understand their transactions and the consequences of the transactions. One problem is to get all of the tools that you need. So yesterday I was asking David about some of the instruments he uses for assessing people's values in matters of natural resource management.

Also, I have learned about the concern over water in planning for urban growth, and this is a valid intention and concept as well. In the Philippines, metropolitan planning was essentially concerned with settlements and industries without regard for water resources. Extensive housing subdivisions and villages are often faced with water shortages during the dry season, because of low water pressure. The planners failed to consider this water problem.

Another issue discussed in the American studies is the explosive issue of traditional rights to water. Whether we have this kind of traditional rights in my country over urban water is not clear. I understand that in irrigation we have a lot of this, and that is an area for us to explore.

Another outstanding feature is the high degree of organization among user groups in the American West as well as in Asia. People should be more aware of their rights as consumers of water in the Philippines. So I think an important area to study is how individual members of each interest group transact business with one another within the organization. What are the internal transactions involved...

I am not quite sure how the issue of water quality could be discussed. An issue to discuss here would be the possibility of allocating water of certain quality standards to particular users. But infrastructure should be provided, e.g., specific structures for domestic and other uses. This leads to the question of whether we can differentiate the quality factor for industrial growth and for housing subdivisions. It is unclear how this could be done, but it is one way of economizing on water.

## Exchange of Views

The other issue that has been raised is the phenomenon of instream water uses in the US. So far this does not occur in the Philippines, but as the population grows and as other uses arise, instream users, like fishermen, might become organized and demanding. Also, the environmental movement could grow in the Philippines, and that is an issue that needs to be addressed.

With regard to organizational arrangements, Honolulu and the Philippines have differences and similarities. However, more time would be required to understand fully the economics of water management in Honolulu.

Nickum: Thank you. Euisoon Shin, please.

Shin: As an economist, I have always thought of problems in terms of economics. I was preoccupied with the neoclassical paradigm in trying to explain everything in terms of cost and price. Now this transaction cost approach has enlarged my perspective in solving the problems. I learned a lot from Monday's sessions, and especially this morning's session which was very informative and provided some insights on the transaction cost approach to real-world problems. From Monday's sessions, I realized that even in developed countries like the US there are many unsolved problems and inefficient ways of allocating resources. Those might be based on lack of proper policies or inefficient management, or sometimes political barriers or the bureaucracy itself might be the big problem. So when we try to explain these inefficiencies in terms of neoclassical economics, we realize that we have a limited tool for analysis. This is because we try to explain everything in terms of costs and prices. But the transaction cost approach adds other dimensions to the analysis; it incorporates political, social, and cultural, as well as economic considerations. I think differences in transaction costs arise because of different situations in these aspects in various countries. This implies that the transaction cost approach can be applied in developing countries as well as the developed countries.

In seminars or workshops of this kind, mostly developed countries' experiences are introduced and those experiences are transmitted, more or less, to the developing countries. But in the case of transaction cost analysis, we are leading. Maybe the cases found in developing countries can be applied in the developed countries. So I think this is a very unique and interesting aspect of this workshop.

In designing the water resource management system, there first has to be goal-setting, and then implementation. In most cases, the goal itself is set by high government officials or by the legislature, where academics do not have much influence. This means that, as we have seen in the US or Japan, the long-term comprehensive supply plan is set first by the government. Allocation or other problems are then dealt with. The question is at which stage could decision makers be influenced: Before setting the goals, or after the overall plan is made? This is very important because if government officials are preoccupied with supply-side management, it is very difficult to change demand-side management. Another factor which affects the choice of policy is the popularity of specific policy tools. The Republic of Korea was forced to change domestic energy policy after

## Exchange of Views

the gulf crisis. When the price of imported crude oil went up, it was discussed whether we should increase the price of domestic oil products or resort to demand constraints through suasion. The conclusion was that, we should wait three or four months for changes to become clear in the world oil market. After three months, finally the price was raised. High-pricing policies are always unpopular; people naturally prefer to have low prices. Even if demand management is a very efficient policy, how can we persuade the government to implement it? Price policy is unpopular, but so is the regulation of usage, as mentioned by Oka. Oka said that even if there should be some use rights to reallocate that go unused, the government has supplied more water through new systems. I think this is because of the unpopularity of regulating the uses and affecting the existing water rights. I think ways must be found to influence government officials. One possibility could be to organize users' groups, as Oya has mentioned. Our main concern is to develop theory and policy instruments; however, we also have to think about institutional and bureaucratic barriers in order to apply our theory and policy tools to real-world problems.

Also important are the studies on cultural traditions, economic development stages, and especially legal issues and procedures. In Hawaii, the *Water Code* was made into law in 1987, and it incorporated groundwater management. In the Republic of Korea, there is no separate water code for managing groundwater.

**Nickum:** I am quite reassured that you note that developed countries, particularly the US, have much to learn from the experiences of Asia. That has probably always been true; I think there is a growing awareness of such a fact now. Ruangdej Srivardhana, please.

**Srivardhana:** First, a few words on what I learned from the US experience. I think that there is both a greater physical and human readiness in the US, in terms of infrastructure, than in the developing countries. There are more complete piped systems for water delivery and more technology for getting groundwater. Also, because of the availability of capital, it is easier to mobilize resources. In developing countries, when investment is needed, time and effort are required to look for capital. When you consider the social infrastructure, such as human manpower, I think both the bureaucracy and the people at large in developing countries are in a worse situation. Maybe this is because in the West the weather is more severe; you cannot stay in the snow without a coat. But in my country, people do not care. Even without a shirt, they can live quite comfortably. In the US, if you do not strive for water, then you do not have water. You need to organize, and that means the development of a social infrastructure and set of institutions. I do not think that countries like Thailand have expended much effort on this, so we have a long way to go. We could learn from the experience of Western countries and try to adopt the lessons to fit our conditions.

**Nickum:** Thank you. Toshihiro Oka, please.

**Oka:** I think there are differences between Japan and the US. The differences are as follows. Firstly, in the US, there may be situations where water is allocated through several kinds of systems which we can compare, such as the market and hierarchy. But in Japan, there is

## Exchange of Views

only one allocation system, that is, the existing system which has been established historically. In this situation, it is not possible to decide whether the transaction cost of the existing system is high or low by comparing it with other systems. Secondly, in the US, I think there exist views which are thought to be challenged by TCE, i.e., the view that allocation ought to be done by the market system in order for it to be efficient. TCE could challenge such views by emphasizing the cost of the institutions. But in Japan, there are no such views which emphasize the workability of the market. So if you emphasize the transaction cost of the market system, you will be....

Nickum: Irrelevant?

Oka: This might be.

Nickum: Thank you. And finally, Kenji Oya.

Oya: I think what Oka said, particularly with respect to the first point, is very valid. In Japan, there is only one system of water allocation; water is allocated everywhere in accordance with that system. So it is more difficult to see the advantages and disadvantages associated with the current system. If there was another system which could be compared with the current one, then perhaps it would be more relevant. I was trying to understand why in Japan this supply-oriented approach has been so enthusiastically pursued, when there exists a policy statement concerning demand management and in spite of the fact that so many researchers have shown the potentials of reallocating existing water rights -- apart from the existing institutional arrangements. Certain groups exist which like to maintain the *status quo* of water institutions and organizations, which may favour a supply-oriented approach. Perhaps everybody agrees that reallocation of existing water rights, coupled with demand management, may solve the water problem, both in the near and distant future. The question is, can TCE shed light on this rather political problem that Japan is facing, particularly in the metropolises? To some extent in many other countries, metropolises are facing a similar problem, including here in Hawaii.

Hufschmidt: I might mention that, as Oya knows, when I was in Japan in 1988, I was asked to speak before a high-level group of policymakers from the Japan Ministry of Construction, which has jurisdiction over national water affairs. I expressed somewhat dramatically that the development age in the US is over, and the age of what I call "management" is in. I then characterized how it has become increasingly difficult for the classic construction agencies, such as the Bureau of Reclamation and the Army Corps of Engineers, to build new projects, because the best sites are gone, costs have gone up, and environmental opposition has become increasingly stronger. In the US, the era of dam building is over. Of course, some are still being built, but basically we are phasing out. For whatever relevance this might have for Japan, this is the trend in the US. I was received very politely, but it was hard to tell whether my remarks had any impact. From my colleagues in Japan, I had become aware of just what Oya is saying -- the very strength of the conventional supply-oriented approach. Among Japanese water policy statements, there is an excellent one on demand management -- except that it is currently not receiving much atten-

## Exchange of Views

tion. But the Japanese are very interested in the American experience, and I hope my comment may have had some impact.

**Nickum:** Regarding the Japanese experience, I have heard two different opinions as to what the corporate culture of the Ministry of Construction is at present. One is that they are not thinking about this generation, they construct for the future. All of this "frivolity" about environmental concerns is not as important as the long range. This is a sufficient justification for uninterrupted development, borne out by the fact that no Ministry of Construction projects have ever been cancelled.

The other thing that I have heard though was, that within the Ministry of Construction, there is some desire to abandon commitments to construct projects that everyone agrees are probably unnecessary. But they do not quite know how to do that and still maintain the other image of themselves....

**Oya:** At one point I thought you were talking about the instream use values. It is one of the areas which has been given great attention in Japan. Of course, in the real world many people benefited from the instream values of the river system, but we did not really articulate those values or uses. And, for instance, these instream values become an issue when they initiate a physical construction like barriers at the river mouth. But in many cases we do not have an established group or organization who can speak for instream values. For instance, freshwater fishery cooperatives have established rights, but they usually...give up water rights in exchange for compensation. The user group speaks for those values. This is one area we may have to investigate from a transaction cost perspective.

**Nickum:** I think perhaps the question of environmental interests and how they are represented is another area for transaction cost analysis.

**Easter:** Even though there is agreement concerning lake levels, would the owners and people living around Lake Biwa ever let you lower the lake by 1.5 or 2 m? Or do you think the same thing would happen as in Minneapolis, when it was thought that water could be obtained from Lake Winnipeg in northern Minnesota and it was learned that the local people would not allow it? During the controversy over increasing the water releases from Lake Winnipeg, the Corps of Engineers official who regulates the lake level was shot at! I can visualize similar things happening at Lake Biwa if you tried to lower that lake by 2 m.

## Discussion on Transaction Cost Economics (Afternoon, 28 November 1990) (Edited excerpts)

---

**Nickum:** Our discussion this afternoon will focus on the value of the transaction cost approach. If it has value, what is its value?

**Zhang:** I would like to follow up on the criteria for a system of water rights. In China, we don't have private water rights. For example, surface rights belong to the state. But even under state ownership, many different arrangements are possible. A very good example is forest land-use rights. Land and forests remain to be government-owned, but a long-term contract for forest rights is given to households.

**Cox:** Obviously, in China, farmers are allowed to continue utilizing water [even though] they are not using it efficiently. The farmers are never deprived of their use of water.

**Zhang:** It is a form of water right, in fact.

**Nickum:** What we call a usufruct right. You may not have the deed, but you have been using it and have some sort of right to it.

**Easter:** From the point of view of reallocating water, though, the question is whether the usufruct right is transferable.

**Zhang:** Also, the user does not care about who owns the right. He cares whether it is available and clean.

**Nunn:** In 1987, the Canary Islands sought to declare their water which had been private, public. They saw this as a move towards the doctrine of the American West, where water is public property. But our public waters are more private than their private waters were in the sense that American landowners' usufruct rights were more independently defined as property rights than those of the Spanish landowners over their private waters in the Canary Islands.

**Nickum:** Ownership is not the same thing as use or transfer mechanisms or the allowability of transfer. Even in state ownership systems, you might have transfers from one state body to another. How does that happen, and what rules guide it? Water rights in Japan obviously guide behaviour, but it is in a much more complex way than a literal reading would make it. Maybe looking at actual transactions, motiva-



## Discussion on TCE

tions and points of transaction will bring us closer to the real issues than talking about who owns the water, or even whether or not there is a market.

Chris, has the concept of transaction costs any value in your work?

**Nunn:** These transaction cost concepts may be employed in such a variety of ways. It has reached the point of unmanageability. I find it a useful way to look at externalities, to try to allocate them as transaction costs, and to relate them to the institutions. But the paradigm is much more complex than this. It seems that the most promising empirical potential is looking at the actors, and how they might use restructured institutional arrangements to minimize their costs. That means that we need to specify many different objective functions. I found that in the Osaka paper in particular, there is a formal institution under which there are no transfers, and a water system under which there are transfers with a lot of reallocation going on in a variety of ways. Another transfer I would not even have noticed if we were not focusing on transaction costs was in the Korean structure presented by Shin, where the water control agency split and contracted in order to satisfy cost-recovery obligations. The agency took on another persona to deal with water users. Instead of filtering down the cost-recovery obligations to itself as the agency responsible for recovering costs, it divided itself up in order to have some flexibility in dealing with water users. That was a very interesting institutional innovation.

**Nickum:** There is a similar phenomenon in Japan, where the Ministry of Construction creates a corporation with which it then interacts and subcontracts in order to carry out many activities.

**Easter:** Isn't this essentially what the US Bureau of Reclamation has done in creating the irrigation districts? They do not turn over water directly to the individual, but to water districts which they helped establish, although these are separate. It is the same kind of idea, as setting up some sort of organization to which you can then sell your water.

**Nunn:** A very big issue in the Bureau of Reclamation is finding ways for the district to split its persona so that it can look at different ways of cost recovery other than to sell the water to the original farmers-contractors. The districts could reallocate water, because the original irrigation uses are not always the best way to use water. Because the districts themselves are not the Bureau, there is quite a difference between them and the Bureau, although they are its creation. Now that some loans have been repaid, the districts tend to think they own the water and the land under the water. The Elephant Butte Irrigation District thinks it owns most of New Mexico, that it is not just a vehicle for the transmission of funds, and that it has a proprietary persona and ownership.

**Cox:** I guess the question I have with respect to these transaction costs is, what percentage of the total cost of water are they? How significant are they?

## Discussion on TCE

Nickum: How large do they seem to be?

Cox: Well, I really do not know. Moncur may have an estimate of the transaction cost amount.

Moncur: It is very difficult to quantify these things and to come up with a measure.

Cox: Now that we have a Water Commission the transaction costs may have increased, but I have no idea what the costs are.

Nickum: As far as I know, no one else has come up with a good measure for transaction costs. At this point, it is more a way to frame the problem so as to bring in institutions than it is a figure that you are going to come up with.

Cox: But if they are very small, why do we then even bother about it? I have a feeling transaction costs are a lot more important than just the monetary costs.

Nickum: What do you measure? For example, there is McBryde's legal costs and the litigation costs, but McBryde's real transaction costs may be more. After McBryde, transfers did not occur anywhere. What was most important was how the decision reverberated through the system and changed buyers' perceptions of risk.

Nunn: Arguments exist on both sides as to what percentage of costs the "real costs" or out-of-pocket expenditures are. You are talking about transaction costs as the full opportunity costs of the transaction or, alternatively, of foregoing the transaction. The real cost, that it would be a percentage of, is likewise not the price of the water, but the full opportunity cost of the water use, including for instance subsidized capital investment. Since we are looking at opportunity cost, the values are speculative.

Moncur: There are all kinds of related questions about the transaction costs. I cannot imagine that the transaction costs in the Hawaii case are negligible under the current regime. They are mixed up with the costs of other resources. Just this morning on the radio I heard that a developer named Herbert Horita has offered to give a community US\$4 million in return for the right to develop some land for a housing project or resort. Well, that is a big transaction cost for land. And you could imagine some other kinds of exactions coming out like that for water transfers too. For example, in return for the right to transfer water you might have to construct a large storage facility, and an extensive system of mains.

Srivardhana(?): The transaction cost is rather abstract to me. When you try to apply the concept, you need to specify what you want to study. How can you make the application of transaction cost economics (TCE)? To what problem?

Nickum: One way of approaching it is to try to decide where it does not apply.

## Discussion on TCE

**Srivardhana:** If you want to discuss organization, it is quite clear that you can get insights if you use transaction cost analysis. But it may not be very helpful if you want to discuss a project appraisal.

**Nunn:** It seems that it has something to do with the numbers to which you are comparing the numbers from cost-benefit analysis. It is a way to apply the opportunity costs concept to alternative institutions, a chance to look at what your barriers to certain sets of choices have cost you, to identify certain alternatives.

**Easter:** It seems to me this would almost be part of your technical feasibility, in that as you look at alternative institutional arrangements, transaction costs tell you that you have to evaluate alternative institutions and organizations. After evaluating a particular organizational or institutional structure, you may find that it is not feasible. We just cannot do it the way we had planned because of the organizational/institutional constraints. You might choose another alternative where you find that transaction costs are going to be a lot less.

**Nickum:** So building a reservoir might be the solution even though...

**Easter:** ...Even though the cost-benefit ratio for a project does not look good, it may be selected because of the low transaction costs. I think this is an important explanation for a lot of our supply-side approach, particularly when appropriating water over which no one else has established prior rights.

When you consider a project, you have to first determine if it is technically possible. What we are saying is, "are the institutions and organizations in place so that we can do the project?" This may be another area where you do technical feasibility.

**Venugopal:** In one place, we orient the problem towards the basin; in another, we talk about a particular city. Sometimes we look at one purpose; other times we look at multipurposes. We may look at one organization or at many. All these situations are different. In each, the place where we can apply transaction costs is now vague.

**Nickum:** It seems to me that transaction costs are of general applicability, like the concepts of diminishing marginal returns, or of optimization under constraint. It is really a perspective that you can take to all of these situations, to find different ways to look at them. It could be within the project, it could be within the river basin. In our case, it could be within extended metropolitan regions.

**Srivardhana:** I think there is a clear and close link between TCE and institutions. But in applying this to a study, it is necessary to consider the operation of the system in a more comprehensive way. For example, if you want to see the transaction costs of delivering water from the upstream to the user, then you have to make an analysis from the beginning up to the end. The information that is so analysed can be used in deciding the best course of action.

**Nickum:** Fellizar and you took quite different approaches. You did an organizational problem and applied transaction cost thinking in a way

## Discussion on TCE

that was quite appropriate. Should the water authority sweep all of this in, what are the advantages and disadvantages of the private alternative, and then what about some sort of decentralized franchise system? But those would all include different transactions. The Manila case, though, was more of a look at water from the source to the sea. In both cases you can use transaction costs to look at transactions for different purposes.

**Hufschmidt:** Jim, you said that maybe one way of looking at it is to see where it did not apply. Take the very simple case of a single decision-making unit, say a farmer who is tapping an abundant groundwater aquifer where no third party effects would be involved, including no effects on return flow. In making a decision he is faced with outside costs of the pumps and pumping, as well as the other factors of production. He then maximizes his returns -- or goes through some decision-making process -- and uses the water for agricultural purposes. All decisions are internal to the single decision-making unit; there are no externalities and no outside transactions. Technically, under the terms of your definition, there are boundaries between where he pumps the water, where he puts it into a ditch, and where he distributes it over the land; you can see the transactions at these boundaries.

I think that those transactions are empty boxes, because they can be handled under the efficiency theory of a firm, and you do not need any TCE for that. Now that's the simplest case. But just stating the case indicates how rare it is. Beyond that, I cannot think of any case that does not involve transaction costs.

**Easter:** Another is if one agency were in control of water within a country. Ideally, they would internalize, for example, return flow decisions and decisions about extracting too much water from the groundwater aquifer. Assuming they could do all this, would that process also be free of transaction cost considerations? I am not sure, since the decisions would still involve some costs and trade-offs. Even if we assume that this agency is internalizing all of the external effects, there are still transaction costs in its doing so.

**Nickum:** What a transaction cost approach would say is that internalization increases governance costs. Maynard's farmer is governing himself, so he avoids those "principal-agent" costs.

Incentives problems are one of the biggest governance costs pointed out by Williamson. But internalization does give a decision maker greater administrative discretion. Because if he sees that the groundwater is being depleted, he can just say "Shut off the wells." The people using the wells have no real say, because they are no longer autonomous. It is similar to the Chinese case with the workers. Shut off the water and go home and when you come back you will still be paid. So you are taken care of internally.

**Hufschmidt:** I have another case. Let us take a Hawaiian large-scale sugar plantation water user. Now, we know there are probably transaction costs with other users, but within the plantation unit, water is being extracted, both groundwater and surface water, and it is then used in some way for irrigation. Is the transaction cost a useful concept

## Discussion on TCE

within that firm?

**Nickum:** I think it would be. In our concept paper, we said that even though in principle you have transactions anytime you have a change in use or whatever, that is not very observable. So the best thing to do might be just to go to the organizational units that are the users or the major points of transaction and look at those first. But if you are going to come up against one of these mega-organizations, then you really probably ought to go inside the "firm" and see what the alternatives are. For example, you ask whether the Bangkok Water Authority should be internalizing the water supply within Samut Prakarn.

**Hufschmidt:** Yes, one of the issues has to do with the internal efficiency of a firm where, paradoxically, you would create transaction costs. Dow Chemical deliberately broke up factory operations into separate decision-making units, each of which engaged in transactions with others; for example, with the suppliers of raw materials and with the recipients of the residuals which were generated by the unit. This change was adopted to improve the firm's performance on pollution control. According to a report by Resources for the Future, Dow increased its efficiency greatly by breaking up into separate units of transactors who were buying and selling from each other. In that sense, maybe they were not creating transaction costs which were already there, but were actually bringing these costs into the open...

**Nickum:** Or the transaction costs were lower than the governance costs.

**Hufschmidt:** Yes, they were bringing these costs out in order to make sure that each subunit was aware of what it had to pay for its resources, and what the unit could get (or be charged) for the residuals.

**Easter:** You improve the efficiency by creating transactions so that their costs have to be looked at.

**Hufschmidt:** That is right. I will give you another example of how industry actually operates. Bob Kates and I visited Bethlehem Steel back in the early 1960s, to find out how the firm was using water. Bethlehem Steel is in Bethlehem, Pennsylvania, on the Lehigh River. We were referred to a utility man, who told us, "We do not have anybody in charge of water." Water was just one of the utilities, along with electricity and fuel. It turned out that they viewed water as very cheap at that time that they did not actually look at it from a managerial point of view. This was an eye-opener to us, because we had thought that water was important enough for a big steel company in its production process; thus, we expected that they would pay some attention to its cost and efficient use, but they did not. As soon as pollution control laws became effective, it became important for Bethlehem Steel to deal with water. But before that, water was almost a free good.

**Nickum:** The relatively low priority of water came up in many of the discussions; for example, it was discussed how land use tends to drive water use here in Hawaii.

**Cox:** That is right. And certainly in municipal water demand it is the land use that the municipal supplier is going to provide for, although

## Discussion on TCE

there may be a long-term problem in terms of the land-use approach. For some years now, land developers on Oahu have been required to find water resources, acquire rights to them, and develop them. Then they turn those rights over to the Board of Water Supply, and the municipal government develops water for them. On Oahu there are many big developers who turn over their access to water resources to the Board of Water Supply.

**Hufschmidt:** I think that until recently, land has been the scarce resource here. It has been so tightly controlled that water has been a secondary problem. That is probably beginning to change, especially now that one is required to go before this conservative commission to get a permit.

**Cox:** I think that is partly true, because water is scarcer now and, with current conservation efforts to protect instream flows, sources are not as plentiful.

**Shin:** I have developed my own way of comparing neoclassical economics with TCE, and explaining how it can be applied to the current case. In neoclassical economics there are behavioural postulates and analytical tools. Behavioural postulates are either profit maximization or utility maximization. From these we can derive a theory, like demand theory, which predicts that if price goes up the quantity demanded will go down. Here, the analytical tool is price; with a price change you can change consumption.

There are two behavioural postulates in TCE: Opportunism and bounded rationality. So in any kind of transaction there is some degree of opportunism and bounded rationality. The analytical tools are asset specificity, frequency, and uncertainty. These are the tools through which we can get some testable implications, like the prices we have in neoclassical economics. So, for example, if asset specificity increases the transaction cost will go up.

**Oka:** Yes, specific assets raise the transaction costs of markets, but lower the transaction costs of hybrid institutions or hierarchy.

**Shin:** So increasing asset specificity means...

**Nickum:** It means that the market would have higher transaction costs compared to the other forms of governance.

**Shin:** So, for example, development of area-wide waterworks is a way of lowering or minimizing transaction costs.

**Easter:** It is a governance structure that minimizes those transaction costs.

**Shin:** And it is the same with frequency. If the transaction takes place frequently, the transaction cost goes up; so as a way of lowering transaction costs, you might decrease transaction frequency. Or if the uncertainty increases, then transaction cost increases. So these are the analytical tools that we can use. And because of differences in transaction costs involved, the choice of governance structure in resource allocation becomes different. In some cases we use the

## Discussion on TCE

market, in other cases government agencies, and sometimes we choose user cooperatives or some hybrid institutions. Now I think what we must do is develop a hypothesis. For example, you developed one hypothesis this morning suggesting that demand-side management is more costly than supply-side management. That is a hypothesis, and we can test it. We can compare the transaction costs involved in each way of handling the problem. To do that, we first have to study the history and the development of existing institutions and list all the potential transaction costs involved. Different countries and regions may have different kinds of potential transaction costs. Next, is to see whether it is possible to change transaction costs through institutional change. If this is possible, then we can use institutions as a policy tool, like we use price.

**Nickum:** What asset specificity says is that the risks of loss to one or both transactors are higher than they would be if you were to use general-purpose technology. Therefore, there is a strong incentive not to use spot markets or continual markets as a way of maintaining a relationship. If you have a bilateral relationship, you will want to find some way to secure it. That requires a governance structure which could be very compelling, such as internalization, or it could have a lot of autonomy, such as contracting and its hybrid forms, or franchising. So your institution is both a tool and a consequence.

**Fellizar:** I think [we need] a lot of conceptualization to identify the parameters as well as indicators of the concepts that we have. I can talk about credible commitment; how is credible commitment measured? What does it mean? One instrument for that would be the contract; a contract with assured credible commitment. Threat is there. Another one would be social closeness...

**Nickum:** An enforceable contract is a credible commitment. I was interested in the role of the memorandum of understanding.

**Fellizar:** Yes. Memoranda of agreement are also an assurance of credible commitment.

**Nickum:** It seems to play a critical role in your system.

**Fellizar:** Yes, once it has been developed. I think we are starting to clarify transaction cost analysis at this point.

**Hufschmidt:** It is interesting that Shin gave a neoclassical economic model and then a transaction cost model. I was interested in the extent to which these two overlap. Let us take cost-benefit analysis where you have economic efficiency as an objective, and then you have resource costs. Part of the transaction costs can be measured and put within a cost-benefit framework. These are the actual resource costs of the transaction itself that include the costs of buying and selling which someone has to bear. I think there is agreement on that. That is the kind of issue that [Nunn and MacDonnell] were talking about in their studies on mainland US. What is a little unclear to me is the other kind of transaction costs that we have been talking about, which are hard to measure and have to do with background perceptions of values and uncertainties; are they ultimately manifested so that we could measure them as resource costs, or are they outside the conventional

## Discussion on TCE

economic efficiency paradigm? I do not know the answer to that.

There is probably some way of measuring institutional change which has been carried out in order to reduce transaction costs. I can give you an example: The auctioning of water on the steps of the cathedral in Valencia, Spain. Presumably that weekly water market developed because some farmers had some water to sell, while others needed water and wanted to buy. Rather than having a lot of bilateral exchanges, an institution was created that has continued for centuries as a viable institution; and it was created in order to reduce transaction costs.

**Nickum:** Like stock markets and banks...

**Hufschmidt:** So in the water literature one should be able to find evidence of institutions created to reduce transaction costs.

**Nunn:** I would like to back up to Maynard's first point. A very real problem is that we do not look at a whole class of costs. We are looking for real resource costs. That is always true of what economists are doing. Then we encounter those areas of costs that seem to be real costs, not transfer payments, that we do not know how to express as real resource costs. These are the costs of changes in sovereignty, changes in value of life, changes in ambient values. We try to measure them as consumption changes, even though we believe that there is a value lost whether or not there was consumption. So these areas of core values are difficult to measure, because we do not really think they are consumption values. The thing that is interesting and difficult about these is that they throw into question our measure of real resource costs as well. If we do not know what value is, then what is it we are saying about what real resource values are? We value the loss of X amount of soil or X amount of water in terms of its productivity, and that is some sort of value. But if we cannot compare that value to other values that we agree are important, we do not know what units we measured the resource loss in either. This indicates a tremendous problem in the measure of value. It is not just in that one area that we have a problem.

We have a real difficulty with value. One of the uncomfortable but, on the other hand, nice things about the transaction cost approach is that you keep coming back to that. In cost-benefit we ignore it, but it is also there just as real. It is not less real in cost-benefit analysis than it is in transaction cost analysis.

**Sazanami:** May I give a UNCRD point of view?

As you know, the UNCRD is a centre for research and training and our research projects are very much policy-oriented; many of our research projects cover areas of interest to policymakers in developing countries. It is important that we persuade them that this project is useful to undertake. We are discussing transaction costs. But policymakers will usually ask what percentage are transaction costs out of the total costs. It is quite important to calculate such costs. If the transaction costs are marginal, then the policymakers will say we do not need to undertake such a study. For instance, where there is 50 or 60 per cent water leakage in, say, Madras or a



## Discussion on TCE

similar city in a developing country, the first priority to the decision maker is to reduce leakage. That is more important than to discuss such kind of economics. We should, for instance, calculate the total costs and then transaction costs [for leakage control].

I find some ambiguities in the concept of transaction costs. In developing countries, transaction costs are more narrowly interpreted than in the USA. The American cases cover not only cost factors, but also quality of water and institutional issues. If we want to apply transaction costs to our case studies then we must really define them.

Especially in developing countries and in Japan, we are concerned about global environmental issues in relation to energy savings. For instance, if the international community decides to limit CO<sub>2</sub>, it will have a great impact on the development of manufacturing in a country such as China or India. So these developing countries are asking the developed countries to assist industrial development with a view to solving CO<sub>2</sub> issues.

As director of UNCRD, I am very concerned with today's challenges. I would like to combine, if possible, these transaction cost studies with crucial issues, such as the environment. Of course, institutional issues are quite important.

You heard the Japanese case reports. I think the Yahagi case is quite exceptional, even in Japan. But it will be interesting to see whether it is applicable to other Asian countries. I want to stress that we should study more the successful examples in both developed and developing countries. For instance (and this is not related to water resources development), the Grameen Bank just started operating in Bangladesh. It is making a great contribution in assisting the urban poor to build their own houses. If we can find such examples in water resources problems, it would be quite useful. So I would like to urge [the identification of] successful cases or failures.

I find, especially in the developing countries, a great lack of data [related to total cost]. How can we set up a data base system, not only for water resources development, but for regional programmes. Without collecting the necessary data, it may not be so feasible to persuade the decision maker.

**Nickum:** These are all quite valuable and instructive comments. In some way we have to address the reality of our organizations and our clients...

**Hufschmidt:** It puts transaction costs in context.

**Nickum:** It certainly does. We are looking at one issue which is water-use conflict, which goes into quality considerations as well. But I am pulled in two directions; I see first of all the need to put the definitions together, to give us an idea of what we can do. But at the same time there is a strong case to be made here for "let's go find some other things to try to apply this to besides just water-use conflicts."

## Discussion on TCE

**Penn:** When I first looked at transaction costs, it looked like many other approaches with which I am familiar, but in new clothes. It seems that one of the real values of this approach is that, once you have a thorough knowledge of the existing system, you can go ahead and use it to develop and evaluate the alternatives for a water environmental issue. Also, structured questions that you asked in the January paper seem to be [aimed at] developing the knowledge of the existing system. Maybe we do not really need to collect a lot of this information. Either it is already in other forms and we can solicit a lot of help from other people and other agencies to get it, and then really get into the meat of the transaction cost itself...

**Nickum:** Our checklist covered a lot of information. Most of that, I was hoping, would be secondary data, and the only primary data that we would be getting out of that is what data does not exist. That would be the information we would need. And trying to figure out what in the checklist is really important to us, what is input in the next checklist, and we need to have more information. We know that we are not going to be able to track every transaction, nor are we going to be able to get the full terms of every contract, even in open systems like in the USA. We are going to have to use indirect methods.

**Penn:** Maybe this is very naive, but it almost seems that if you were successful in tracking every single transaction cost, your total cost over transaction costs would equal one.

**Anonymous:** Maybe it would be even lower.

**Penn:** It also seems that it could be very useful in revitalizing the power of environmental impact assessments, because you are laying out all of these points of contact between various groups and various physical effects. Maynard, John Dixon, and others have demonstrated some success in the economic valuation of some environmental impacts, and it seems that this is another thing that could be drawn into it. But the part that we still do not have a good grasp of, is not necessarily physical environment impacts, but social environment...values. I think that relates to what Sazanami was saying. Any activity that we undertake is either going to validate or invalidate someone's values, and there are costs attached to each.

**Nickum:** I agree that most of the ideas in TCE are old theories in new forms. But these ideas are put together differently, and that is what is appealing about transaction costs. They are put together in a way that expands economics and brings in some factors that we have otherwise ignored, such as law, sociology, values and culture, and forces us to confront them within a framework that still fits into an economics framework, as Shin pointed out. They are not alien to neoclassical economics. We are used to thinking of things in this way. But we can now go to our colleagues in sociology or law, we can start talking together; we are beginning to find a common language and a common way of looking at the problem.

**Hufschmidt:** I would say, in the US, the rise of the mediation movement was in response to the heavy transaction costs of the litigation movement in the environmental area.

## Discussion on TCE

**Nickum:** It is expensive in several ways; not just in money terms, but in terms of the relationship which suffers when you turn to an outside authority.

**Hufschmidt:** That is right. For instance, we have an excellent example of that in Honolulu today, where our environmentalists are suing the city and county over the Kailua wastewater treatment plant. The city is saying that the legal costs of these cases are going to be several million dollars. The city says it has already made an agreement with the State Department of Health to clean this up as fast as they can. So transaction costs are coming up in a conflict in which everybody probably agrees with the objective of cleaning up the pollution, but there is a disagreement as to whether the city is moving fast enough and whether the state has been acting properly.

**Easter:** Another kind of transaction cost is that of failing to measure the potential benefits from the increased treatment. As I understand it, a costly secondary treatment facility is going to be constructed, but the benefits of that level of treatment are almost nil. The problem is that we do not have really good ways of measuring benefits such as long-term health effects. There are always difficulties in designing a good contingency valuation study. But it would be interesting to estimate the willingness of the community to pay for that kind of treatment.

**Nickum:** That is irrelevant if they can get someone else to pay for it.

**Moncur:** Yes, that is the rent-seeking business.

**Lee:** The increasing use of mediation and negotiation in resolving conflicts is not just to reduce the cost of litigation. It is also due to the realization that there is no such thing as the public interest, and that the interests of both contesting parties are valid. So the only way to resolve such conflicts of interest is not through litigation, but to sit down and negotiate, and to see how both parties can benefit from a settlement.

**Hufschmidt:** I was wondering whether there should be some discussion of alternative or complementary approaches. Associated with the new institutional economics is public choice theory, a conservative doctrine. And then we have conflict resolution and, in public administration, interorganizational theory, the very nature of which involves transaction costs, how organizations fit with each other. So there is a whole body of social science literature, in political science, sociology, and some branches of economics -- including Bromley's institutional economics -- that have a bearing on transaction costs. And so when you say "alternative," maybe there is something in those theories.

**Nickum:** I wonder if they are alternative or complementary. Again, I see TCE as a way of taking those theories and sweeping them into the analysis. I do not know the risk literature very well, but there might be something there to use in looking at transaction costs -- because the implications of asset specificity, frequency, and uncertainty are increased risks to the transacting parties. There are others, like Baumol's contestability theory, the principal-agency

## Discussion on TCE

theory...

Fellizar: Also, the group policy theory, or group theory in policy-making...

Nickum: Game theoretical approaches would presumably be complementary...

Fellizar: Public choice models...

Oka: I have a question about Shin's formulation. [He claims] TCE should use institutions as a tool. I do not understand the meaning. I understand that TCE explains institutions through the use of transaction costs. Then, how can you use the institutions as a tool?

Shin: There are two things: First, one has to explain why the present institution was chosen; next, it is necessary to know what kind of alternatives are available. Through this study, one will be able to find the best option.

Nickum: The question of whether or not to minimize transaction costs is not necessarily given. For equity considerations, for example, you may wish to selectively increase transaction costs. In the case of differential supply of water to different populations, you may wish to erect transaction cost boundaries around population groups.

Oka(?): Transaction cost minimization is a reason why the existing form of institution emerged.

Shin: And the next question is, then what? How do we evaluate the present choice?

Oka: Yes, the next question is that. But you cannot answer the question by using TCE, because TCE always justifies the existing institutions. The existence of the institution is evidence of its comparatively small transaction cost.

Lee(?): [What we have is] only a set of analytical tools to understand the problem of institutions. Whether those institutions are minimizing transaction costs or not is something to analyse. The assumption that institutions are trying to minimize transaction costs is only an assumption.

Nickum: To go back to Shin, neoclassical economics assumes, *ceteris paribus*, profit and utility maximization. TCE assumes, *ceteris paribus*, minimization of production plus transaction costs. But the *ceteris* is not always *paribus*, and in particular you may find some real-world situations where transaction costs remain high for some reason or other. What you can say is, if we note that there is a general trend in behaviour, maybe in some previously inexplicable behaviour, the parties concerned are trying to minimize transaction costs. But that does not mean that they are actually succeeding.

Nunn: Is there a problem with the level at which we are observing the costs and the level at which decisions are made? I mean, we say in neoclassical economics that we are looking at profit maximizing, utility maximizing behaviour, and that does not -- even *ceteris*

## Discussion on TCE

*paribus* -- assure us that we see universal maxima. Individual maxima does not assure us the universal maximum at all. Is there a similar relationship within the Williamson transaction costs...

**Nickum:** Williamson may be looking at transaction costs minimization as a partial framework, but it may lead to increases in transaction costs in the larger area. This is where looking at environmental costs in a transaction costs framework might go beyond Williamson.

**Easter:** Also, we have to be careful to specify whether we are dealing with a static or dynamic setting, because in a static setting you can take Williamson literally, but in a dynamic setting the situation changes. The institutional arrangements may no longer fit your needs because of major changes. One of the things Williamson asks is, "How are the institutions able to adjust to changing conditions?" The McBryde decision is a good example of where the rules changed. You may no longer be minimizing your transaction costs because of that change. So, you have to be careful in saying at what point in time these institutional arrangements minimize transaction costs.

**Nickum:** Williamson says given a choice, the parties concerned will not always opt for a market. They might opt for a firm. They might surrender control to the government. They might opt for nonstandard contracting, monopolistic but not monopoly arrangements. But there is that first premise: Given free choice, and in actuality many of the relevant decision makers, such as the engineers we were talking about, are not working with a full range of choices. They are constrained by the political situation, by arbitrary decisions, and even by history. Those are some of the real-world considerations we need to go into, and where the value of transaction cost analysis might be to identify some of those blockages.

**Hufschmidt:** I think that if you were not to worry about objective functions, but start off by trying to identify transaction costs -- measure them quantitatively if you can, otherwise indicate their plus or minus direction, then the initial hypothesis of minimization of transaction costs where they are real resource costs is a basically reasonable one. When there are overriding social objectives in the objective function, such as equity or maintenance of public order, you would measure changes in transaction cost magnitudes and direction in relationship to meeting those objectives. In that way the transaction costs information would be in addition to the usual type of socio-economic analysis obtained from conventional economics by adding in equity considerations. Then [because of your initial assumption], there is no need for an ultimate answer to the question "does this improve social welfare or not?"

**Nickum:** To go back to Sazanami's first point -- the percentage of transaction costs in total costs -- there is a large conceptual problem there. I believe we can get some of these measurable transaction costs, but perhaps we need another term for what we are referring to as here "transaction costs." We could avoid the problem by using another term that does not have "cost" in it, so that policymakers do not think we are going to come up with an exact number. In that case, what we can do is to try to define the problem for them so that they have a different perception on it, and use that as a guide to policy.

## Discussion on TCE

**Oya:** We have not clearly defined the problem in the real world, which is the ultimate target of our work. Of course, the conceptual framework developed by Nickum and Easter is a guide for academic research. What we at UNCRD are very much concerned with is how to present the problem we are dealing with in ways that make sense to policymakers. Here we are dealing with institutions, and perhaps this transaction cost approach may give us better understanding.

**Nickum:** Let me try to think of some current policy issues that transaction cost analysis might be of value to all countries. Privatization: Should we or shouldn't we? What should we privatize? That is a vital policy issue almost everywhere in the world today. Charges for water, charges for pollution. What kind can we use? What works? What does not work? Can we have pollution trading rights? What are the considerations involved there? That is really not so much a technical issue as an institutional, transaction cost issue.

**Venugopal:** I think one of the points involving policy is to see what costs occur, for example, when you talk about transacting water from irrigation use to domestic use.

We purchase irrigation rights and we want to transfer water from irrigation to domestic use. That is a transaction. You have a one-time expenditure to see that the water, previously placed for irrigation, can be put to domestic use. This is likely to take place whenever we talk about urban water development. We are just trying to see what this sort of exercise is likely to involve within various sectors, and what sort of thinking has gone into it. Ideally, we can quantify this.

**Fellizar:** The question being asked is, why bother about TCE, if some other methods can be utilized? What is the value of TCE in the real-world policy-making arena? In academia, we tend to either oversimplify or make it too sophisticated. We just cut off the real value of the things we are discussing.

**Nickum:** And your conclusion?

**Fellizar:** Later... But I refuse to give up. There is still a lot that we can do together...

**Zhang:** I would like to raise a few issues. First, as Sazanami mentioned, transaction costs should be expressed in a way that is comprehensible to the decision makers. This is the application side; the other side is the academic approach. This workshop is in the middle. So we should consider both sides, not only application, but also the theory, as Shin mentioned. On the application side, one of the biggest problems is how or can we measure in some way transaction costs in terms of total costs. This is a key problem. We cannot simply say that it is impossible. Can we, for example, through one case, or some examples, compare different institutional options, to show how a different institutional choice can give higher or better efficiency or greater benefit through the lowering of some sort of transaction costs. So the measurement can be expressed, not necessarily in exact dollars, but in other ways, in a comparison of cases or one case evolving over time, with different arrangements.

## Discussion on TCE

**Nickum:** Service coverage might be an indicator in the urban water supply case...

**Zhang:** Something like that would be better than nothing, because decision makers want to at least see a possible result.

My second point is about the existing system, mentioned by Oka. I think this very much relies on the scale with which you look at the problem. The existing system may have relatively low transaction costs under the present social or political arrangement. But if you change the outside conditions, maybe this institutional choice would change. To make a change on a small scale you have to go to a larger scale, and that transaction cost is much higher, so you do not change. This is the case in China, that the [prerequisite] social framework is much more costly to change than the water management or water pricing systems. That is why water pricing is very questionable, but nobody likes to touch it, because the social framework is an immense problem.

I would like to look at things on a different scale. Here we are looking at water-use conflicts. But there is another way of looking at things, for example, as in the Indian or Chinese case, where you cannot just look at the water delivery sequence. You have to look at things from a larger perspective, including all the policy possibilities; for example, a new source of water, a new market, or changing the whole social system. So, on a larger scale, the first objective is what kind of problem you are going to solve; second is the strategy you choose; and third is the implementation. The transaction cost [approach] can only be effective in the implementation stage. Although the other problems are very much related to water problems, you can do nothing about transaction cost. In our case, nobody in the past cared about implementation because the goal was wrong. This ensured that the implementation, whether effective or not, would also be wrong. Secondly, if the strategy is wrong, implementation means nothing. Only when both of these are correct, can a more effective approach to implementation be found. Finally, I wonder if it is possible to decompose all the elements or components of the institutional choices, and then use transaction cost as a tool to analyse some alternative combinations to find a way out of a conflict?

**Srivardhana:** We have spent a lot of time and effort on transaction cost. I think that we have learned something about TCE. One beauty of this approach is the fact that it allows you to use both economic tools for the analysis and other disciplines to arrive at the analysis. I think it would be beneficial to go back one step to the problem of organization, to see what else needs to be considered. That way you can come up with a policy recommendation to the government.

**Nickum:** It looks like we have quite a lot of work ahead of us here. I think we have made a lot of progress.

**Srivardhana:** In the workshop you emphasize the metropolitan area. You should expand a little bit more and use the term "water management" so as to include the rural sector...

**Easter:** I think this is what your study shows; this is what the Philip-pines and almost all the other studies show -- that you cannot ignore

## Discussion on TCE

other sectors, because there is competition for water. If there is no competition now, there will be very soon.

**Nickum:** What interested me in this topic in the first place was coming from the irrigation literature; to look at irrigation schemes and realize that water encompasses many more things than just irrigation, and that there are cities encroaching on it. Now we are looking at it from the other viewpoint -- cities are beginning to run out of options, except to transfer water from irrigation. There is a problem, but it is a problem that is hard to address through standard economic tools, because it involves ways of life, ways of doing things, different bureaucracies, allocation rules...all sorts of things that are not standard ways of doing business. You have pervasive public agencies; you have semipublic agencies or cooperative organizations...

**Srivardhana(?):** I think that by allowing those to come in, it makes your study or your recommendations more sensible.

**Nickum:** Correct. And some of the transaction cost analysis is a way of avoiding throwing away economics in addressing, in a rational way, some issues that are really public administration issues or organizational ones.

**Zhang:** Just one additional point. We are facing such a variety of problems that the decision makers nowadays prefer to listen to, for example, computerized modelling results, so-called optimization... I am not against optimization modelling; I myself deal with information systems and create a lot of models and optimize many things. But those things mostly are worked out within a limited system, which has a single variable, for example, a production line. You can optimize them. But for social, economic, politically involved problems, those kind of applications sometimes give decision makers a very, very limited choice. Although they optimize thousands of alternatives and give you fifteen, all those fifteen are very, very questionable. Why? Because they ignore political choices, social factors, and many, many other things. Because there is no accompanying data, those factors are unmanageable; they cannot be put in the equation, nor be entered in the function, as they are incalculable. Transaction costs have an advantage over that. But how can we compete? They present very definite choice priorities that we do not. We can only say that this may be better.

**Nickum:** The transaction cost of using models is actually that the decision makers themselves know the limitations of these options, and those limitations are the ones that we are trying to address. We do not have a way of measuring it yet; we are trying to find a way. If we do, decision makers could start making some choices about these things that they know, matter, but do not show up in the model.

**Oka:** I agree with Zhang on the point regarding social framework. Neoclassical economics refers to costs -- resource or production costs -- for a given institution. TCE refers to the institution, but within a given social framework, as he says. The boundary between the institution and the social framework, however, is ambiguous. In the extreme view, TCE can explain the social framework by using transaction costs.



## Discussion on TCE

But I do not know to what extent TCE explains this.

**Easter:** It is very difficult to draw the line. This is one of the problems. We need to consider different scales. Right now we do not have very good guidelines for what those scales should be.

**Nickum:** Our different case studies look at different scales, different problems, all under something called TCE.

**Fellizar:** I think, so far, my perception is that TCE cannot be treated like a pure skill that is like an established skill or paradigm, because transaction cost analysis has borrowed many concepts from public administration, politics, policy, and even psychology. So it should not really be compared exactly with neoclassical economics, because it borrows a lot from all these fields.

**Nickum:** I agree. Right now, it is really a technique or an integrating method.

**Nunn:** As Zhang indicates, one of the priorities that those of you who are working in this might have, as opposed to the priority of the people who might be using it, would be to look for crispness. I think we are competing with a very crisp paradigm. It may give us answers that do not pertain to the problem, but it gives these answers very crisply, and in a way that is easy -- in fact, too easy -- to absorb.

What would a recommendation on the basis of transaction costs look like, what would it tell you? What result would you use to pass on a useful insight? This might be a good next step towards getting a sharper-edged definition of what it is you can do.

**Nickum:** I think it is a good thing to look at in sifting through what we have got even in the second set, because I think we do have some clear policy implications that may not be derived by other tools.

**Fellizar:** I am getting to enjoy this more. We should not give up.

**Setting New Rules for Water Allocation in Hawaii and the American West:  
A Symposium held at the East-West Center, Honolulu, Hawaii,  
26 November 1990 (Summary prepared by Regina Gregory)**

---

**INTRODUCTION**

This one-day symposium, cosponsored by the East-West Center (EWC) and the Ford Foundation, brought together speakers knowledgeable about the principles and problems associated with water allocation and reallocation in Hawaii and the western USA. The meeting was open to the public and led to a lively exchange of views between speakers and the audience, which included participants of the EWC-UNCRD workshop. The full proceedings may be obtained from James E. Nickum at the EWC. Following are summaries of the presentations.

**HAWAII**

**Maynard Hufschmidt**

Maynard Hufschmidt described Hawaii's hydrology and water resources and reviewed the evolution of water rights: The native Hawaiians' traditional system of water-sharing; appurtenant rights after private landownership was established; correlative use rights when groundwater gained importance; and the governmental regulation of groundwater withdrawals where the resource is now scarce. Hufschmidt also described the ongoing legal debate over the line between public and private water interests, most notably the decision that water rights cannot be bought and sold.

The water supply and demand situation on Oahu is as follows: According to revised estimates of sustainable groundwater yield, a total of 432 million gallons per day (mgd) can be withdrawn without jeopardizing the resource. In 1988, withdrawals of potable groundwater were around 339 mgd, or 78 per cent of the total sustainable yield. Projected water use in the year 2010 is 393 mgd, or 91 per cent of the total sustainable yield for Oahu. This figure is misleading, however, since it does not account for the link between groundwater withdrawals and surface flows. Requirements for stream flow preservation could reduce sustainable yield by up to 45 mgd. Thus, water use in the year 2010 might actually exceed sustainable yield. Groundwater use for sugarcane irrigation has been in decline, and is expected to decrease further. But it cannot be assumed that this water

## Setting New Rules for Water Allocation in Hawaii and the American West

will be available to the Board of Water Supply to satisfy the projected increase in municipal demand.

In conclusion, Hufschmidt stressed the uncertain nature of estimates of sustained yield and identified the major issues concerning water allocations in Hawaii: How can transfer of water from sugarcane to urban use be achieved efficiently and equitably? How can local water uses and instream values best be preserved? How can native Hawaiian water rights be preserved (especially currently unused rights)? To what extent can "demand management" and water reuse reduce the amount of water needed for urban use?

### James E. T. Moncur

James E. T. Moncur addressed the issue of market versus government allocation of water resources. He described the major provisions of the state *Water Code*, which relies heavily on administrative allocation by the state Commission on Water Resource Management. Moncur compared this mechanism to market allocation, using six criteria:

- (1) **Flexibility.** Compared to free markets, Hawaii's water allocation system is not very flexible. In groundwater management areas, water use permits cannot be transferred to different uses without a lengthy review process, and the water commission has little incentive to transfer water to higher-valued uses.
- (2) **Security of tenure.** In this respect the *Water Code*, by establishing permanent permits, is excellent. But there is the threat of a permit being revoked when the water is no longer put to "beneficial use." One cannot say that this system is better than privately secured water rights, which would presumably be secure in perpetuity.
- (3) **Whether rights holders bear the full real costs of using the water.** By providing for water transfers without monetary payment, the *Water Code* allows the Board of Water Supply to acquire free water, which is then sold to consumers at prices that do not reflect the true economic scarcity of water.
- (4) **Predictability.** It is hard to say which system is more predictable.
- (5) **Equity and fairness.** If private property rights were defined differently, market transfers might not generate extensive third-party effects.
- (6) **Public values.** The *Water Code* is explicit in addressing public values, but overlooks the potential for efficient market processes in, for example, ensuring preservation of water quality.

Moncur noted that it makes little sense to desalinate water at great expense when water transfers could satisfy demand. It also makes little sense to transfer water to municipal use at less than the full economic cost of the water. In conclusion, he said that the marginal productivity of privatization and market-like processes is probably greater than the

## Setting New Rules for Water Allocation in Hawaii and the American West

marginal productivity of influencing government officials to make favourable water allocations.

### David Penn

David Penn began by saying that there are many problems with values. Hence, not all values are considered within the institutional framework that governs water allocation in Hawaii. The maze of water allocation patterns and practices in Hawaii is the product of closed market mechanisms, inconsistent policies, contradictory legislation, and adversarial legal principles. These evolved primarily to fulfill the needs of plantation agriculture, military operations, real estate, and tourism -- and only secondarily those of the communities. Closed markets characterize municipal water pricing, water leasing and licensing, new source development, and water for military use. Among Hawaii's inconsistent water policies, Penn highlighted the Hawaii state plan and the vague guidelines of the Hawaii water plan. Contradictory legislation exists in the areas of environmental protection and native Hawaiian rights, and in the conflicts between the State of Hawaii and the four counties. Matters are further complicated by the conflicting principles of prior appropriation; appurtenant, riparian, and correlative rights; natural flow; public interest; and reserved Hawaiian rights. The recently established Commission on Water Resource Management must consider all these things in certifying "reasonable and beneficial" uses (another vague term from the *Water Code*).

Penn then turned to a discussion of the instream values of water, and how these might be protected under the *Water Code*. He listed many instream uses declared by various parties for certification by the Commission on Water Resource Management. The commission is mandated to compare these instream values with the economic consequences of disallowing diversions, but it has not been given any guidelines for measuring these values. Penn noted that native Hawaiian rights may not be adequately protected by the *Water Code* and the administrative rules that implement it. Many native Hawaiians view the *Water Code* -- in particular, the requirement that declarations of use be filed -- as a violation of their sovereignty and a threat to their rights. As one group stated, "Basically this process requires traditional users to jump through hoops, follow gobbledygook language, and meet deadlines, or be faced with the loss of all legal claim to the water that was rightfully ours." The process reminds native Hawaiians of the Kuleana Act of 1850, when land was privatized, mostly to the advantage of foreigners.

### Richard Cox

Richard Cox began by explaining the origins of Hawaii's *Water Code*. In 1978, the state constitution was amended to say that "The State has an obligation to protect, control, and regulate the use of water resources for the benefit of the people." After ten years of study and debate, the *Water Code* was finally adopted in 1987. It provided for the establishment of the six-member Commission on Water Resource Management, with the Director of the Board of Land and Natural Resources as its chair.

Cox stated that the commission's collecting basic data on water use by requiring every user to file a declaration was initially considered

## Setting New Rules for Water Allocation in Hawaii and the American West

uncontroversial. To date, the commission has received 2,580 declarations, and now faces the task of verifying each one. Some questions have arisen over how to handle nonconsumptive uses, and with the problems that small water users -- unlike the Board of Water Supply and large plantations -- have with measuring their water use.

The commission is responsible for granting permits for wells and any stream diversion or modification, protecting instream uses, preparing the state water resource protection plan, and coordinating and adopting the rest of the Hawaii water plan. Since the county development plans were being prepared at the same time that sustainable yields for water were being estimated, there are some serious deficiencies, notably inadequate water to support planned developments. On Oahu, population growth is compounded by increased per capita use which will follow new development planned on the dry side of the island. It is hoped that a dual (potable/nonpotable) water system and low-use water fixtures will moderate increased demand to some extent. The commission is also charged with setting instream flow standards on a stream-by-stream basis. So far it has only set an interim standard of *status quo*.

Cox reviewed the criteria for designation of water management areas outlined in the *Water Code*. The Honolulu, Pearl Harbor, and Waialua aquifers on Oahu were designated before the *Water Code* took effect. Since the commission was established, it has received three petitions for designation. Designation of Lanai was denied; and designations of Windward Oahu, and Molokai are still under review.

The *Water Code* is scheduled for a thorough review beginning in 1992, and Cox noted that the issues raised by Penn and Moncur will probably be debated again at that time. The ensuing discussion included comments by local activists, the director of the Board of Water Supply, and an attorney for the McBryde Sugar Company, as well as the panelists.

### THE AMERICAN WEST

#### Lawrence J. MacDonnell

Lawrence J. MacDonnell began by noting that the same problems are being discussed wherever he goes, and he was glad to hear that some people here are also turning towards an examination of values. He noted that, like in Hawaii, urban demand for water is growing rapidly in the American West, but most of the water is being used for agriculture. In the West, however, there are irrigation districts and mutual ditch companies, whereas Hawaii's irrigation is dominated by large corporate interests.

In most western states with appropriative rights, changes in the point of diversion, water quantity, place of use, and/or purpose of use require a review process, including the opportunity for anyone to object to the change. However, transfers of water rights ownership -- without change in use or location -- are accomplished with minimal supervision.

MacDonnell described water transfers in six western states. He presented data on the number of transfer applications, amount of water, pro-

## Setting New Rules for Water Allocation in Hawaii and the American West

posed changes in use, amount of time between application and the final decision, percentage of applications for which objections were registered, and percentage of transfers finally approved. He cited another study, by Lee and Nunn, of costs incurred by the applicants in water transfer procedures. This is only part of the transaction costs, however, since costs such as those paid by the State Engineer's Office and other parties in the proceedings would need to be included.

In general, reallocation seems more benign than developing new water resources, but it also has problems, and may not be the best alternative in all situations. Absolute prohibition of water transfers is not desirable, but ground rules are needed for making the changes. MacDonnell noted the desirability of encouraging negotiations among affected parties and of attaching terms and conditions to transfer agreements. In cases of uncertainty about third-party effects, temporary or conditional agreements could be devised.

While Americans have been very good at protecting water rights, they are only starting to learn how to assess third-party effects, and are still far behind in finding ways to protect the public interest. In discussing instream values, MacDonnell noted that fish cannot buy water rights, but groups such as the Nature Conservancy have purchased rights for them. The problem is that such groups are few in number. If we were to shift to a market-based approach to water rights allocation, there would have to be more participants in the market -- for instance, the Fish and Wildlife Service, which is already occasionally involved, or state agencies.

### Susan Christopher Nunn

In the American West, Susan Christopher Nunn noted that water actually moves quite readily towards new, higher-valued uses. Cities like Los Angeles always manage to acquire water, even if it means building massive infrastructure and signing multistate compacts. Most recently, Los Angeles has acquired salvaged irrigation water from the Imperial Valley. The third parties to such transfers are legion. Affected ranchers, farmers, and citizens have kept the City of Los Angeles in court since 1925. Injuries include effects on local economies, tax base, employment, environment, and local self-governance institutions. To some extent, the water development policies of Colorado, Utah, Wyoming, New Mexico, and Arizona are driven by preemptive strategies designed to capture some of the water of the Colorado River before Los Angeles takes all of it. Phoenix, Albuquerque, and Reno also operate in the same manner as Los Angeles, drawing water from their hinterlands and creating third-party effects.

Nunn discussed specific examples from Arizona and New Mexico. In Arizona, as in Hawaii, there are active management areas where groundwater is scarce. One powerful feature of the *Arizona Groundwater Management Act* is that for new housing subdivisions to be approved they need assured water supplies for 100 years. Unfortunately, this provision accelerated the practice of "water farming" -- purchase of land to obtain the appurtenant rights. Examples of "water farming" by the cities of Tucson and Phoenix reveal how communities can be severely affected when their water is taken away. Some of the impacts might have been mitigated had the affected parties discussed beforehand the full range of costs involved.

## Setting New Rules for Water Allocation in Hawaii and the American West

Nunn described a dispute between New Mexico and Texas, in which a federal court ruled that New Mexico could not prohibit transfer of its water to Texas because of the commerce clause in the US constitution. New Mexico had to devise new laws to protect its water resources. Another interesting example from New Mexico is the conflict between ski resort development and the traditional acequia irrigation associations. Not only are all the association members affected when a few sell their water, but such action also undermines an important collective cultural institution.

The people of the western USA, like in other areas around the world where there is rapid economic growth, have trouble deciding which changes are necessary for economic development and change, and which are the results of poor management, inequitable decision-making structures, and power politics. In the West, water has always been considered public property, but usufruct rights are private real property rights. Markets are efficient resource allocators, but where many third-party effects exist, unimpeded markets are not so desirable. Private individual values can be protected by clearly defined property rights, but for collective values the usual property right theory does not apply. In conclusion, Nunn said that water transfers must be allowed, but a number of specific questions about the various impacts must be addressed in each case. It may be preferable to transfer only part of a water right, so that, for example, a transfer of economic benefits would leave the environmental duties of water intact in the region of origin.

Questions from the audience generated further discussion about transaction costs and water management issues.

# CONTRIBUTORS

---

Richard Cox  
1951 Kakela Drive, Honolulu, Hawaii 96822, USA

K. William Easter  
Professor, Department of Agricultural and Applied Economics, University of Minnesota, 317 Classroom Office Building, 1994 Buford Avenue, St. Paul, MN 55108, USA

Francisco P. Fellizar, Jr.  
Dean, College of Human Ecology, University of the Philippines at Los Baños, College, Laguna, Philippines 4031

Regina Gregory  
Project Assistant, Environment and Policy Institute, East-West Center (EAPI/EWC), 1777 East-West Road, Honolulu, Hawaii 96848, USA

Maynard Hufschmidt  
Fellow, EAPI/EWC, 1777 East-West Road, Honolulu, Hawaii 96848, USA

Yok-shiu Lee  
Research Associate, EAPI/EWC, 1777 East-West Road, Honolulu, Hawaii 96848, USA

Lawrence J. MacDonnell  
Director, Natural Resources Law Center, University of Colorado, Campus Box 401, Boulder, CO 80309-0401, USA

James E. T. Moncur  
Associate Professor, Department of Economics, University of Hawaii at Manoa, Porteus Hall 530, Honolulu, Hawaii 96822, USA

James E. Nickum  
Research Associate, EAPI/EWC, 1777 East-West Road, Honolulu, Hawaii 96848, USA

Susan Christopher Nunn  
Professor, Department of Economics, University of New Mexico, 1915 Roma NE, Albuquerque, NM 87131, USA



## Contributors

Toshihiro Oka

Researcher, Lake Biwa Research Institute, Uchidehama 1-10, Otsu City, Shiga Pref. 520, Japan

Kenji Oya

Programme Specialist, United Nations Centre for Regional Development (UNCRD), Nagono 1-47-1, Nakamura-ku, Nagoya 450, Japan

David Penn

EAPI/EWC, 1777 East-West Road, Honolulu, Hawaii 96848, USA

Hidehiko Sazanami

Director, UNCRD, Nagono 1-47-1, Nakamura-ku, Nagoya 450, Japan

Euisoon Shin

Associate Professor, Department of Economics, College of Business and Economics, Yonsei University, 135 Shinchon-dong, Seodaemun-gu, Seoul 120, Republic of Korea

Ruangdej Srivardhana

Associate Professor, Department of Economics, Faculty of Economics and Business Administration, Kasetsart University, Bangkhen, Bangkok 10900, Thailand

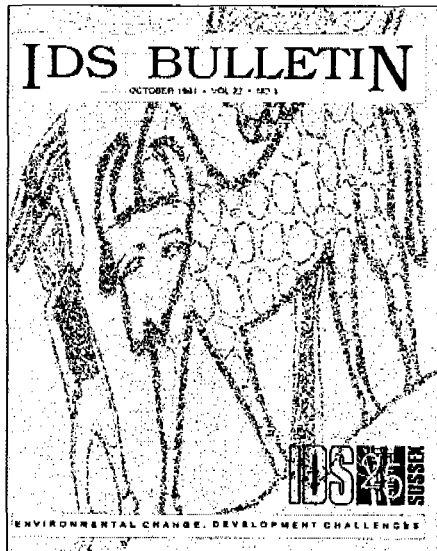
K. Venugopal

Assistant Professor, Centre for Water Resources, College of Engineering, Anna University, Madras 600025, India

Jichang Zhang

Vice-Chairman, Academic Committee, Chinese Research Academy of Environmental Sciences, Anwai, Beiyuan, Beijing 100012, People's Republic of China

# IDS BULLETIN



The IDS Bulletin is a unique source of information for those interested in the Third World and its problems. Each issue deals with a particular theme and provides an entry to current debates. The articles are written by people who are involved in both theory and practice.

Published quarterly in January, April, July and October. Print run 2,600. Distribution worldwide. Sent free to selected Third World Institutions.

Issues covered include: agriculture and rural problems, politics, economic development, socialist strategies, gender issues, health, education, employment, technology, trade, aid, debt and poverty.

## S U B S C R I B E N O W !

### R A T E S 1 9 9 2

Surface mail: £30.00 (\$60.00)

Airmail: £39.00 (\$79.00)



All subscriptions run to calendar years. For further details and our Publications Catalogue write to: IDS Publications Office (Subscriptions), Institute of Development Studies at the University of Sussex, Brighton BN1 9RE, England. Telex: 877997 IDSBTN G. Tel: (0273) 606261. Fax: (0273) 678420 / 62120



# Leading the field in sociology and the related social sciences:

## **sociological abstracts (sa)**

and

## **Social Planning / Policy & Development Abstracts (SOPODA)**

Our subject specialists track the broad spectrum of theoretical and applied sociology from the more than 1,800 discipline-specific and related journals published in North America, Europe, Asia, Africa, Australia, and South America.

**sa** and **SOPODA** each offer you in-depth abstracts and precise indexing of timely journal articles and books, enhanced dissertation listings, and a bibliography of book reviews from the journals screened.

**sa** and **SOPODA** are available together on the **sociofile** CD-ROM and are hosted online by BRS, DATA-

STAR, DIALOG, and DIMDI. Hardcopy subscriptions can be ordered from the address below.

The **sa** and **SOPODA** information products are supported by:

- Database-specific user manuals
- The latest journal coverage list
- The **sociofile** Quick Reference Guide and User's Handbook
- The **Thesaurus of Sociological Indexing Terms**
- Your Guide to Searching **sa** using a Personal Computer
- A professional workshop program

The **sa** family of databases — your fast track to the information you need, in the format you want.

### **sociological abstracts, inc.**

p.o. box 22206 • san diego, ca 92192-0206  
phone (619) 695-8803 / FAX (619) 695-0416 / Help Desk (800) 752-3945

# THIRD WORLD PLANNING REVIEW

URBAN AND REGIONAL  
PLANNING IN  
DEVELOPING COUNTRIES

For more than a decade, the *Third World Planning Review* has focused on urban and regional planning in the developing world, but in spite of this central concern, editorial policy recognises the social, cultural, and political relationships which must inform planning practice. From 1991 an expanded International Advisory Board, representing different disciplines and areas of the world, is assisting the Editor to develop the journal. New occasional features are Professional Note, Technical Report and Debate; shorter contributions will be encouraged alongside the traditional content of scholarly papers.

## February 1991

High Density Housing in Harare: commodification and Overcrowding by DEBORAH POTTS with C. C. MUTAMBIRWA; Tenure Choice in an African City by A. GRAHAM TIPPLE and KENNETH G. WILLIS; Planning and Development of Industrial Estates in Singapore by BELINDA YUEN; Filtering and Third World Housing Policy by WILLIAM C. BAER

## May 1991

The Commercialisation of the Land Market? Land Ownership in the Mexican City of Puebla by GARETH JONES; The Role and Structure of Metropolises in China's Urban Economy by WON BAE KIM; Physical Planning in the Grenada Revolution : Achievement and Legacy by BRIAN HUDSON; Socio-economic and Investment Characteristics of a Traditional Yoruba Market by RALPH MILLS-TETTEY and OLAWALE FADARE

Further information and sample copies are available on request.

---

LIVERPOOL UNIVERSITY PRESS

PO Box 147 Liverpool L69 3BX Telex 627095 Fax 051-708 6502

An International Journal Focusing on Third World Development Problems

## REGIONAL DEVELOPMENT DIALOGUE



United Nations Centre for Regional Development Nagoya Japan

### PAST ISSUES

Water-Use Conflicts in Asian-Pacific Metropolises (Winter 1991), guest editor, James E. Nickum

International Migration: Perspectives from Three Continents (Autumn 1991), guest editors, Tomas Hammar and Pan Eng Fong

Cities, Hills, and Hillside: Revitalization of Medium-Sized Cities (Summer 1991), guest editor, Reinhard Goethert

TNCs, Industrialization, and Social Restructuring in the ASEAN Region (Spring 1991), guest editor, Manuel Castells

Multilevel Development in Pacific Island Countries (Winter 1990), guest editor, R. Gerard Ward

Geographic Information Systems and Regional Planning (Autumn 1990), guest editors, Richard K. Brail and Britton Harris

Emerging Urban-Regional Linkages: Challenges for Industrialization, Employment, and Regional Development (Summer 1990), guest editor, Terry G. McGee

Urbanization and Population Distribution Policies in Asia and the Pacific (Spring 1990), guest editor, Niles Hansen

Strategic Areal Development: Case Studies on the Management of Metropolitan Change (Winter 1989), guest editor, Peter Hall

Solid Waste Management for Metropolitan Development (Autumn 1989), guest editors, Christine Furedy and Sukehiro Gotoh

### FORTHCOMING ISSUES

Urban Land Policies (Spring 1992), guest editor, Malcolm Grant

Industrialization and Regional Development (Summer 1992)

Urban Development and Transportation in Asian Metropolises (Autumn 1992)

Annual subscription: Developing Countries -- US\$30; Developed Countries -- US\$50

Address: United Nations Centre for Regional Development, Nagoya 1-47-1, Nakamura-ku, Nagoya 450, Japan; Telephone: (052) 561-9377; Telefax: (052) 561-9375; Telex: J59620 UNCENTRE; Cable: UNCENTRE NAGOYA



## UNCRD PUBLICATIONS

### Commercial Publications

*Industrial Change and Regional Economic Transformation: The Experience of Western Europe*, edited by Lloyd Rodwin and Hidehiko Sazanami (London: Published for UNCRD by Harper Collins Academic, 1991) (ISBN 0-04-445882-7 and ISBN 0-04-445883-5) (Hardback: UK£35.00; Paperback: UK£14.95) (Please send orders directly to Harper Collins Academic, 77-85 Fulham Palace Road, Hammersmith, London W6 8JB, UK)

*Deindustrialization and Regional Economic Transformation: The Experience of the United States*, edited by Lloyd Rodwin and Hidehiko Sazanami (Boston, MA: Published for UNCRD by Unwin Hyman Ltd., 1989) (ISBN 0-04-445538-OHB and ISBN 0-04-445539-9PB) (Please send orders to Harper Collins Academic, 77-85 Fulham Palace Road, Hammersmith, London W6 8JB, UK)

### Books

*Critical Success Factors: Key to the Use of Information Systems/Technology in Local/Regional Planning*. 1990 (US\$20 for developed countries; US\$15 for developing countries)

*Planning for Crisis Relief: Towards Comprehensive Resource Management and Planning for Natural Disaster Prevention*. Vol. 1: *Planning and Management for the Prevention and Mitigation from Flood and Highwind Disasters*; Vol. 2: *Planning and Management for the Prevention and Mitigation from Earthquake Disasters*; Vol. 3: *Planning and Management for the Prevention and Mitigation from Natural Disasters in Metropolis*; Vol. 4: *Planning and Management for the Prevention and Mitigation from Natural Disasters -- Japanese Experiences*. 1988 (One set, US\$40)

*Training Modules: Local Social Development Planning*. Vol. 1: *Perspectives*; Vol. 2: *Techniques*. 1988 (One set, US\$30 for developed countries; US\$20 for developing countries)

*Information Systems for Government and Business: Trends, Issues, Challenges*. 1988 (US\$20 for developed countries; US\$15 for developing countries)

### Meeting Reports

"A Summary of Proceedings." Country Seminar on Geographic Information Systems and Regional Development Planning, Yogyakarta, Indonesia, 4-6 July 1990 (UNCRD Meeting report series; no. 42) (US\$6)

"Planning Problems, Models, and Geographic Information Systems." Report and Summary of Proceedings of the Malaysia-UNCRD International Expert Group Meeting on Regional Planning in the 1990s: Using and Managing Geographic Information, Kuala Lumpur, Malaysia, 24-28 September 1990 (UNCRD Meeting report series; no. 41) (US\$8)

"Disaster Management and Regional Development Planning with People's Participation," vol. 1. Report and Summary of Proceedings of the UNCRD-CIRDAP Workshop on Integrated Approach to Disaster Management and Regional Development Planning with People's Participation, Dhaka, Bangladesh, 28 January-1 February 1990 (UNCRD Meeting report series; no. 40) (US\$6)

"Hillside Cities." Report and Summary of the Proceedings of the International Conference on Hillside Cities: Focus on the Revitalization of Local Cities, 3-7 November 1989, Nagasaki, Japan (UNCRD Meeting report series; no. 39) (US\$6)

"Geographic Information Systems Applications for Urban and Regional Planning." Report and Summary of Proceedings of the International Conference, 3-6 October 1989, Ciloto, Indonesia. (UNCRD Meeting report series; no. 38) (US\$6)

"Metropolitan Metamorphosis and Development." Report and Summary of Proceedings of the International Conference, 20-26 October 1988, Nagoya (UNCRD Meeting report series; no. 37) (US\$6)

"Report of the Third International Research and Training Seminar on Regional Development Planning for Disaster Prevention, 5-7 September 1989, Nagoya" (UNCRD Meeting report series; no. 36) (US\$6)

"Regional Development Planning for Earthquake Disaster Prevention." Report and Summary of Proceedings of the Second International Research and Training Seminar on Regional Development Planning for Disaster Prevention, 26-29 July 1988, Nagoya and Shimizu (UNCRD Meeting report series; no. 35) (US\$6)

"Industrialization and Development: Focus on ASEAN." Report and Summary of Proceedings of the International Seminar on Industrialization and Development: Focus on ASEAN, 21-26 August 1989, Bangkok, Thailand (UNCRD Meeting report series; no. 34) (US\$6)

"Emerging Urban-Regional Linkages: Challenges for Industrialization, Employment, and Regional Development." Report of the Proceedings of an Expert Group Meeting, 16-19 August 1989, Bangkok, Thailand (UNCRD Meeting report series; no. 33) (US\$6)

"Challenges of the IDNDR." Report and Summary of Proceedings of the International Symposium on Challenges of the IDNDR, 13 April 1989, Yokohama (UNCRD Meeting report series; no. 32) (US\$6) (Japanese edition available at Yen 500)

#### **Research Synthesis Report**

*Information Systems and Technology in Urban and Regional Planning: A Review of UNCRD's Research Project.* 1990 (US\$15 for developed countries; US\$10 for developing countries)

## Working Papers

- 91-3 Rotgé, Vincent  
Some Remarks Concerning the Social and Regional Development Impact of Land Control, Drawn from an Analysis of the US Experience -- With Further Reference to the Recent French Experience. 1991 (US\$4)
- 91-2 Setty, E. Desingu  
Rural Industrialization, Small-Scale and Cottage Industries in Asia. 1991 (US\$10)
- 91-1 Ramm, Johann-Friedrich  
Towards a Framework for Participatory Subnational Development Planning in Pacific Countries. 1991 (US\$4)
- 90-4 Ferguson, Bruce W.  
Toledo: A Case Study of Municipal Development in Brazil. 1990 (US\$4)
- 90-3 Mantra, Ida Bagus  
Urbanization in Indonesia. 1990 (US\$4)
- 90-2 Douglass, Mike  
Urban and Regional Development Strategies in Indonesia. 1990 (US\$4)
- 90-1 Kevenhorster, Paul  
Development through Decentralization: An Assessment of Local Administration Promotion in Developing Countries. 1990 (US\$4)

## Case Study Series on Local Social Development (US\$3 per paper)

- No. 11 Rahman, Rubiah Bt. Hj. Abd.  
Training Programmes and Materials on Local Social Development in Malaysia. 1990.
- No. 10 Direk Rerkrai  
Training Programmes and Materials on Local Social Development in Thailand. 1990.
- No. 9 Dai, Ishak  
Training Programme on Local Social Development in Indonesia. 1990.
- No. 8 Salahuddin, Sadiqa  
Local Social Development Training in Pakistan. 1990.

---

Please direct your inquiries to:

Information Exchange Section  
United Nations Centre for Regional Development (UNCRD)  
Nagano 1-47-1, Nakamura-ku, Nagoya 450, Japan

Telephone: (052) 561-9377      Telefax: (052) 561-9375  
Telex: J59620 UNCENTRE      Cable: UNCENTRE NAGOYA

---



# REGIONAL DEVELOPMENT DIALOGUE

An International Journal

Focusing on Third World Development Problems

---

The *Regional Development Dialogue (RDD)* supersedes the *Asian Development Dialogue*, which ceased publication in 1977. It is intended to be interdisciplinary and to focus on current development issues. Its basic objective is to bridge the gap between concept and reality, and policy and practice, in regional development.

The *RDD* is one of the media through which the United Nations Centre for Regional Development (UNCRD) shares its experiences and research findings and generates a dialogue with a wide-ranging audience on various theoretical and applied aspects of regional development. By encouraging debate on critical questions in the field of regional development, the *RDD* hopes to contribute to greater understanding of these issues, and thus ultimately to improvements in regional development policy and planning.

Each issue of the *RDD* deals with a topical theme. The editors welcome suggestions for themes, papers for possible publication, and comments on articles. Readers wishing to comment on material appearing in the *RDD* are encouraged to write to the editors.

The *RDD* is published quarterly, in Spring, Summer, Autumn, and Winter, by UNCRD.

---

Please direct manuscripts, comments on articles, and correspondence to the Editors-in-Chief, *Regional Development Dialogue*, United Nations Centre for Regional Development, Nagono 1-47-1, Nakamura-ku, Nagoya 450, Japan.

---

## Guide to Contributors

Authors and commentators writing for the *RDD* should aim at contributing to the theory and practice of regional development and planning relevant to the third world countries.

While considering their contributions, the authors should keep in view that this journal communicates with a wide audience not only in terms of geographic distribution but also specialization, concern, and professional background. The presentation should be in clear English. While no precise limits are imposed, articles in the range of twenty to thirty typed manuscript pages, double-spaced, are preferred.

The acceptance of an article by the *RDD* implies an understanding by the author(s) that UNCRD will have the sole publication rights over the article; the author(s) should not submit it to any other journal or book for publication; and once published in the *RDD* it will not be reprinted in any other form without prior written permission from UNCRD.

Prospective contributors to the *RDD* are requested to obtain a copy of the "UNCRD Styleguide: Information for Authors" from UNCRD.

## ABOUT THE UNCRD

The United Nations Centre for Regional Development was set up in 1971 in pursuance of the terms of ECOSOC resolutions 1086C (XXXIX) and 1141 (XLI) which called for global action to promote regional development, and resolution 1582 (L) that provided guidelines for its establishment. The principal aim of UNCRD is to enhance the capabilities of the developing countries in local and regional (subnational) development and planning. Towards this aim, UNCRD organizes training courses, promotes collaborative research on substantive issues in regional development, extends technical advisory services, serves as a forum for exchange of experiences, and fosters exchange of publications and information on local and regional development and planning.

UNCRD recently reorganized its programmes into seven major operational units. UNCRD also launched a new programme known as its Strategic Assistance Programme. Although the projects focus primarily on research and training, they also include advisory services and information dissemination components.

The seven operational units provide a framework within which UNCRD can identify, design, and manage research and training projects. These units include: (a) Urban Development and Housing Unit (UDHU); (b) Regional Development and Management Unit (RDMU); (c) Environmental Planning and Management Unit (EPMU); (d) Regional Disaster Prevention Unit (RDPU); (e) Information Systems Unit (ISU); (f) Social Development Unit (SDU); and (g) Industrial Development Unit (IDU).

The Strategic Assistance Programme provides support for specific activities in local and regional development and planning that are of demonstrated importance to the developing countries. Current projects include: (a) Disaster Management and Environmental Impact Studies of Urban and Rural Areas in Bangladesh; (b) Regional Development Planning in China; (c) Urban and Regional Planning in Yogyakarta, Indonesia; (d) Social Forestry and Community Development in Thailand; (e) Subnational Development Planning and Management in Pacific Island Countries; and (f) Sustaining Self-Reliant Local-Level Development in Eastern and Southern Africa -- Phase III: Environmental and Infrastructure Issues.

---

For further information, please write to:

The Director  
United Nations Centre for Regional Development  
Nagano 1-47-1, Nakamura-ku, Nagoya 450, JAPAN

Phone: (052) 561-9377  
Fax: (052) 561-9375  
Telex: J59620 UNCENTRE  
Cable: UNCENTRE NAGOYA

---