JBIC Review

No. 10
March 2005

ISSN 1347-5681

JBIC
JAPAN BANK FOR INTERNATIONAL COOPERATION

The Role of Private Sector Participation (PSP) for Sustainable Water Supply and Sanitation Sectors
－The Case of Latin America－

Estimation of Willingness-to-Pay (WTP) for Water and Sanitation Services through Contingent Valuation Method (CVM)
－A Case Study in Iquitos City, The Republic of Peru－

Urbanization and Development of Infrastructure in the East Asian Region

JBICI Review No.10
March 2005

Published semiannually
by JBIC Institute, Japan Bank for International Cooperation
4-1, Ohtemachi 1-chome, Chiyoda-ku, Tokyo 100-8144, Japan

JBIC Institute
JAPAN BANK FOR INTERNATIONAL COOPERATION

JBICI Review No.10

March 2005

The Role of Private Sector Participation (PSP) for Sustainable Water Supply and Sanitation Sectors — The Case of Latin America —*

Shigeki Furukawa**

Abstract

In the world, more than 1.1 billion out of 6 billion people are without access to safe drinking water. Most of them live in developing countries. 80% of their diseases are caused by poor sanitation system. For the purpose of improving this situation, the UN Millennium Development Goals (2000) set the target, "halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation." In order to attain the goal, water and sanitation sectors must be sustainable; and it would be effective for governments of developing countries to set a long-term vision and concrete targets for the sectors.

Private sector participation (PSP) can be useful to ensure the sustainability of the sectors. In considering PSP, it is worth emphasizing two types of policy sequences. The first is sequence of improving financial aspects of service providers. For example, service providers must first implement self-efforts, such as improvement of user charge collection and unaccounted for water, before raising tariff. The second is related to sequence of introducing PSP in accordance with countries' circumstances. More concretely, governments should select appropriate PSP options ranging from moderate ones such as service contract to radical ones including asset sale, depending on their countries' political, economic, social and institutional situations about PSP.

The results of Contingent Valuation Method (CVM) Survey conducted in Iqitos City (Peru) show that affordability-to-pay (ATP) of the residents for water and sanitation services was almost equivalent to their current average payment; and that their willingness-to-pay (WTP) was about twice as high as their current payment. It seems difficult to raise the tariff level in view of payment ability of the users in the City in spite of the high WTP. Before imposing financial burden on the users, the supplier in the City should improve its tariff collection rate, unaccounted for water rate, recurrent cost rate, etc.

Regarding water and sanitation sectors, radical privatization approach may not be appropriate. Public service suppliers must first make best efforts in solving their own problems. In parallel, national governments should set up institutions and regulations and long-term support policy such as subsidy. If these important changes are made, governments should select appropriate PSP options and steadily realize gains of PSP. Such policy approach is considered to contribute to sustainability of water and sanitation sectors in Latain American countries.

Chapter 1. Introduction

This paper is aimed at suggesting effective measures for the introduction of Private Sector Participation (PSP), by examining how the introduction of Private Sector Participation (PSP) can contribute to building up sustainable water and sanitation sectors in developing countries, and extracting essential features from the successes and failures of actual PSP cases that have taken place in Latin America.

Chapter 1 ascertains the deterioration of the water environment on a global scale and the features of water and sanitation services, and outlines various problems underlying the sector and the roles of PSP to solve the problems, all of which will be analyzed in detail in the subsequent chapters.

* This paper was made, with major revisions and editing, from the report "The Role of Private Sector Participation (PSP) for Sustainable Water Supply and Sanitation Sectors - The Case of Latin America -" s conducted through Special Assistance for Development Policy and Project (SADEP) in Japanese fiscal year 2003 (The study was commissioned to KRI International Corp. and Nippon Koei, co. Ltd. Study period: Oct 2003 to March 2004). The study team received valuable advice and comments by Mr. Hitoshi Ikuma, Deputy Director, Center for the Strategy of Emergence, The Japan Research Institute, Limited; and Professor Yoshiaki Kaoru, Nanzan University.

** Deputy Director, Development Policy Research Div., JBIC Institute

JBICI Review No.10 March 2005 pp1~58

1. The deterioration of the water environment on a global scale

Water is indispensable for the continued existence of human beings. Problems either in drinking water or in sewerage systems will threaten our existence. Although the former must be supplied safely and continuously, 1.1 billion out of approximately 6 billion people on the earth had reportedly no access to safe drinking water as of 2003[1]. Where sanitation is concerned, water contamination has been spreading largely in developing countries due to lack of adequate sewerage systems. According to a U.N. report (1998), since appropriate sanitation facilities are not available for half of the world population, 80 percent of diseases in developing countries are attributable to water contamination and 20 percent of species of freshwater fish are on the edge of extinction. The current state concerning sewerage systems not only accelerates the global-scale deterioration of the water environment, but also has deleterious effects on human life, particularly in developing countries. Thus, water supply and sanitation systems must be adequately developed in such countries as soon as possible with active support of the international community.

2. Features of water supply and sanitation services

Electricity, gas, water and other fundamental services for the proper operation of economies and societies are, in many cases, provided as public services by governments, public corporation, or other public sectors. Above all, the water supply and sanitation services are counted as (i) a basic human need[2] for the continued existence of human beings, are (ii) a universal service[3] which has to be equally provided to the population as a whole. In this sense, the water supply and sanitation services are of public nature in the broadest sense, and thus must continue to be improved into the future.

Accordingly, the water supply and sanitation services ought to be provided constantly with a certain level of quality for the long term (sustainable operation and maintenance) at an affordable tariff level for users and require timely capital investment necessary for achieving the long-term objective of 100% coverage that is, equitable accessibility (sustainable investment). This principle of sustainability must be followed by developing countries, as well as developed countries, and the establishment of a sustainable framework is absolutely essential for achieving long-term, stable development, which is a primary objective of yen-loan projects and other development projects.

3. The roles of PSP in sustainable development

The development of the water and sanitation sector in developing countries has to be carried out in accordance with the global environment and the features of the water supply and sanitation services stated above. In fact, however, improvement of the coverage ratio and the collection ratio have been at a slow pace, while utilities - that is, public agencies or public corporations - suffer from serious financial problems, due to shortage of tariff revenues, and cannot afford appropriate operation and maintenance and the necessary capital investment. The chronic state of deficit and insufficient facilities in the water and sanitation sector leads to the stagnation of progress with people's access to water and sanitation services, and even results in deterioration of the water circulation. In short, the water supply and sanitation sector in many developing countries is not yet in a sustainable state.

In order to make a breakthrough with this situation and develop a sustainable water and sanitation sector, the introduction of Private Sector Participation (hereinafter referred to as PSP) can be regarded as a powerful device, in addition to efforts for improvement made by policy makers, utilities and other public entities. Since the water supply and sanitation sector is chargeable, participation by the private sector is quite active, following the electricity and telecommunication sectors, and in fact the Philippines, Indonesia, Argentina, and Chile have already adopted PSP activities.

In general, various theories on PSP options and introduction methodologies, as well as case studies, are available, with regard to the introduction of PSP

1 Source: "Final Report, Kyoto, Japan, 22-23 March 2003," the 3rd World Water Forum, Ministerial Conference.
2 Basic Human Needs: BHN
3 Universal Service

into the public sector. Regardless of the PSP option adopted, the implementation procedure (sequence) of policy measures is extremely crucial. In the case of the water and sanitation sector, two types of sequence will be taken into consideration.

The first type concerns the "order of implementation of measures to improve the management in the sector", regardless of whether or not PSP is introduced. For example, in the four Latin American countries focused in this study where only about half of the users pay for the water supply and sanitation services, any increase in water tariffs will be inappropriate unless fairness of financial burden (i.e. collection of charges from non-payers) is secured. Otherwise those who currently pay for the services will be charged more. Under such circumstances, the authorities or the utilities must undertake measures to increase the collection ratio, which does not require any bold political decisions or alterations to the existing policies, and subsequently measures to increase the tariff can be examined.

The second type of sequence is the "order of selecting PSP options that match individual service environments", which must be considered when introducing PSP into the water supply and sanitation services. If a radical PSP option is to be applied to an environment where there is no mechanism that enables PSP to work smoothly, the PSP introduction will generate strong resentment and resistance from users, and may likely collapse the services themselves, rather than securing the sustainability of the services. In order to take full advantage of PSP for sustainable development, it is important to carefully examine the environment surrounding individual utilities, choose an appropriate PSP option, and implement PSP activity steps one at a time after confirming the success of each step.

However, there seem to be few studies or reports of research carried out with regard to assuring "sustainability" in the water and sanitation sector (not at individual utility or project level) that attempt to study issues of the introduction of PSP both systematically and demonstratively, from a viewpoint which emphasizes the importance of the two types of policy sequences and the subsequent need for securing the effects of projects on the development. This paper is based on the foregoing viewpoint and aimed at investigating various issues in the following chapters and providing some suggestions. An outline of the subsequent chapters is as follows:

In order to examine conditions, options, methodologies, and case studies of the introduction of PSP into the water supply and sanitation sector in developing countries, Chapter 2 presents a long-term vision (i.e., an ideal picture) for the creation of a sustainable sector, and specify a series of parameters to gauge the degree of achievement of the long-term objectives (e.g., the coverage rate, the collection ratio, etc.), together with the target values for these parameters and the current state. Chapter 3 is devoted to the understanding of the current situations and problems of four Latin American countries - Mexico, Peru, Panama and Costa Rica (hereinafter referred to as the focused Four Countries) - in the light of the evaluation parameters selected in the preceding chapter, and presents future challenges in the water and sanitation sector in individual countries. Chapter 4 outlines the current status of the introduction of the private sector in each of the focused Four Countries, and its advantages and disadvantages, and examines and suggests effective PSP options to attain objectives set in each country. Chapter 5 highlights new and existing ODA loan projects in two of the focused Four Countries[4]; examines the feasibility and conditions for the introduction of PSP in these projects from the viewpoint of assuring sustainable realization of development effects; and estimates the user charges which beneficiaries should bear for the water and sanitation services on the basis of the findings of a questionnaire survey[5] carried out in Iquitos City in Peru to consider a reasonable tariff level. Finally, taking into account all the analyses made in the previous chapters, chapter 6 attempts to provide some recommendations concerning possible roles for the introduction of the private sector in establishing sustainable water and sanitation sectors in Latin America.

4 Provincial Cities Water Supply and Sewerage Inprovement and Expansion Project (II) (Ongoing); and Panama Bay and Panama City Sanitation Project (New)

5 The questionnaire survey made use of the Contingent Valuation Method (CVM), addressed to 1,000 users of water supply and sanitation services in Iquitos City in Peru concerning the Affordability to Pay (ATP) and the expressed Willingness to Pay (WTP). (See Chapter 5.)

Chapter 2. Requirements for Establishing Sustainable Water Supply and Sanitation Sectors in Developing Countries

Water supply and sanitation services is a Basic Human Need (BHN) for the continued existence of human beings, and must be provided equally to all the population. However, the access to such systems is not at an adequate level in developing countries because of shortage of funds and insufficient technology. In the water and sanitation sectors of those countries, it is therefore necessary to take action to provide water and sanitation services widely to the population in a long-term and stable manner.

This chapter, first of all, presents long-term visions that the water and sanitation sectors should provide the services on a sustainable basis. Then, in order to grasp and clarify problems arising in the entire sector and at the government, utility, and project levels, appropriate quantitative indicators for evaluation (e.g., water and sanitation coverage ratios, collection ratio, etc.) will be selected[6] In addition, this chapter attempts to identify ideal values and status for individual indicators as targets to be achieved, thereby presenting future challenges in the sectors.

1. The current situation in the water and sanitation sectors in developing countries

Currently, on a global scale, 2.4 billion people have no access to appropriate sanitation facilities, and 1.1 billion people have no access to safe drinking water. As these problems are widely observed in developing countries, the United Nations has set an objective that the proportion of people who have no access to safe drinking water should be halved by 2015 (Target 10) within the context of Goal 7 of its "Creating a Sustainable Environment" program, which is a part of its Millennium Development Goals (MDGs) [7].

In fact, a comparison of the water coverage ratios in the world shows that, while the ratios in developed countries exceed 90%, those in countries in Asia, Africa, and Latin America are below 50% in many cases, showing an obvious inferiority to the advanced countries. This indicates the fact that, although water supply service is counted as a BHN, it is not provided sufficiently to the population of developing countries.

This tendency is far more conspicuous in sanitation coverage. From the standpoints of improvement of the sanitary conditions in the living environment and conservation of the natural environment, many countries have begun emphasizing the promotion of sewerage works in recent years. However, since the implementation of sewerage works requires a large amount of investment, and individual developing countries are short of funds for this investment, they tend to attach more importance to water supply works, rather than sewerage works from the viewpoint of BHN. All this contributes to the hovering of the sanitation coverage ratio below 50% in most countries in developing countries, and to no sign of the rapid improvement.

The water and sanitation sectors in developing countries face not only the problem of low coverage ratio but also various other problems related to the quality of service provided by the utilities and raising of funds necessary for continuous development of the sectors. In order to achieve the goal of improvement of sanitary conditions and elimination of poverty, immediate improvement of performance of the entire water and sanitation sectors is vital.

2. The long-term vision of the water and sanitation sector

As described above, the MDGs set a numerical target concerning water supply systems that the proportion of people who have no access to safe drinking water should be halved by 2015, and at the same time emphasized the importance of sewerage systems with

6 Items which cannot be evaluated with quantitative indicators were evaluated with qualitative indicators (e.g., "establishment of accountability" which cannot be numerically expressed.)

7 A United Nation Millennium Summit (held in September 2000) adopted a UN Millennium Declaration whereby Millennium Development Goals (MDGs) were set. There were eight goals which the international society must achieve by 2015, and 18 more specific targets and 48 indicators required to accomplish the goals.
http://www.developmentgoals.org/About_the_goals.htm

a specific numerical target to gauge the impact of water contamination caused by the absence of proper sewerage systems. This is because the absence of sewerage systems results in the direct discharge of untreated wastewater into rivers, which will contaminate public water and ground water. Therefore, the establishment of both water supply and sewerage systems is a prerequisite for long term, sustainable provision of the services in the water and sanitation sectors.

In line with this, the long-term vision for the water and sanitation sectors will be presented. More specifically, three requirements are focused on for the water and sanitation sector to assure sustainability - (1) securing a suitable level of service quality, (2) increasing the coverage ratio, and (3) making the expenditure and benefits at appropriate levels - and specific objectives which should be attained in the long term have been set (in Table 1). The contents of the three long-term objectives are as follows.

(1) Assuring a Adequate Level of Service Quality

The service quality required for a water supply system is to provide a sufficient volume of water at a with adequate quality. The target water quality is assumed as that meeting the drinking water quality standards set by the World Health Organization (WHO)[8] upon the belief that, in developing countries, so long as water satisfies the WHO standards, it should be supplied as drinking water. On the other hand, where the water volume is concerned, the ultimate target is to supply water 24 hours per day to individual households whenever they need it.

The required service quality of a sanitation system is to assure suitable drainage of rainwater and wastewater and secondary treatment of wastewater before discharging into public water areas. (This is because it is desirable to treat wastewater collected via drainpipes into clean water before it is discharged into public water areas.) This treatment should ideally be adopted in local areas, too. But standards for water treatment in such areas are adjustable in accordance with the economic and social situations of individual regions.

Table 1: Long-Term Vision of Water and Sanitation Sectors

Item	Class	Long-Term Targets	
		Urban areas	Rural areas
(1)Quality of service	Water Supply	Water supply to individual households with safe water quality to meet WHO water quality standard 24 hours per day	
	Sanitation	Appropriate elimination of rainwater and polluted water, and implemention of secondary treatment of polluted water	Being able to provide services that are tailored to the social and economic circumstances
(2)Coverage ratio	Water Supply	A coverage ratio of nearly 100%	
	Sanitation	Conforming to the drinking water coverage ratio	Achieving a coverage ratio that is tailored to the social and economic circumstances
(3)Sound financial situation and tariff policy	Water Supply	(i) To realize benefits appropriately corresponding to the magnitude of expenditure on the sectors.	
	Sanitation	(ii) The amount and use of subsidies, long-term loan, funds raised by bond floatation must be reasonable, and must not surpress funds required in other sectors.	

Source: SADEP Study Team

8 The drinking water quality standards set forth by WHO: the standards of water quality which is free from problems as drinking water, although the level does not reach the quality of drinking water in developed countries.

(2) Increase in Coverage Ratio

In order for the population to live in a sanitary living environment, it is required that the entire population can access water from the water supply system at any given time. However, it is difficult to achieve the 100 % water coverage ratio due to difficulty in water supply through pipes in areas such as isolated islands and mountainous areas. The goal was therefore set at "nearly 100%."

Where the sewerage system is concerned, it should ideally be provided interdependently with the water system for the purpose of achieving sustainable water circulation (at least, this system is essential in urban areas), so the sanitation coverage ratio was set at the proportion corresponding to the water coverage (nearly 100% at a maximum). In rural areas, however, inexpensive methods, for example, installing septic tanks, are more effective than sewerage systems in some cases, and thus consideration should be given to the social and economic situation, in developing a sanitation system.

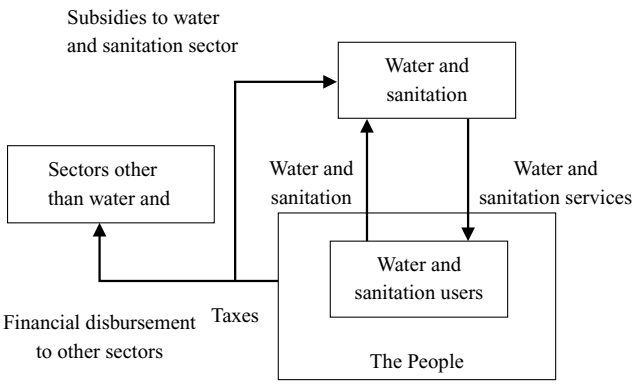
(3) Realizing Benefits Appropriately Corresponding to the Magnitude of Expenditure

Where the financial situation of the water and sanitation sector is concerned, the utilities levy water supply and sewerage tariffs on their users in return for the services, but in many developing countries, the revenue from the tariffs falls extremely short. Therefore, a part of tax revenue is used to subsidize the water and sanitation sectors to make up the deficits in the current account (insufficient revenue) and to compensate for insufficient funds for capital investment (insufficient capital)[9] (Figure 1).

As for the expenditure, on the other hand, the water and sanitation sectors cannot afford downsizing of its services simply because of the shortage of collected charges, in that drinking water is essential for human existence and wastewater, unless processed, does substantial harm to substantially on the sanitary conditions and environment. Therefore, when needed, a possible reasonable policy option is to maintain the scale of expenditure by means of actively injecting subsidies and raising funds through long-term loans and bond floatations as a means to provide quality water supply and sanitation services to people. It must be borne in mind as to whether the people can benefit from the services sufficiently to meet the scale of expenditure (that is, the sum of revenue from tariffs, subsidies, borrowing/funds raising by bond floatation, plus other income.).

More specifically, in light of income redistribution policies (paying attention to the poverty group and gaps between urban and rural areas), geographical unbalance between beneficiaries and those who bear costs (e.g., residents near the downstream of rivers can benefit from an upstream sewerage system without bearing costs) and fair

Figure 1: Financial flow in the water and sanitation sectors



Source: SADEP Study Team

9 In this study, the financial analysis of the water and sanitation services is made based on the so-called "accounting method for public corporations"(for details, see Box 1 in Chapter 2). Subsidies are granted by the government or municipalities to make up for the deficits of the current account balance or insufficient revenues from the investment balance.

allocation of burdens among generations concerning expenditure on investment (e.g., costs of facilities with a useful lifespan of many years should be borne by several generations in accordance with the actual lifespan), the government will be able to gain the understanding of the people concerning measures such as active injections of subsidies into the sector and fund raising through long-term loan and bond floatation. On the other hand, the amount of subsidies, funds raised by borrowing or bond flotation may expand far more than the scope of the policies due to inefficient operation or inappropriate investment activities. In such cases the benefits are not brought to the people despite the massive amount of expenditure and the government may fall short of funds required for other sectors. Then the financial situation is obviously inappropriate, and fails to gain support from the people. Taking all this into account, the long-term objectives of the water and sanitation sectors have been set at (i) realizing benefits matching the scale of expenditure in the entire sectors and (ii) making reasonable use of the right amount of subsidies and funds raised by borrowing and bond floatation, together with avoiding excessively increased pressure on funds required in other sectors.

3. Problems and Future Challenges in the Water and Sanitation Sectors and at the Levels of Three Components

In order to clarify problems and future challenges which the water and sanitation sector has to tackle, the problems and challenges will be examined in the sectors as a whole (i) and by dividing the structure of the sectors into three components: the government level (ii), the utility level (iii), and the project level (iv) However, some countries have only one single utility which is responsible for the management of the water and sanitation sectors, whereas others have more than one. The basic components of the structure at each level, despite some differences among countries, are as shown in Figure 2.

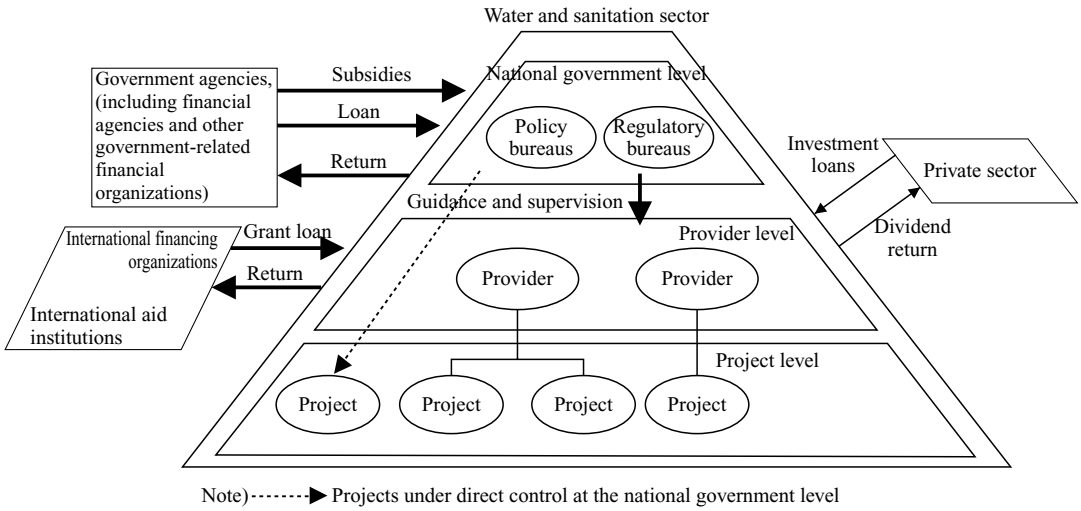
(1) Water and sanitation sectors

This is the collective unit consisting of all concerned organizations, such as agencies in charge of policy-making or regulations in conjunction with the water and sanitation services, water and sanitation utilities (local governments, public corporations and private firms), and other organizations related to projects being implemented and planned.

(2) National government level

This indicates policy bureaus (such as the Ministry of Health) that are the top-level decision-making organizations in the sectors, overseeing the policies

Figure :2 Relationships in the water and sanitation sectors



Note) Government organizations, international development financial organizations, and the private sector each provide direct supportive financing for government, providers and projects.
Source: SADEP Study Team

and laws governing the sectors. It includes the regulatory monitoring agencies that approve tariffs and various other matters for which petitions are submitted by utilities, financial agencies (such as the Ministry of Finance) that are in charge of the distribution of subsidies, and so on.

(3) Utility level

This indicates the implementing organizations that develop water and sanitation facilities and provide services using the facilities. Included are local governments, public utilities that have jurisdiction over the water and sanitation services under local government authorities, licenced or commissioned private utilities, and public entities that manage and supervise the water and sanitation services regardless of the administrative area.

(4) Project level

This indicates the smallest element in the water and sanitation sectors, that is, individual projects, including a project as a whole and parts of projects from construction to operation and maintenance of water and sanitation facilities. Projects are usually implemented by utilities.

4. Selecting indicators for evaluation

In order to make water and sanitation sectors sustainable, problems involved in the sector and at each component level (national government, utility and project levels) must be clarified and solved for the improvement of the sectors. For this purpose, certain criteria are needed to evaluate the presence of or the extent of such problems if any. Thus, a number of indicators are selected for the sector itself and the individual sector components, for which ideal numerical figures or statistics are presented as targets[10]. (In Chapter 3, the water and sanitation sectors in the focused Four Countries will be analyzed in accordance with these evaluation indicators to the extent possible.)

(1) Water and sanitation sector

The long-term visions pursued in the water and sanitation sectors in one country are, as stated before, to achieve three goals:"assuring a adequate level of service quality", "increasing coverage ratios", and "Realizing benefits approriately corresponding the magnitude of expenditure". These are used as evaluation indicators (Table 2). Since the definitions of selective indicators and ideal numerical figures and conditions must be common among all the countries concerned, those have been taken from standards and criteria used in the U.N. Millennium Development Goals, the World Bank, and the WHO. In terms of contribution to public sanitation, the number of waterborn infectious disease cases is set as an indicator. This would enable overall evaluation of whether water quality and sewage treatment rates in the country to be studied are adequate and appropriate.

(2)National government level

The four parameters were selected as the national government level indicators to be used for evaluation, by assessing the circumstances of institutions, investment, subsidy and tariff systems, whether the government has succeeded in realizing sustainable water and sanitation sectors and constructing a system in which utilities can provide their services on a sustainable basis (Table 3). Because the organizational structures of central governments, and the economic and social conditions vary from one country to another, it is difficult to carry out straightforward comparisons of countries making use of quantitative numerical values. Thus, these indicators are compared on a qualitative basis as stated before. The outline of governmental subsidy policy is presented in Box 1, and the outline of tariff policies in Box 2.

(3)Utility level

In order for the water and sanitation sectors to be sustainable, the three areas, (i)"provision of services", (ii)"operation and maintenance" and (iii) "financial management", need to be sound at the utility level. The evaluation indicators were selected taking into consideration the following with regard to

10 For indicators, qualitative ones (establishment of accountability, etc.), in addition to quantitative ones (coverage ratios, etc.) have been included as many as possible.

Table 2: Indicators and Ideal Numerical Figures for Conditions in the Water and Sanitation Sectors

No.	Indicator	Description	Ideal Conditions
a	Water Coverage Ratio	Water coverage ratio (%) = (Actual population with access to water / Total population) x 100	Nearly 100%
b	Quality of Supplied Water	Supply of good quality water	Water quality that meets WHO water quality standards.
c	Quality of Supplied Water	Sanitation coverage ratio (%) = (Actual population with access to sanitation services / Total population) x 100	Nearly 100%
d	Wastewater Treatment Ratio	Wastewater treatment ratio (%) = (Volume treated at sanitation facilities / Total wastewater volume discharged from area with sewerage system) x 100	The wastewater treatment ratio to be 100%.
e	Unaccounted for Water (UFW)	UFW rate (%) = [(Physical losses + commercial losses) / Total water distributed] x 100	An average of about 30% throughout developing countries (World Bank TWUWS[11], 1996).
f	Statistical Data on the Occurrence of Waterborne Diseases	Trends in the number of occurrences of waterborn infectious diseases Trends in the medical expenses on waterborn infectious diseases	No occurrence of waterborn infectious diseases. A small proportion of medical expenses on waterborn infectious diseases to all medical expenses (the target is the level observed in developed countries.)

prerequisites for soundness (in Table 4). The definitions of the indicators at the utility level and a description of the ideal conditions are given below.

(i) Provision of services

Criteria to evaluate the content of services provided is necessarily required to be able to measure how many people the services cover in practice. Thus, the "coverage ratio of water supply" and the "coverage ratio of sanitation services" were selected as the indicators.

As for indicators to assess the quality level of the services provided,"quality of supplied water," "supply continuity" and "water pressure" can be evaluated to grasp a rough idea about the water services quality. As for sewerage, on the other hand, "wastewater treatment ratio" was selected, in that it can evaluate whether wastewater is appropriately treated with secondary treatment in the sanitation facility.

(ii) Operation and maintenance

The operation and maintenance is the routine work for which the utility is responsible in order to maintain the quality and quantity of services and to provide the services continuously and steadily. A primary task in the operation and maintenance is to minimize the leakage (physical losses) likely to occur in the service of supplying water. At the same time, if the volume of non-metered water (commercial losses) is substantial, it causes, like water leakage, a reduction in the collection of water tariffs, so that appropriate maintenance is needed. Supplied water that does not result in revenue, such as that which has leaked out or is non-metered, is called "unaccounted-for water" (UFW), and this can serve as an appropriate indicator for the level of operation and maintenance.

11 TWUWS : Transportation, Water, and Urban development department's Water and Sewerage division

Table 3 Sustainability Indicators and Ideal Conditions at Government Level

No.	Indicator	Definition and Description	Ideal Conditions
a	Establishment of an accountability system	Degree of clarity and establishment of roles, functions and supervisory authorities of policy-making agency, supervisory agency, financing agency in the central government.	* The functions and accountability of the administrative organizations – the central government, local governments and semi-governmental organizations must be clearly established. * In order for the utilities to implement services smoothly, the legal and regulatory systems must be appropriately established.
b	Trend of Investments	The presence or absence of any national investment plan based on the long-term visions of the water and sanitation sector (including plans related to overseas economic assistance).	* Long-term investment plans must be formulated which take into consideration a balance in overall national revenue and expenditure, and the investment activities in the sector must be appropriately made at the right timing with the right balance of distribution.
c	Trend of Subsidies	* The amount of governmental subsidies allocated to new and continued investments in fixed capital stock in the water and sanitation sector. * The amount of governmental subsidies allocated to the current account income.	* Subsidies allocated to capital investment necessary to form fixed capital stock must be assured. * The proportion of subsidies to the balance of the current account should not be excessively large compared to the revenues from water tariffs.
d	Tariff Policy d-1 Tariff Structure	(Tariff Structure) * Metered tariff system making use of water meters. * Tariff system which provides incentives for water savings. * Tariff system which pays careful attention to low-income customers as necessary.	* The structure must comprise basic fees for maintenance costs required even when facilities are not used and increasing metered tariffs (progressive tariff structure). * Tariff categories must be simply divided into general household and business. * A separate tariff structure is provided for low-income customers as necessary.
	d-2 Tariff Level	(Tariff Level) * Degree of transparency in the procedures of setting and revising the tariff level. * Degree of political and social considerations	* Tariff system must be established and revised in the manner that the people involved can clearly understand the procedure. * The setting and revision of tariff levels must be conducted on a reasonable basis (e.g., ATP, WTP, etc.).

== Box 1. Financial Accounting for Water and Sanitation Services ==

Water and sanitation services are a revenue-oriented public service. In Japan, for example, the provider of the services classifies its balance of payments into an investment balance (the capital revenue and expenditure) and a current account balance (the balance of revenue and expenditure of a profit-making business) in accordance with the accounting method for public corporations, so as to run on a standalone basis. The accounting method for public corporations, unlike a method for public agencies, is similar to that for private companies, and is aimed at making up for the depreciation of fixed capital stock (depreciation allowance) with revenues of the public firm itself.

In general, the establishment of the infrastructure of water and sanitation systems requires a massive amount of investment in facilities, which include construction of water supply piping networks, ground burial of sewerage pipes, and construction of water filtration and wastewater treatment facilities. This investment expenditure on fixed capital stocks with many long years of depreciation is normally financed by subsidies and funds raised by long-term loans (including floating bonds). The injection of tax revenues means that the cost is borne by the people as a whole if it is a national tax income, or by people in particular regions if it is a local tax income, and the governmental subsidies are granted to the provider of the water supply and sanitation services.

On the other hand, the current account balance (operation and maintenance cost, payment of interest on loans and debentures, depreciation costs, etc.) should, in principle, be ideally financed by revenues from charges levied on the users, so that securing of tariff collection becomes essential. However, utilities in some areas cannot expect sufficient collection due to, for example, water leakage, absence of water meters and a large number of non-payments, and thus the balance of their current account may, in many cases, be in the red. In such cases, the shortage of funds is normally compensated by tax revenues (local tax) from the citizens concerned, but at the same time the utilities themselves are required to make efforts to balance the budget via, for example, streamlining the operation and maintenance cost (cost reduction). Where a sewerage system is concerned, beneficiaries of the service include not only those who discharge water through the system (users) but also a wider range of people. That means the system contributes to the improvement of the local environment as a whole. Hence, the construction of sewerage systems may be financed by public subsidies from national or local tax funds.

Another element that requires operation and maintenance cost is workforce, which has to be the right number within the organization of the service provision (neither overstaffed nor understaffed). If the organization is understaffed, they may be unable to detect water leakage or disabled meters, or collect water tariffs. On the contrary, if it is overstaffed, the operation may become inefficient. As an indicator to gauge the appropriate number of staff members of the utility, a "Staff per Thousand Water Connections" (SWC) made use of by the World Bank will be considered.

(iii) Financial management

In assessing the appropriateness of the financial management[12], it is necessary, above all, to see how much the revenue from water tariffs can finance the current account expenditure. It is ideal at individual utility level if the revenue arising from the collection of water tariffs can finance all the current account expenditure, but in practice as described earlier, the utilities are in many cases in deficits (most of which

12 The financial management will be assessed in accordance with the accounting method for public corporations (see description in Box1). For references of the same method applied in Japan, see homepages (financial and account reports) of the financial reports of municipalities and public firms, such as the Bureau of Water Works of Tokyo Metropolitan Government; Bureau of Sewerage of Tokyo Metropolitan Government; Water Bureau, Corporate Agency, Kanagawa Prefecture; and Bureau of Sewerage, Yokohama City.

== Box 2. Three important criteria for setting water supply and sewerage tariffs ==

There are several criteria for setting a tariff level for water supply and sanitation services. First, it is necessary to set a tariff level in accordance with the income levels of users so that they can actually afford to pay. The upper limit of the charge is normally called "Affordability to Pay"(ATP). (See Chapter 5) Second, it is also important to recognize"Willingness to Pay"(WTP) as a reference, which is obtained by a questionnaire survey which asks users how much they are willing to pay at a maximum for the services (See Chapter 5) A tariff level in excess of ATP or WTP may make it impossible for many users to pay their tariffs, or may even make them refuse to pay. Third, a tariff level may be determined from the viewpoint of profitability. The utility is required to pay their operation and maintenance costs for everyday services, and thus it is appropriate to finance the cost by the tariffs collected from users in consideration for the service provided. At the same time, the payments for interest on loans and debentures (capital costs for facilities accrued in the fiscal year in question) and depreciation costs should ideally be financed from revenues accrued within the same fiscal year as much as possible. Hence, it is necessary, when profitability is being taken into account, to set a level which can support the operation and maintenance cost and the payments for interests and depreciation costs.

Accordingly, it is vital to set a tariff level for the water supply and sanitation services, taking all factors into account - (i) ATP, and (ii) WTP - and at the same time, (iii) trying to make the tariff such that it is possible to finance the current account expenditures as much as possible under the principle of profitability.

is made up for by governmental subsidies, etc.). Such chronic states of deficit can be gauged by the proportion (Working Ratio, WR) of operation costs (operation and maintenance cost) to the revenue from water tariffs as a whole, and the proportion (Operating Ratio, OR) of management costs (the total current account expenditure which is the sum of operation and maintenance cost, costs for the payments of interest for loans and bonds and depreciation costs) to the tariff revenue. In other words, a 100% working ratio suggests that all the operation and maintenance costs are financed from tariff revenue, and a 100% operating ratio indicates that all the current account expenditure is financed from tariff revenue.

In evaluating the financial position of the water supply and sanitation utility, it is important to grasp whether water tariffs are appropriately collected. In developing countries, quite a few utilities fail to collect water tariffs although the meters installed indicate the volume of consumed water (in some cases, the amount of collected tariffs cannot reach even half of the amount claimed). Therefore, it is essential to grasp the Collection Ratio (CR) to enhance the financial strength of the utilities.

(4)Project level

Problematic projects are those that are not carried out as planned, that are implemented despite their lack of profitability, and that have a negative impact on society. With that in mind, the following three parameters have been selected as indicators for evaluating project sustainability. (Table 5)

(i) Adequacy of project plan

Projects to be carried out must bring about adequate socio-economic benefits to the population for the burden to be incurred by them. Sufficient consideration must be given to the necessity and effects of a project as well as to the scale required for the project.

(ii) Financial situation

It is essential to assure profitability in terms of costs, such as investment and O&M funds, to be spent on new construction, expansion, maintenance or repair work on facilities.

(iii) Social impact

It is vital to ensure that the project appropriately satisfies the demand for the service provided, avoids any harmful impact on society, and users and function properly to contribute to society.

Table 4: Sustainability Indicators and Ideal Conditions at Utility Level

	No.	Indicator	Description	Ideal Conditions
(i) Provision of Service	a	Water Coverage Ratio	Water coverage ratio (%) = (Actual population with access to water / Total population) x 100	nearly 100%.
	b	b-1 Quality of Supplied Water	b-1 Quality of Supplied Water	Water quality that meets WHO water quality standards.
		b-2 Supply Continuity	Ensured hours of water supply	Continuous 24-hour supply of water to every household.
		b-3 Water Pressure	Optimal water pressure	Minimum 0.2 MPa.
	c	Sanitation Coverage Ratio	Sanitation coverage ratio (%) = (Actual population with access to sanitation services / Total population) x 100	nearly 100%. (However, in rural areas, expansion of sanitation should be promoted by means other than sewerage systems with consideration socioeconomic conditions.)
	d	Wastewater Treatment Ratio	Wastewater treatment ratio (%) = (Volume treated at sanitation facilities / Total wastewater volume discharged from area with sewerage system) x 100	The wastewater treatment rate should be 100%.
	e	Water to sewerage Coverage Ratio	Sewerage coverage / water coverage (%) = (Sewerage coverage / water coverage) x 100	100% (The sewerage coverage ratio must be the same as the water coverage ratio.)
(ii) Operation and Maintenance	f	Un-accounted-for Water (UFW)	UFW rate (%) = [(Physical losses + commercial losses) / Total water distributed] x 100 Physical loss means water leakage; commercial loss means non-metered water and water consumption for parks, public spaces, and firefighting.	An average of about 30% throughout developing countries (World Bank TWUWS, 1996)
	g	Staff per Thousand Water Connections (SWC)	Staff per 1,000 Water Connections = Total Staff / (Number of water connections / 1,000)	5 persons per thousand connections (according to a World Bank data)
(iii) Financial Management	h	h-1 Working Ratio (WR)	Working ratio = Operational cost / Tariff revenue Where operational cost includes electricity charges, repairs, repair materials, and labor, but not depreciation.	Not exceeding 100%. (A recommended value is 70% or less)
		h-2 Operating Ratio (OR)	Operating ratio = (Total operating costs / Tariff revenue x 100 Where total operating costs = operational costs + depreciation + interest repayment.	Not exceeding 120%. (A recommended value is 100% or less.)
	i	i-1 Collection Ratio (CR)	Collection ratio (%)= (Amount of money collected from water and sanitation bills / Total value of billing) x 100	90%. (100% is recommended.)
		i-2 Tariff Level	Same as shown in Table 3	Same as shown in Table 3

Table 5: Sustainability Indicators and Ideal Conditions at Project Level

	No.	Indicator	Description	Ideal Conditions
(i) Adequacy of Project	a	Progress against the project plan	* Progress of project compared to the planned schedule	Project is undertaken according to the plan from the perspectives of the national plan, priority, appropriate scale, efficiency, project effects, and spillover effects.
	b	Appropriateness of scale of project	•Scale of project in the light of its purpose, effect, and cost and benefit •Political consideration, requests from social policy viewpoint, and economic situation	•The scale of project is appropriate in the light of revenue from the tariffs accrued from the operation of the project. •If any subsidies or other available funds are invested in the project, apart from the revenue from water tariffs, its scale is appropriate when the benefit meets the total costs.
(ii) Financial Situation	c	Financial Internal Rate of Return (FIRR)	Financial internal rate of return (FIRR) (Discount rate where the revenue and the cost become equal at the present value.)	FIRR = 12% or above. (FIRR must be greater than the opportunity cost of the capital.)
(iii) Social impact	d	Prevalence rate for waterborne infectious diseases	Prevalence rate for waterborne infectious diseases	The prevalence rate for waterborne infectious diseases within the beneficiary areas of the project must declined (At the same time, mortality rates for infants and adults must decline the medical expenditures reduce and absentee rate due to illness reduce.)

Chapter 3. Analysis of the Water Supply and Sanitation Sectors in the focused Four Countries

This chapter analyses the water supply and sanitation sectors in the focused Four Countries (Mexico, Peru, Panama, and Costa Rica) included in this study in terms of (i) the sector as a whole, (ii) national government level, and (iii) utility level, based on the evaluation items and evaluation indicators set up in Chapter 2. (Issues at the project level will be studied and analyzed in Chapter 5.) It first illustrates the present situation and structures of the sectors in the focused Four Countries, and then specifies problems lying at the central government level, and at the utility level in those Countries, thereby extracting future challenges to be addressed in the sectors.

1. Mexico

(1) The Present Situation and Structure of the Water Supply and Sanitation Sectors in Mexico

Mexico covers an area of some 1,970,000 square kilometers and has a population of about 103.2 million, 70% of which resides in urban areas, mostly on the central and the northwest parts of the country. Although the water demand in these geographical parts is thus high, the regions suffer from frequently occurring droughts and lack sufficient water supply.

Although the coverage ratios of the water and sanitation sectors in Mexico are relatively high - 89% (urban area: 95%, rural area: 68%) for water coverage and 76% (urban area: 89%, rural area: 36%) for sanitation coverage (see Table 6), there is a wide disparity in coverage between urban and rural areas as is the case with many other countries. Since the nationwide sanitation treatment ratio is somewhat low at 28% (of which approximately 10% is for Mexico City), the government established a standard to legally prohibit discharge of untreated wastewater.

The structure of the water and sanitation sectors in Mexico, the roles of relevant organizations and the relationships among them are shown in Figure 3. The main authority in relation to water supply and sanitation is a Comision Nacional del Agua (CNA)[13] - the National Water Commission, which was established under SEMARNAT (Secretaria del Medio Ambiente y Recursos Naturles)[14] for the management and operation of water services, in order to achieve sustainable use of the national asset. The main functions of CNA are (1) control of water demand and supply in municipalities, (2) provision of permission and approval for water supply and sanitation services to either public or private utilities, (3) provision of water and sanitation services covering more than one state, and (4) regulation and supervision of agencies in accordance with four official standards related to water pollution control [(i) the standard for discharge of wastewater to water courses, (ii) the standard for discharge of wastewater to municipal sewerage networks, (iii) the standard for reuse of wastewater, and (iv) the standard for disposal or reuse of sludge and biosolids]. While CNA administers the overall water supply and sanitation in the country, it is local governments that are responsible for the management of the water and sanitation services. The Ministry of Health (Secretaria de Salud) is in charge of formulating policies and plans for the services and drafting relevant bills.

(2) The Present Situation and Problems at the National Government Level in Mexico

Building on the current state and structure of the water and sanitation sector in Mexico as mentioned above, this section addresses the current state and problems observable at the national government level in line with the indicators selected in Chapter 2.

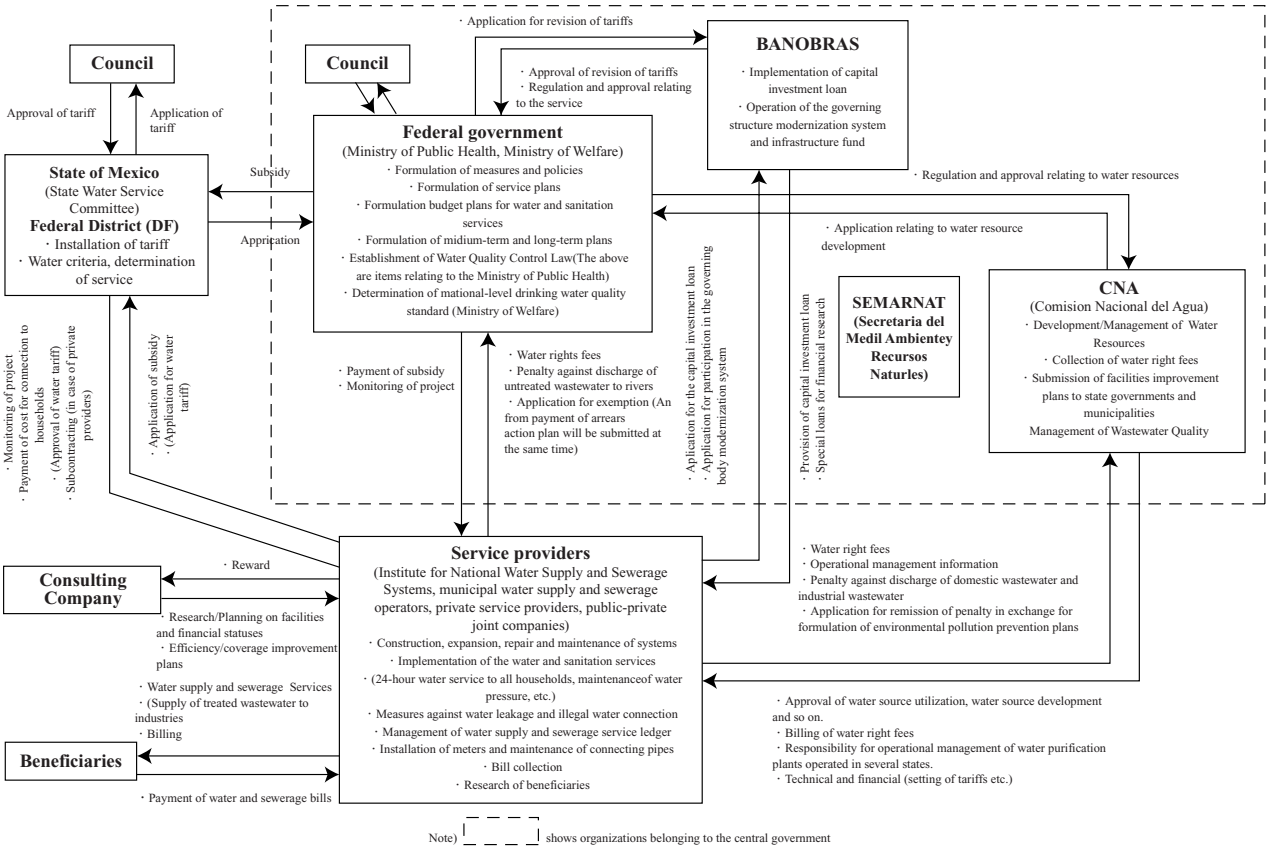
(i) Accountability system

In Mexico, the state governments and ministries of the Federal Government and the state governments supervise water supply and sanitation utilities. Under current circumstances with fragile supervision by

13 Comision Nacional del Agua: CNA, consists of the Enforcement Department, the Construction Department, the Water Administration Department, the Planning Department, the Technical Department, and the Administration Department.

14 Secretaria del Medio Ambiente y Recursos Naturles: SEMARNAT was established in 1989.

Figure 3: Structure of the Water and Sanitation Sector in Mexico



Source: Prepared by SADEP Study Team based on reference materials

authories, 1,000 out of approximately 2,400 operating utilities in the whole country do not pay their water rights fees to CNA. In addition, many do not even report their performance results to CNA. In summary, accountability of the supervisory authority of utilities is dispersed.

In addition, although the water resources are limited in Mexico, they are free when used for the agricultural sector, and there is no incentive for water conservation. Despite this, currently the central government cannot be accountable for improving the situation in a comprehensive manner.

(ii) Investment Plan

Despite the expectation that the demand for water and sanitation will grow with the continuous economic growth of Mexico for the next 20 years (until 2025) and the expected incidental improvement of the living standards of the population in future, investment in the sectors has been on a downward trend for the past ten years, with no progress in improvement of sanitation facilities and with a deteriorating balance in water circulation.

In response to this situation, the government is upgrading its investment plan in the water sector, scheduling an investment of approximately three billion US dollars in the coming two to three years (it has invested approximately one billion dollars in the sector every two to three years so far) and has already provided 12 cities with loans for capital investment through the Bank for the Development of Public Services (BONOBRAS)[15].

(iii) Subsidies

In Mexico, governmental subsidies are utilized to compensate for the part of expenditure that cannot be

15 Banco National de Obras y Servicios Publicos,S.N.C: BANOBRAS

covered by the water and sanitation tariffs collected by the utilities. However, too much dependence on subsidies has been a problem.

While the government grants subsidies to the Water Supply System of Mexico City (SACM)[16], 70% of the subsidies were allocated to operating expenses for operation and maintenance which suppresses the supplementary injection of subsidies into investment expenditure.

(iv) Tariff Policy

The water tariff is structured with a metered tariff system as a principle, with the beneficiaries classified into low-income earners, households and industries. However, the current water tariff is not profitable enough to cover all the current account expenditure, and thus the shortage is made up for by subsidies, that is, the service does not have sufficient profitability.

In terms of the sewerage tariff, which is set at maximum 30% of the water tariff, many utilities are facing difficulties in collecting the bills due to the difficulty for beneficiaries to understand its benefits.

(3) The Present Situation and Problems at the Utility Level in Mexico

The total number of utilities engaged in water and sanitation services throughout the 31 states of Mexico and Mexico's Federal District (Distrito Federal: DF) is over 2,000. As major entities around Mexico City, the State of Mexico Water Commission (CEAM)[17] and the Water Supply System of Mexico City (SACM)[18] were selected for this study. The current state and problems with their services are considered in line with the assessment indicators selected in Chapter 2 (Table 6).

(i) Service Provision

<The State of Mexico Water Commission (CEAM)>

Although the water and sanitation coverage ratios have both reached levels as high as 90% (1,600,000 public water connections) and 72% respectively, the wastewater treatment ratio is limited to only 22% and most wastewater is discharged into watercourses without being treated.

<The Water Supply System of Mexico City(SACM)>

The water coverage has reached 2,100,000 public water connections (water coverage: 98%) with household, commercial and industrial uses combined. In addition, the sanitation coverage is also as high as 95%. However, with scarcity of additional water sources to cover the growing needs for water and overuse of groundwater, recovery of the aquifer water level is urgently required. Further, continuous water supply (24 hours a day) is not provided in some areas and intentional water interruption is sometimes enforced during the nighttime or on a weekly basis. Improvement of the low sanitation treatment ratio of 10% is urgently required in the Federal District under the jurisdiction of SACM where a large number of population is concentrated and the sanitation coverage ratio is high.

(ii) Operation and Maintenance

<State of Mexico Water Commission (CEAM)>

The current UFW 40% is well above the ideal value (30%).

<Water Supply System of Mexico City (SACM)>

The current SWC (5.5) slightly exceeds the ideal value (5.0).

(iii) Financial Management

<State of Mexico Water Commission (CEAM)>

Of areas under CEAM's jurisdiction, only approximately 20% can manage to cover the

16 Sistema de Agua de la Ciudad de Mexico: SACM

17 The State of Mexico Water Commission: Comision Estatal de Agua del Estado de Mexico (CEAM)
CEAM serves 13 million people in its coverage, and is responsible not only for the management of water resources in the State of Mexico, but also for the management of purification and water distribution facilities, as well as the authorizing rights to entrust parts of services to private companies.

18 The Water Supply System of Mexico City: Sistema de Agua de la Ciudad de Mexico (SACM)
SACM was established in January 2003 as a result of a merger between a public corporation for the construction of water service facilities, which had been mainly responsible for the construction of water supply and sewerage network, and the Federal Committee for Water Supply, which had been in charge of the supervision of the service. SACM covers areas where there are 8.5 million residents. The number of its staff members totals 11,500.

Table 6: Result of Evaluation Items for Major Utilities in Mexico

No	Indicator		National average[1)]	CEAM	SACM	Ideal value
Service provision (water service, sanitation service)						
1	Water coverage ratio (%)	Total	89	90	98	Nearly 100
		Range 2)	72-97	-	-	Nearly 100
		Urban area	95	90	98	Nearly 100
		Rural area	68	-	-	Nearly 100
2	Quality of water supply service		N.A.	N.A.	Restricted supply	24h water service
3	Sanitation coverage ratio (%)	Total	76	72	95	Nearly 100
		Range 2)	47-94	-	-	-
		Urban area	89	72	95	Nearly 100
		Rural area	36	-	-	-
4	Sanitation coverage ratio (%)		28	22	10	100
5	Sanitation coverage ratio/ water coverage ratio		0.85	0.80	0.97	1.00
Operation and maintenance						
6	Unaccounted for Water (UFW: %)		40	40	N.A.	30
7	Staff per 1000 water connections (SWC: persons)		N.A.	N.A.	5.5	5.0
Financial management						
8	Working ratio (WR: %)		N.A.	N.A.	130	70
	Operating ratio (OR: %)		N.A.	N.A.	N.A.	100
9	Tariff collection rate (CR: %)		N.A.	36	50	90

Note: 1) Value as of 2000: "Water Condition in Mexico" (CNA Report, 2003), 2) Range of CNA Control Area, N/A : no data was available
Source: Prepared by SADEP Study Team based on reference materials

operation and maintenance costs with the collected tariffs, and 80% depend on subsidies from the government.

The tariff collection ratio stood at 36%, extremely low due to the deficiency in the billing and collecting system of the utilities.

<Water Supply System of Mexico City (SACM)>

The working ratio (operational cost / tariff revenue) is 130%, far above the ideal value of 70%, indicating the failure in establishing a sound financial management. Similar to CEAM, the tariff collection ratio hovers around 50% due to its inadequate billing and collecting system.

(4) Challenges in the Water and Sanitation Sector of Mexico

Based on the above, the following challenges at the sector as a whole, national government and utility levels need to be addressed.

(i) Challenges in the Sectors

1) The water and sanitation coverage ratios are 89% and 76% respectively across the nation, and efforts should be made to increase the latter up to the

level of the former. It is necessary to improve the coverage in the rural areas to narrow the gap of the ratios observed between urban and rural areas.

2) The sewege treatment ratio, a prerequisite for sustainable water circulation, is conspicuously low (28% of the nationwide average). Therefore it is necessary to draw up a national investment plan for improvement, according to which the government should supervise individual utilities and promote sewerage services further.

3) Although investment in the sectors is required to improve both the quality and the quantity of service, the investment amount has followed a downward trend in recent years. Because of the shortage and deterioration of the facilities, it is necessary to upgrade the overall facility stocks of the sectors forthwith. The sectors need to urgently have a clear-cut vision of a long-term investment plan that portrays a picture of the sectors in the future.

4) Most subsidies have been used to make up for the deficits in the current account expenditure (operation and maintenance costs, etc.) and little has been used in investment. Hence, it is necessary to take comprehensive measures in the sectors so as to redirect available subsidies to investment as much as possible.

(ii) Challenges at National Government Level

1) It is necessary to strengthen and clarify the role and responsibility of CNA, the authority for comprehensive water management of the country, and to strengthen its capacity in information gathering and supervision concerning the water and sanitation sectors.

2) Since the water resources are limited in Mexico, CNA needs to play a more proactive role and take responsibility for effective distribution of water to the agricultural and other sectors.

3) Investments in the water and sanitation sector have been diminishing. The government should draw up a long-term investment plan and undertake supporting measures for utilities through the distribution of funds for facilities (grants of governmental subsidies) if necessary[19].

4) As for the tariff policy, an increase in the tariff level should be carefully considered[20]. In light of the high UFW and low tariff collection rate, the increase in tariff should not be done without due care. What is required is to encourage utilities to make an effort to improve these indicators, and to put their financial position on the right track.

(iii) Challenges at the Utility Level

1) Both utilities surveyed have achieved significantly high ratios of water and sanitation coverage (water supply of CEAM stood at 90%, water supply of SACM at 98%, sanitation coverage of CEAM at 72% and that of SACM at 95%). However, there are water supply restrictions, and the water treatment ratios for sewerage are low at the utilities (CEAM 22% and SACM 10%). Thus it is still necessary to improve the quality of the services.

2) As for the operation and maintenance of the services, repair and refurbishment as a policy against water leakage must be carried out thoroughly. Also, the current allocation of personnel should be reconsidered so that excess staff members can be reallocated to augment the sections responsible for leakage reduction and improvement of the collection ratio.

3) Where financial management is concerned, in order to increase the collection ratios that are currently 36% for CEAM and 50% for SACM, urgent measures must be taken including notices, reminders and/or application of penalties to non-payers. Also, the benefits and the social significance of sewerage systems must be communicated more widely for better understanding by the users for the purpose of the appropriate collection of sewerage charges. It is necessary for the utilities to establish a system, through these measures, to increase the collection ratios, so they can afford the current account expenditure with minimum subsidies.

19 The government limits the investment amount in individual projects: the upper limits are 30% of the total project costs for the water supply, and 40% for the sewerage systems.

20 The water tariff for households in the State of Mexico is 10 peso per cubic meter. However, the current tariff is not profitable, and is scheduled to be rise by 50% in the near future (at the time of this study).

2. Peru

(1) The Present Situation and Structure of the Water Supply and Sanitation Sector in Peru

Peru covers an area of 1,285,000 square kilometers and has a population of about 27 million. About 70% of the population lives in urban areas composed of cities with a population over two thousand residents and 30% in rural areas. The country consists of 23 Departments plus the independent Province of Callao. The Departments comprises several provinces, within which there are Districts. In terms of the water service in Peru, partly because the Pacific region has little rain and is increasingly densely populated, water scarcity is a serious problem. In terms of the sanitation service, although the wastewater collection system has been developed, there is a growing concern over such problems as water pollution due to the lack of wastewater treatment plants.

The water and sanitation sector in Peru shows high water and sanitation coverage ratios at 83% and 75%, respectively, though the figures are slightly lower than those in Mexico (Table 7). However, the gap in ratios among regions is great. While such high coverage ratios are limited to the water supply and sanitation utilities (EPS)[21] in Lima and Cuzco with large populations, smaller EPSs like in Loreto have not reached sufficient levels of water and sanitation coverage (in Loreto, the water coverage ratio is 61% and the sanitation coverage ratio is 55%). In the meantime, the percentage of sewege treatment is as low as 19% nationwide.

The structure of the water and sanitation sector (government and utility) in Peru is shown in Figure 4. The management, supervision and policy planning of the water and sanitation sectors in Peru are the responsibility of the Ministry of Housing, Construction and Sanitation (MVCS)[22]. The National Superintendence of Sanitary Services (SUNASS)[24], established under MCVS, sets and approves water and sewerage tariffs at the request of the utilities. A special unit within the above Ministry - Support Program for the Sanitary Sector Reform (PARSSA)[23] - serves as the intermediary for national and foreign loans provided to the water supply and sanitation services. Other government agencies involved in the sector include: the Ministry of Economy and Finances, the General Controller's Office[25], the Ministry of Health[26], and the Natural Resources Institute (INRENA)[27].

(2) The Present Situation and Problems at National Government Level in Peru

(i) Accountability system

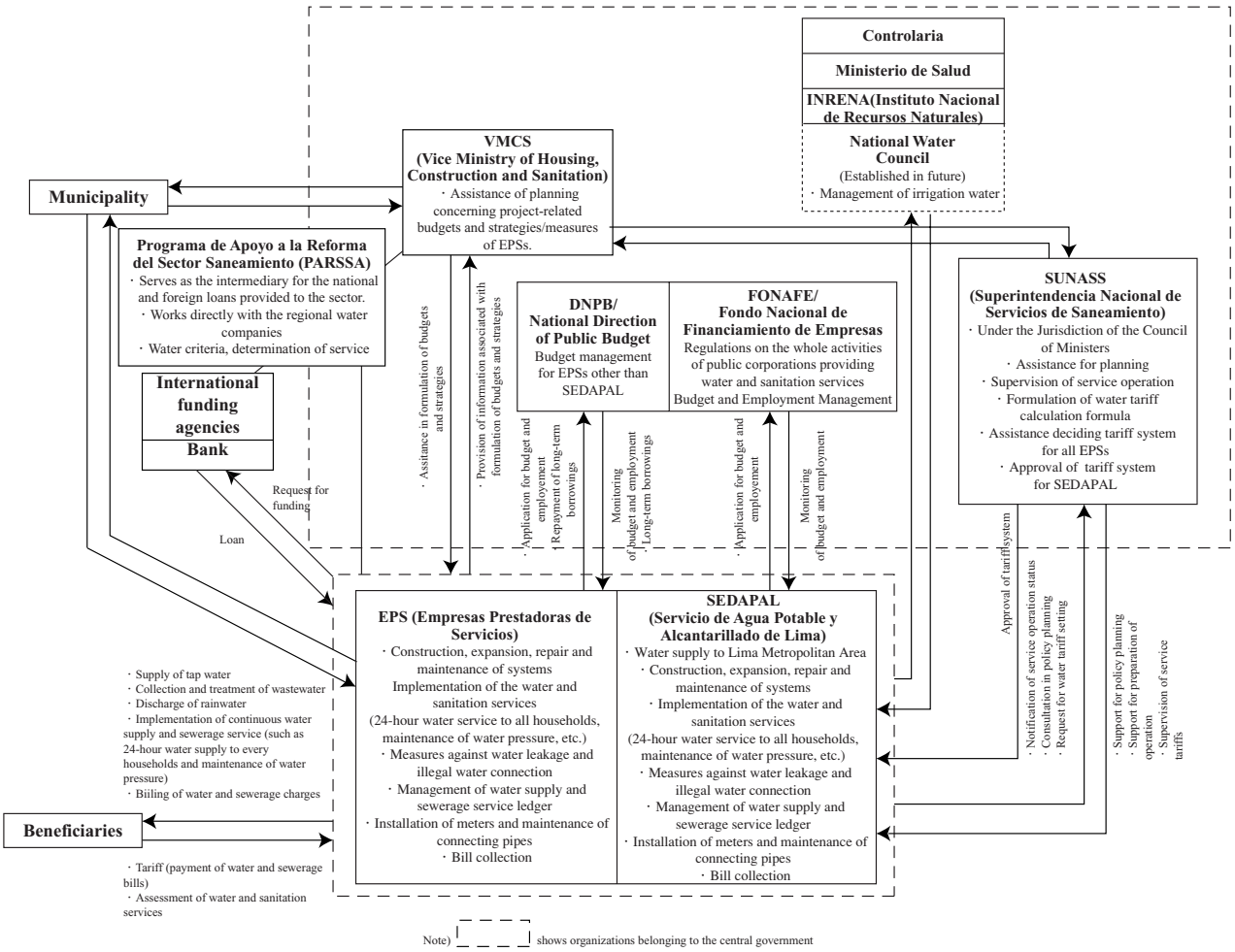
In the water and sanitation sectors, multiple ministries including the Ministry of Housing, Construction and Sanitation (MVCS), the National Superintendence of Sanitary Services (SUNASS), and the Ministry of Economy and Finances (DNPB) are in the position of supervising EPSs - Empresas Prestadoras de Servicios (Service Providing Companies). With this structure, sometimes there is no coordination among them, probably due to the lack of a clear definition of the roles of respective entities against the EPSs. In addition, their sector policy, which all entities superior to the EPSs should follow, has not been clearly established. From the above situation, there is a concern over the redundancy and lack of role definition in the entities.

(ii) Investment Plan

No investment plan in the sectors has been clearly defined. Although approximately six million people, mostly in rural areas, of the total population of 27 million have no access to water supply and sanitation services and approximately 11 million people have no access to the sanitation service (including latrines) in Peru[28], government-led development of water supply

21 Empresas Prestadoras de Servicios : EPS
22 Ministerio de Vivienda, Construccion y Saneamiento:MVCS was established in 2002.
23 Programa de Apoyo a la Reforma del Sector Saneamiento : PARSSA
24 Superintendencia Nacional de Servicios de Saneamiento : SUNASS was established in 1992.
25 Contraloria General de la Republica
26 Ministerio de Salud
27 Instnituto Nacional de Recursos Naturales : INRENA

Figure 4: Structure of the Water and Sanitation Sector in Peru



Source: Prepared by SADEP Study Team based on reference materials

and sewerage systems is not being actively implemented.

Investment amounts allocated to the sectors, including foreign loans, have been diminishing in the last few years. (The investment of 120 million dollars in 1998 was down to 80 million dollars in 2002.)

(iii) Subsidies

In Peru, EPSs rely on loans from the government and commercial banks for capital investment concerning the water supply and sanitation services, but reportedly they face difficulty in the repayment due to their high interest rates.

Under such circumstances, in the 1991-2000 decade, the Government of Peru invested in the sectors, mostly in urban areas, some US$2 billion as a special grant for the purpose of assisting EPSs to improve their financial standing. This subsidy helped improve the water coverage to a certain extent. However, it was not effective enough to improve the financial standing of the EPSs.

(iv) Tariff Policy

The water and sewerage tariffs include operation and maintenance costs required for wastewater collection, but do not include a tariff for wastewater treatment.

Revisions of tariffs get finally approved at meetings when local government representatives and

28 A decline in the quality of the services provided by the utilities, low coverage ratios, and, above all, the absence of wastewater treatment facilities lead to the discharging of unprocessed wastewater to areas near water sources. This causes the deterioration of the quality of drinking water and sanitary conditions in many cities. In the 1990s, cholera incidents were found in rural cities in Peru.

politicians are present, after an EPS has proposed a tariff and SUNASS has examined it. SUNASS, which plays a central role in reviewing the tariffs, is apt to consider the political influence. EPSs hoping for revision of the tariffs are not positive in raising the tariff due to political consideration. As a result, no new tariff proposal has been made to SUNASS in the last two years.

(3) The Present Situation and Problems at the Utility Level in Peru

There are EPSs of various sizes operated by the 45 municipalities, which provide services under the supervision of SUNASS. EPSs are incorporated in municipalities and run on a stand-alone basis. In some rural areas, the water and sanitation services are provided by Administrative Associations of Sanitary Services (JASS)[29], which are smaller than EPSs, as well as by other types of community organizations and NGOs[30]. Currently, SEDAPAL[31] and the other municipal EPSs provide service to about 65% of the population, and the remaining 35% is serviced by JASS and other organizations, mostly in rural areas.

Analysis will be focused on representative utilities in Peru, Servicio de Agua Potable y Alcantarillado de Lima (SEDAPAL) and the Institute for National Water Supply and Sewerage Systems in Loreto Province (EPS Loreto) (see Table 7).

(i) Service Provision

<Servicio de Agua Potable y Alcantarillado de Lima (SEDAPAL)>

The water coverage of the area covered by SEDAPAL is 88%, higher than the national average of 83%. (However, the coverage is not particularly high when compared with the mean coverage of cities of a similar size in other countries.) The sanitation coverage of the area covered by SEDAPAL is 83%, also higher than the national average of 75%. However, the sewerage coverage is extremely low, a mere 5%.

As opposed to the average continuity of water supply in Peru of 17 hours, that in the area covered by SEDAPAL was 20.4 hours (as of 2002), indicating that continuous 24-hour service has not yet been achieved.

<Institute for National Water Supply and Sewerage Systems in Loreto Province (EPS Loreto)>

The water coverage of the area under the jurisdiction of EPS Loreto is 61%, considerably lower than the national average (83%). The average number of hours with continuous water supply provided by EPS Loreto is 15 hours per day, less than the national average (17 hours). Also, some regions can enjoy water supply for only several hours a day, the others suffer from low water pressure, hence the regional gap existing in Peru.

Although Loreto Province is favored with abundant water because it relies on the Amazon River for its water source, the water treatment ratio is zero and thus wastewater is discharged into the river without treatment. This is a serious problem in terms of sustainable water circulation.

(ii) Operation and Maintenance

<Servicio de Agua Potable y Alcantarillado de Lima (SEDAPAL)>

Although the UFW of SEDAPAL stood at 42%, slightly better than the national average of 45%, it is still far from the ideal figure (30%) set as a target.

SEDAPAL seems to implement an effective service operation in terms of the staff per 1000 water connections (SWC), with a total number of employees of 2,100, corresponding to 2.0 employees per 1,000 connections, well under the ideal figure (5.0). However, the shortage of staff members may cause inadequate handling of UFW (water leakage) and collection of tariffs.

<Institute for National Water Supply and Sewerage Systems in Loreto Province (EPS Loreto)>

---

29 Juntas Administradoras de Servicios de Saneamiento : JASS

30 Until 1991, water and sanitation services were provided by a central government agency - SENAPA. In 1991, a sector decentralization reform was implemented, whereby SENAPA was liquidated and the services became independent and were transferred to the municipalities. At present, the water and sanitation services are operated by EPSs owned by the municipalities. The only exception is SEDAPAL - the company that provides services to Lima Metropolitan Area, which remained under the direct jurisdiction of the central government.

31 Servicio de Agua Potable y AlCNAtarillado de Lima:SEDAPAL

Table 7: Result of Evaluation Items on Major Utilities in Peru

No	Indicator	National average[1)]	SEDAPAL	EPS Loreto	Ideal value
Service provision (water service, sanitation service)					
1	Water coverage ratio (%)	83	88	61	Nearly 100
2	Service quality of water supply	17h water service	20h water service	15h water service	24h water service
3	Sanitation coverage ratio (%)	75	83	55	Nearly 100
4	Sewerage treatment ratio (%)	19	5	0	100
5	Sanitation coverage ratio/ water coverage ratio	0.90	0.94	0.90	1.00
Operation and maintenance					
6	Unaccounted for Water (UFW: %)	45	42	63	30
7	No. of staff per 1000 water connections (SWC: persons)	1.6~8.0(Note 2)	2.0	5.0	5.0
Financial management					
8	Working ratio (WR: %)	68	59	94	70
	Operating ratio (OR: %)	N.A.	79	99	100
9	Collection ratio (CR: %)(Note 1)	77	87	55	90

Note: 1) Value as of 2000: "Water Condition in Mexico" (CNA Report, 2003), 2) Range of CNA Control Area, N/A : no data was unavailable
Source: Prepared by SADEP Study Team based on reference materials

The extremely high UWF of EPS Loreto, which amounts to 63%, is considered chiefly attributable to water leakage caused by damage to existing pipes and drains.

The ratio of metered connections to total connections for EPS Loreto quite low at 36%. They bill regions not equipped with water meters for water supply in accordance with the average water consumption, which is less than the quantity actually consumed.

(iii) Financial management

<Servicio de Agua Potable y Alcantarillado de Lima (SEDAPAL)>

SEDAPAL shows a good performance in terms of the working ratio and the operating ratio, 59% and 79% respectively, both of which have reached far under the ideal values (100% and 120% respectively). The collection ratio also stood at 87%, which is relatively high.

<Institute for National Water Supply and Sewerage Systems in Loreto Province (EPS Loreto)>

A high UWF (63%) and a low tariff collection rate of EPS Loreto (55%) seem to tighten its financial standing, and thus EPS Loreto's working ratio and operating ratio are obviously bad, 94% and 99%, respectively. The marginal difference between the two ratios (+5%) suggests that the utility has not reserved sufficient funds for the depreciation costs (shortfall in depreciation), and there is a possibility that EPS Loreto has not assured capital funds necessary for the improvement of UWF.

(4)Challenges in the Water and Sanitation Sectors of Peru

Taking all the analyses above into account, problems that should be solved at the sectors, National government and utility levels are summarized below.

(i) Challenges in the Sector

1) Although both the water and the sanitation coverage ratios are relatively high (a national average of 83% and 75%, respectively), the ratios for rural areas are somewhat lower (61% and 55%, respectively in the areas covered by EPS Loreto) and should be improved. In addition, waterborne infectious diseases still remain in the country and the water quality must be improved, too. For this, the currently low level of sewege treatment ratio (the national average of 19%) has to be improved

immediately.

2) While the investment status in the metropolitan area is generally acceptable, the investment in rural areas lags behind (EPS Loreto lacks depreciation costs and thus seems unable to make sufficient investment in repairs and new facilities). It is necessary to fill in the regional gap in the sector by increasing the investment amount in the rural areas.

(ii) Challenges at the National Government Level

1) The role sharing among multiple bodies involved in the water and sanitation sectors needs to be clearly defined.

2) Central government policies need to be formulated for improvement in the water and sanitation coverage ratios in rural areas and support and guidance need to be given to EPSs for the purpose of realization of those policies.

3) Wastewater treatment costs need to be incorporated into the water and sanitation tariff structure as they are currently not included.

(iii) Challenges at Utility Level

1) SEDAPAL has demonstrated a certain achievement in coverage ratios, but the area which SEDAPAL covers (Metropolitan area of Lima) faces the Pacific Ocean, is short of rainfall, and thus cannot take full advantage of the water supply and sewerage piping networks. Thus, it should make efforts to secure water with an eye to the development of new water resources.

Due to the responsibility for the protection of the environment surrounding the densely populated metropolitan area of Lima, SEDAPAL should be proactively committed to the construction of water treatment facilities for the sake of sustainable water circulation and improvement of sanitary conditions. More precisely, it needs to improve the water treatment ratio from the current 5% to the national average of 19%.

2) EPS Loreto recorded water and sewerage coverage ratios of 61% and 55% respectively, substantially lower than the national average of 83% and 75%, and so it should, first of all, aim to improve the ratios up to the national average levels.

The UFW of EPS Loreto stood at a significantly high level of 63%, the main reason being the water leakage. Thus, EPS Loreto is required to take immediate action for repair or renewal of the existing water supply piping system.

The low installation rate of meters within the region covered by EPS Loreto (36%) makes it difficult to secure collection of charges for actually consumed amounts of water, so the utility is urgently required to install and utilize meters as the first step towards the improvement of the collection ratio.

3. Panama

(1) The Present Situation and Structure of the Water Supply and Sanitation Sectors in Panama

Panama has a population of approximately 3 million, its total land area being almost 76,000 square kilometers. About two thirds of the population reside in urban areas, mostly in Panama State.[32] The major water sources in Panama are using surface water. The water utility, IDAAN[33], procures water sources to supply to the Panama Metropolitan Area from the Panama Canal Authority (ACP - Autoridad del Canal de Panama) and private companies.

The water coverage ratio in Panama is 70% (the ratio in the metropolitan area is 87%), most of which is provided by IDAAN. (It is more or less one utility in one country.) The remaining area is managed by regional associations JAAR). In areas where water supply systems have not been developed, water is supplied through wells and water tank trucks. Meanwhile, the sanitation coverage ratio of the country is 27% (the ratio in the metropolitan area is 53%). In areas where sewerage systems have not been developed, septic tanks are largely used. The wastewater treatment ratio is as low as 30% even in the metropolitan area. The water quality of Panama is assessed as generally good because the country has experienced no major outbreak of waterborne infectious diseases in the past.

32 National Census in 2000.
33 Instituto de Acueductos y Alcantarillados Nacionales:IDAAN

As for the structure of the water and sanitation sectors in Panama (Figure 5), the Ministry of Health (MINSA)[34] is entirely responsible for the formulation of measures and plans concerning the water supply services, whereas the Institute for National Water Supply and Sewerage (Instituto de Acueductos y Alcantarillados Nacionales: IDAAN) is responsible for the provision of the actual services. The Ministry of Economy and Finance (Ministerio de Economia y Finanzas), on the other hand, is in charge of financing and budget allocation for the sector.

The agency responsible for regulation and control of the sector is the Public Services Regulatory Entity (Ente Regulador de Servicios Publicos: ERSP)[35], which independently controls setting and revision of tariffs.

(2) The Present Situation and Problems at the National Government Level in Panama

(i) Accountability system

A structural reform of the water and sanitation sector was implemented in 1996-1997, and the role of the central government was reorganized concerning the drawing up of water supply measures and plans and the service operating functions (as stated above). As a result, individual functions of concerned organizations in the water and sanitation sector in Panama became clearer and such problems as redundancy and deficiency have been considerably alleviated, at least institutionally[36].

However, although the accountability of MINSA as a policy-making agency and ERSP as a regulatory and supervisory agency has been clarified, but IDAAN still suffers from chronic deficits and thus the administrative reform has not yet demonstrated its effects on the sectors.

(ii) Investment Plan

Government's investment to the water and sanitation sectors have been increasing in recent years; the budget allocated to IDAAN from the national treasury[37] was eight million dollars in FY2001, 11 million dollars in FY2002, and soaring to 205 million dollars in FY2003.

(iii) Subsidies

Although the government has been continuously granting subsidies to IDAAN to cover its chronic deficits, the cost reduction on the IDAAN side is not necessarily in progress, which obliges the government to continue granting subsidies to make up for the deficit of IDAAN.

(iv) Tariff Policy

While the water tariff includes a base rate and a escalating rate, no bill is collected for sewerage on the grounds that the sewerage system has not been sufficiently developed. IDAAN has not revised the water and sewerage tariffs for the past 20 years. This assumedly results from a concern that an increase of the tariff, and the consequent burden on the population, may develop into political criticism.

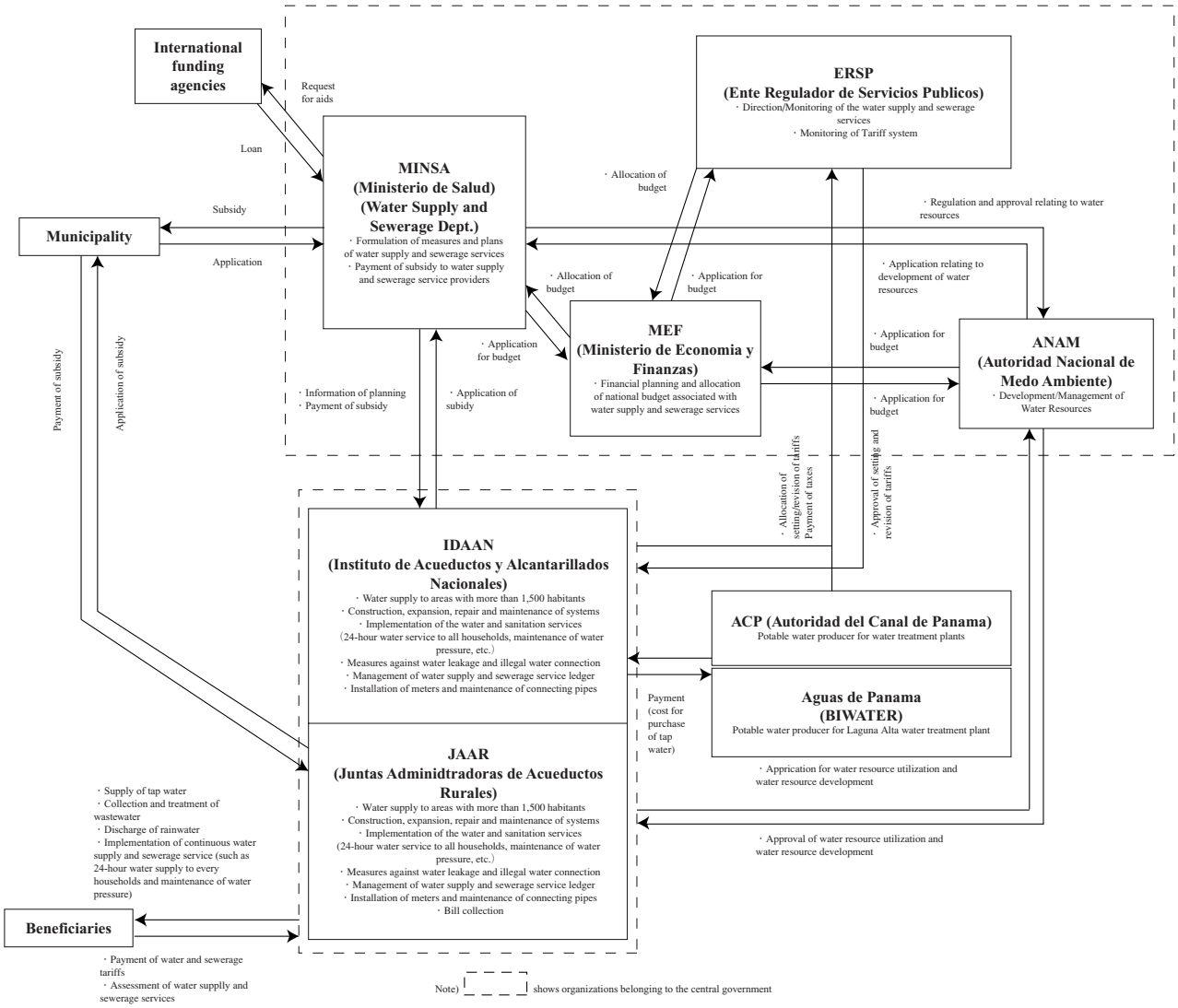
A unique feature of IDAAN's water bills is that they include, in addition to the water tariff, the fees for garbage collection and disposal, because IDAAN collects it on behalf of Panama City. This system gives the impression that the water tariffs are unnecessarily higher than they should be, and many people in fact misunderstand the bills thinking that they are all for the water supply.

(3) The Present Situation and Problems at the Utility Level in Panama

Water services in urban areas (localities with 1,500 residents or more) are provided by IDAAN and those in rural areas (localities with less than 1,500 residents) by MINSA. In the latter (rural) areas MINSA is responsible for the process of providing the services up to the construction of facilities. MINSA transfers the remaining functions - the operation and maintenance - to rural associations[38]

34 Ministerio de Salud : MINSA
35 Ente Regulador de Servicios Publicos : ERSP was established in 1996.
36 In 1996 - 1997, the government considered the privatization of IDAAN, which was no eventually put into practice.
37 IDAAN is in practice treated in the same way as ministries and agencies of the central government, and receives revenues from the national budget.

Figure 5: Structure of the Water and Sanitation Sector in Panama



Source: Prepared by SADEP Study Team based on reference materials

(JAAR). IDAAN will be hereinafter analyzed as a representative utility in Panama (Table 8)[39].

(i) Service Provision

The water coverage ratio in the region covered by IDAAN is more or less acceptable and is 87%, while the ratio in regions outside its coverage (i.e., outside the Panama metropolitan are) is low. As for water service continuity in the region covered by IDAAN, 55% is supplied for 24 hours, 22% limited to daytime, and 23% supplied only intermittently, more than half the population not having 24-hour access to water service. Similar conditions apply with the sanitation coverage ratio (53%). The wastewater treatment ratio is as low as approximately 30%.

(ii) Operation and Maintenance

The UFW ratio of IDAAN is high at 48%, indicating a possible loss of water due to leakage. The number of staff members per 1,000 connections is seven, which is considerably above the ideal figure (5 workers), so the utility is likely to be overstaffed.

38 Juntas Adminidtradoras de Acueductos Rurales : JAAR

39 The data and information related to IDAAN are based on oral information received during the meetings held with IDAAN's personnel, and on the IDAAN's annual reports for five years (Year 2002).

Table 8: Result of Evaluation Items for Major Utilities in Panama

No	Indicator	National average	IDAAN	Ideal value
Service provision (water service, sanitation service)				
1	Water coverage ratio (%)	70	87	Nearly 100
2	Service quality of water supply	N.A.	24h water service for 55%	24h water service
3	Sanitation coverage ratio (%)	27	53	Nearly 100
4	Sanitation coverage ratio (%)	N.A.	30	100
5	Sanitation coverage ratio/ water coverage ratio	0.40	>0.76	1.00
Operation and maintenance				
6	Unaccounted for Water (UFW: %)	N.A.	48	30
7	Staff per1000 water connections (SWC: persons)	N.A.	7.0	5.0
Financial management				
8	Working ratio (WR: %)	N.A.	100 or more	70
	Operating ratio (OR: %)	N.A.	100 or more	100
9	Tariff collection rate (CR: %)	N.A.	45	90

Source: Prepared by SADEP Study Team based on reference materials

Behind the poor management of IDAAN lies a report that it is overstaffed under inefficient management.

(iii) Financial Management

The current account balance (the balance of revenue and expenditure of a profit-making business) of IDAAN has been chronically in the red in recent years. This is because: (1) while IDAAN depends of private companies (ACP and Aguas de Panama) for its water sources (approximately 20% of all), its cost is relatively high[40], (2) the UFW ratio is quite high at 48%, (3) the collection ratio is low at 45%, and (4) the tariff level has not been updated for more than 20 years. As a measure to be used against users who refuse to pay for the services, the current regulation allows the disconnection of the water supply, but since the measure is not effective and it results in a prevalence of illegal connections to the water piping network, the measure of disconnection is seldom implemented.

(4) Challenges in the Water and Sanitation Sectors of Panama

Taking all the analyses above into account, problems that should be solved at the sector, national government and utility levels are summarized below.

(i) Challenges of the Sectors

1) The nationwide average of the water supply coverage (currently 70%) must be improved further. While the rate is relatively high at 87%, in the metropolitan area, it is significantly low in the rural areas, therefore the priority should be placed on the rural areas to increase the water coverage ratio.

2) The national average of the sewerage coverage is very low (27%). While continued efforts should be made to raise the rate in the metropolitan area (53%), urgent action should be taken to promote the installation of sewerage piping networks, particularly in the rural areas for a higher ratio.

3) The water treatment ratio is low at 30%, even in the region covered by IDAAN (the rate in the rural areas is likely to be much lower), so it is necessary to

40 While the cost of bulk water produced by IDAAN itself is 6 cent per m^3, the cost of bulk water purchased from ACP is 16 cent per m^3 and the cost of bulk water purchased from Aguas de Panama is 24 cent per m^3.

encourage capital investment in water treatment facilities to construct new facilities.

(ii) Challenges at National Government Level

1) Although the role and accountability of the central government concerning the water and sanitation sector has been reorganized, not enough obvious effects have yet appeared. Thus, ERSP and MINSA should continue to give instructions to and supervise IDAAN, whereas the government should strictly monitor what is to be done with the large amount of subsidies allocated to IDDAN from the national treasury and encourage IDAAN to rectify its financial position.

2) Since the current collection system levies water tariffs combined with the fees for garbage collection and disposal, the two charges should be separately stated in the bill for better understanding of the users.

3) Regarding the approval for hikes in the tariff, the government should take it into account that the tariff level has remained unchanged for 20 years. It still needs to consider a revision, paying attention to the payment capacity of the current users and the unfair balance of payments among users (i.e., more than half of the users do not pay their bills).

(iii) Challenges at Utility Level

1) IDAAN should strive to increase the water coverage ratio (currently 87%) in the metropolitan area of Panama, whereas utilities outside the metropolitan area should take immediate action to improve the ratios of regions they are responsible for.

2) The proportion of users who have access to the water supply service for 24 hours (55% at present) compared to the population as a whole should be increased.

3) To raise the collection ratio (45%), utilities should reinforce their duties concerning collection, make sure the process from meter-reading to issuing of bills is working, and make regulations concerning illegal connection to the service stricter.

4) As a measure to deal with high UFW, mainly due to leakage, necessary repair and refurbishment must be performed. If the cost for repair is beyond the financial ability of the utilities concerned, they must take proactive action to secure financial resources, including requests to the supervisory agencies.

5) It is necessary to raise the sanitation ratio (Currently 53% for the region covered by IDAAN) with a considerable expansion of the sewerage network, and to improve the water treatment ratio (30%) by the construction of additional water treatment facilities. Since these comprehensive measures for upgrading the sewerage system requires a large amount of capital investment, the utilities concerned should make efforts to participate actively in drawing up long-term investment plans for the government, and to secure funds required for capital investment from the national treasury (subsidies).

4. Costa Rica

(1) The Present Situation and Structure of the Water Supply and Sanitation Sector in Costa Rica

Costa Rica has an area of 51,000 square kilometers and a population of about 4 million, of which approximately 60% reside in urban areas and 40% in rural areas. It is a small country like Panama. The largest urban area of the country is the Gran Area Metropolitana (Great Metropolitan Area), which consists of the capital city of Jose_ and three surrounding municipalities (Alajuelo, Cartago, and Heredia), where approximately half of the total population is concentrated. Although Costa Rica is a small country in terms of territory, it is favored with water resources because of its affluent precipitation, high mountain high rainfall ranges and numerous rivers. However, due to the high density of population in the metropolitan area of San Jose and other urban areas in recent years, deterioration of the water environment, caused by untreated wastewater discharged into watercourses, has become a problem.

Costa Rica shows high water coverage The ratios in urban areas covered by (i) Costa Rican Institute for Water Supply and Sewerage (AyA)[41], a water supply and sewerage utility, (ii) ESPH[42], and (iii) municipalities, are almost 100%. In rural areas,

41 Instituto Costarricense de Acueductos y AlCNAtarillados : AyA
42 E.S. Publicos de Heredia, S.A : ESPH

too, the ratio is at a relatively high level between 75% and 100%.

On the other hand, sanitation coverage is much lower. The sanitation coverage ratio in the area served by AyA is 47%, whereas the average sanitation coverage in municipalities is 11%. The rural areas, served by the Administrative Associations of Water Supply and Sewerage (ASADAs) and the Administrative Committees of Rural Water Supply (CAARs), lack any sewerage networks, and thus septic tanks and latrines are utilized.

The structure of the water and sanitation sectors in Costa Rica is shown in Figure 6, The Ministry of Environment and Energy[43] (MINAE) is responsible for the water sector, securing water sources, and issuing licenses concerning the water and sewerage services (though the services are managed by municipalities). MINAE is in the process of establishing the"New Law of Water Resources (Ley del Recurso Hidrico)"which aims to stimulate both the industries and the municipalities to treat their wastewater and to comply with present discharge standards at the time of the study. Meanwhile, the Ministry of Health (MINSALUD) is in charge of controlling the drinking-water quality, as well as the discharge of contaminants to water resources, in accordance with the"General Health Law". All water and wastewater projects must be approved by MINSALUD. On the other hand, environmental impact assessments to be performed prior to construction have to be reviewed and approved by MINAE. As for regulation and control authorities, the Regulatory Authority of Public Services[44] (ARESEP) is in charge of control and approval of water and sewerage tariffs for all the sector utilities with the exception of the municipalities. However, the tariffs of the municipalities are approved by the Controller's Office (Controlaria).

The major water and sanitation utility in the country is the Costa Rican Institute for Water Supply and Sewerage (AyA), which is also authorized to provide guidance and approval on the setting of tariffs and to give direction and supervision to small utilities in rural areas in addition to its own operation as a utility. Other water and sanitation utilities include Heredia Public Services Company (ESPH), which provides infrastructure, mostly in urban areas such as Heredia in the proximity of San Jose. This public company operates the service independently without being directed by MINAE.

(2) The Present Situation and Problems at the Government Level in Costa Rica

This section analyzes problems at the national government level using the evaluation items selected in Chapter 2, in light of the current situation in Costa Rica.

(i) Accountability system

The accountability system and the authorities in the sector at the government level are not clear. For example, AyA is authorized to direct and supervise utilities in rural areas, although it is a utility itself. Thus there is no entity that takes responsibility for the comprehensive supervision of the sectors, and the accountability system is somewhat dispensed.

Because various entities are in charge of guidance and approval of setting of tariffs according to the target utility, such as ARESEP, AyA, or Controlaria, there is a possibility that the administrative guidance on the water and sewerage tariffs may be inconsistent.

(ii) Investment Plan

No medium-term and long-term national plans or policy for the sector are defined. Although the budget for the water and sanitation sectors has been on an upward trend, the growth is low in comparison with other public sectors[45]

The government infused 20 million dollars of budget in total into the sector for eight years from 1991. AyA received 91% of that budget, most of which was allocated to water supply with the allocation to sanitation extremely low at about 4%.

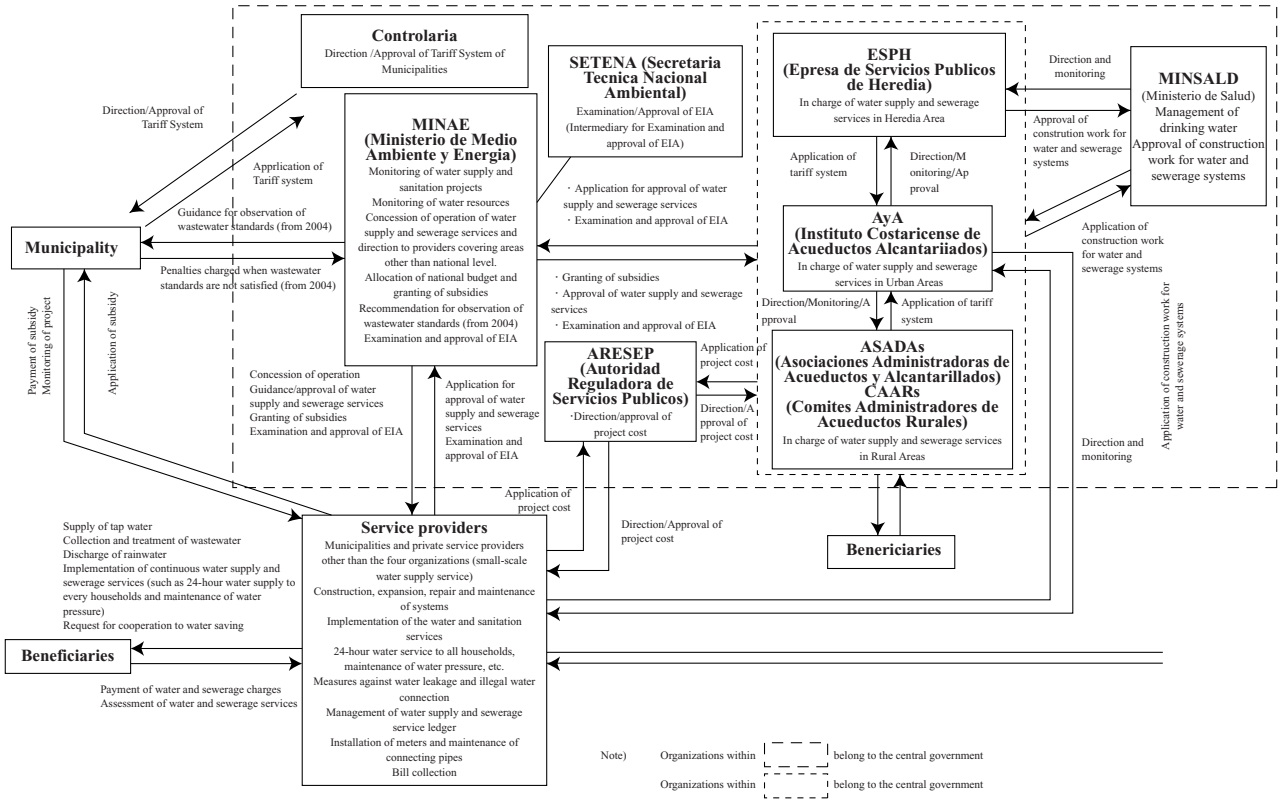
---

43 Ministerio del Medio Ambiente y Energia : MINAE

44 Autoridad Reguladora de los Servicios Publico : ARESEP

45 While the investment in such public sectors as health, education, social assistance and energy increased in the range of 5% to 7% of GNP, the investment in water and sanitation increased in the range of 0.5-0.7% of GNP.

Figure 6: Structure of the Water and Sanitation Sector in Costa Rica



Source: Prepared by SADEP Study Team based on reference materials

(iii) Subsidies

Governmental subsidies are available for water and sanitation utilities, and no particular problems have been confirmed in Costa Rica.

(iv) Tariff Policy

The tariff level is determined in consideration of the required operation and maintenance costs and the affordable payment levels of beneficiaries. The tariff has been revised every year in recent years.

It includes a tariff for wastewater collection, but it does not include a tariff for wastewater treatment. The cost for wastewater treatment seems to be financed by a subsidy from the government.

Because individual municipalities support poverty alleviation in their own ways in Costa Rica, the water supply and sewerage tariffs are designed on an individual basis in accordance with their supportive measures. The tariff levels in areas covered by AyA are set on a regional basis in a manner that sustains the operation and maintenance in each region. This tariff policy tends to increase the burden on each user in less-populated areas. The central government takes measures to correct such imbalances among regions.

(3) The Present Situation and Problems at the Utility Level in Costa Rica

The main water and sanitation utility in the country is AyA, which operates the water and sewerage systems in most of the urban areas, as well as in some rural areas. Another public company, ESPH, currently operates the water supply systems of three (3) municipalities located in the proximity of San Jose (Heredia, San Rafael and San Isidro)[46].

In the other urban areas of the country that are not operated by AyA, the main operators are the Administrative Associations of Water Supply and Sewerage (ASADAs - Asociaciones Administradoras de Acueductos y Alcantarillados Sanitarios) or

46 ESPH is a public company transformed in 1998 from a private company owned by three (3) municipalities located in the proximity of San Jose (Heredia, San Rafael and San Isidro). In addition to the water supply and sanitation service, ESPH operates electricity supply, public lighting, and the Intenet service.

Administrative Committees of Rural Water Supply (CAARs) organized by the municipalities themselves. There are some 1,700 ASADAs operating in the 38 Municipalities of the country. In some municipalities, private firms operate small water supply services.

As representative operators in Cost Rica, the Costa Rican Institute for Water Supply and Sewerage (AyA) and Heredia Public Services Company (ESPH) will be focused on for study (Table 9).

(i) Service Provision

<Costa Rican Institute for Water Supply and Sewerage (AyA)>

While the water coverage has been considerably improved to 98%, the sanitation coverage ratio remains undeveloped at 47%. In addition, the wastewater treatment ratio is extremely low at 4%.

<Heredia Public Services Company (ESPH)>

The service area covered by ESPH is limited to three urban cities in the neighborhood of San Jose, where the water coverage ratio has reached 100%.

Existing sewerage systems are decrepit, as in the case of AyA, and wastewater is discharged without being treated to rivers, which is a great concern for water contamination.

ESPH depends on underground water sources to a large extent within the San Jose metropolitan area and within the territory of ESPH. However, untreated wastewater is discharged through the sewerage system in the San Jose metropolitan area into rivers, contaminating the underground water sources from the river.

(ii) Operation and Maintenance

<Costa Rican Institute for Water Supply and Sewerage (AyA)>

One of the reasons for the high UFW ratio (48%) is the leakage problem. As for the number of staff per 1,000 connections, it is a little higher than the ideal value at 6.3, but the service efficiency seems to be generally acceptable.

<Heredia Public Services Company (ESPH)>

Judging from the acceptable indices including the operating ratio and the tariff collection ratio, the performance as a utility is considered acceptable. However, the UFW ratio is relatively high at 45%.

The number of staff per 1,000 water and sewerage connections is as low as 2.6. Therefore, the company seems to be under a good management with a smaller number of staff members than the ideal number (5 persons). What is more, since there is no particular complaint from the users concerning the quality of their services, their service seems to be more or less efficient.

(iii) Financial Management

Both AyA and ESPH show high collection ratios, and their working ratio and operating ratio are quite acceptable, too. Their satisfactory performance is considered to be attributable to their sound tariff collection systems, and efficient operations minimizing unnecessary expenditure. On the other hand, water supply and sanitation utilities in under-populated areas such as ASADAs stand in poor financial positions.

(4) Challenges in the Water and Sanitation Sector of Costa Rica

Taking all the analyses above into account, problems that should be solved at the sectors, national government and utility levels are summarized below.

(i) Challenges of the Sectors

1) While the water coverage ratios are adequate in general, and the priority in future should be placed on improvement of the ratios, particularly in the rural areas.

2) The sewerage ratios lag behind the water ratios as a result of the traditional policy to attach greater importance to the water supply. In future, the sector should shift the priority to the sewerage system, organizing sewerage networks and improving water treatment ratios nationwide(which will also contribute to the development of the tourism industry in Costa Rica).

(ii) Challenges at the National Government Level

1) Thanks to the policy of the central government giving priority to the diffusion of water supply networks in the urban areas, a great achievement can be observed in the water supply system. In future, the government should promote the development of water supply networks in the rural areas, as well as the spread of sewerage networks and

Table 9: Result of Evaluation Items of on Major Utilities in Costa Rica

No	Indicator		AyA	ESPH	Municipalities	ASADAs, CAARs	Ideal value
Service provision (water service, sanitation service)							
1	Water coverage (%)	Urban area:	98	100	98 1)	-	Nearly 100
		Rural area:	75	100	-	N.A.	
2	Service quality of water supply		Acceptable	12-hour service during drought	Occasionally interrupted	Occasionally interrupted	24h water service
3	Sanitation coverage ratio (%)	Urban area:	47	33	11		Nearly 100
		Rural area:	-	-	-	N.A.	
4	Sanitation coverage ratio: (%)		4	4	4	N.A.	100
5	Sanitation coverage ratio/ water coverage ratio		0.48	0.33	0.11	N.A.	1.00
Operation and maintenance							
6	Unaccounted for Water (UFW: %)		48	45	50 or more	50 or more	30
7	Staff per 1000 water connections (SWC: persons)		6.3	2.6	N.A.	N.A.	5.0
Financial management							
8	Working ratio (WR: %)		72	66	73-93	98	70
	Operating ratio (OR: %)		89	86	83	125	100
9	Tariff collection rate (CR: %)		96	97	50	N.A.	90

Note: 1) Including ESPH.
Source: Prepared by SADEP Study Team based on reference materials

investment in construction of wastewater treatment facilities.

2) In order to shift the priority, as suggested above, the central government and advisory agencies should upgrade their accountability systems and draw up long-term national plans and policies, and reconsider the distribution of budgets.

(iii) Challenges at the Utility Level

1) AyA and ESPH operate their services more or less efficiently, but their UFW ratios which stand at 48% and 45%, respectively, together with the ratio of 50% or above for municipalities, do not indicate satisfactory performance, compared to other indices. At the same time, although the water supply piping networks have good coverage, the high UFW ratio seems to be attributable to leakage due to the deterioration of the networks. Hence, in future, the utilities concerned should conduct appropriate operation and maintenance, primarily of repair and refurbishment of piping systems, so as to decrease the UFW ratio.

2) ESPH relies heavily on deep wells as water sources during the dry season[47]. Since more water is consumed than the replenishment rate of available groundwater, the lifespan of the deep wells is estimated at 10 years or so. It is necessary to promote the development of other water sources that are available sustainably, even in the dry season.

3) The improvement of water coverage and wastewater treatment ratios is a task which not only the central government but also the utilities should tackle actively, but since it requires a large amount of capital investment, it is necessary for the utilities to make an effort to obtain funds from the national treasury, to commit themselves to approach supervisory and other related agencies continuously over a long period, and participate in the activities of such agencies.

47 As for ESPH, for 80% of the rainy season supply comes from surface water and only 20% from groundwater, whereas during the dry season 30% of the supply comes from surface water while the remaining 70% comes from deep wells (250-300 m depth).

Chapter 4. The Role of PSP in the Water and Sanitation Sectors in Developing Countries

This chapter analyzes the objectives for implementing Private Sector Participation (PSP) in the water supply and sanitation sectors of developing countries, as well as the types of implementation and the subsequent results, and examines the contributions of PSP in realizing sustainable water supply and sanitation sectors. It also elicits lessons learned and factors to be considered in implementing PSP, from examples in six Central and South American countries (Argentina, Brazil, Bolivia, Chile, Colombia and Mexico), the Philippines and Malaysia. Building on this, the chapter subsequently gives a broad overview of the status of PSP implementation in the water and sanitation sectors of the focused Four Countries (Mexico, Peru, Panama and Costa Rica), and summarizes challenges related to PSP.

1. Management System that the Water and Sanitation Sectors should aim at

Behind the chronic deficits of the utilities in the sector - public organizations, state-run public bodies, and public companies (hereinafter referred to as public corporations) - lie the following problems extracted in Chapter 3.

(i) The accountability at the central government and utility levels in the water and sanitation sector is not clear; or the locus of responsibility for management is ambiguous because of the presence of organizations that do not function properly.

(ii) The central government is unable to provide clear policies and plans, therefore, although an appropriate investment in the sector is urgently required, the investment amount itself is decreasing, and this weakens the quality of the water and sanitation services.

These factors discourage the activities of the entire sector, and make it almost impossible to remedy the problems, which include a large amount of leakage, low collection ratios, excessively large amounts of current account expenditure, and a small amount of capital investment.

These problems must be solved regardless of the means - either the public sector makes voluntary efforts, or, PSP is introduced when that is impossible. Either way, the following management system seems to be vital.

1) The Establishment of a Management System on a Standalone Basis

Public corporations, regardless of whether or not they will introduce PSP, should make continued efforts to establish a management system on a standalone basis. Since water is one of the Basic Human Needs which have to be supplied as a universal service (see Chapter 1), it is not realistic to expect the water and sanitation sectors to be perfectly financially independent (management without any subsidies) (see Chapter 2). Nevertheless, it is still important for the organization in charge of the sector to set an independent entity as an ideal objective, and continue making efforts to improve and bring the management close to the ideal form.

Under a profit-conscious management system, it is effective to introduce a system of assessing the degree of achievement by means of setting easily understandable objectives, that is, showing clear numerical objectives, and also, if possible, setting numerical targets for individual sections or staff members.

2) Improvement of Service Quality for User-Oriented Service

The public corporations should commit themselves to successful maintenance and improvement of the service quality, together with the necessary higher efficiency through improvement of management. They are also required to take a management stance of being accountable to their service users concerning efforts for improvement and the standard of service in order to obtain the understanding of their customers.

2. The Purpose and Current Situation Concerning the Introduction of PSP

In cases where it seems almost impossible for the public sector to establish such a system with its own self-reliant efforts, the introduction of PSP serves as an alternative solution. While the water and sanitation services have been traditionally provided by the public sector, they are in recent years widely provided

in France, Spain, the U.K, and other developed countries by government-private joint or private companies. Subsequently in Latin American countries, too, the failure of many public corporations in offering appropriate water and sanitation services led to the adoption of PSP in an increasing number of countries in the 1990s. Since 1993 when a concession of private water supply and sewerage service companies became successful in Buenos Aires, the capital of Argentina, the water and sanitation sectors in Latin American countries have heightened its momentum towards the introduction of PSP. Many public corporations have begun entrusting, not only the operation of the facilities, but also the ownership of their assets, to private operators.

However, now that the case in Buenos Aires, which had been considered successful, has shown the vulnerability to foreign exchange risks and other problems, it is not necessarily common to simply consider the introduction of PSP to be an absolute device for success. There are arguments for and against PSP in the water and sanitation sectors and many countries are still assessing the possibility of PSP introduction. Hence, from the viewpoint of the sustainable sectors, it is essential to examine cases where PSP can serve as an effective device, as well as the timing of the introduction, and the form of PSP, if it is to be adopted, before appropriate advantage is taken of it.

3. The Decision-Making Process Toward the Introduction of PSP

Whether or not PSP can improve the performance of the water and sanitation sectors inevitably depends on the correct understanding of existing problems, a judgment of whether it is impossible to solve the problems through self-help efforts within the public corporations and, if so, the right decision concerning the option of PSP which leads to the solution to a problems.

In some cases, problems may be solved through appropriate measures, and guidance and supervision at the government level, or through self-efforts by the public corporation itself. Where such is the case, the feasibility of solving the problems on the government or utility side must be considered first. Nevertheless, there is a limitation on the capability of the government and the public corporations on one hand, while a potentially high efficiency is available at the private sector on the other. And at the same time, so long as the sector has a potential value for investment from the viewpoint of private companies, the introduction of PSP may well be a policy option to take into account.

This section examines the process of decision-making over the introduction of PSP by dividing it into two steps: the judgment of whether or not PSP should be introduced (step 1), and the feasibility and option of PSP if it is to be introduced (step 2) (Figure 7). The primary aim of Step 1 is to rectify problems in the management of the public corporations through self-effort without the introduction of PSP. This is the first possible solution which the public corporations should make use of so as to solve their problems. Even so, not all public corporations can resort to this method, since, in fact, the problems have often arisen because the public corporations cannot solve them from the beginning. In such cases, Step 2 (introduction of PSP) is to be considered. The flow of the selection of options of PSP is summarized below.

(1) Step 1: Management Reform through Efforts by Public Corporations

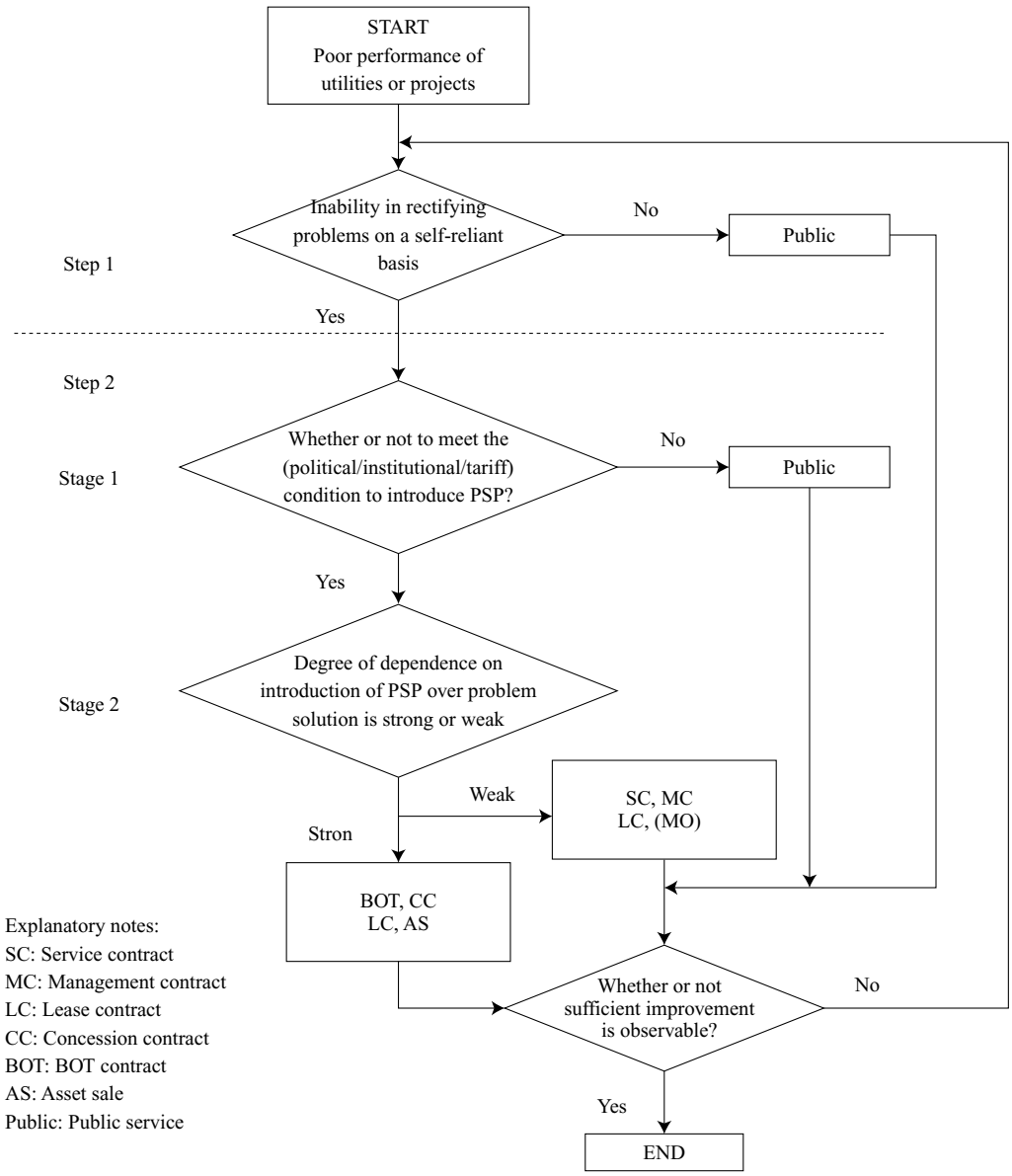
The purpose of step one is for the public entity to rebuild its management with its own self-reliant efforts. The following are possible renewals of the management with the self-dependent efforts.

(a) Voluntary Reformation of the Management of Public Corporations

The voluntary reformation of the management suggests that public corporations should make self-reliant efforts to rectify the current inefficient management without resorting to, in particular, substantial revision of laws and other settings. However, as is often observed in the public sectors, they are highly likely to fail to do so, because their accountability is quite ambiguous and they can be restricted by overstaffing due to strong labor unions and loose employment regulations, and thus the problem arising from both labor and management sides makes the management inefficient.

Whether PSP should be introduced to take advantage of the impact from outside for

Figure 7: Flow Chart of the PSP Selection Process



improvement, or voluntary, internal efforts should be utilized for the renewal depends on the degree of labor-management cooperation. If labor and their cooperation is difficult, voluntary reform of the management is hardly a desirable choice, but if their collaboration can be expected to some extent, the following method is likely to be an alternative choice.

(b) Introducing Private Company Management Techniques by Public Corporations

The introduction of private company management techniques is simply to adopt efficient know-how from the private sector, while retaining ownership of assets. This method does not involve the participation of private companies. In this method, public corporations themselves adopt the principle of competition as a basic principle as in the private sector, and introduce management skills based on the market principle so as to establish a management system where profitability is pursued. The specific nature of the management techniques is identical to that in the PSP options described subsequently, whereby the public corporations themselves promote the reform.

(2) Step 2: The Introduction of PSP

Step 2 is used when the public corporations are unable to rectify their problems from within, and thus is aimed at renewing the management system with the help of private companies. Since problems and the environment of individual public corporations are all different, the PSP option to be adopted varies accordingly. In the selection of a specific PSP option, consideration follows two stages:

(a) First Stage

In the first stage, the following three basic conditions needed to implement PSP in this sector must be considered. These are 1) political commitment, 2) the institutions and 3) tariff structure and level.

1) Political Commitment

One important prerequisite for the participation of a private company is continuous political support, which determines how the public accepts PSP implementation. At the same time, if it is seen that PSP cases in neighboring countries and at home ended in failure, an uncooperative attitude of the people towards companies taking part in PSP activities will make it difficult to proceed with the operation. It is essential for the government to assist private companies involved by calling for understanding among the people, and, for this purpose, to make the PSP policy as clear as possible.

2) The Establishment of Institutions

Institutional foundation must be established in order to make the introduction of PSP effective, and regulations and laws should be added or revised, if necessary, so that any possible hindrances for PSP can be relaxed or removed.

3) The Establishment of Tariff Structure and Levels

In the cases where the tariff system is distorted due to political considerations or other reasons, it should be revised prior to the implementation of PSP to the extent possible. If the system excessively favors particular industries or users, the tariff system is likely to fail to gain the understanding of the people even if PSP is adopted. On the other hand, if the tariff level is excessively low due to reasons related to social policies, the low tariff level will suppress the management of the private companies participating in the PSP operation, and they are likely to be obliged to raise the level. Where this is the case, the private companies involved may encounter considerable resistance and non-cooperation, and thus any distortion should be corrected to the extent possible in advance.

(b) Second Stage

The second stage involves selecting the option of PSP to implement once the appropriate conditions for doing so have been established. Here, "how much private companies should be committed to solving the existing problems" should be taken into account in the criteria. More specifically, the following three factors will be assessed:

1) Capacity of Public Corporations to Carry out Projects

If the public corporations' capacity for carrying out projects is low, more involvement from the private company is required. It is necessary to first evaluate the capacity of the public entity and then determine what level of improvement can be achieved by itself, and how much improvement could be achieved through the involvement of a private company. With regard to the ability to collect bills, for example, it is necessary to consider the required collection system - how much the private companies are expected to perform in the collection of bills, how much authority they are given concerning the collection of bills, and so on.

2) Need for Private Investment

The private company's involvement in the services will be even larger if the public entity can count on it for capital procurement. In general, water and sanitation sectors suffer from more serious shortage of funds for refurbishment and expansion of their facilities than other sectors. After determining the amount of public funding that can be used to cover the investment necessary, the public entity needs to assess how much private capital will be needed.

3) Asset Ownership Issues

If the private companies involved take ownership of the assets, the degree of their commitment becomes much greater. The management ability of the companies directly reflects on the success or failure of the PSP operation. Therefore it is crucial to consider how to select private companies, and how much share of the ownership should be given to them.

4. Options and Effects of PSP

Various options of PSP are available in accordance with the degree of commitment of the private companies involved (Table 10), and individual options have different effects. This section highlights the following six options - (1) service contract, (2) management contract, (3) lease contract, (4) concession contract, (5) BOT contract, and (6) asset sale of property (see also Figure 8).

In cases where the potential of private companies is taken advantage of in the form of entrusting them with part of the operation, the degree of commitment of the private companies is small. Therefore, suitable PSP options would be (1) service contract, (2) management contract, and (3) (weak) lease contract. On the other hand, in cases where the potential of a private company is reflected in the service operation as a whole, greater commitment is required and suitable PSP options would be (3) (strong) lease contract, (4) concession contract, (5) BOT contract, and (6) asset sale.

The most common PSP options in the water and sanitation sector in Latin America are (1) service contract, (2) management contract, (3) lease contract, and (4) concession. Since these options do not involve the sale of public assets, they are easily accepted both politically and socially, and have been implemented in a large number of countries including Argentina, Bolivia, Brazil, Chile and Mexico.

In the meantime, (5) BOT contracts, whereby private companies construct new facilities and have ownership of them, is frequently adopted in wastewater treatment projects. When new wastewater treatment facilities are constructed in Latin American countries which are short of those facilities, it requires not only initial capital investment from private companies but also subsequently efficient operation and maintenance, and sound financial management, to take advantage of their management know-how. Therefore, the BOT method where the private companies have ownership would be appropriate. In cases where new facilities are constructed under the BOT method, since the ownership of the existing facilities, which belong to the nation (Government property), is not transferred, it is more likely to be acceptable to the people.

In PSP involving (6) asset sale, since the private company management capability has a great impact on the services, a careful, strict judgment is required for its adoption. Although not so many PSP projects have been undertaken under this option, six cases in Chile and three in Brazil were carried out and produced certain achievements. In the cases of Chile, concession contracts were agreed to gain the understanding of the people concerning the PSP operation, and the property concerned was sold in a tendering process, which secured transparency for the operation. (It seems that, if any particular problems arose in the water and sanitation services, even if the public corporation was replaced by a private one under a concession contract, they did not show any negative reaction against the following stage, that is, the asset sale.)

Following are some details of the PSP options (1)~(6) (Figure 8)

(1) Service Contracts

This type of contract is suitable for a case such that a portion of work from a public entity (e.g. minor services such meter reading) is outsourced to a private company for a relatively short period of time (one to two years) (Figure 8 (1)). The main purpose of this contract is to make operations more efficient. Almost all the burden of responsibility and risk related to the corresponding water and sewerage project as a whole is ultimately borne by the public entity, while the responsibility and risk taken on by the private company is extremely limited.

In this type of contract, public entities are able to make the service operations more efficient in the region covered by the contract with simple contract terms and procedures. Also, this format allows public entities to outsource work appropriately, slim down their organization, and focus resources on their core business. Moreover, since the size and scope of the contract is small, there is little risk and damage suffered by either side even if the execution of the contract fails, which also facilitates contract cancellations and re-bidding.

This option requires little complicated knowledge from either party, and serves well as a first step in implementing PSP as it can easily gain public understanding. However, the extent of PSP benefits at this level is limited.

Table 10: Characteristics of PSP Options

PPP Option	Service Contract	Management Contract	Lease Contract	Concession Contract	BOT Contract	Asset Sale
Financing investments	Public sector	Public sector	Public sector	Private sector	Private sector	Private sector
Financing working capital	Public sector	Public sector	Private sector	Private sector	Private sector	Private sector
Contractual relationg with retail customers	Public sector	Public sector (on behalf of the public sector)	Private sector	Private sector	Private sector	Private sector
Private sector responsibility and autonomy	Low	Low	Low to Medium	High	Medium to High	High
Demand for private capital	Low	Low	Low	High	High	High
Financial risk for private sector	Low	Low	Low to Medium	High	High	High
Duration of contract / license (years)	1-2	3-5	5-10	20-30	20-30	License may be in perpetuity with provision to withdraw or revoke
Ownership	Public sector	Public sector	Public sector	Public or private sector	Private then public sector	Private sector
Management	Mainly public sector	Private sector	Private sector	Private sector	Private sector	Private sector
Setting tariffs	Public sector	Public sector	Contract and regulator	Contract and regulator	Public sector	Regulator
Collecting tariffs	Public sector	Public sector	Private sector	Private sector	Public sector	Private sector
Main objectives of Private sector Participation	Improve operating efficiency	Improve operating and technical efficiency	Improve operating and technical efficiency	Mobilize private capital and expertise	Mobilize private capital and / or expertise	Mobilize private capital and expertise

Source: Based on the Ontario SuperBuild Corp., "Study 8: Water and Wastewater Markets, Investors and Suppliers" Jan., 2003, which was edited by the SADEP Study Team

(2) Management Contract

In a management contract, the private company takes on additional management responsibilities beyond those included in a service contract. If it succeeds in increasing operations efficiency, the private company is rewarded for its managerial skills and if it fails to do so, it will be penalized as the contract stipulates. The flow of capital and services is the same as that of a service contract (Figure 8 (2)), but the contract terms are slightly longer, 3-5 years. Normally, individual contracts with users are agreed by a contract private company on behalf of the public entity. The public entity gives stronger incentives to the private company for improvement of the services in that this option gives it the same advantages as for service contracts, but lets the private company take greater responsibility for the operation of the services. It is thus the next easiest contract option, after a service contract, for the public entity.

(3) Lease Contract

In this type of contract, a public entity leases the

water and sanitation facilities to a private company, which in turn collects tariffs from users, pays a leasing fee to the public entity (the owner), and makes a profit from the difference between these two amounts after covering operation and maintenance costs (Figure 8 (3)). The principal goals of this option are to make the operations more efficient and introduce management know-how from the private sector. The contractual period is longer than that of a management contract at a standard length of five to ten years. The public corporation holds the ownership of the facilities and conducts capital investment, whereas the private company is responsible for fundraising for the operation, agreeing contracts with users, and the operation of services. Thus, the risk the private company is required to bear is greater than that under a service or management contract.

The most notable feature of a lease contract is that any revenue from tariffs collected that remains after deducting the leasing fee, and operations and maintenance costs becomes the profit of the private company. Meanwhile, the public entity is guaranteed a certain amount of revenue in the form of the leasing fee from the private company during the contract term regardless of the company's revenue from tariffs collected or operations and maintenance costs paid. On the other hand, if the private company runs the services in the red, it will have to bear the deficit. This fact provides all the more incentive to the private company to minimize operations and maintenance costs, offer reliable service, and increase revenue from tariffs.

(4) Concession Contract

In a concession contract[48], the private company (referred to as a concessionaire) is commissioned with the comprehensive operation of the water and sanitation services (Figure 8 (4)). In the case of the water and sanitation sectors, the concessionaire does obtain the rights to use water and sanitation facilities, though in exchange it is required to take responsibility for accomplishing a set of "concession targets" which relate to aspects such as the service quality and investment amount. The principal goal is to introduce capital and management and operations know-how from the private sector.

One of largest characteristics of this type lies in the fact that the private company is entrusted to make "new" capital investment (i.e. new investment as well as investment to repair and update existing facilities) in addition to operating "existing" water and sanitation facilities. Although in service, management and lease contracts, the private company is expected to improve the operations of existing facilities, it is still the public sector that is responsible for capital investment. BOT contracts, on the other hand, are primarily effective for "new" capital investment, but are not suitable for improvement of the operation of "existing" facilities. A concession, however, covers both improvement of operations efficiency of existing facilities and capital investment for new facilities. From the point of view of the public entity, a successful concession has the potential of resolving all of its problems in one fell swoop. And, from the private company's perspective, it has the potential possibility of being a high-risk, high-return option.

(5) BOT Contract[50]

In this type of contract, a private company constructs water and sanitation facilities with its own finance, operates them for a certain period of time, and subsequently transfers the ownership to the public entity (Figure 8 (5)). BOT contracts have been taken advantage of in many cases in sewerage systems in Latin American countries. However, since difficulty in collecting sewerage bills was predicted from the beginning, many of them stipulated that private companies are guaranteed to receive a certain amount of money from the collected bills from the public corporations during the BOT contract periods. The primary goal of this option is to thoroughly introduce

48 Concession contracts in water projects clearly state that the services cannot be cancelled or interrupted regardless of the length of contract. For example, in October 2003, a private company in Argentina called Aguas Argentina's caused a major accident that disrupted the water supply in Buenos Aires, which was an infringement of their concession. As a result, ETOSS, the owner and agency overseeing Argentina's public works and sanitation services, filed to impose a fine in excess of $400,000 against the company for negligence of maintenance duties.

capital and management know-how from private companies, and the private companies involved play a much greater role than in other forms of contracts. The usual contract period is 20 - 30 years, reflecting the long lifespan of facilities in which the private companies have invested.

One of most defining characteristics of this option lies in the fact that the public entity commissions the operations of the services for a long period of 20 - 30 years in addition to the investment for facility development by giving approvals. This option is normally made use of in cases where the public entity lacks capital, know-how, and human resources and wishes to expand the service area through new capital investment. The amount of risk that the private company undertakes with this option is, of course, high given that it has to carry the responsibility of management for a certain period of time in addition to financing and capital investment. In return, however, it can prove to be an excellent business opportunity for the private company if it succeeds. Also, since the ownership of the existing facilities is not transferred to the private company, this option is palatable to the entire population and users of such facilities, and is also welcomed by new users resulting from a BOT project as long as the services and tariffs are set appropriately.

It should be noted, however, is the fact that the risk involved in case of failure is high for the public entity and the private company alike, requiring the use of caution when considering this option. The private company carries long-term political, economic and commercial risk, which tends to be high in financial terms. Under normal contractual conditions, the private company is obligated to provide services and cannot readily discontinue such services even if they become unprofitable. However, the risk of the private company defaulting on its obligations does exist and, depending on the wording of the contract, could result in the public sector being forced to accept contingent liabilities if this were to occur.

(6) Asset Sale

In an asset sale, the public entity sells a portion or all of the service assets to private companies[51] (Figure 8 (6)). Unlike concession contracts, the private companies assumes ownership of the assets, and, as the operator (or an equity holder) of the water and sanitation utilities, it becomes more responsibly involved in the management of the services. However, given the nature of the services being public, although the private company can acquire the assets, it is normally required to meet a certain set of goals pertaining to improvement of operations efficiency and service coverage. Besides, an approval by a regulatory body is required for tariff levels. The principal goal of this option is to infuse capital from the private company in addition to knowledge regarding management and operations.

Similar to a concession contract, the asset sale option can be approached multi-purposefully for problems in the water and sanitation sectors (improvement of operations efficiency of existing facilities and investment in new facilities). An asset sale also has the potential of providing short term benefits in the areas of improving the balance of fiscal revenue and expenditure, and decreasing public debt, (which is one of the reasons why the privatization and asset sale of public entities was so popular in the past in Central and South America). Furthermore, in addition to the fact that acquiring assets is an advantage in itself for the private company, an asset sale also allows the company to take initiative in managing the services as the operator itself (or the equity holder). However, it should be noted that this option involves various management risks at the level of private companies,

50 BOT: Building, operation and transfer. Since the ownership of the facilities involved belongs to the private company before they are transferred to public sector, "O" for the ownership is sometimes included in this abbreviation, and the method is called "BOOT" rather than BOT. Also, the private companies are frequently involved in this type of PSP operations at the stage of "designing," so the method is also called DBOT or DBOOT. Alternatively Or, to distinguish "O" for operation from "O" for ownership, "F" for finance is used instead of the latter "O," in that the ownership belongs to the private companies which "finance" the facilities. In this case, the method is called BOFT or DBOFT. In either case, this paper calls the method BOT contracts.

51 The proportion of assets sold in Chile accounts for 35 - 40% of the total assets. Not all the assets are sold in every case.

and is likely to be subject to resistance among the people/users at the time the introduction of PSP is planned or after the sales of assets. It is possible that national sentiments could have a negative impact on the management. These include resistance against the sales of national facilities to the private sector, which were built with taxes and fees paid by the people; a concern over the provision of the water and sanitation services by the private sector; dissatisfaction with the tariff level to be set; and so on. Hence, it is crucial to secure transparency of the process of introduction, and to be accountable to the people.

5. Cases where the PSP contributes to the Sustainability

The previous section showed that PSP takes various forms. This section examines various PSP activities seen in the World Bank's report and adopted in countries in Latin America and Asia, and is aimed at clarifying how the introduction of PSP has contributed to sustainable water and sanitation sectors.

(1) World Bank's Assessment of the Degree of Contribution of PSP

The Operations Evaluation Department of the World Bank (OED) carried out assessments of projects in which the World Bank assisted in the water and sanitation sector in the past[52] (Table 11). Dividing the projects to be evaluated into (1) cases where PSP was introduced (with PSP[53]) and (2) cases where it was not (without PSP[54]), the analysis was made on the states of the sectors before and after the implementation of the project, giving certain assessments in accordance with eight indicators to measure their performances.

The conclusions of the World Bank evaluation are summarized below:

1) Enormous investment is required to increase the water and sanitation coverage rate, which tends to improve in proportion to the amount of investment being made. PSP does not necessarily produce particularly outstanding effects (in that any improvement is hardly achievable unless a certain amount of capital is invested.). This is a reason why the margins of increased water supply and sewerage ratios under the PSP projects investigated (+14% and +10%, respectively) were not conspicuously greater than the figures (+16% and +9%, respectively) observed in the projects without PSP.

2) Since the collection of sewerage bills is not necessarily an easy task, financial profitability is not expected to come easily from the investment in sanitation services. Thus, normally, the sewerage service in general is financed by part of the revenue from the water supply service, a massive amount of subsidy, and low-interest loans. The margin of increased wastewater treatment ratio for projects with PSP (+6%) is less than that for projects without PSP (+22%). The substantial difference suggests that it is difficult to make profits in wastewater treatment projects because they require a large amount of investment, and thus that projects show a greater impact on the improvement of the service under the non-PSP (i.e., public) operation rather than under operations with PSP.

3) As for the operation and maintenance measured by the unaccounted for water (UFW) and Staff per thousand Water Connections (SWC), the introduction of PSP shows a greater improvement in projects than the absence of PSP.

(2) Lessons Learned from the Introduction of PSP

From past cases in six Latin American countries (Argentina, Brazil, Bolivia, Chile, Colombia and Mexico), in addition to the Philippines and Malaysia, This section describes a number of actual lessons learned from the past experiences in implementing PSP.

1) Political commitment (e.g. creating legal systems to support PSP and strengthening guidance from

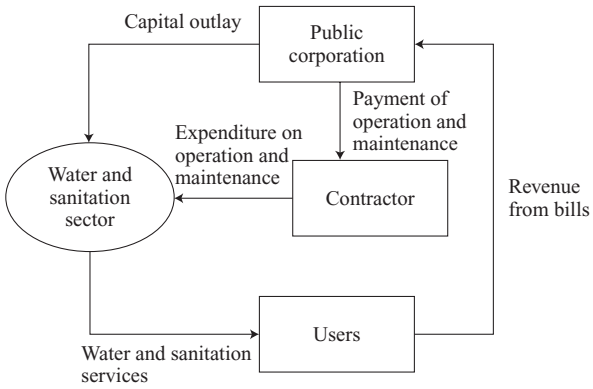
52 Efficient, Sustainable Service for All ?, Operations Evaluation Department of World Bank, Sep. 1, 2003

53 (1) With PSP: Based on responses from 11 private companies engaged in PSP projects in Turkey, Colombia, Argentina, Indonesia, the Philippines, Bolivia, and Trinidad and Tobago.

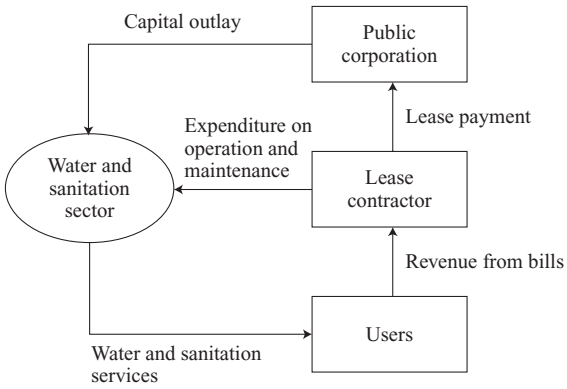
54 (2) Without PSP: This covers 28 public projects, i.e. non-PSP projects, in countries such as China. Note that even though 18 out of the 28 projects are in China, considerations were made so that this does not influence the results.

Figure 8: Major PSP Options

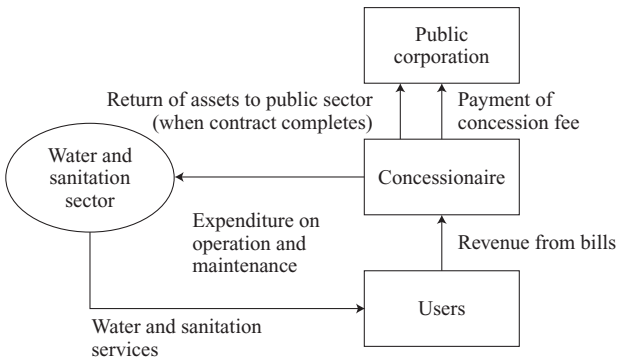
(1) Service (2) Management Contract Model



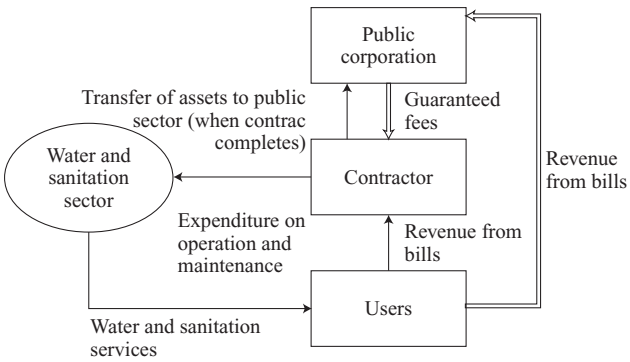
(3) Lease Contract Model



(4) Concession Contract Model



(5) BOT Contract Model



(6) Asset Sale Model

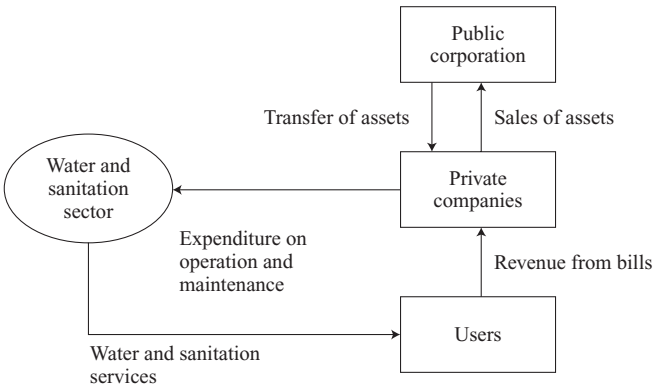


Table 11: Comparative Performance of Public and Private Water and Sewerage Projects

Performance Indicator	(1) With PSP		(2) Without PSP	
	Before Project	After Project	Before Project	After Project
1. Service-for-All				
1) Water Coverage ratio	66%	80% (+14%)	70%	86% (+16%)
2) Sanitation coverage ratio	38%	48% (+10%)	32%	41% (+9%)
3) Proportion of households connected to continuous water supply service	68%	94% (-26%)	N.A.	N.A.
4) Proportion of household connected to disinfected water	82%	97% (+15%)	N.A.	N.A.
2. Efficiency of Service				
5) Unaccounted for Water (UFW)	53%	46% (-7%)	40%	38% (-2%)
6) Staff per Thousand Water Connections (SWC)	8.2	4.2 (-4.0)	7.6	4.4 (-3.2)
3. Sustainability of Service				
7) Financial working Ratio	0.77	0.70 (-0.07)	0.71	0.66 (-0.05)
8) Wastewater Treatment Ratio	7%	13% (+6%)	9%	31% (+22)

Notes: UFW rate (%) = Losses / Total water distributed
Staff per Thousand Water Connections (SWC) = number of staff at the water supply service company / (number of households connected to water supply / 1,000)
Financial working ratio = operational cost (minus depreciation cost) / Tariff revenue
Wastewater treatment ratio = the proportion of wastewater volume which has been processed at the second treatment facility to the total volume of wastewater generated
Source: Formed according to the World Ban, "An OED Review of the World Bank's assistance to Water Supply and sanitation" Sep. 2003.

government agencies overseeing policy/regulation) supporting the project is indispensable if the project is to be implemented with speed and sustainability. (example: Concession in Cochabamba, Bolivia)

2) As water and sanitation projects are in essence public projects, ensuring accountability to the stakeholders - the beneficiaries in this case - is essential when implementing PSP. (example: Asset sale in Chile)

3) Suddenly raising tariffs immediately after implementing PSP can easily antagonize the public. Even if a tariff increase is necessary, 1) carry out the increase only after the private company under obligation has done everything it can to improve its service management, and 2) it is essential to closely examine the Willingness to Pay (WTP) and Affordability to Pay (ATP) to avoid an unacceptable sharp and sudden increase. It is also possible to use the range of tariff increases as a selection criterion in the bidding process. (example: Water and sanitation project in Manila, The Philippines)

4) When implementing PSP, private companies should be selected after having undergone a thoroughly competitive bidding process. The PSP contract should clearly state where all responsibilities lie, the goals expected of the company, and any penalties and incentives related to carrying out the project. It is also preferable to include in writing options that allow adjustments to the contract as a measure to prevent possible problems in a long-term contract in the event that the program undergoes changes. (example: Water and sanitation project in Manila, The Philippines)

5) Even if PSP is urgently needed, drastic introduction of PSP is highly unlikely to gain the understanding of the users. Thus, ideally, a feasibility study (F/S) or other study has to be carried out first, and then PSP operations can be launched gradually in the form of, for example, service contracts or management contracts, and finally a lease contract or a full-concession contract could be adopted. (example: Aguas Calientes, Mexico)

6) As water and sanitation facilities can directly affect the lives and well-being of the public, and since they are created and maintained over many years at the expense of the public, one may think that public

entities should retain assets to the greatest extent possible, leaving the sale of assets as a last resort. (example: BOT contract on wastewater treatment facility in Mexico)

6. Implementation Status of PSP in the focused Four Countries

This section summarizes the current status of PSP implementation in the four countries surveyed in this study, and looks at the problems and issues in the water and sanitation sectors of these countries as outlined in Chapter 3, to examine the types of contribution of PSP towards creating sustainable water and sanitation sectors.

Mexico

(1) Current Status of PSP Implementation in the Sectors

In Mexico, the privatization of water supply and sanitation services began in the 1980s and expanded further in the 1990s. Currently, services where the private sector is taken advantage of include water treatment facilities for bulk supply of water, the management of wastewater treatment facilities, and the management of the water and sanitation services in municipalities[55]. Mexico's experience in implementing PSP since the 1990s ranks second in Central and South America after Brazil in terms of the number of projects carried out (21) and sixth in terms of the amount invested. The PSP operation in Mexico is concentrated in the sewerage services, currently 26 wastewater facilities being under construction or operation by the private sector under BOT contracts. The promotion of constructing or upgrading wastewater treatment facilities reflects a national law concerning water[56] which has prohibited the discharge of untreated wastewater.

One characteristic of the introduction of PSP in the water and sanitation sector in Mexico is the presence of a policy (PROMAGUA[57]) that supplies financial resources to utilities who are highly motivated to improve operations efficiency, which allows them to be more active in planning PSP implementation. Apart from the BOT method, which has been increasingly made use of in the previous 10 years, some other PSP options have begun to be introduced. In Mexico City, there are plans to carry out individual PSP projects in three steps: (1) surveys of sewerage networks / meter installations (service contract), (2) water usage measurement / tariff collection (service contract), and (3) reduction in the volume of leaked water (concession - being planned). Additionally, there is also a water and sanitation service under full concession in Cancun, a rural area, and a management contract of a public-private partnership in Saltillo.

(2) PSP Issues and Possibilities in the Water and Sanitation Sectors

Since Mexico has suffered from low collection ratios (CEAM 36%, and SACM 50%) for many years, there is room to take advantage of service contracts, management contracts, or other PSP options to improve the ratios.

While the water and sanitation coverage ratios show reasonably acceptable figures, the wastewater treatment ratios are extremely low (CEAM 22%, and SACM 10%). Therefore wastewater treatment facilities should be constructed or upgraded as early as possible. For this, the construction of facilities, which is currently in progress under the BOT method of PSP, could be encouraged further.

As for the water supply service, the coverage ratio is, as stated above, generally acceptable. However, a high UFW due to a large volume of leaked water suppresses the management. Therefore, it is an option to improve the UFW through a concession contract, which includes capital investments for reducing the leakage.

---

55 CNA: La Participacion Privada en la Prestacion de los Servicios de Agua y Saneamiento - Conceptos Basicos y Experiencias", Mexico City, September 2003

56 Established in December 1992. In accordance with this law, any untreated water being discharged into public bodies of water must be stopped by December 2006 otherwise a fine will be imposed.

57 PROMAGUA (Programa para la Modernizacion de Organismos Operadores de Agua - Program for the Modernization of Water Operation Organizations) is funded through the BANOBRAS Infrastructure Fund (FINFRA) and is an assistance program targeting over 50,000 utilities (half of the total number in Mexico). The types of PSP envisioned by PROMAGUA include service contracts, management contracts, concessions and companies operated through public-private partnerships.

Peru

(1) Current Status of PSP Implementation in the Sectors

Peru has developed a legal system[58] that effectively utilizes private sector investment, and PSP is already being carried out in the communications and port sectors. However, the government and the people are not necessarily keen on the introduction of PSP, because of the outbreak of riots against the PSP operation that was to be introduced in the energy sector in Arequipa.

Partly because of this, although a concession contract was about to be concluded for the water supply and sewerage services in the metropolitan area of Lima in the 1990s, problems arose during the process of bidding, and the bidding was eventually cancelled. There has yet to be a single example of a PSP project implemented in the country's water and sanitation sectors.

Recently, however, preparations for the construction of a water treatment plant[59] are in progress, under a BOT contract, with a 27-year term already approved by the government, to apply for the region covered by SEDAPAL. The World Bank is considering the introduction of PSP as a strategy for the development of the water and sanitation sectors, which may lead to a change in the present perception of PSP activities.

(2) PSP Issues and Possibilities in the Water and Sanitation Sectors

Given that a legal system covering PSP implementation has been set up in Peru, there is room for improvement in utilization of PSP as a solution to the problems in the water and sanitation sectors. Before this can be accomplished, however, the following issues should be addressed at the government level: (1) establishment of the accountability of SUNASS (the government regulatory entity), (2) measures to construct and refurbish facilities in rural areas, (3) a revision of the tariff system which incorporates the tariff for wastewater treatment, and (4) the removal of the negative impression of PSP arising from past experiences. Addressing these issues will pave the way for PSP application in future projects.

For this reason, possible PSP options to be examined include a service or management contract, which facilitates improvement of the low collection ratio due to the absence of meters in rural areas, or a concession or other contract including an increase in the number of meters installed.

The improvement of the extremely low level of the current wastewater treatment ratio requires a large amount of new investment, so that it is necessary to construct new facilities with private funds, and to encourage PSP using the BOT method, which is less likely to invite resistance from the public in that it does not transfer the ownership of the existing facilities to the private sector.

Panama

(1) Current Status of PSP Implementation in the Sectors

In 1995 the government of Panama started to privatize some public sectors which included communications, energy, and transportation. It also planned to put IDAAN, of the water and sanitation sectors, under the private operation of a single nationwide concession in accordance with the legal foundation (Law no.2 of January 1996) and a feasibility study was carried out in 1996, which also selected the PSP option. However, in the presidential election in 1999, all the candidates made pledges against the plan, which has not yet been realized at the time of this study. (This seems to be attributable to the fact that the public opinion was against the PSP operation.) There are PSP projects in Panama where private water companies, such as Aguas de Panama, supply water to IDAAN under a concession contract.

(2) PSP Issues and Possibilities in the Water and Sanitation Sectors

Given the small size of Panama, IDAAN covers most of the water and sanitation projects in the country. Thus, any problem arising from IDAAN immediately

58 The organization Proinversion is the primary point of contact and is working to utilize PSP to improve the quality of service in public works projects and to strengthen the competitiveness of the national economy. In working to accomplish this, the organization oversees efforts to try to attract private companies and plan PSP contracts in accordance with the law.

59 The scale of the project is US$60 million and will have a water processing capacity of 172,800m3/day.

becomes a problem of national significance. Therefore, its privatization must be carried out under collaboration between the central government and other related organizations. As for the improvement of the financial position of IDAAN, an environment allowing PSP to function smoothly must be created. It is necessary for MINSA, a policy-making agency, to strengthen its guiding and supervisory power over the management of IDAAN, and for ERSP, an agency to approve tariff structures, to encourage the construction of an appropriate tariff system. In line with this, the privatization process should begin with minor aspects of the sector and achieve results steadily so as not to stimulate unnecessarily any negative sentiments of the public. Of all the problems of IDAAN, the following two will be solved with the introduction of PSP, and efforts must be made to do so.

First, poor indicators (Chapter 3) suggest that IDAAN does not manage its operation and maintenance appropriately, so that it is necessary to introduce PSP under a service or management contract for increasing the collection ratio. This will bring in a certain result within a relatively short time and result in obtaining the understanding and support of the public. The least radical PSP options, such as service and management contracts, should be taken advantage of with the revision of the tariff system where the bill currently incorporates charges for garbage collection and garbage treatment. Once they have attained certain results, a lease, concession, or other form of contract should be proactively considered to reduce the UFW, which requires a certain amount of investment.

Second, the water and sanitation coverage ratios and the wastewater treatment ratio of IDAAN are quite poor among the four priority countries, and thus they should be improved through capital investment. However, it is not reasonable to authorize IDAAN to make decisions concerning new investments since it is the organization that presently has problems in exercising management. Therefore, it is necessary to adopt a BOT-method contract using investment funds from the private sector to promote an increase in the fund for the investment in new facilities.

Costa Rica

(1) Current Status of PSP Implementation in the Sector

As a result of the establishment of the concession law in 1998 which covers approval for public services in the roads and transportation sector, future development in institutional and political conditions could pave the way for PSP implementation in the water and sanitation sectors. For now, however, past opposition to PSP implementation from public officials and the population have led to its postponement. Recent activity has nonetheless included AyA considering the use of PSP in the water and sanitation sectors, as well as ESPH considering it for use in water purification and wastewater treatment plant operations. Furthermore, various PSP options are considered in the modernization project of the sectors, which may be co-financed by JBIC and the World Bank.

(2) PSP Issues and Possibilities in the Water and Sanitation Sector

Costa Rica, like Panama, is a small country, and thus the central government has to play a great role in solving problems in the water and sanitation sector. Of the problems in the sector in this country (Chapter 3), the following ways of introduction of PSP seem to be effective for the solution of these problems.

While the water coverage ratio in Costa Rica shows a more or less acceptable figure, the improvement of the sewerage coverage ratio and the wastewater treatment ratio lags behind. Thus, there is possibility that in addition to the central government's positive decisions the participation of private funds through actively making use of BOT-method contracts, would lead to a substantial expansion of new facilities.

Among problems with the public corporations, AyA and ESPH, the large volume of water leaked is counted as a major one. Still, since their collection ratios are quite good, so long as the facilities are repaired or refurbished appropriately by the private sector under a concession contract, they are still able to increase the profitability, and serve as a strong incentive for a cut in the leakage amount The introduction of PSP under the concession method could be considered as an option.

Chapter 5. Case Studies of Yen Loan Projects and Possibilities of Private Sector Participation (PSP)

This chapter takes up on going and future yen-loan projects (one each from Peru and Panama) as case studies, and simulates the profitability of the projects. Based on the assessments obtained, the feasibility of the introduction of PSP into the relevant yen-loan projects is examined. In general, in order to assure financial soundness at the utility level, it is ideal to assure the profitability of as many individual projects as possible among all the projects which the utilities in question are operating. However, in developing countries, many public companies involved in the water and sanitation services hold projects in deficit, and are confronted with financial difficulties. In this sense, assuring the profitability of individual projects is virtually a starting point for improvement of their own management.

The simulations of profitability of projects will be carried out by comparing and examining three or four scenarios. After obtaining the results of the simulations, the possibility of introducing PSP into the foregoing yen-loan projects is explored.

1. Estimation of Willingness to Pay (WTP) Using the Contingent Valuation Method (CVM) -a case study in Iquitos City, Peru-

Prior to a simulation of the yen-loan project in Peru (Provincial Cities Water Supply and Sewerage Improvement and Expansion Project (II), in Iquitos, Loreto), whether or not the current tariff level in the city of Iquitos was appropriate was examined. For this, attempts were made to estimate "Willingness to Pay (WTP)[60]" which literally means the amount of tariff to the water and sanitation services which their users are prepared to pay in accordance with the results of a questionnaire survey[61] using the Contingent Valuation Method (CVM) on one hand, and "Affordability to Pay (ATP)[62]" which is the amount of tariff which the users can actually afford calculated based on household and other surveys (Table 12). The appropriateness of the current tariff level was evaluated in comparison with these WTP and ATP values.

(1) Estimation of Willingness to Pay (WTP)

A questionnaire survey addressed to the population of Iquitos, (1,000 samples) gave an estimated total amount of WTP of 16,242 thousand soles (approximately 494 million yen). The figure is equivalent to 83.9% of the current total actual amount of payment to the water and sanitation services. The estimated adoptable values of the additional WTP reaches 65.1% increase of the current payment amount for the water supply service and 144.5%

Table 12 Comparison of Willingness to Pay, Affordability to Pay, and Current Payment Amount of Water and Sewerage Tariffs

Item	Current average amount of monthly payment (Soles/month)	Affordability to Pay (ATP) (Soles/month)	Willingness to Pay (WTP) (Soles/month)
Water tariff	20.81	18.70～24.90	34.35
Sewerage tariff	6.48	6.90～ 9.20	15.84
Total amount	27.29	25.60～34.10	50.19

Source: SADEP Study Team

60 Willingness to Pay (WTP): the value expressed in a monetary term that direct beneficiaries are willing to pay at the maximum, when certain public goods or services are supplied or the environmental resources are improved under an imaginary setting (imaginary because it is difficult to evaluate the value in the real market). Beneficialies are asked about the value in a questionnaire survey.

61 For detail analysis, see "Estimation of Willingness-to-pay (WTP) for the Water and Sanitation Services through Contingent Valuation Method (CVM): A Case Study in Iquitos City, The Republic of Peru", in this JBICI Review.

62 Affordability to Pay (ATP) : the value that users are able to pay for certain services, computed with reference to data on household incomes of residents in the region in question (users of the services) and the components of the expenditures.

increase of the current payment amount for the sanitation service, suggesting a strong preference among the residents to pay for the sanitation service.

(2) Estimation of Affordability to Pay (ATP)

While the foregoing WTP represents the largest amount willing to be paid against the assumed service, it is not appropriate to base the setting of tariff directly on the data, as stated in Chapter 2. This is because the tariffs for water and sanitation service need to be set within the range payable for many beneficiaries for the services to fulfill their role as public services, and thus the ATP is more frequently used for the setting of tariffs in practice. The ATP for the water and sewerage tariffs was estimated to be 18.7-24.9 soles/month and that for the sewerage tariff 6.9-9.2 soles/month (Table 12). Those estimates are found to be reasonable when cross-checking them with the components in the domestic budget expenses surveyed by the National Statistical Information Institution (INEI: Instituto Nacional de Estadistica e Informatica).

(3) Possibility to raise Tariff Rates considering WTP, and ATP

Comparing the estimated ATP and WTP values obtained in the above process with the current water and sewerage tariffs (Table 12), and obtaining a tendency of WTP by deploying a regression analysis with the Weibull model, an examination is conducted to see whether it is possible to raise the tariff level.

The possible range of ATP for water and sewerage tariffs in Iquitos City is between approximately 10% lower and approximately 20% higher than the current monthly payment level, respectively, based on the current tariff level, and therefore the room for a tariff level increase by 20% or more is thus limited.

On the other hand, the estimated WTP considerably exceeds the current monthly payment level and ATP (about twice as much as ATP), which suggests that the residents of Iquitos surveyed have quite a strong willingness to pay. In this sense, the people surveyed seemed to show a favorable stance towards a rise in the tariff level.

However, in practice it is difficult to resort to an easy rise in the tariff level simply because of the high WTP, in that it will enlarge the gap to the ATP due to the income constraint. What is more, WTP obtained by the CVM was solely based on the approach from the users' (demand) side. In other words, the WTP acceptance rate curve simply shows the relationship between the WTP (acceptability rates) and various tariff levels presented, that is, the relationship between the levels of demand and the corresponding prices. In short, the acceptability rate curve cannot serve as an ultimate, sole measurement to obtain one particular optimal tariff level[63]. Therefore, regarding it as a simple demand curve[64], and laying on it a supply curve which indicates the relationship between the tariff levels offered by the service provider (supply side) and the volume of supply, general diagrams of supply and demand curves were drawn up (Figure 9). For simplicity, the supply curves were depicted so that they interact with the corresponding demand curves at the point where the current tariff level is identical to the volume of demand. The following are the results of examination of the factors that cause the shifts in each curve.

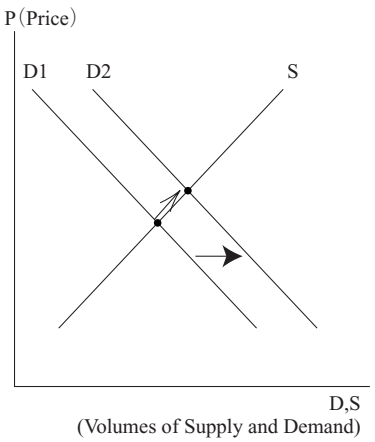
Where the effects of an income increase due to an economic growth on the demand curve are concerned, the increase in incomes raise the WTP (as well as the ATP), shifting the demand curve to the right (Figure 9 (1)), so that the equilibrium point

63 CVM can be an effective device to help political decision-making of policits to take, or to assure the financial sustainability of utilities and projects, but WTP values estimated under the method are nothing but a values computed based on figures that survey respondents give in reply to an imaginary scenario. Also, the CVM analyzes the event solely from the demand side, so that the value cannot be necessarily applicable to actual tariff systems. Upon setting the tariff level, it is necessary to analyze the system from the supply side, too, and to conduct a cost-benefit analysis in a comprehensive manner before making decisions concerning a reasonable tariff level.

64 As is obvious in the acceptability rate curve, the acceptability rate (vertical axis) takes 1 (all the users demand it) when the tariff (price) displayed by the horizontal axis takes zero, and approaches to zero (no-one demands it) as the price increases. Suppose that the acceptability rate is considered to be as a proxy variable for the volume of demand, and is set on the horizontal axis, while the price is set on the vertical axis. Then, the acceptance rate curve can be drawn reversibly in terms of the horizontal and vertical axes, which is identical to the standard demand curve (Figure 9).

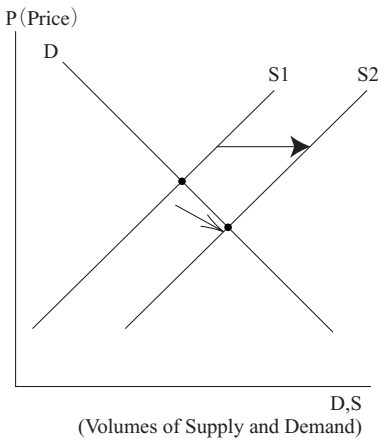
Figure 9 Supply and Demand Relationship in Water and Sanitation Services in Iquitos

(1) Case where demand curve shifts



D: factors for shifting – effects of income increase

(2) Case where supply curve shifts



S: factors for shifting: - rise in collection rate, improvement of UFW, Effects of adjusting personnel allocation on cost reduction

shifts to the right even if the supply curve remains unchanged, bringing in a positive impact of the combination of a higher price and the amount of supply and demand on the sustainability of the services. However, taking into account the fact that the actual growth rate of the Peruvian economy in the previous five years (1997-2002) was a mere 1.6% per year, and that this economic expansion was largely attributable to the growth in the industries in the urban area, the income growth in Iquitos, a rural area, is inevitably much slower. In other words, since the rapid increase of income (and ATP) cannot be expected, the upward shift of the demand curve is not likely to happen.

Factors that shift the supply curve, on the other hand, include a drop in the UFW rate, an increase in the collection ratio, and adjustment of the personnel allocation or staff to an appropriate level. If these factors lead to an increase in revenue and/or cost reduction, the supply curve will shift to the right (Figure 9 (2)), enabling an increase in the amount of services at the same tariff level. It is thus possible to expand the demand level while reducing the tariff level, taking into account the equilibrium point with the corresponding demand curve (where the intersection point shifts to the lower right).

As seen above, the understanding of WTP is of extreme importance in the sense that it gives essential information concerning assurance of sustainable services and the introduction of PSP, and also in the political sense that it helps predict the response of the people towards tariff policies. Nevertheless, since WTP simply gives the picture of one aspect, the demand side, it is inadequate to overestimate it and hastily go for a rise in tariff level from the viewpoint of policy making. In order to increase the tariff level on the grounds of WTP, an increase in ATP due to an income increase should be a prerequisite, and if this increase is not likely to happen, the best, appropriate, and essential way to assure sustainability of the sectors is to rely on the self-reliant efforts on the supply side. Taking all this into account, measures for the city of Iquitos can be summarized below:

1) The current tariff level in Iquitos is more or less the same as the ATP of the users in question; the level nearly reaches the upper limit of the payment. On the other hand, however, as seen in the current collection rate of 55% (in regions covered by EPS Loreto), nearly half of the users do not pay their bills. In line with this, the top priority must be placed on making efforts to increase the collection rate from the viewpoint of sustainable service and the principle of equity.

2) The UFW rate in Iquitos (in regions covered by EPS Loreto) stood at an extremely high level, 63%. Therefore, the management of the service should be thoroughly strengthened to reduce it substantially.

3) So long as the efforts of the service provider bear fruit and improve the financial position, and the

population gives understanding support, since WTP shows a high level, too, it is possible in future to increase the tariff level within the range of the magnitude of increase in ATP, though it should be carefully considered.

2. Provincial Cities Water Supply and Sewerage Improvement and Expansion Project (II) in Iquitos City, Peru

This project covers the city of Iquitos in Loreto out of the Provincial Cities Water Supply and Sewerage Improvement and Expansion Project (II) (three cities of Iquitos, Cuzco, and Sicuani). The Water Supply and Sewerage Improvement and Expansion Project in the northernmost province of Loreto is aimed at an increase in the population able to enjoy water supply (approximately 225,000 people) and undertakes (i) new projects to refurbish water facilities to take in and convey water from the Nanay River of the Amazon water system (ii) the new construction of a water treatment plant (iii) the improvement of the water conveyance and distribution system (water network, tanks, distribution reservoirs) and (iv) new construction and repair of pump stations, and installation of meters (including replacement). At the moment, the sanitation service is not included in the yen loan project of Iquitos City, but the need for sewerage system development (in particular, upgrading of the wastewater treatment facilities) is still high[65] Therefore, There is possibility that it can incorporated in a future yen loan project, a simulation was carried out for the improvement of the sewerage system, as well.

Basic assumptions are as follows. The Peruvian government subleases the fund raised from the yen loan to the implementation body, EPS Loreto. The fund for water supply and sanitation services will be financed by JBIC for 75% of the operation costs with the remaining 25%, the portion borne by the Peruvian side, provided by the regulatory agency of the project, the Ministry of Housing Construction and Sanitation, and the municipalities involved.

(1) Water Supply Service of Iquitos City

Following the findings of the CVM carried out with a local questionnaire survey, the values of ATP and WTP of the users of the water and sanitation services in Iquitos were estimated. In accordance with them, a simulation analysis was conduced in cases where the tariff level of the water supply service under the yen-loan project was (A) the same as the current level (B) the lower value of the ATP and (C) the same as the WTP, and the financial position (during the project of 30 years) was forecast according to these three scenarios (Table 13).

Upon conducting simulations to see the profitability of the three scenarios, three objectives of the sector were taken in account (this is the same as the case when the sector achieves its targets in Scenario 2 in the next simulations of the sanitation services in Iquitos city.) : (1) the UFW rate will be halved by 2010 (2) the operation and maintenance cost will be reduced by 20% from the current level and (3) the collection ratio will be improved up to 85% by 2010.

As a result of the simulations, profitability measured by the Financial Internal Rate of Return (FIRR) seems to be assured to some extent in every scenario[66]. As is clearly observable in Scenario (A), even if the current tariff level is maintained, so long as the utility achieves the expected improvements, the FIRR will reach 11.9% without any additional subsidies from the central government, proving that the case will a make a profit to some extent.

At the same time, the current water tariff rate (20.81 sole/month) is already higher than the lower value of the ATP found in the local survey in Iquitos (18.70 soles/month) by 10% or so, so that the possibility of increasing the current rate seems likely to be marginal, although the CVM survey shows a high WTP (34.35 soles/month).

---

65 Much of the wastewater in the city is flowing into the Nanay River, which is a water source for the civil drinking water system via the water area called Laguna de Moronacocha. As a result, the Nanay River and the lagoon, where wastewater concentrates, are significantly polluted.

66 The Financial Internal Rate of Return (FIRR) required to assure the profitability is assumed at 12% (as in the analyses conducted in the subsequent sections in Chapter 5).

Table 13 Financial Simulation by Scenario (in Water and Sanitation sector in Iquitos)

Water tariff (sole/month)	Scenario (A) Current amount of payment 20.81	Scenario (B) ATP 18.70	Scenario (C) WTP 34.35
Financial internal rate of return (FIRR) (%) Estimated values	11.9	7.7	37.57

Source: SADEP Study Team

(2) Sanitation service of Iquitos City

Next, simulations to see the profitability of cases where the sewerage project is implemented with yen loans were carried out. In the simulations, four scenarios were designed, compared with one another, and examined one by one (the same method is deployed in the Panama Bay and Panama City Sanitation Project in the subsequent section). The order of the four scenarios (Scenario 1 to Scenario 4) meets the sequence of measures for management improvement, it is not appropriate to change the order under any circumstances. First, as the basic scenario, the project to be operated under the current condition and circumstances will be examined (Scenario 1). Then, the case where certain improvements have been achieved at the utility level (Scenario 2) is analyzed and the case where support from the central government is available (Scenario 3) is examined to see how the profitability of the project changes. Finally, the effect of an increase in tariff levels (Scenario 4) will be examined. In other words, this section sheds light on a potential change in profitability of the project when additional measures for improvement - from Scenario 1 to Scenario 4 - are carried out in this right order. In order to make an objective analysis concerning the appropriateness of an increase in the tariff level, Scenario 4 assumes that the level is increased by 20% which is based on the ATP and WTP values found in a local questionnaire survey by CVM addressed to the people in Iquitos, Peru.

The findings of the simulations of the sewerage project in Iquitos (Table 14) show that the implementation of this project in Scenario 1 (basic scenario) gives a negative value of FIRR. It would be difficult to assure a sound financial position under the current conditions.

The implementation of the project in Scenario 2 would improve the FIRR to 7.59%. In other words, if efforts made at the utility level lead to the improvement of the nature of the project, such as a smaller UFW rate, a reduction in the operation and maintenance costs, a higher collection rate, and so on, the financial conditions would be considerably improved. Thus, self-reliant efforts by the utility itself for management improvement and execution of reforms will be required primarily.

In Scenario 3, a governmental subsidy (financing 40% of the total project cost) will improve the FIRR to 14.07%, compared to the project in Scenario 2 (+6.48%). However, such a subsidiary policy can be realistic only when the government can afford to grant the subsidy. At the same time, easy dependence on the governmental budget may hinder self-reliant efforts of the utility towards the improvement, and thus a careful decision should be made.

In Scenario 4, an increase in the tariff level by 20% will improve the FIRR up to 19.24%, but the margin of the improvement (+5.17%) occasioned by the hike in tariffs is not greater than that attainable in Scenario 2 (self-reliant efforts by the utility: +8.08%) or in Scenario 3 (governmental subsidy: +6.48%). Moreover, the 20% increase in the tariff level would be far above the ATP, which may create a concern that it would not be politically and socially acceptable. To increase the tariff level, a long-term policy at the government level is essential together with the hike in the level, such as exercising measures to increase national income via economic growth and to increase the ATP level.

The results of the foregoing simulations, and the policy order (sequence) give a conclusion that, in order to assure a sustainable project, EPS Loreto, the utility of the project, first of all, should make efforts for the improvement of management under Scenario

Table 14 Financial Simulations by Scenario (in the Water and Sanitation sector in Iquitos)

Item		Scenario 1 (Basic case)	Scenario 2	Scenario 3	Scenario 4
Scenario		The profitability will be assessed on the premise that the current levels will be retained.	Scenario 1, plus self-reliant efforts of the utility itself	Scenario 2, plus governmental subsidy to finance part of the project cost	Scenario 3, plus an increase in tariff level
Utility level	Unaccounted for Water (UFW) ratio	Current level (63%)	Improved to about half of the current level by 2010	ditto	ditto
	Operational management cost	Based on the EPS Loreto Financial Plan 2003 - 2011	20% of the current level will be reduced by 2010	ditto	ditto
	Collection Ratio	Current level (55%)	Improved to 85% of the current level by 2010	ditto	ditto
Government level	Subsidies	As per the current plan	ditto	40% of the project cost will be financed by a governmental subsidy.	ditto
	Tariff Level	Current level (30% of the water tariff)	ditto	ditto	20% up on the current level based on the CVM study
Financial indicators	Financial internal rate of return (FIRR: %) Estimated values	- 0.49	7.59	14.07	19.24

Source: SADEP Study Team

2, while reasonably taking on the element of Scenario 3 (governmental subsidy) as the situation allows. The right order is to carry out these measures, and then or in parallel, to consider Scenario 4 (an increase in tariff level) within the level of ATP.

3. Panama Bay and Panama City Sanitation Project

This project aims to purify the Panama Bay through the improvement of sewer pipe networks and sanitation facilities covering the whole area of Panama City. The plan for this project (including the IDB loan portion) consists of four components: (i) renovation of existing sewers and development of sewer pipes in areas not equipped with facilities preventing wastewater from flowing into the Panama Bay (ii) new construction and replacement of diversion manholes (iii) improvement of conveying pipes and pump stations and (iv) improvement of wastewater treatment plants, sludge treatment plants and discharge ports. The term of the yen loan is set at 30 years, and simulations of forecasting the financial conditions are carried out for the four scenarios in the right order (the same as the foregoing case of the project for the sanitation sectors in Iquitos) (Table 15). at the time of this study, an yen loan has not yet been committed.

In the case where this project is implemented under the present conditions, that is, in Scenario 1, the FIRR takes a negative value. Even if all the UFW rate, the operation and maintenance cost and the collection ratio show highly satisfactory improvements, the FIRR still remains negative (Scenario 2), the reason being that the tariff for the sewerage system[67] is hardly collected at the moment and this makes the collection ratio at a low level. Thus, it is necessary to implement appropriate measures to collect the bills and to increase the rate gradually for the higher profitability of the project. At the same time, ERSP, a supervisory agency, is

67 Laws stipulate that the upper limit of the sewerage tariff level is 50% of the water tariff level (and the actual rate currently used is 30% of the water tariff level).

required to take the initiative in the project.

If all the problems are rectified at the utility level in Scenario 2, and the central government injects a certain amount of subsidy as in Scenario 3, the value of FIRR turns around - if the subsidy accounts for 40% of the total project cost, FIRR would improve to 2.97%.

If the sewerage tariff is raised up to 50% of the level of the water tariff level (currently 30% of the water tariff), the upper limit of hikes defined in a relevant law after the implementation of all the measures for improvement laid down in Scenarios 2 and 3, the FIRR stands at 15.81%, making the project profitable (profitable when the rate is 12% or higher) with the effective improvement of +12.84%, together with the effects gained in Scenario 3. Also, an increase in the tariff level can be counted as a powerful measure since the water tariff level has remained unchanged for 20 years in Panama. In line with this, a review was made to see if the current level was lower than the appropriate level. For this, it might be appropriate, as in the case of Peru, to deploy the CVM to estimate a WTP, and take it into account. However, the review made with only reference to the ATP value[68] found that the current tariff level is at a reasonable level compared to the ATP. Thus, despite the fact that the level has not been raised over the past 20 years though the hike may have an impact on improvement of the financial position, an increase in the tariff level maynot easily implemented.

The results of the foregoing simulations suggest that the first step is the self-reliance efforts at the utility level for a better financial position, but at the same time that it is difficult to make this project profitable if IDAAN remains at the current performance. Hence, it is necessary to follow the "plan for optimizing IDAAN performance" in progress in order to reduce the UFW rate, improve the collection ratio, and steadily make the general operation and maintenance more efficient as pointed out in Scenario 2. Where subsidies from the central government proposed in Scenario 3, and an increase in the tariff level in Scenario 4 are concerned, ideally the former should be incorporated so as to make the amount of the subsidy meet the expenditure on capital investment, whereas the tariff level should be increased in accordance with the current account expenditure. This is because, although both the measures have a positive impact on the financial position, the amount of subsidy has a constraint on the national budget, and an increase in the tariff level faces constraints from the political and social viewpoints. Since an increase in the tariff level is not an option that should be easily taken on, the appropriate course of measures is to realize the certain improvement through Scenario 2, and then use subsidies in Scenario 3 to form a fixed capital stock (expenditure on investment), and carefully cansider tariff increase.

4. Possibility of the Introduction of PSP at the Project Level

The above case study revealed that, on the condition that the yen loan is used for the project, considerable efforts. by the governments and implementation agencies of the borrower countries (government subsidization and management improvement of the implementation agencies) is essential to secure their profitability in every project. Setting these as a prerequisite, the introduction of PSP can be counted as an option to assure sustainable management at the utility level and serve as an effective device for improvement in yen loan projects. Although there are some limitations in yen loan projects because of the fact that the government of the borrowing country or the implementation agency needs to have ownership of the facilities (assets) constructed with the finance of the loan, PSP operations are still worthwhile. For example, various PSP options - service contract, management contract, lease contract, and concession contract - are available. (On the other hand, the use of asset sales in the privatization process in yen loan projects requires certain conditions because the ownership of the assets created by the loan is

68 The ATP value for water supply was computed with reference to data in the national household survey conducted by the Bureau of Statistics of the Panamanian Government. More specifically, the proportion of expenditure concerning the water and sanitation services to the household outlays as a whole was analyzed and compared with other components of the household expenditures for the calculation.

Table 15: Scenarios for Financial Analysis (Panama Bay and Panama City Sanitation Project)

Item		Scenario 1 (Basic case)	Scenario 2	Scenario 3	Scenario 4
Scenario		The profitability will be evaluated given that the current level will remain as it is.	Scenario 1, plus self-reliant efforts of the utility itself	Scenario 2, plus governmental subsidy to finance part of the project cost	Scenario 3, plus an increase in tariff level
Utility level	Unaccounted for water (UFW) ratio	Same as at present (48%)	To be improved to 30% by 2011	ditto	ditto
	Operational management cost	Current level	To be reduced by 20% of the current level by 2015*	ditto	ditto
	Collection Ratio	Same as at present (45%)	To be improved to 80% by 2011 (Government's target value)	ditto	ditto
Government level	Subsidies	Same as the current plan	ditto	40% of the project cost will be borne by the government	ditto
	Tariff Level	At 30% of the current water tariff	ditto	ditto	An increase by 66% from the current level (55% of water tariffs)**
Financial indicators	Financial internal rate of return (FIRR: %) Estimated value	-13.16	-1.12	2.97	15.81

* In response to the high ratio of the electric power cost, the reduction goal of the total management cost is set at 20%.

** The tariff level is assumed to be raised to 50% of the water tariff which is the upper limit allowed in the current law, from 30% which is quivalent to the average water tariff of developing countries in Latin America.

Source: SADEP Study Team

transferred from the borrowing organization to a third party.)

(1) PSP for Water Supply and Sanitation Services in Iquitos City, Peru

Although the legal system for PSP has been established well enough to operate PSP activities, the introduction of PSP itself has to be conducted gradually with careful consideration in the light of the fact that the public opinion is not necessarily favorable to the introduction that the project site is in a rural area, and that EPS Loreto is not in a sound financial position.

Possible introduction of PSP, if any at this stage, includes improvement of the collection ratio and reduction of the operational management cost through service contracts or management contracts (in this case, the investment into measures to deal with unaccounted for water needs to be made by EPS Loreto).

(2) PSP for Panama Bay and Panama City Sanitation Project

Taking into account the fact that IDAAN is slow in its self-reliant reforms, that the introduction of PSP in the past did not go successfully, and that the current political and public opinions do not show support or understanding of PSP, there are many problems to overcome to produce positive effects with the introduction of PSP.

The most realistic option is based on the political and public opinions concerning the current PSP operations. A service contract will be the most realistic option for a discrete project, a management contract as the second, if this project is treated as an independent project within the framework of the organizational reform of IDAAN in the mid and long terms.

Chapter 6. Recommendations for the Roles of PSP in Realizing a Sustainable Water and Sanitation Sector

This chapter takes all examinations made so far and presents recommendations the roles of private sector participation (PSP) in achieving sustainable water and sanitation sectors.

1. The ideal configuration for the water and sanitation sectors

Water and sanitation services are an indispensable basic human need (BHN), and must be provided for all the people in the country in question. Thus, it is necessary to boost the coverage ratios in the water and sanitation sectors extensively and rapidly, while maintaining a certain quality of the services. To do that, the entire water and sanitation sectors, not to mention individual utilities, will be called on to maintain a sustainable, sound and lean financial position.

Necessary expenses in the water and sanitation sectors are financed by revenues from tariffs charging beneficiaries for the services, but the sectors cannot necessarily be financed by such revenues alone. Thus, under normal circumstances, a substantial proportion of the operation and maintenance costs, as well as funds for capital investment, are financed by public funds (subsidies) or funds raised by the floatation of long-term bonds. In developing countries, in particular, many beneficiaries tend to be low-income households or face poverty problems, and thus are not capable of affording the services, so that, in practice, the service providers are obliged to rely on a large amount of public budget from taxes (i.e., there is a chronic deficit in the public entities and companies in charge of the services). However, if the sum of the burden borne by the people - tariffs collected by the water and sanitation sectors and subsidies - exceeds the total value of the benefits from the sectors, problems arise from the viewpoint of the national economy, in that it implies a reduction of resources for development which could have been allocated to other sectors.

The development of a sustainable water and sanitation sectors essentially requires an appropriate vision for long-term investment, with which the utilities involved should make management more efficient, make the financial position healthier based on stable collection of tariffs, and continue providing quality services for the long term.

2. The role to be played by PSP

Generally, PSP is counted as a solution at the project level. If operational improvements are efficiently implemented with respect to individual projects or suppliers using PSP, there will also be positive effects on other projects and suppliers. Accordingly, it will contribute to the improvement of sustainability of the sector as a whole.

In Latin America, as a result of failures of many public organizations and companies in providing appropriate water and sanitation services, attention was drawn to the potential introduction of PSP and PSP was in fact introduced in the 1990s. A concession contract concerning the water and sanitation services in Buenos Aires agreed in 1993 was instrumental in accelerating the introduction of PSP operations in the water and sanitation sectors in Latin American countries.

However, PSP is not necessarily a cure-all for any water and sanitation services. Rather, a lot of problems in the sectors (shortage of funds for investment, overstaffed organizations, low tariff levels, low collection rates, etc.) can actually be solved by the self-reliant efforts of the public companies themselves. An important thing is to explore the possibility of handling the problems, first, with self-dependent efforts of the public sector, rather than easily resorting to the introduction of PSP. A PSP operation should be considered when the public sector cannot overcome the problems with its own efforts, and the problems are likely to do harm to the sector as a whole.

3. The PSP options and their applicability

Generally, when PSP is introduced, there are a variety of PSP options that may be selected depending on the degree of commitment of the private sector: (i) service contract, (the simplest option), (ii) management contract, (iii) lease contract, (iv) concession contract, (v) BOT contract, and (vi) asset sale.

When selecting an appropriate PSP option, the type of the problem for which improvement is expected by the utility is important. Moreover, rather than starting out with an option involving high risk to be borne by the private sector, it is reasonable to begin with an option with a low investment risk for the private sector, and shift gradually to options that involve higher risks while deepening the mutual trust between the parties. For example, even the concession contract concerning the water and sanitation sector in Buenos Aires, which had been a success in the 1990s, failed to continue its operation due to the sudden change in the foreign exchange rates. Thus, a careful, thorough examination is required to introduce a long-term PSP operation with high risks.

From the lessons learned from the past experiences of the introduction of PSP to the water and sanitation sectors, several key issues must be highlighted.

First, a successful PSP requires not only political commitment surrounding the services (institutional building, strengthening of the functions of related organizations, etc.), but also accountability to users of the services. Second, if tariffs are impetuously raised immediately after introducing PSP, the support of public opinion will be lost, and in fact, there is a danger that negative feelings will be provoked. Thus, every effort must be made to avoid this. Third, utilities must be selected by means of carefully conducted competitive bidding, and contracts need to include the necessary items for long-term continuation of the work.

4. Procedure for introducing PSP

The introduction of PSP and the approach up to the point of introduction can be generally divided into two steps.

The objective of Step 1 is for the public entity to reform its management through its own self-help efforts. This is the first measure that public corporations having manegement problems should take. Looking at the water and sanitation sectors in Latin America by country, there are more than a few cases in which the sustainability of the sectors is questionable because of problems such as high rates of UFW and low tariff collection ratios. From this standpoint, at step1. public corporations aim at grasping their own problems and improve their performance with employer/employee cooperation as well as private sector management techniques. It is assumed that at Step 1, the public entity will initiate improvements to achieve its ideal stance by carrying out what should naturally be done. As a result, even if PSP is introduced in Step 2, the risk borne by the private sector will be lessened and the business foundation will be strengthened.

Step 2 is aimed at solving problems with management know-how of the private sector and forming sustainable water and sanitation sectors. Before implementing this step, various environments allowing the introduction of PSP must be established as the first stage: political commitment, legal foundations, tariff system, and so on. After the establishment of these conditions to some extent, as the second stage, PSP options essential for the problem solution are selected, and they should be introduced gradually.

5. The possibilities for PSP in the focused Four Countries

In the four Latin American countries included in this study, namely Mexico, Peru, Panama and Costa Rica, the question of how PSP might contribute to solving problems was examined, starting from elements such as sector analysis and the status of PSP introduction. The results are described below for each of those countries.

(1) Mexico

Mexico has a proven performance in PSP introduction since 1990 The country is also progressing with the legal infrastructure to accept PSP activities, such as the enactment of the national law concerning water, and the establishment of funds for infrastructures. Thus, it seems that PSP will be able to contribute to the water and sanitation services in Mexico. In the sewerage sector, revised laws prohibit the discharging of unprocessed wastewater into rivers from 2006, and the construction of wastewater treatment facilities is an urgent task. At the sector level, the CNA is required to promote sector reform on a voluntary basis.

Because Mexico has accumulated experience

and know-how, it would be effective to introduce service contracts or management contracts in order to improve the operating efficiency of existing facilities, or to take advantage of BOT contracts for constructing wastewater treatment facilities which require a large amount of initial investment.

(2) Peru

Peru has been somewhat negative about the introduction of PSP, reflecting the negative public opinion of privatization. However, the introduction of PSP has been gathering momentum in recent years: the approval of private-sector projects for building water treatment plants based on BOT contracts in regions covered by SEDAPAL.

In Peru, the requisite political commitment has been obtained, such as the legal framework relating to private investment, and it is possible to introduce PSP for the purpose of achieving sustainable water and sanitation sectors.

For the introduction of PSP, it will be necessary to simultaneously undertake the action to establish the legal system and care for low-income households. From the standpoint of sanitary conditions, the application of PSP to the construction of the sewerage system would be effective.

Since public utilities (EPS), in rural areas are required to improve the current quality of services and produce greater efficiency, a concession contract may well be an appropriate option. However, unless a certain scale is involved, it is unlikely to attract the participation of private companies. Thus, if the merit of scale cannot be expected, a service or management contract seems to be an effective option.

(3) Panama

In Panama, the public shows a strong resistance against the introduction of PSP, so that a privatization plan already determined to commence was called off. Thus, at the moment, there is no prospect of introducing PSP in the water and sanitation sector in Panama.

As for the current state surrounding the water and sanitation sectors in this country, a fundamental problem is observable in the sector: although IDAAN suffers from a chronic financial deficit, it is failing to deal with it on its own.

In light of the situation seen above, IDAAN, first of all, must renew its recognition of the needs concerning the water and sanitation services, and make a serious effort to achieve improvement. For this, it is ideal to introduce PSP partially under a service contract, and then aim at greater efficiency within a short period under a management contract (for mid and long-term achievements, the Govenment should consider organizational reform of IDAAN, together with other PSP options).

In Panama, there is room for proactively taking advantage of a BOT or other contract for the construction of important facilities or new wastewater treatment facilities.

(4) Costa Rica

In Costa Rica, judging from the fact that enterprises such as ESPH run efficient operations, PSP could be efficiently implemented, if it is correctly utilized Therefore, the water and sanitation sectors should ideally take the initiative in encouraging the introduction of PSP across the country.

AyA is planning to introduce PSP in the future, and it would be effective to do so as a remedy for its high unaccounted-for water (UFW) ratio.

If PSP were introduced in the services provided by AyA and ESPH, since their collection rates are more or less good, it is desirable to focus on the reduction in the UFW ratios. Where appropriate PSP options are concerned, since ESPH and other public companies can relatively freely deploy their activities in the public sector in Costa Rica, a concession contract seems to be an option in that it gives the discretion to some extent to the public companies involved.

In Costa Rica, because the infrastructure related to the sewerage system is underdeveloped throughout the country, the introduction of PSP may be ideal if a BOT contract is agreed, so as to take in the know-how of private companies for the sewerage services.

References

ADB Reference"Best Practices for Promoting Private Sector Investment in Infrastructure"

___, Reference"Performance Monitoring Indicator Data Sheet"

Dickinson College/World Bank (2002)"Effective Water Service Provision: Performance targets for a well-run utility"

Harris, Clive, Private Sector Advisory Services (2003)"Private Participation in Infrastructure in Developing Countries: Trends, Impacts, and Policy Lessons."

Hazen and Sawyer, (2003)"Addendum to Panama Bay and Panama City Sanitation Project"

Idelovitch, Emanuel, WB, (1995)"Private Sector Participation in Water Supply and Sanitation in Latin America"

IDB, (2003)"Private Infrastructure at the Subnational Level: Challenges in Emerging Economies"

___, (2003)"Report on Water Pricing/Cost Recovery in the Baltic Sea Countries"

___, (2003)"F/S for the Expansion Plans of the Drinking Water Supply and Sewerage Systems at Minimum Cost, Final Report-Iquitos, Vol. 2 Book1/8 Tex Part 1/2"

___, (2003)"F/S for the Expansion Plans of the Drinking Water Supply and Sewerage Systems at Minimum Cost, Final Report-Iquitos, Vol. 2 Book2/8 Tex Part 2/2"

___, (2003)"F/S for the Expansion Plans of the Drinking Water Supply and Sewerage Systems at Minimum Cost, Final Report-Iquitos, Vol. 2 Book3/8 Tex Part 1/2"

___, (2003)"F/S for the Expansion Plans of the Drinking Water Supply and Sewerage Systems at Minimum Cost, Final Report-Iquitos, Vol. 2 Book4/8 Tex Part 2/2"

___, (2003)"F/S for the Expansion Plans of the Drinking Water Supply and Sewerage Systems at Minimum Cost, Final Report-Iquitos, Vol. 2 Book6/8 Add. Study"

___, (2003)"F/S for the Expansion Plans of the Drinking Water Supply and Sewerage Systems at Minimum Cost, Final Report-Iquitos, Vol. 2 Book4A/8 Exhibit Part 2/2"

___, (2003)"F/S for the Expansion Plans of the Drinking Water Supply and Sewerage Systems at Minimum Cost, Final Report-Iquitos, Vol.1,2,3,4 Book 8"

INEI (2002)"INEI Encuesta Nacional de Hogares - Ivtrimetre del 2001"

JBIC (2000)"Special Assistance for Project Formation (SAPROF) for Provincial Cities Water Supply and Sewerage System Improvement and Expansion Project in the Republic of Peru—Final Report—"

___, (2000)"Implementation Program for Provincial Water Supply and Sewerage System Improvement and Expansion Project in the Republic of Peru"

___, (1995)"Feasibility Study for the Sanitation of the Valley of Mexico, Final Report, Mexico"

OECF (1997)"The Study of the Wastewater Treatment Privatization Project in Malaysia"

Project Finance International (2003) "Mexico looks offshore for water investors"

___, (2002)"Struggling for capital in the US and global water sector"

___, (2001)"Water gets more attention"

Project Finance International Americas Report Latam Water (1999) "Opporutunities and challenges for the private sector in Latam Water"

SEDA Loreto, (2002)"Financial Plan of SEDA Loreto, 2003 - 2011"

Sotomayor, Maria Angelica: , WB Note, (2003), "Colombia - Expanding Services to Low Income Areas; Comparing Private and Public Utilities No.24"

UNDP-World Bank (1999)"Willing ness to Pay but Unwilling to Charge"

___, (1999)"Do Cross-Subsidies Help the Poor to Benefit from Water and Wastewater Services?—Lessons from Guayaquil—"

UTCE Ltd./Japan PFI Association (2003)"Impact Evaluation Study on Public-Private Partnership—Republic of the Philippines—"

WB OED (2003)"Efficient, Sustainable Service for All?"

WB, (2003)"Colombia: Expanding Services to Low-income Areas Comparing Private and Public Water Utilities No. 24"

___, (2002)"Private Participation in Infrastructure: Trends in Development Countries in 1990 to 2001"

___, and PIAF, (2003)"Private Solutions for Infrastructure in Mexico, "Country Report for Private Participation in Infrastructure""

ACP, Panama, (2002)"ACP Carpeta"

___, (2002)"ACP Informe Anual 2002"

AyA (2001)"Estados Financieros Auditados de AyA al 31 de diciembre del 2001"

AyA/Banco Interamericano de Desarrollo Washington, D.C., (2003)"Análisis de la concesión de acueducto y alcantarillado en la ciudad de Monteria"

Business Transformation Advisors, Inc (2002) "Plan de Transformaci_n Institucional 2002-2005—Estrategia de Rentabilización—"

___, (2002)"Plan de Transformación Institucional 2002-2005—Análisis de la Situación Actual—"

___, (2002)"Plan de Transformación Institucional 2002-2005—Estructura Organizativa y Administrativa Propuesta—"

___, "Panamá en Cifras"

___, (1997)"IDAAN Memoria 1996 - 1997"

___, (1998)"IDAAN Memoria 1997 - 1998"

___, (1999)"IDAAN Memoria 1998 - 1999"

___, (2000)"IDAAN Memoria 1999 - 2000"

___, (2001)"IDAAN Memoria 2000 - 2001"

___, (2002)"IDAAN Memoria 2001 - 2002"

___, (2001)"IDAAN Informe a la Presidencia 2000 - 2001"

___, (2002)"IDAAN Informe a la Presidencia 2001 - 2002"

___, (2003)"IDAAN Informe a la Presidencia 2002 - 2003"

___, (2003)"IDAAN Resumen de Proyectos de Inversiones al 30 de noviembre de 2003, IDAAN Proyectos de Optimización"

___,"IDAAN Proyecto de Optimización (Biwater)"

___,"IDAAN Estructura Orgánica"

___, (2002)"IDAAN Funcionarios Totales al Año 2002"

___, (2001)"Direccion de Servicios Financieros"

___, (2000)"Direccion de Servicios Financieros"

___, (1999)"Direccion de Servicios Financieros"

CNA, (2003)"La Participacion Privada en la Prestacion de los Servicios de Agua y Saneamiento - Conceptos Basicos y Experiencias, Mexico city"

___, (2003)"Estadisticas del Agua Mexico"

___, (2002)"Compendio del Programa Para la Sostenibilidad de loa Servicios de Agua Potable y Saneaminento en Comunidades Rurales 1998-2002"

___, (2001) Programa Nacional Hidraulico 2001-2006"

Direccion de Estadistica y Censo, Panama"Direccion de Estadistica y Censo"

Dirección Financiera, (2003)"Instituto Costarricense de Acueductos y Alcantarillados—Proyecciones Finencieras Período 2002-2012—"

ENNIV, Instituto Cuanto, (2000) Resultados preliinares: ENNIV-2000"

EPS Grau S.A / Emfapatumbes S.A. "Plan de Promocion—Para la Concesion de los Servicios de Agua Potable y Alcantarillado de las EPS—"

ERSP, Panama, (2002)"ERSP Memoria Anual 2002"

___, (2002)"ERSP Estructura Orgánica"

Hazen and Sawyer, (2003)"Addendum to Panama Bay and Panama City Sanitation Project"

IDAAN, Panama"IDAAN Manual de Organización y Funciones (Último Borrador)"

___, (2001)"lan de Transformacion Institucional 2002-2005, Estructura Organizativa y Administrativa Propuesta"

___, (2001)"Plan de Transformacion Institucional 2002-2005, Estrategia de Rentabilizacion"

___, (2001)"Plan de Transformacion Institucional 2002-2005, Analisis de la Situacion Actual"

INEI (2002)"INEI Encuesta Nacional de Hogares - Ivtrimetre del 2001"

MINSA, Panama"MINSA Normas para Aguas Residuales"

___,"MINSA Comunidades con Necesidades de Redes (de Alcantarillado)"

SEDA Loreto, (2002)"Financial Plan of SEDA Loreto, 2003 - 2011"

___,(2002)"Balance General y Astados Financieros"

___, (2001)"Balance General y Astados Financieros"

Total Urbano del Pais, Panama, (1999)"V Enquesta de Ingresos y Gastos de los Hogares 1997/98"

Estimation of Willingness-to-Pay (WTP) for Water and Sanitation Services through Contingent Valuation Method (CVM) — A Case Study in Iquitos City, The Republic of Peru —[1]

Yasuo Fujita*
Ayumi Fujii**
Shigeki Furukawa***
Takehiko Ogawa****

Abstract

This study conducted estimates of Willingness to Pay (WTP) and Affordability to Pay (ATP)of beneficiaries for water and sanitation services in Iquitos City, Peru as part of Special Assistance for Development Policy and Projects (SADEP) "The Role of Private Sector Participation (PSP) for Sustainable Water Supply and Sanitation Sectors- The Case of Latin America-" in 2004.

The WTP was estimated through a questionnaire survey in line with Contingent Valuation Method (CVM), while the ATP was computed with reference to available data including the household survey data in the area. The main findings are: (i) WTP is approximately twice of the current average payment level; and (ii) ATP is roughly in the range from 10% - 20%lower to 20% higher than the current average payment level. The implication of this result is that although the beneficiaries' valuation on the improvement of the water and sanitation services is high, the room for increasing the tariff level for financing a portion of the project cost would be small due to their limited payment capacity. Therefore, other means of revenue generation, such as strengthening of payment collection to realize the expressed high WTP, cost reduction through more efficient operation and management, and regional development activities contributing to the increase of income would be necessary in order to improve the sustainability of the services in the city.

The estimated WTP through CVM is expected to be utilized as useful information of the demand side on tariff level of services with consideration to its limitations.

Introduction

JBIC conducted a study, "The Role of Private Sector Participation (PSP) for Sustainable Water Supply and Sanitation Sectors - The Case of Latin America -" as Special Assistance for Development Policy and Project (SADEP) in Japanese fiscal year 2003. It analyzed the problems of water supply and sanitation sectors in Latin American countries from the view of point of enhancing sustainability of the sectors, and examined the possibility of solving the problems by introduction of PSP. In the study, it was pointed that it is sometimes difficult to set water and sanitation tariffs at appropriate levels due to political reasons, and that tariff increase after introducing PSP caused problems in some cases. In order to improve the sustainability of the sectors and ensure successful PSP, it is important to set appropriate tariff levels with sufficient justifications.

* Senior Economist/Director, Development Policy Research Div., JBIC Institute
** Former Research Officer, Development Policy Research Div., JBIC Institute
*** Deputy Director, Development Policy Research Div., JBIC Institute
**** Engineering Consulting Firms Association, Japan (ECFA)[2]

1 This study was made from a part of the "The Role of Private Sector Participation (PSP) for Sustainable Water Supply and Sanitation Sectors - The Case of Latin America -" as conducted through Special Assistance for Development Policy and Project (SADEP) in Japanese fiscal year 2003 (The study was commissioned to KRI International Corp. and Nippon Koei, co. Ltd.). The study team received valuable advice and comments by Mr. Hitoshi Ikuma, Deputy Director, Center for the Strategy of Emergence, The Japan Research Institute, Limited; and Professor Yoshiaki Kaoru, School of Business Administration, Nanzan University (In particular from prof. Kaoru on this CVM study).

2 Member of SADEP study team

JBICI Review No.11 March 2005 pp59~87

There are a variety of methodologies for setting tariffs of water and sanitation services in developing countries. This study attempted to collect basic data in order to examine amount to be paid by beneficiaries for the services (i.e. tariff levels), through estimating Affordability-to-Pay (ATP) of beneficiaries based on household's income and expenditures, and Willingness-to-Pay (WTP) of beneficiaries.

This study implemented a questionnaire survey using the "Contingent Valuation Method" (CVM) in the city of Iquitos, Peru, from November 2003 to January 2004. It aimed at estimating appropriate tariff levels to ensure the sustainability of the projects taking a water and sanitation project in the city as a case. The CVM is a technique that uses questionnaires to measure WTP for water and sanitation services, from which the value of environmental improvement is estimated. This study used the CVM for "estimating WTP of Iquitos residents for environmental improvement in the form of upgrading of the water supply and sanitation services" through in a water and sanitation development project[3]. The results of the study would enable appropriate water and sanitation service pricing options to be suggested with reference to the estimated WTP for water and sanitation services.

Chapter 1: Study Methodology

(1) What is Contingent Valuation Method (CVM)?

In the field of environment economics, a variety of methods are developed to measure benefits of improvement of environmental quality and infrastructure such as public works. While Alternative Method, Travel Cost Method (TCM), Hedonic Price Method (HPM), and Contingent Valuation Method (CVM) are used to evaluate values of these non-market goods, CVM is the most popular method in recent years because it can cover wide range of themes.

The CVM measures project benefits (e.g. improvement of envionmental resourus, and provision of public goods) in monetary terms by directly asking people's WTP for such projects through a questionnarie survey with assuming that they will be implemented. It is said that there have been more than 2000 CVM studies conducted since a CVM survey on Forest Recreation Activities conducted in the State of Maine of USA. Since 1980s in the United States, due to growing concerns on environmental issues, CVM studies were conducted very frequently in order to assess social impacts of environmental conservation policies[4]. In Japan, more CVM studies are conducted to analyze cost and benefits of public investment projects.

(2) Considerations in theory and application of CVM

The CVM assesses, by using a questionnaire, how much in maximum they are willing to pay to conserve or improve environment. The concept of WTP is originated from economic theory (consumer theory). WTP is expressed in currency to represent effects in accordance with the variance in indifference curves between two points of time—the present, at which the environment has not undergone improvement, and a future time, at which it is supposed that environment is improved—and the variance in the effects.

①WTP depends on person.

Since WTP reflects people's different valuations on environment and public goods, the amount varies depending on person. The CVM decides WTP of the survey area through estimating a representative value of different WTPs among people.[5]

---

3 The SADEP study focused on Mexico, Peru, Costa Rica and Panama. Especially in three countries, Mexico, Peru, and Panama, the case study on Yen Loan Project about the feasibility of Private Sector Participation was executed. In Peru the Yen Loan Project in Peru, "Provincial cities water supply and sewerage improvement and expansion project II", Iquitos was chosen for this case study. (Date of the loan agreement: September 2002; Amount of the JBIC ODA loan 7,636million yen. This project includes sub-projects in Iquitos, Cuzco and Sicuani). The CVM study is a part of the case study in Iquitos and analyzes the tariff level of water and sanitation services was in detail. Although sanitation water project was not included in this project of Iquitos, both of water and sanitation services were investigated because of the potential needs for sanitation services.

4 See Kuriyama (1998) and Kuriyama (2000)

②WTP is decided only from demand side.
WTP is decided only from demand side. Therefore, it can be said that CVM is a demand oriented method. As for supply side, CVM can only assess benefits arising from the investment in services, not costs borne by the service providers. The supply side is indicated as a supply curve of the services provided and the supply cost, and the equilibrium point is derived from the demand and supply curves. Estimation of WTP provides basic information for tariff setting.

③Existence of biases
The representative WTP value derived from the CVM analysis cannot be used, as it is, as a basis for revising actual tariff. The WTP includes certain biases, and therefore it is no more than an estimation derived from the CVM analysis based on a hypothetical situation communicated to the respondents. Specifically, there is a gap between the WTP derived from the CVM and the WTP in actuality where one has to pay according to the current tariff. This is called the "budget constraint" bias among those caused by scenario transmission errors. The hypothetical WTP at the time of answering the questionnaire is different from the actual WTP because the former may fail to account for effect of paying the tariff on the affordability of other goods and services (=budget constraint). In other words, the demand curve derived from the CVM analysis results is hypothetical and has certain deviations from reality, and the CVM results cannot necessarily be applied to the actual tariff as they are.

④Uniqueness of the CVM Analysis Results
CVM provides an estimate of how a certain group of respondents living in a certain area at a given time value their environment. It should be noted that the results of this CVM survey cannot be applied to the other areas in Peru, since the results represent nothing other than the present WTP of existing and potential water and sanitation users in Iquitos city.

In consideration of these characters and limitations of CVM, this study estimates beneficiaries' WTP which gives a basis for appropriate tariff.[6]

Chapter 2: CVM Research in Iquitos City, Peru

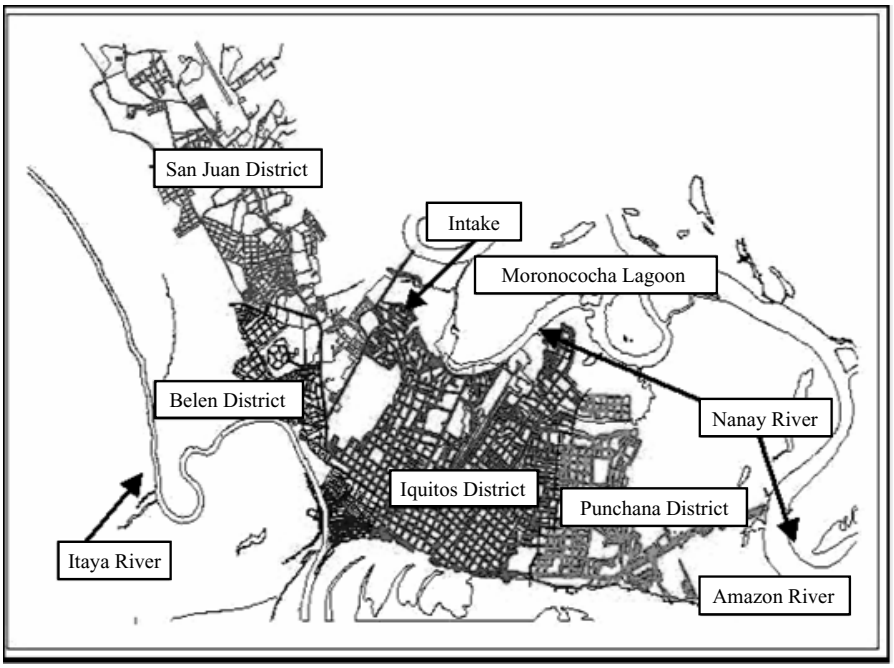
The procedures of this CVM study consisted of the following seven steps: (i) collection of information to be evaluated, (ii) determination of the population and sampling, (iii) development of scenarios, (iv) preparation of the questionnaire, (v) implementation of focus group meetings and pretests, (vi) implementation of the full-scale survey, and (vii) analysis of the study results and estimation of WTP. In this study, we began with identifying, the survey population and setting an appropriate scenario in consideration of the plan of the water and sanitation service project in Iquitos.

(1) Beneficiaries and Study Area[7]

This study covered the city of Iquitos, the capital of the Department State of Loreto. In 2003, Iquitos had an estimated population of approximately 420,000 in 2003. It is divided into four administrative districts: the Iquitos District, Punchana District, Belen District and San Juan District (Figure 1). Its major industries are tourism, small-scale farming, small-scale fishing, agricultural processing, and lumber processing. Iquitos has no large industry. The city is surrounded by the Amazon River and two of its tributaries, the Nanay River and the Itaya River; the Nanay River provides the residents' drinking water. The residents also use the Nanay River for swimming, and some make a living from small-scale fishing on it. Sewage

5 There are several CVM models for double-bound data sets, such as "Random utility model," "WTP function model," and "Survival analysis." to estimate a represetative value of WTP. The CVM 2002 adopts the survival analysis. See Kuriyama (1998) for details.
6 In the main part of this SADEP study, benefits of the water and sanitation project in Iquitos is measured with reference to the estimated WTP here.
7 In this paper, we describe the survey results of general household users conducted in this study. The survey results of commercial users are indicated in the appendix at end of this paper.

Figure 1: Conceptual diagram of the city of Iquitos



Source:SADEP Study Team

from Iquitos is discharged untreated to the surrounding water basin via existing sewer pipes. The topography of Iquitos places it on an incline from the Amazon River to the Nanay River; most of the city's sewage flows into the Nanay River through a water basin known as the Moronococha Lagoon. Because of this, there is marked pollution in the Nanay River and in the lagoon, where sewage concentrates. The lagoon suffers from foul odors, and there are reports of skin problems caused by eating fish from it.

Only about 60% of Iquitos households are registered as residents, making the resident registry inadequate for our purposes. We therefore received information on about water and sanitation service beneficiaries from the "registry of users and potential users" maintained by the Iquitos Water and Sanitation Public Corporation. This registry lists approximately 52,000 households that are either current users or potential users in the near future. It is considered the most reliable beneficiary list available. The list enables confirmation of water and sanitation access, head of household names and addresses for almost the entire territory of Iquitos. However, the San Juan District, located in the northwest of the city near the Iquitos Airport, lacks either water or sewer pipes, so most of the households in the District are not included as potential users on the registry. We therefore supplemented the list with data for the San Juan District from the resident registry (approximately 5,800 households).

(2) Population and Sampling

In CVM, the population should be, in principle, all beneficiaries of the environmental values to be evaluated (in this case, all beneficiaries of water and sanitation services). For this survey, the scope of the population was deemed to be all beneficiaries of water services and sanitation services provided by a water and sanitation construction project for the city of Iquitos. As described above, the beneficiary list for the CVM survey consisted of a list of approximately 58,000 user and potential user households obtained from the Loreto Water and Sanitation Public Corporation, to which was added a list of approximately 5,800 households for the San Juan District, which was obtained from the Iquitos City resident registry[8]. The combined lists provided a list of beneficiary candidates to comprise the population required for sample extraction.

8 Covers most of San Juan District.

Table 1 Status of water service beneficiary households in Iquitos (Oct. 2003)

Type of service	*Services available (1)*	*Services suspended (2)*	*Households registered (1)+(2)*
24-hour basis	12,700	2,399	15,099
Time restriction	19,777	7,440	27,217
Total	32,477	9,839	42,316

Source: Department of Loreto Water and Sanitation Public Corporation

①Population of the water service beneficiary area

The water service covers all of Iquitos except the San Juan District, but there are problems throughout the entire city area (described below), leading us to categorize beneficiaries of the water service area into the following two groups[9]. Table 1 shows the status of water service beneficiary households in Iquitos.

i) Group 1: Areas not currently connected to the water mains and not receiving any water services

ii) Group 2: Areas provided with water services but only incompletely because of restricted times or low water pressure

There are problems with the water supply virtually throughout Iquitos. JBIC provides an ODA loan to assist the water supply project in Iquitos under "Provincial Cities Water and Sewerage Improvement and Expansion Project Ⅱ". In Iquitos, the project includes new construction and rehabilitation of water supply facilities, such as water intakes transmissions, treatment plants, and distribution system.This project will provide water services for virtually the entire San Juan district, bring 24-hour water services throughout the city and assure sufficient water pressure, thereby providing some form of benefit for the entire city. We therefore considered the population to be all user and potential user households on the lists. Chart 3 shows the conceptual diagram of water supply hours for different areas of Iquitos.

②Population of sanitation service beneficiaries

Most of the central part of the city is connected to the sanitation service, but there is no sewage treatment. As described above, raw sewage is discharged untreated into the rivers that surround Iquitos: the Amazon and two tributaries (the Nanay and the Itaya). Sanitation service beneficiaries were categorized into the following three groups:

i) Group 1: Areas not currently connected to the sewer mains and not receiving any sanitation services

ii) Group 2: Areas connected to the sewer mains but receiving incomplete services due to, for example, overflow of sewage during rainfalls

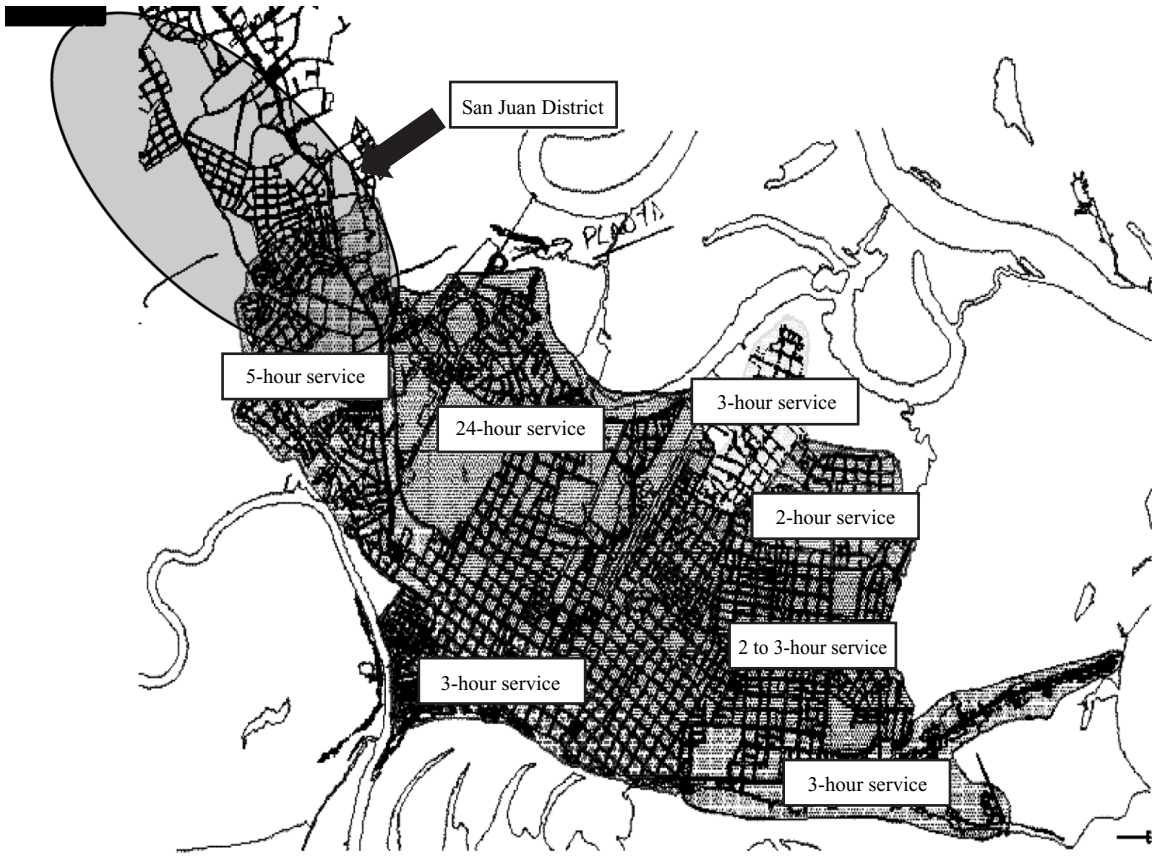
iii) Group 3: Areas connected to the sewer mains and receiving services in the aspect that sewage is removed sewage from households to a safe place, but nonetheless the services are incomplete because they are concerned about risk of environmental degradation due to discharge of raw sewage into surrounding rivers. The Table 2 shows status of sanitation service beneficiary household in Iquitos.

The loan does not cover the Iquitos city sewerage project, but the Loreto Water and Sanitation Public Corporation envisions three options for the sanitation construction project, which are shown in Table 3. Of these three, Option 2 would discharge raw sewage into the Amazon without treatment. The flow of the Amazon River is reportedly 300 times that of the Rhine River in Germany, and there are no factories in Iquitos that discharge chemical substances, so there is no problem with the Amazon's purification capacity (from an engineering perspective), which perhaps makes a sewage treatment plant less urgent. However, even focus group meeting members who do not reside near the Moronococha Lagoon or the Nanay River, where most of the raw sewage is discharged, were of the opinion that the practice: (i) harms the scenery (some argued that it had an impact on tourism resources), (ii) smelled bad, and (iii) resulted in raw sewage being discharged near drinking water intakes. Obviously, most residents from the area around the Nanay River, where the drinking water intakes are located, commented on the need for sewage treatment.

9 Please note that this grouping of beneficiaries is important in the implementation and analysis of this CVM and frequently referred to in this paper.

Therefore, in order to avoid pollution of the Amazon, we assumed Option 1, a project that would cover the entire city and include a sewage treatment plant, not just a sewer mains and pumping station, and we deemed the population to be all users connected to the sanitation service, including those households that were satisfied with current conditions.

Figure 2: Conceptual diagram of water supply hours for different areas of Iquitos



Source: SADEP Study Team

Table 2: Status of sanitation service beneficiary households in Iquitos

Type of household	No. of households
Households with connections	32,498
Registered households without connections due to aging facilities, etc. (Rehabilitation needed)	2,444
Total number of registered households	34,942

Source: Department of Loreto Water and Sanitation Public Corporation

Table 3: Options of the assumed sanitation project

Option	*Sewage Treatment Plant*	*No. of Pumping stations*	*Total project cost*
Option 1	With plant	6	808 million dollars
Option 2	Without plant	6	460 million dollars
Option 3	With plant	3	470 million dollars

Source:Department of Loreto Water and Sanitation Public Corporation

③ Sampling

The most important factor to be taken into account when determining the sample number, n, of samples is whether statistical errors for the estimated WTP will be within a tolerable range. Obviously, estimation errors tend to decrease as the number of samples increases, but it is known to almost cease decreasing after the number of samples when n

exceeds 1,000. According to recent research, at least 600 samples are needed for single bound and at least 400 samples for a double bound in order to ensure the statistical reliability of WTP estimations. As described above, water and sanitation services cover multiple groups, so we decided to extract 1,000 samples in order to ensure a minimum number of samples for each group.

There are four main methods before extracting choosing samples: simple random sampling, systematic sampling, multistage sampling, and stratified sampling. Stratified sampling has the greatest precision but requires the creation of strata for the areas covered. Being unable to obtain in advance the household information required for this, we elected to use simple random sampling, relying on random numbers to select samples from the population list.

(3) Scenario formulation

The scenario is the most basic component of the questionnaire. It was formulated by positing an envisioned status for the water and sanitation construction project. For this scenario, the "current status" was deemed to be "no supply of water and sanitation services" and "not supplying unsatisfactory water and sanitation services" due to limited water supply and low water pressure, the envisioned status was defined as, "supplying satisfactory water and sanitation services" (by implementation of a water and sanitation construction project). The important point here is that the respondents are the ordinary residents of Iquitos and it was therefore necessary to communicate the current status and envisioned status in a way that could be easily understood. To do this we obtained publicity materials meant for the general public from SUNASS (Superintendencia Nacional de Servicios de Saneamiento) and the Loreto Water and Sanitation Public Corporation and used them in for explaining the scenario.

(4) Questionnaire

Like the scenario explanation, the questionnaire were designed to be as easily to understand as possible because of the general public of Iquitos would be asked to respond and it was desirable to reduce response stress. We also took full account of not only of the local circumstances in Iquitos, but also of the results from a focus group meeting and pre-tests (explained in detail below) and revised the questionnaires as appropriate. The final version of the questionnaire contained the following questions.

① Present status of water supply
② Present status of sewege treatment
③ Evaluation of present water supply services
④ Present status of supply periods and pressure of water supply
⑤ Evaluation of current sanitation services
⑥ Water consumption and demand
⑦ Status of waterborne diseases
⑧ WTP for water services
⑨ WTP for sanitation services
⑩ Payment for other public utilities
⑪ Understanding of scenarios
⑫ Basic profiles of the head of household and interviewee
⑬ Total monthly income and savings of household

Questions on WTP were the most important part of the CVM questionnaire, and there were several techniques possible: "free response" , "pricing game", "payment card" or "choice of two options." For this survey, we used the "choice of two options" technique, which is the most commonly used technique. There are two forms that this technique can take: single bound and double bound. In the "single bound" form, the respondent is provided with a price only once; in the "double bound" , he/she is provided with prices twice. We used the double bound version because it enables comparatively good estimation results even with a small number of samples.

The survey was implemented with direct interviews since it was possible to hire enough survey staff. The quality of the survey staff has a significant impact on the results of interview surveys, and staff training must therefore be emphasized. We hired 10 university students from Iquitos and gave them sufficient training.

(5) Focus Group Meeting and Pre-test

Focus group meetings and pre-testing prior to the main survey are absolutely essential in CVM studies.

Meetings and tests confirm matters issues related to questionnaire surveys in general as well as matters peculiar to CVM. Examples of the former would include checks of: (i) whether there were any misunderstandings of the questions by respondents, (ii) whether respondents understood the questions, (iii) whether the alternatives were appropriate, (iv) whether there were large numbers of unanswered questions, and (v) whether all respondents gave the same answers to particular questions. Examples of the latter would include: (i) whether respondents were able to understand the evaluation scenario, (ii) whether the prices suggested were appropriate, and (iii) the extent of resistance responses.

① Focus group meeting

The focus group consisted of 10 heads of household selected at random from the population (one of the selected was absent on the day of the meeting). It used a free discussion format to elucidate problems with the questionnaire; for example, how well the participants understood the purpose of the survey and the scenarios presented. The meeting had two parts: a group discussion held once all participants assembled and followed by one-on-one interviews with individual heads of household.

② Pre-testing

We conducted two pre-tests, asking beneficiaries randomly selected from the population to fill in a draft questionnaire. Each pre-test covered 50 households and was conducted in interview format.

(6) Revision and finalization of Questionnaires

We created the final version of the questionnaire based on results from the focus group meeting and the two pre-tests. The final version of the questionnaire was translated into the Iquitos dialect of Spanish.

Iquitos residents, who participated in the focus group meetings and pre-tests were extremely aware of these issues and had a good understanding of the systems used to provide water and sanitation services, so it was deemed unlikely that there would be any problems understanding the scenarios. However, circumstances differ for the two water service groups and three sanitation service groups (described above), and so the final scenarios posited envisioned circumstances described conditions for "satisfactory services" based on the current baselines for each of these groups (two water and three sanitation groups). Here, we explain the three issues to which we paid special attention in conducting the final survey in consideration of results of the focus group meetings and pre-tests: method of presenting prices in questions to different groups; questions about the presented amount of WTP; and elimination of biases.

① Method of presenting prices in questions to different groups

The following questions were designed to present prices according to the scenarios for the two water and three sanitation groups due to their differences in circumstances.[10] Multiple versions were applied to each of the groups by combining the first and second prices set at appropriate levels as evidenced by pre-test findings. (The prices are shown in (②))

(i) Water services

Group 1 households: Your household currently does not receive water services so you do not pay water tariffs to the Water and Sanitation Public Corporation. If you were to receive "satisfactory water services" as we explained, would you be for or against paying _____ sols per month in new water tariffs? Note that this amount would be in addition to your current monthly household expenditures, but if you are paying money to purchase water from a source other than the Water and Sanitation Public Corporation, that amount would be deducted from your current monthly household expenditures.

Group 2 households: Your household currently pays _____ sols per month in water tariffs to the Water and Sanitation Public Corporation. However,

10 Please note that the questions intend to ask new water tariffs and/or amount to be added to current payment due to improvement of service. "Sol" is the currency unit of Peru. In this study: 1 USD = 3.45 sols = 105 yen (Exchange rates as of January 31, 2004)

water availability times and water pressure etc. are not satisfactory. If you were to receive "satisfactory water services" as we explained, would you be for or against paying an additional _____ sols per month? Note that this amount would be in addition to your current monthly household expenditures, but if you are paying money to purchase water from a source other than the Water and Sanitation Public Corporation, that amount would be deducted from your current monthly household expenditures.

(ii) Sanitation services

Group 1 households: Your household is not currently connected to the sanitation system so you do not pay sanitation tariffs to the Water and Sanitation Public Corporation. If you were to receive "satisfactory sanitation services" as we explained, would you be for or against paying _____ sols per month in new sanitation tariffs? Note that this amount would be in addition to your current monthly household expenditures. Please also note that all sewage would be treated in a sanitary manner before being discharged into the Amazon River.

Group 2 households: Your household currently pays _____ sols per month in sanitation tariffs to the Water and Sanitation Public Corporation. However, current sanitation services are not satisfactory because, for example, sewage overflows during rainfall. If you were to receive "satisfactory sanitation services" as we explained, would you be for or against paying an additional _____ sols per month? Note that this amount would be in addition to your current monthly household expenditures. Please also note that all sewage would be treated in a sanitary manner before being discharged into the Amazon River.

Group 3 households: Your household currently pays _____ sols per month in sanitation tariffs to the Water and Sanitation Public Corporation. You are satisfied with current services in the sense that sewage from your household is transported to a safe place. However, the sewage is not treated before being discharged into the surrounding rivers. If all sewage were to be treated in a sanitary fashion before being discharged into the Amazon River, would you be for or against paying an additional _____ sols per month? Note that this amount would be in addition to your current monthly household expenditures.

② Questions about the presented amount of WTP and applicable versions

In Iquitos City, most households are classified into a very small number of wealthy class, and a great number of general middle class. According to the individual interviews and pre-tests during the focus group meeting, the WTP for water supply and sanitation charges was concentrates within a narrow range. Therefore, the dominant such a view was that "if high amounts are indicated, all the answerers except some major users will answer "No." since the residents' WTP is limited. Taking this view into account and based on the aforementioned pre-test results, various versions of amounts used for the WTP questions were determined for each water supply group and each sanitation service group as shown in Tables 4 and 5.

Table 4: Versions of prices suggested in WTP question (Water services)

Group	*Group 1*			*Group 2*		
No. of samples	295			705		
Connection to water system	Unconnected			Connected		
Satisfaction with services	Dissatisfied			Dissatisfied		
Version	Ver. 1	Ver. 2	Ver. 3	Ver. 1	Ver. 2	Ver. 3
The first suggested price (sol)	20	25	30	5	10	15
The second (When yes)	25	35	40	10	15	20
The second (When no)	10	15	20	3	5	10

Source:SADEP Study Team

Table 5: Versions of prices suggested in WTP question (Sanitation services)

Group	*Group 1*			*Group 2*			*Group 3*		
No. of samples	383			274			343		
Connection to sanitation system	Unconnected			Connected			Connected		
Satisfaction with services	Dissatisfied			Dissatisfied			Dissatisfied (as for discharging sewage to surrounding rivers)		
Version	Ver. 1	Ver. 2	Ver. 3	Ver. 1	Ver. 2	Ver. 3	Ver. 1	Ver. 2	Ver. 3
The first suggested price (sol)	10	15	20	5	10	15	4	6	8
The second (When yes)	15	20	25	10	15	20	6	8	10
The second (When no)	5	10	15	3	5	10	2	4	6

Source:SADEP Study Team

③ Elimination of biases

Table 6 summarizes the possible biases concerned about when conducting this CMV research. In this survey, there are two types of possible bias. First, such information as "a yen loan project will be implemented by JBIC" may induce a so-called strategic bias that causes "an incentive to underestimate the WTP". Second is a so-called start-point bias that is specific to the double-bound type questions and makes "the amount initially shown by the questioner influence the answer as a downward bias". To eliminate these biases, it was checked whether there was any bias or not during the pre-tests, and the questionnaire was modified so that biases can be eliminated as much as possible.[11]

(7) Research results analysis method

The full-scale research was implemented after training 10 staff and furnishing them with (i) a questionnaire kit, (ii) a research area map and list of addresses of subjects, (iii) a research manual, (iv) an official ID card (with a signature of the Mayor of Iquitos City), etc. Where the questionnaire could not be recovered, sampling was repeated, achieving 100% of recovery rate from the target samples, i.e., a sample of 1000 general users and 200 commercial users.

After the data collection, the local consultants checked and encoded the results of the questionnaire , completed the classified total, and constructed a data base of the survey. The results of the research were analyzed in the following procedure:

① Simple totalization, cross totalization, basic statistical calculation (understanding of the interviewees' profiles)
② Estimate of the WTP
③ Examination of the reliability (examination of the appropriateness of the WTP by statistical test)
④ Analysis of factors influencing the WTP

The data were analyzed by a statistics package called "CVM2002" that supports the data collected using double-bound questions. There are several CVM estimation models for double-bound data sets, such as "Rondam utility model", "WTP function model", and "Survival analysis". The CVM 2002 adopts the survival analysis and does not require programming. The CVM2002 performs basic statistical value calculations, cross totalization, estimation of the average and median of the WTP, examination of the reliability, WTP factor analysis (regression analysis using attributes), etc. for the double-bound data set.

The estimate using the CVM2002 applies "parametric" methods that assume and analyzes specific distribution functions. To be more precise, the estimates lead from the acceptability curve that assumes the Weibull distribution or other distribution functions. (See Box below)

11 In the survey, the study team placed, in order, respondents selected through random sampling (with a random number table) from the registry of users, and applied to them ver. 1, ver. 2, and ver. 3 in a cyclic manner (i.e. ver 1 for sample 1, ver 2 for sample 2, ver 3 for sample 3, ver 1 for sample 4,ver 2 for sample 5, ver 3 for sample 6, ver 1 for sample 7…..). This method allows the survey team to apply each version on a random basis.

BOX: Weibull Model

In CVM survey, estimation of WTP can be done through two methods: the Parametric Model in which a distribution function, such as a logarithmic function, is assumed as the decay curve (i.e. acceptability curve); and the Non-Parametric Model in which no distribution is assumed. Although the parametric model has certain disadvantages such as it may be affected by the distribution curve, it has major advantages: a point estimation of WTP's median value is available, and an analysis of the reasons for the WTP (based on the full model) is possible.

The parametric models include three: the Log-logarithm Model, in which a log-logarithm distribution is used to define the WTP distribution; the Log-Normal Model, in which a log-normal distribution is used to define the WTP distribution; and the Weibull Model, in which a Weibull distribution is used to define the WTP distribution. The density function for the Weibull distribution is defined as follows:

$$f(WTP)=p.\gamma / p.\lambda\,(WTP / p.\lambda)^{p.\lambda-1} \exp\{-(WTP / p.\lambda)^{p.\gamma}\}$$

Where WTP stands for Willingness to Pay and $p.\gamma$ and $p.\lambda$ are parameters for the assumed distribution.

It should be noted that the log-logistic model tends to have a wide distribution area and a relatively high average value, while the Weibull model is known to have a high flexibility and derives excellent results.

Table 6 : Anticipated biases and measures taken

Bias type			*Possibility*	*Measure*
Biases caused by the incentives for distorted answers				
	Strategic bias	An incentive for the underestimation that will be made if the charges are determined in accordance with the answered charges although supply of an environmental service was already determined.	○	It was explained that the research was neutrally held by a Japanese research organization, so information that a yen loan project would be implemented was shut out, eliminating bias.
	Flattery bias	An incitement for flattery answers. There are a research agency bias and a questioner bias.	△	No flattery bias was seen.
Biases caused by the information that gives evaluation clues				
	Start-point bias	The amount initially shown by the questioner could influence the answers.	○	There was a possibility of this, but no influence of a start-point bias could be seen since the answerers fully understood the scenario.
	Range bias	If shown, the range of WTP could influence the answers.	×	The bias had no relation since double-bound type questions were made.
	Relation bias	If indicated, relationship between the evaluation target and the other assets could influence the answers.	×	Relations with any other public assets were not shown.
	Importance bias	If suggested by the questions, the importance of the evaluation target could influence the answers.	△	The evaluation target was objectively explained based on facts only.
Biases caused by scenario transmission errors				
	Theoretical transmission error	The scenario is not appropriate economically or politically.	△	The water and sanitation system construction project was politically appropriate.
	Evaluation target transmission error	The answerers receive the information unintended by the questioner.	△	The answerers extremely accurately understood the scenario.
	Status transmission error	The explained virtual market status differs from that intended by the researcher.	△	The answerers extremely accurately understood the scenario.
Sample design and sample implementation biases				
	Population selection	The selected target population is not appropriate in relation to the benefits and costs of the service to be provided.	△	The target population covered all the beneficiaries.
	Sampling limit	The data used for sampling do not reflect the population as a whole.	△	The nearly entire population was reflected.
	Sample selection	There is a tendency that the number of effective answers increases as interest in the evaluation target increases.	△	Interest in the evaluation target was high, and no difference in interest was seen among residents.

Note: ○: Bias concerned about, △: Possible bias, ×: Least possible bias

Source: SADEP Study Team

Chaper 3: Analysis of the survey results

(1) Basic statistical values and general situation

The basic statistical values for sample of 1,000 sample general users were calculated as shown in Table 7. The basic statistical values were calculated, totalizing the samples for each user profile questioned in the questionnaire, and computing the minimum, maximum, average and standard deviation values for each of the water supply groups, sanitation groups and four districts.

Table 7: Basic statistical values for 1,000 sampled general users

Class.	*Basic statistical value*	*Sample total*	*Water service group*		*Sanitation service group*			*District*			
			1	*2*	*1*	*2*	*3*	*Belen*	*Iquitos*	*Punchana*	*San Juan*
No. of samples		1,000	295	705	383	274	343	251	498	151	100
Age (year)	Minimum	14.0	14.0	15.0	14.0	15.0	15.0	18.0	15.0	14.0	15.0
	Maximum	100.0	81.0	100.0	81.0	82.0	100.0	81.0	100.0	79.0	75.0
	Average	41.3	38.7	42.4	38.3	39.8	46.0	44.2	42.6	39.3	36.0
	Standard deviation	15.7	14.7	15.9	13.9	15.0	16.9	14.7	16.4	15.2	12.1
Family size (person)	Minimum	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Maximum	20.0	18.0	20.0	15.0	20.0	18.0	12.0	18.0	20.0	13.0
	Average	5.8	5.8	5.8	5.9	5.9	5.7	5.6	5.8	6.2	5.3
	Standard deviation	2.7	2.4	2.8	2.5	2.8	2.8	2.4	2.7	2.8	2.4
Monthly income (sols)	Minimum	60.0	60.0	80.0	60.0	100.0	82.0	80.0	82.0	74.0	60.0
	Maximum	5,000.0	2,000.0	5,000.0	4,500.0	5,000.0	5,000.0	2,500.0	5,000.0	4,500.0	4,500.0
	Average	852.4	578.3	958.8	619.2	1042.3	944.8	656.1	983.1	713.0	903.1
	Standard deviation	753.4	408.0	825.9	490.5	918.4	771.2	456.1	868.5	661.6	713.0
Monthly savings (sols)	Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Maximum	3,000.0	600.0	3,000.0	2,000.0	3,000.0	1,000.0	1,000.0	3,000.0	3,000.0	600.0
	Average	46.9	36.5	51.0	42.7	71.1	32.0	31.3	41.3	66.3	69.6
	Standard deviation	218.5	92.7	250.8	157.0	350.4	108.0	109.8	226.6	316.8	144.1
Water usage volume (liters/person/ month)	Minimum	21.0	38.0	21.0	38.0	21.0	26.0	113.0	26.0	21.0	38.0
	Maximum	8,700.0	8,700.0	7,500.0	8,700.0	7,500.0	6,000.0	6,000.0	7,500.00	8,700.0	6,000.0
	Average	952.0	965.3	944.5	802.0	1,017.2	1,093.3	958.1	985.7	1,006.7	682.7
	Standard deviation	1,105.8	1,098.1	1,110.0	930.7	1,247.1	1,179.5	887.7	1,273.0	1,060.8	820.5
Water availability time (hour)	Minimum	1.0	n.r.	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Maximum	24.0	n.r.	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
	Average	12.7	n.r.	12.7	12.4	14.5	11.3	6.1	15.9	7.3	11.3
	Standard deviation	9.1	n.r.	9.1	9.0	9.1	8.9	4.8	8.8	7.7	8.2
Monthly water tariff (sols)	Minimum	3.0	n.r.	3.0	3.0	7.0	4.2	7.7	7.0	4.2	3.0
	Maximum	154.0	n.r.	154.0	45.0	154.0	93.8	38.0	154.0	52.4	45.0
	Average	20.8	n.r.	20.8	19.9	21.1	21.0	18.4	21.6	20.1	20.2
	Standard deviation	10.2	n.r.	10.2	6.0	12.9	9.2	3.8	12.1	5.6	8.4
Monthly sanitation tariff (sols)	Minimum	1.3	3.7	1.3	n.r.	2.0	1.3	2.3	2.0	1.3	3.7
	Maximum	46.0	13.0	46.0	n.r.	46.0	31.3	12.0	46.0	15.7	8.8
	Average	6.5	6.1	6.5	n.r.	6.5	6.4	5.6	6.7	6.2	6.1
	Standard deviation	3.5	1.7	3.5	n.r.	4.1	2.9	1.4	4.0	1.9	1.1
Electricity tariff payment (sols)	Minimum	3.0	4.6	3.0	3.0	5.8	6.0	3.0	5.0	4.0	6.0
	Maximum	400.0	185.0	400.0	400.0	220.0	350.0	185.0	400.0	200.0	143.0
	Average	49.2	31.3	55.6	32.1	58.5	58.6	41.6	58.0	40.9	36.4
	Standard deviation	43.4	28.3	46.0	34.4	46.1	44.0	37.8	48.6	35.8	28.9

Source: SADEP Study Team

The profiles of the average beneficiaries read from these quantitative data and cross-totalized qualitative data can be summarized as follows:

(i) The average age of the answerers is 41.3 years old, and the average family size is 5.8 people.
(ii) The monthly household income is 852.4 sols, about 5.5% (46.9 sols) of which is saved.
(iii) Monthly water consumption and payment for the water supply service for each family member are 952 liters and 20.8 sols respectively. This amount corresponds to 2.44% of monthly income.[80]
(iv) Water supply service is limited to 12.7 hours a day. In other words, water is not supplied for about

half of a day.
(v) The monthly sanitation service charge to pay per family member is 6.5 sols. This amount corresponds to 0.76% of monthly income.
(vi) As another public utility charge, 49.2 sols, is paid for electricity service, about twice the water supply and sanitation service charges

In addition to the basic profiles above, the major profiles that can be read from the cross-totalization are shown below.

① Current status of water supply and sanitation services

70.7% of all the households are connected to the water supply system. In sanitation group 1, of the households that were not connected to the sanitation system, 38.3% of them are connected to the water supply system. The rate is extremely low compared with the other groups. As such, it can be seen that the households that are not connected to the water supply service are related to those that are not connected to the sanitation service. Water leakage rate was only little, 3.1%. Water meter installation rate was only 22.7%. As a substitute water supply for group 1, of which households has not been connected to the water supply system, 60.3% of the households in group 1 use wells. Also, 61.5% of them have not been connected to the sanitation system, and 69.9% of them have a lavatory inside the home. As a matter of course, only a few, 23.0%, of the sanitation group 1 households that are not connected to the sanitation system have a lavatory inside the home. (Table 8)

Table 8: Status of water and sanitation services of 1,000 sampled general users

Item	*Explanation of index*	*Entire beneficiaries*	*Water service group*		*Sanitation service group*		
			1	2	1	2	3
No. of samples		1,000	295	705	383	274	343
Connection to water system	Water service diffusion rate (%)	70.7	0.0	98.9	38.3	92.3	89.2
Water leakage	Rate of water leakage occurrence (%)	3.1	-	3.1	4.7	2.4	2.9
Meter	Rate of mater installation (%)	22.7	-	32.2	5.7	33.2	33.2
Use of well	Rate of use of well (%)	20.7	60.3	4.1	41.5	4.0	10.8
Connection to sanitation system	Sanitation service diffusion rate (%)	61.5	21.4	78.3	1.0	98.9	99.1
Indoor toilet	Rate of indoor toilet installation (%)	69.9	41.0	82.0	23.0	99.0	99.1

Source: SADEP Study Team

② Evaluation of the current water supply service

30.4% of the group 1 households that are not connected to the water supply system and 20.5% of the group 2 households that were being connected to the water supply system answered "relatively unsatisfied" or "very unsatiafied". The reasons for the dissatisfaction were mostly limited water pressure and limited water supply time. (Table 9)

80 Water and sanitation tariffs in the city of Iquitos

Water service	*Monthly usage volume (cubic meter)*	*Tariffs applied by the city of Iquitos (sol/cubic meter)*	*Minimum usage volume (cubic meter/month)*
General users	0-20	0.956	8.0
	21-30	1.463	
	31-	1.558	
Commercial users	0-30	0.684	12.0
	31-	1.109	
Industrial users	0-60	0.661	24.0
	61-	1.051	
Sanitation services	Charged at the rate of 30% of water tariffs across the board		

Source: Department of Loreto Water and Sanitation Public Corporation

Table 9: Evaluation of current water services of 1,000 sampled general users

Item	*Group 1*		*Group 2*	
	No. of responses	*Ratio (%)*	*No. of responses*	*Ratio (%)*
No. of samples	295		705	
Evaluation of current water services	273	100.0	700	100.0
Very satisfied	48	17.6	74	10.6
Relatively satisfied	51	18.7	156	22.3
Average	91	33.3	327	46.7
Relatively unsatisfied	54	19.8	109	15.6
Very unsatisfied	29	10.6	34	4.9

Source: SADEP Study Team

③ Evaluation of the current sanitation service

More than a half, 54.5%, of the group 1 households that are not connected to the sanitation system answered "relatively unsatisfied" or "very unsatisfied". The group of the households that are not connected to the sanitation system evaluated the sanitation service to be less satisfactory than the group of households that are not connected to the water supply system, indicating that they are forced to live in an unsatisfactory hygienic environment. (Table 10)

Table 10: Evaluation of current sanitation services of 1,000 sampled general users (By sanitation service group)

Item	*Group 1*		*Group 2*		*Group 3*	
	No. of responses	*Ratio (%)*	*No. of responses*	*Ratio (%)*	*No. of responses*	*Ratio (%)*
No. of samples	383		274		343	
Evaluation of current water services	367	100.0	274	100.0	343	100.0
Very satisfied	57	15.5	7	2.6	330	96.2
Relatively satisfied	31	8.4	42	15.3	7	2.0
Average	79	21.5	118	43.1	4	1.2
Relatively unsatisfied	135	36.8	80	29.2	2	0.6
Very unsatisfied	65	17.7	27	9.9	0	0.0

Source: SADEP Study Team

Table 11: Morbidity of water-borne diseases of 1,000 sampled general users

Disease	*1,000 sampled general users*
No. of samples	1,000
Dermatitis	55.4
Malaria	453.0
Cholera	60.6
Typhoid fever	23.9
Dengue	343.3
Chronic diarrhea	111.7
Others	133.6
Total	1,181.5

Source: SADEP Study Team

The lack of sanitation system has a close relationship with waterborne diseases. The questionnaire also contained questions about waterborne diseases. Based on the answers, Table 11 shows the annual morbidity of the waterborne diseases (revealed by the pre-tests.) per 100,000 persons around Iquitos City.

According to the report by WHO[13], for example, annual morbidity of typhoid fever per 100,000 persons in rural areas in Latin America is about 20 persons. The results of this research were therefore found to be largely reliable since the numbers revealed by this research were in the average of 23.9

13 WHO Department of Communicable Disease Surveillance and Response. CSR, 2003

persons. Besides, the morbidities of malaria and dengue fever, which are carried by mosquitoes, are high, indicating that sanitation system construction is a matter of urgency. Reduction of the waterborne diseases is one of important benefits that would be brought about by the sanitation construction project. Generally, quantification of this benefit is difficult. If the situation of the waterborne diseases in this CVM research area is additionally investigated, however, the benefits of the sanitation construction project can be quantified from a viewpoint different from the total amount of WTP for the sanitation service.

④ Status of water availability time period and water pressure

34.7% of the total households enjoyed 24-hour water supply service. The average water availability time was 12.7 hours. The average water availability time for the households under water supply restrictions was only 6.6 hours. As high as 61.1% of the households have water supply service at the minimum water pressure.

⑤ Water consumption[14]

Water consumption of interviewees who are connected to the water supply service and were able to confirm the bills from the Water Supply and Sanitation Public Corporation is based on the water consumption indicated in the bills. Water consumption of those who are not connected to the water supply service is based on the water consumption estimated by the answerers themselves (Table 12). From these answers, water consumption for each district and each group was calculated.

Generally, it is said that minimum required water is 30 liters/day/person. Calculation of the sufficiency rate for each district and each group based on this standard shows that only sanitation group 3 is supplied with more water than the minimum volume. It is considered that the short water supply availability time and low water pressure significantly influence the water consumption by the researched households.

Table 12: Status of water consumption of 1,000 sampled general users

Item	*District*				*Water service group*		*Sanitation service group*			*Total*
	Belen	*Iquitos*	*Punchana*	*San Juan*	*Group 1*	*Group 2*	*Group 1*	*Group 2*	*Group 3*	
No. of samples	251	498	151	100	295	705	383	274	343	1,000
Monthly water usage volume (liters/month/household)	5,335.0	4,702.3	4,630.6	3,114.1	4,785.8	4,636.3	4,008.5	5,071.7	5,275.7	1,689.8
Average family size (person)	6.2	5.8	5.6	5.3	5.8	5.8	5.9	5.9	5.7	5.8
Daily water usage volume (liters/day)	177.8	156.7	154.4	103.8	159.5	154.5	133.6	169.1	175.9	156.3
Minimum required volume (liters/month/person)[note]	186.9	172.5	167.1	160.2	174.3	174.0	177.0	175.8	169.8	174.0
Rate of sufficiency (%)	**95.1**	**90.9**	**92.4**	**64.8**	**91.5**	**88.8**	**75.5**	**96.2**	**103.6**	**89.8**

Note: Figuires of minimum required volume (liters/mouth/person) involve differences due to round-off despite identical numer of family members.
Source: SADEP Study Team

14 In addition to the questions about current water consumption, the questionnaire of this CVM research included questions about on (i) WTP for the "satisfactory" water supply and sanitation services and (ii) expected water consumption (multiples of the current water consumption) when such "satisfactory" water supply and sanitation services are available. It is therefore possible to numerically show the demand for water supply (or sewage volume) and the corresponding service prices (WTP). That is, where the x-axis represents demand for water supply (wv)(or sewage sv), and the y-axis shows WTP for water supply service (wp) (or WTP for sanitation service (sp)), the demand curves of water supply and sanitation services can be respectively determined by plotting the combinations of the 1,000 samples (wv^n, wp^n) and (sv^n, sp^n). In addition, by drawing the supply curves of the water supply and sanitation service facilities, it is possible to estimate appropriate theoretical service prices based on the price theory. However, since it is beyond the scope of this study, it can be done in the future.

(2) Estimation of WTP

The most important purpose of this CVM research was to estimate WTP for water supply service and sanitation service. WTP was investigated using double-bound questions. The typical WTP values were estimated using specialized CVM software. With double-bound questions, calculation was performed by interpreting (i) the rejection of both amounts presented : "WTP is less than the lower amount presented", (ii) the acceptance of both amounts presented : "WTP is higher than the higher amount presented ", and (iii) the acceptance of only one presented amount : "WTP is more than the low amount presented and less than the higher amount presented". The CVM2002 obtains the representative WTP values by assuming the "Weibull distribution" or other distribution function as the WTP distribution of the population, and using the most likelihood estimate method for estimating the acceptability rate curve that gives the maximum probability of the answer pattern shown by the sample data.

Tables 13 shows summary of the answers given by the 1,000 sampled general users to the two questions for confirming the WTP for water supply services. The answers to the first question about the WTP for water supply service showed acceptability rates in the range of 36.2% - 53.0% across the four districts in Iquitos City. Of the four districts, San Juan district gave the highest acceptability rate, 53.0%. Of the water supply groups, the group 1 (not connected to the water supply system) produced 49.1% acceptability, and the group 2 (connected to the water supply system), 40.2%.

As for the answer to the first and second questions about the WTP for water supply service acceptability rates of the first and / or second questions were in the range of 62.1%-86.1% across the four district, and Punchana district produced the highest acceptability. Of the water supply groups, the group1 (not connected to the water supply system) produced 79.6% acceptability rate and the group 2 (connected to the water supply), 63.3%. That is, in the group which has more room for improvement of water supply service, WTP may be higher when the water supply service is improved.

Table 13: Status Summary of the answers to the WTP questions about water services by groups

Section (1st -2nd)	*Yes-Yes*	*Yes-No*	*No-Yes*	*No-No*	*Total*
Belen					
No. of responses	39	52	65	95	251
Ratio of responses	15.5%	20.7%	25.9%	37.9%	100.0%
		36.2%		63.8%	100.0%
Iquitos					
No. of responses	61	156	97	184	498
Ratio of responses	12.2%	31.3%	19.5%	37.0%	100.0%
		43.5%		56.5%	100.0%
Punchana					
No. of responses	53	14	63	21	151
Ratio of responses	35.1%	9.3%	41.7%	13.9%	100.0%
		44.4%		55.6%	100.0%
San Juan					
No. of responses	16	37	28	19	100
Ratio of responses	16.0%	37.0%	28.0%	19.0%	100.0%
		53.0%	47.0%	47.0%	100.0%
By water service groups (1st -2nd)	*Yes-Yes*	*Yes-No*	*No-Yes*	*No-No*	*Total*
Group 1					
No. of responses	62	83	90	60	295
Ratio of responses	21.0%	28.1%	30.5%	20.4%	100.0%
		49.1%		50.9%	100.0%
Group 2					
No. of responses	107	176	163	259	705
Ratio of responses	15.2%	25.0%	23.1%	36.7%	100.0%
		40.2%		59.8%	100.0%

Source: SADEP Study Team

Tables 14 shows the summary of answers by 1,000 sample general users to the questions asked twice for confirming the WTP for sanitation service. The answers to the first question about the WTP for sanitation service showed the acceptability in the range of 32.2% - 61.0% across the four districts. San Juan district showed the highest acceptability, 61.0%. Of the sanitation groups, the group1 (not connected to the sanitation service) produced 43.5% acceptability, and the group 2 (connected to the sanitation service but with overflow), 40.9%, and the group 3 (connected to sanitation services and without overflow), 37.4%.

In terms of the answers to the first and second questions about the WTP for santation service, acceptability rates of the first and or second question were in the range of 61.5%-83.0%, and San Juan district produced the highest acceptability. Of the sanitation groups, the group1 (not connected to the sanitation service) produced acceptability of the first and / or second questions, 76.8%, and the group 2 (connected to the sanitation service but with overflow), 67.5%, and the group 3 (connected to sanitation services and without overflow), 57.3%. That is, as the water supply service, in the group which has more room for improvement of sanitation service, WTP may be higher when the sanitation service is improved.

Table 14: Summary of the answers to the WTP questions about sanitation services by groups

Section (1st -2nd)	*Yes-Yes*	*Yes-No*	*No-Yes*	*No-No*	*Total*
Belen					
No. of responses	29	49	71	93	242
Ratio of responses	12.0%	20.2%	29.3%	38.5%	100.0%
		32.2%		67.8%	100.0%
Iquitos					
No. of responses	57	145	110	186	498
Ratio of responses	11.4%	29.1%	22.1%	37.4%	100.0%
		40.5%		59.5%	100.0%
Punchana					
No. of responses	57	5	63	26	151
Ratio of responses	37.7%	3.3%	41.8%	17.2%	100.0%
		41.0%		59.0%	100.0%
San Juan					
No. of responses	22	39	22	17	100
Ratio of responses	22.0%	39.0%	22.0%	17.0%	100.0%
		61.0%		39.0%	100.0%
Answers to WTP questions(1st -2nd)	*Yes-Yes*	*Yes-No*	*No-Yes*	*No-No*	*Total*
Group 1					
No. of responses	66	97	125	87	375
Ratio of responses	17.6%	25.9%	33.3%	23.2%	100.0%
		43.5%		56.5%	100.0%
Group 2					
No. of responses	37	75	73	89	274
Ratio of responses	13.5%	27.4%	26.6%	32.5%	100.0%
		40.9%		59.1%	100.0%
Group 3					
No. of responses	62	66	68	146	342
Ratio of responses	18.1%	19.3%	19.9%	42.7%	100.0%
		37.4%		62.6%	100.0%

Source: SADEP Study Team

With combinations of answers Yes and No to the two questions about WTP as they are, WTP representative value cannot be estimated. To obtain WTP representative value, an acceptability rate curve that maximizes the probability of the answer pattern shown by the samples needs to be estimated by assuming Weibull or other distribution model. The acceptability rate with y axis, S(T), indicates “share of people who accepted the prices presented both in the first and second questions, or either of the prices”. In this case, when an extremely high WTP value is obtained, the average value may become

infinite. So, the "rounded averages" were also obtained by excluding WTP values higher than the highest price presented. The estimation equation (*) of an acceptability rate curve through Weibull regression is as follows:

$S(T) = \exp[-\exp(\ln T - \mu)/\sigma]$ (*)

T: The presented price

μ : Location parameter [the parameter which determines the shape of an acceptability rate curve with response to each person's answer pattern, $\mu = \beta$ Xi (Xi are explanation variables for individual persons' attributes, and β is the coefficient of the explanation variables.)]

σ : Scale parameter (which determines an acceptability rate curve).

Table 15 : Estimate result of WTP representative value

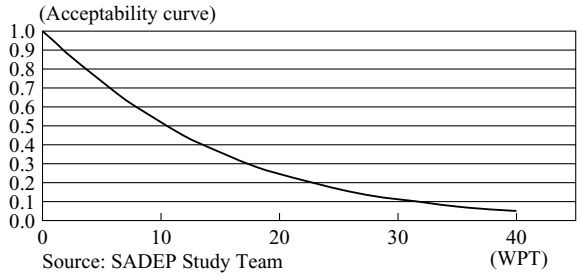
Estimate result	No. of samples	Sigma (σ)			Constant term			WTP representative value (sol)		
Section		Factor	Asymptotic t value	P value	Factor	Asymptotic t value	P value	Average	Rounded average	Median value
Model		Weibull	Weibull	Weibull	Weibull	Weibull	Weibull	Weibull	Weibull	Weibull
Water	1000	0.917	28.10	0.00	2.680	81.40	0.00	**14.13	**13.54	**10.44
Group 1	295	0.369	16.20	0.00	3.310	133.00	0.00	**24.47	**24.18	**24.04
Group 2	705	0.757	22.40	0.00	2.260	69.30	0.00	**8.82	**8.81	**7.26
Sanitation	1000	0.794	28.20	0.00	2.340	81.60	0.00	**9.66	**9.36	**7.77
Group 1	383	0.426	18.50	0.00	2.760	111.10	0.00	*13.99	**13.82	**13.50
Group 2	274	0.632	14.90	0.00	2.250	51.60	0.00	**8.50	**8.47	**7.51
Group 3	343	0.722	13.80	0.00	1.680	37.10	0.00	**4.91	**4.64	**4.13
Water	1000	0.917	28.10	0.00	2.680	81.40	0.00	**14.13	**13.54	**10.44
Belen	251	0.754	10.60	0.00	3.110	40.30	0.00	**20.53	**19.06	**16.92
Iquitos	498	0.908	20.10	0.00	2.390	51.80	0.00	**10.57	**10.44	**7.86
Punchana	151	0.861	13.40	0.00	2.750	43.90	0.00	**14.77	**14.22	**11.36
San Juan	100	0.786	9.480	0.00	3.080	35.30	0,00	**20.24	**18.68	**16.36
Sanitation	1000	0.794	28.20	0.00	2.340	81.60	0.00	**9.66	**9.36	**7.77
Belen	251	0.647	10.20	0.00	2.750	40.60	0.00	**14.02	**13.16	**12.30
Iquitos	498	0.845	20.00	0.00	2.120	49.30	0.00	**7.89	**7.74	**6.13
Punchana	151	0.711	14.51	0.00	2.230	42.60	0.00	**8.45	**8.37	**7.15
San Juan	100	0.467	9.36	0.00	2.830	52.60	0.00	**15.03	**14.60	**14.30

Note: Shaded cells mean to be statistically-significant.
* $p < 0.05$ (Statistically-significant when no less than the level of 5%)
** $p < 0.01$ (Statistically-significant when no less than the level of 1%)
Source: SADEP Study Team

As a result, the optimum representative values for all groups were obtained with assuming a Weibull model. In the water supply system groups, the representative value of the group 1 (not connected to water supply system) was much greater than that of the group 2 (connected to water supply system) indicating the difference of WTP between the groups.

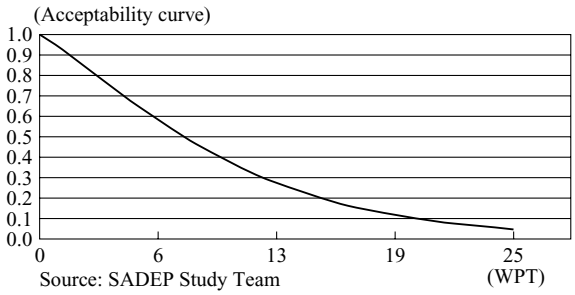
Similarly, in the sanitation groups, the group 3 (connected to the sanitation system and without overflow) showed a rounded average WTP value of 4.64 sols. As such, it was confirmed that there exists "WTP" of the group concerned about discharge of untreated sewage to the Amazon and which place environmental value on "disposal through the final treatment plant" provided in the scenario. The water supply and sanitation acceptability rate curves showing the relationship between acceptability rate and WTP were drawn from the Weibull model (Figures 3 and 4).

Figure 3: Acceptability rate curve of WTP for water services



Source: SADEP Study Team

Figure 4: Acceptability rate curve of WTP for sanitation services



Source: SADEP Study Team

The total WTP in the area to be benefited from the scenario can be estimated by multiplying the estimated monthly WTP per household by the number of beneficiary households. The total is the sum of the value of the environmental improvement project explained in the scenario prepared. The number of beneficiary households in this case is the sum of the number of households that are already connected to the water supply and sanitation systems and the number of households that are expected to enjoy benefits to be brought about by the scenario in the future. As a result, the total WTP in Iquitos City in 2003 is estimated as 16,241,900 sols (4,707,800 US dollars or approximately 494 million yen). The total WTP in 2004 and 2005 estimated, taking the increase in the number of households into consideration, is 16,388,700 sol (4,750,000 US dollars or approximately 499 million yen) and 16,545,800 thousand sols (4,796,000 US dollars, or approximately 504 million yen) respectively. (Table 16)

Table 16: Estimated WTP total in the beneficiary areas

Section	No. of samples	Estimated monthly WTP (sol)	Share (%)	Estimated No. of beneficiary households (household)			Estimated annual total of WTP (1,000 sols)		
				2003	2004	2005	2003	2004	2005
Total	1,000	-	100.0	60,023	60,566	61,146	16,241.9	16,388.7	16,545.8
Water service WTP total	1,000	13.54	100.0	60,023	60,566	61,146	9,611.5	9,698.3	9,791.3
Group 1	295	24.18	29.5	17,707	17,867	18,038	5,137.9	5,184.2	5,233.9
Group 2	705	8.81	70.5	42,316	42,699	43,108	4,473.6	4,514.1	4,557.4
Sanitation service WTP total	1,000	9.36	100.0	60,023	60,566	61,146	6,630.4	6,690.4	6,754.5
Group 1	383	13.82	38.3	22,989	23,197	23,419	3,812.5	3,847.0	3,883.8
Group 2	274	8.47	27.4	16,446	16,595	16,754	1,671.6	1,686.7	1,702.9
Group 3	343	4.64	34.3	20,588	20,774	20,973	1,146.3	1,156.7	1,167.8

Note: WTP is incremental payment when satisfactory services are provided.
Source: SADEP Study Team

Table 17 shows the current average payment, the employed estimated additional WTP, the ratios of the WTP to the current average payment, and the total WTP after adding the additional amount for water supply and sanitation services. The employed estimated additional WTP was 65.1% of the current payment for water supply service, 144.5% of current for sanitation service, and 83.9% of the current total payment for water supply and sanitation services, verifying that the WTP for sanitation service was higher than current charges.

Table 17: Comparison between WTP and current water/sanitation tariffs

Section	No. of samples	Current average payment (sols) (A)			Employed estimated additional WTP (sols) (B)			Ratio of WTP to current average payment (%) (B / A)			Total WTP after addition (sols) (A+B)		
Section	1,000	Water	Sanitation	Total	Water	Sanitation	Total	Water	Sanitation	Total	Water	Sanitation	Total
Water	1,000	20.81	6.48	27.29	13.54	9.36	22.90	65.1	144.5	83.9	34.35	15.84	50.19
Group 1	295	0.00	6.10	6.10	24.18	-	-	-	-	-	24.18	-	-
Group 2	705	20.80	6.50	27.30	8.81	-	-	42.4	-	-	29.61	-	-
Sanitation	1,000	20.81	6.48	27.29	13.54	9.36	22.90	65.1	144.5	83.9	34.35	15.84	50.19
Group 1	383	19.90	0.00	19.90	-	13.82	-	-	-	-	-	13.82	-
Group 2	274	21.10	6.50	27.60	-	8.47	-	-	130.3	-	-	14.97	-
Group 3	343	21.00	6.40	27.40	-	4.64	-	-	72.5	-	-	11.04	-
District	1,000	20.81	6.48	27.29	13.54	9.36	22.90	65.1	144.5	83.9	34.35	15.84	50.19
Belen	251	18.39	5.59	23.98	19.06	13.16	32.22	103.6	235.4	134.4	37.45	18.75	56.20
Iquitos	498	21.63	6.74	28.37	10.44	7.74	18.18	48.3	114.8	64.1	32.07	14.48	46.55
Punchana	151	20.05	6.20	26.25	14.22	8.37	22.59	70.9	135.0	86.1	34.27	14.57	48.84
San Juan	100	20.16	6.10	26.26	18.68	14.60	33.28	92.7	239.3	126.7	38.84	20.70	59.54

Source: SADEP Study Team

(3) WTP factor analysis

We used the Weibull model to perform regression analysis of various factors potentially related to WTP for water services and or sanitation services, respectively. In the analysis, the proposed prices served as dependent variables with the following independent variables selected on the expectation that they would have impact on the proposed prices. (See Tables 18 through 23.)

Water service factors analysis : independent variables

Gender, age, number of persons in household, monthly income, water usage volume, water pressure, water availability time, water charges, and satisfaction with water services.

Sanitation service factors analysis : independent variables

Gender, age, number of persons in household, monthly income, sanitation service charges, satisfaction with sanitation services, susceptibility to water-borne diseases, and presence or absence of indoor toilet

Table 18 : Factor analysis of WTP for water service (Weibull regression I-1)

Section	Group (Sample numbers are in parentheses)	Result of model estimation		Factors										
		Log likelihood	AIC	x_1	x_2	x_3	x_4	x_5	x_6	X_7	x_8	x_9	x_{10}	x_{11}
				σ	Gender	Age	Persons in household	Monthly income	Water usage volume	Water pressure	Water availability times	Water tariffs	Satisfaction	Constant term
Entire beneficiaries	Entire beneficiaries [1000]	-397.27	816.54	**0.618	-0.056	*-0.108	0.041	*0.128	0.039	-0.073	*-0.112	-0.072	-0.043	**2.370
Water service group	Group 1 [295]	-233.71	481.41	**0.461	-0.052	-0.013	*-0.102	0.024	**-0.213	-	-	-	-0.026	**2.750
	Group 2 [705]	-397.27	816.54	**0.618	-0.057	*-0.108	0.041	*0.128	0.039	-0.073	*-0.112	-0.072	-0.043	**2.370
Sanitation service group	Group 1 [383]	-72.79	167.57	**0.453	-0.138	0.098	0.075	*0.314	-0.018	0.052	-0.021	0.028	-0.135	**2.840
	Group 2 [274]	-129.82	281.64	**0.513	-0.016	-0.053	0.056	0.010	0.017	0.092	-0.052	-0.048	0.027	**2.320
	Group 3 [343]	-186.03	394.06	**0.611	*-0.129	-0.084	0.010	*0.147	-0.011	-0.054	-0.065	0.023	-0.063	**1.780

Note1 (Tables 18 and 21): Shaded cells indicate results that are mean to be statistically-significant.
* < 0.05 (Statistically-significant when no less than the level of 5%)
**< 0.01 (Statistically-significant when no less than the level of 1%)

Note2 (Tables 18 to 23): AIC is an indicator to show the degree of fitness of estimation through weibull distribution model, to the pattern of WTP answers of the 1,000 samples. The smaller figures are (i.e. the more logarithmic likelihood is), the more degree of fitness of the model is.

Source: SADEP Study Team

Table 19: Factor analysis of WTP for water service (Weibull regression I-2)

Section	Group (Sample numbers are in parentheses)	Result of model estimation		Asymptotic t value										
		Log likelihood	AIC	x_1	x_2	x_3	x_4	x_5	X_6	X_7	x_8	X_9	x_{10}	x_{11}
				σ	Gender	Age	Persons in household	Monthly income	Water usage volume	Water pressure	Water availability times	Water tariffs	Satisfaction	Constant term
Entire beneficiaries	Entire beneficiaries [1000]	-435.36	892.72	15.20	-1.34	-2.74	0.09	2.51	0.85	-1.79	-2.55	-1.68	-0.92	57.70
Water service group	Group 1 [295]	-233.71	481.41	12.20	-1.23	-0.31	-2.13	0.57	-3.98	-	-	-	-0.53	62.00
	Group 2 [705]	-397.27	816.54	15.20	-1.34	-2.74	0.09	2.51	0.85	-1.79	-2.55	-1.68	-0.92	57.70
Sanitation service group	Group 1 [383]	-72.79	167.57	6.34	-1.76	1.20	0.90	2.17	-0.17	0.58	-0.25	0.33	-1.40	38.00
	Group 2 [274]	-129.82	281.64	9.43	-0.25	-0.79	0.84	0.13	0.25	1.51	-0.78	-0.77	0.37	39.90
	Group 3 [343]	-186.03	394.06	9.29	-2.10	-1.43	0.14	2.02	-0.17	-0.87	-0.98	0.37	-0.96	29.60

Source: SADEP Study Team

Table 20: Factor analysis of WTP for water service (Weibull regression I-3)

Section	Group (Sample numbers are in parentheses)	Result of model estimation		p value										
		Log likelihood	AIC	x_1	x_2	x_3	x_4	x_5	x_6	X_7	x_8	x_9	x_{10}	x_{10}
				σ	Gender	Age	Persons in household	Monthly income	Water usage volume	Water pressure	Water availability times	Water tariffs	Satisfaction	Constant term
Entire beneficiaries	Entire beneficiaries [1000]	-435.36	892.72	0.00	0.18	0.01	0.35	0.01	0.40	0.07	0.01	0.09	0.36	0.00
Water service group	Group 1 [295]	-233.71	481.41	0.00	0.22	0.76	0.03	0.57	0.00	-	-	-	0.59	0.00
	Group 2 [705]	-397.27	816.54	0.00	0.18	0.01	0.35	0.01	0.40	0.07	0.01	0.09	0.36	0.00
Sanitation service group	Group 1 [383]	-72.79	167.57	0.00	0.08	0.23	0.37	0.03	0.87	0.56	0.80	0.74	0.18	0.00
	Group 2 [274]	-129.82	281.64	0.00	0.80	0.43	0.40	0.89	0.80	0.13	0.44	0.44	0.72	0.00
	Group 3 [343]	-186.03	394.06	0.00	0.04	0.15	0.89	0.04	0.86	0.39	0.33	0.72	0.34	0.00

Source: SADEP Study Team

Using p values, we have identified the following explanatory variables as having a significant impact on WTP.

WTP for water services:

① The younger the age of the respondent, the higher WTP.

② The higher the monthly income,[15] the higher WTP.

③ The lower the current water usage volume or the shorter the water availability time, the higher WTP. We therefore consider that water supply volume restricted by limited water availability time resulted in the higher WTP.

WTP for sanitation services :

① Lower WTP when the respondent is female.

② The younger the age of the respondent, the higher WTP.

③ The lower the satisfaction with the current sanitation service, the higher WTP. Satisfaction with the water service was not recognized as having a significant impact on WTP for water services, but this was probably because many households are satisfied with alternative sources of water (for example, wells or tank trucks). By contrast, it is difficult to use other means to reduce the degree of dissatisfaction with sanitation services, and this probably resulted in the degree of dissatisfaction being expressed directly as WTP.

④ Higher WTP, if households lack an indoor toilet. On this point, it would seem that installation of a toilet served as a direct image for reflection of the household sanitary environment that would result from connection to sanitation system.

15 It is possible to perform international comparisons of the relationship between monthly income and WTP by calculating the income elasticity of WTP (the rate of increase of WTP for a 1.0% increase of income).

Table 21: Factor analysis of WTP for sanitation service (Weibull regression II-1)

Section	Group (Sample numbers are in parentheses)	Result of model estimation		Factors									
		Log likelihood	AIC	X_1	x_2	x_3	x_4	x_5	x_6	X_7	x_8	x_9	x_{10}
				σ	Gender	Age	Persons in household	Monthly income	Sanitation tariffs	Satisfaction	Water-borne diseases	Indoor toilet	Constant Term
Entire beneficiaries	Entire beneficiaries [1000]	-376.89	771.78	**0.592	*-0.085	-0.034	-0.029	0.065	-0.007	**-0.221	-0.038	**0.167	**2.030
Water service group	Group 1 [295]	-15.74	49.48	**0.291	*-0.319	*-0.267	**-0.385	0.082	-0.140	*-0.316	-0.033	-0.029	**1.760
	Group 2 [705]	-347.42	712.85	**0.608	-0.070	*-0.088	0.050	*0.098	-0.086	-0.027	-0.025	0.006	**2.370
Sanitation service group	Group 1 [383]	-7.14	24.28	*0.262	-	-	-	-	-0.138	-0.050	0.027	-	**2.600
	Group 2 [274]	-141.57	301.14	**0.527	-0.036	-0.062	0.003	0.014	-0.045	-0.048	-0.072	0.018	**2.290
	Group 3 [343]	-221.48	460.97	**0.604	*-0.128	-0.031	-0.032	0.123	0.027	-0.122	-0.009	0.040	**1.820

Source: SADEP Study Team

Table 22: Factor analysis of WTP for sanitation service (Weibull regression II-2)

Section	Group (Sample numbers are in parentheses)	Result of model estimation		Asymptotic t value									
		Log likelihood	AIC	x_1	x_2	x_3	x_4	x_5	X_6	x_7	x_8	x_9	x_{10}
				σ	Gender	Age	Persons in household	Monthly income	Sanitation tariffs	Satisfaction	Water-borne diseases	Indoor toilet	Constant Term
Entire beneficiaries	Entire beneficiaries [1000]	-376.89	771.78	14.60	-2.11	-0.80	-0.64	1.41	-0.17	-5.01	-0.93	4.81	50.00
Water service group	Group 1 [295]	-15.74	49.48	3.10	-2.66	-2.07	-3.32	0.79	-1.22	-2.78	-0.29	-0.65	19.50
	Group 2 [705]	-347.42	712.85	14.10	-1.64	-2.02	1.10	2.02	-1.94	-0.58	-0.56	0.15	55.10
Sanitation service group	Group 1 [383]	-7.14	24.28	2.45	-	-	-	-	-0.71	-0.34	0.24	-	22.30
	Group 2 [274]	-141.57	301.14	9.73	-0.63	-0.94	0.04	0.21	-0.80	-0.77	-1.22	0.27	40.04
	Group 3 [343]	-221.48	460.97	10.01	-2.35	-0.57	-0.50	1.92	-0.48	-1.19	-0.16	0.84	32.80

Source: SADEP Study Team

Table 23: Factor analysis of WTP for sanitation service (Weibull regression II-3)

Section	Group (Sample numbers are in parentheses)	Result of model estimation		p value									
		Log likelihood	AIC	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
				σ	Gender	Age	Persons in household	Monthly income	Sanitation tariffs	Satisfaction	Water-borne diseases	Indoor toilet	Constant Term
Entire beneficiaries	Entire beneficiaries [1000]	-376.89	771.78	0.00	0.03	0.43	0.52	0.16	0.86	0.00	0.35	0.00	0.00
Water service group	Group 1 [295]	-15.74	49.48	0.00	0.01	0.04	0.00	0.43	0.22	0.01	0.77	0.51	0.00
	Group 2 [705]	-347.42	712.85	0.00	0.10	0.04	0.27	0.04	0.05	0.56	0.58	0.88	0.00
Sanitation service group	Group 1 [383]	-7.14	24.28	0.01	-	-	-	-	0.48	0.74	0.81	-	0.00
	Group 2 [274]	-141.57	301.14	0.00	0.53	0.35	0.96	0.83	0.43	0.44	0.22	0.79	0.00
	Group 3 [343]	-221.48	460.97	0.00	0.02	0.57	0.61	0.05	0.63	0.23	0.87	0.40	0.00

Source: SADEP Study Team

(4) Estimation of ATP

While WTP is a maximum amount which beneficiaries are willing to pay for certain hypothetical service, it is difficult to directly use this data as basis of setting its tariff.

Moreover, it is necessary to set water and sanitation tariff at price level that majority of beneficiaries can actually afford because the water and sanitation services is of highly public nature. For that purpose, ATP is frequently referred and used. The ATP is considered as amount, which beneficiaries can pay for certain services, calculated with reference to household income and composition of household expenditures in the service area. There are various methodologies proposed for computing ATP. For example, one is to determine ATP as a certain share of household's disposable income based on past surveys and experiences (The World Bank sets as ceiling benchmark of ATP, 4% for water service, and 1 % for sanitation service of household's disposable income – in total 5% for water and sanitation services.).[16] Another is to compute ATP for

16 JICA (2002)

a certain service by finding out the ranking of the expenditure for the service among various expenditure items, and comparing the expenditure for the service with one-rank-higher and one-rank-lower expenditure items.[17] This study estimated ATP with the following method.[18]

Since 1995 the National Institute of Statistics and Information (INEI: Instituto Nacional de Estadistica e Informatica) has conducted the National Household Survey (ENAHO: Enucuesta Nacional de Hogares) to measure living standards of the people. The 2001 ENAHO results are currently available and was used to estimate ATP. The theoretical rationale for revising tariffs requires a detailed study of beneficiary's ATP, and estimating ATP requires access to detailed breakdowns such as water and sanitation service charges in the ENAHO household data. Water and sanitation charges are included in the Item 2 (Housing) of Table 24, but the breakdonn of the Housing cost is not published. In the data published by ENAHO, that for the Department of Loreto, in which Iquitos is located, most closely approximates the current conditions in Iquitos.

It is generally believed that 5.0% is the ceiling for the ratio of water and sanitation tariffs to total household expenditures. This ratio declines as per capita GDP increases. This is because the share of expenditure on water and sanitation services as Basic Human Needs decreases due to increased income level and change of expenditure structure of households. For example, an appropriate, payable amount for water and sanitation service tariffs in Denmark is 0.8% of household expenditures, while in Pakistan it is 4.5%. Besides, detailed analysis of the nation wide household survey of Panama in this SADEP study slows that the share in Panama was 2.33%. (See Table 25.)

Table 24: Result of household survey in Peru (2001)

Expenditure breakdown	Monthly expenditure (sol)			Composition ratio (%)		
	Peru Average	Lima Average	Department of Loreto Average	Peru Average	Lima Average	Department of Loreto Average
1. Food	533.0	764.0	479.0	42.7	36.3	49.2
2. Housing	271.0	549.0	204.0	21.7	26.1	21.0
3. Transportation/Correspondence	145.0	284.0	94.0	11.6	13.5	9.7
4. Education/Amusement	113.0	238.0	52.0	9.1	11.3	5.3
5. Personal goods	36.0	62.0	35.0	2.9	2.9	3.6
6. Clothing	40.0	49.0	30.0	3.2	2.3	3.1
7. Medical/Drug	50.0	84.0	37.0	4.0	4.0	3.8
8. Household goods	29.0	22.0	17.0	2.3	1.0	1.7
9. Others	30.0	53.0	25.0	2.4	2.5	2.6
Monthly expense total	1247.0	2105.0	973.0	100.0	100.0	100.0

Source: * INEI (2001). Encuesta Nacional de Hogares – Ivtrimetre del 2001

17 JBIC encourage this methodology to be used in the case of sanitation services. This methodology, firstly, acknowledges that there is global commonality in the ranking of various household's expenditure items, regardless income levels and regions. Secondly, it grasps the structure of household's expenditures in a certain area. And, thirdly, it considers to set the expenditure for sanitation services, following: ① food expenditure indispensable in daily life; ② education and medical expenditure useful for poverty eradication in the future; and ③ utility charges (electric and water) necessary in urban life (see Infrastructure Development Institute (2002)). However, in this study, this methodology could not be used because the detailed structure of household's expenditure was not available.

18 In the case of sanitation services, there is a possibility that beneficiaries and users are not necessarily identical. Sanitation services provide benefits of improvement of river environment, not only to nearby residents, but also residents in downstream of the river. However, sanitation charges are shouldered by users connected to sewerage system. In this case, although the benefit of sanitation services can wide spread, the cost needs to be paid by users, who are part of beneficiaries. Therefore, there is a view that cost of sanitation services should be not only from user charges, but also from subsidies (this issue needs to be further elaborated in another study). It should be noted that in the case of Iquitos City the beneficiaries of sanitation services are considered mainly Iquitos citizens because there is no large cities about 50km downstream of the Amazon River. It is considered that, as potential beneficiaries, there are those who think highly of value of bio-diversity of the Amazon River in Peru and from Iquitos in the world. CVM study this time focuses only on Iquitos residents, and therefore, there is possibility that the overall project benefit is underestimated.

Table 25: International comparison of ratio of Water/Sanitation tariffs to Household Expenses

Country	Gross National Income per capita* (USD)	Ratio of Water/Sanitation Tariff to Household Expense
Denmark	31,090	0.8%**
Germany	23,700	1.0%**
Poland	4,240	1.4%**
Estonia	3,810	2.5%**
Panama	3,290	2.33%***
Pakistan	420	4.5%****

Source: *World Development Report 2003
**Report on Water Pricing/Cost Recovery in the Baltic Sea Countries (2002)
***Estimated based on figures by Censos Nationales de Poblacion y Vivienda Resultados Finales 2000 (Panama), Direccion de Estadistica y Censo.
****Pakistan Water Sector Strategy (http://www.waterinfo.net.pk/pwss/vol4j.htm

Table 24, together with World Development Report 2003 (The World Bank), suggests the following:

① Table 24 shows that the average Peruvian household expenditure in 2001 was 1,247 sols, which amounts to an average annual expenditure of 744.4 USD per capita, given that the average family consists of 5.6 persons.

② According to World Development Report 2003, Peru's gross national income per capita in 2001 was 2,000 USD.

③ The CVM survey shows that the average monthly household income in Iquitos City is 852.44 sols = 247.1USD, which amounts to an average annual income per capita of 511.2 USD, given that the average family consists of 5.8 persons.

④ From ①, ② and ③, the gross annual income per capita in Iquitos City is estimated to be 1,374.2USD.

⑤ According to World Development Report 2003, the gross national income per capita and ratio of water and sanitatim tariff to household expense for the six countries (the five countries whose ratio of water and sanitation tariff to household expenditure is already available, plus Panama whose figure is available from the SADEP survey) is as shown in Table 25.

⑥ From ④ and ⑤, it may be estimated that the ratio of water and sanitation tariff against household expenditure in Iquitos City may would fall between 4.5% (Pakistan) and 2.5% (Estonia); given its income level, it is expected to fall between 3.00% and 4.00%. (A more accurate estimate would be possible if the ratio of water and sanitation tariff as compared to household expense, and gross national income per capita of each country are available.)

From these data, we used the following four ratios in estimating ATP.

(i) Ceiling for developing country ATP estimated at 5.00%.

(ii) Estimated maximum ratio for Iquitos city (based on its income level): 4.00%

(iii) Estimated minimum ratio for Iquitos city (based on its income level): 3.00%

(iv) Figures for Panama estimated at 2.33% (based on SADEP survey)

For the total monthly expenditure, the following two figures were used:

(i) Household figures based on ENAHO (973.00 sols/m)

(ii) Estimated monthly average expense, based on a sample of 1,000 households from the CVM survey (852.44 sols/m)

As shown in Table 26, eight ATPs for water and sanitation services were estimated. Considering the city's income level, the ratio of water and sanitation tariffs against household expenses was set at 3.00% to 4.00%, and the figures from the CVM survey were employed as monthly expenses. This resulted in the ATP for water and sanitation service being 18.7 - 24.9 sols/month for water service, and 6.9 - 9.2 sols/month for sanitation service, respectively. Comparison of estimated WTPs and ATPs are shown in Table 27.

Table 26: Estimated Results of ATP

Expenditure Breakdown	*INEI2001				**Monthly spending estimates in this CVM survey			
Applied ratio for water and sanitation service charges	max	Ceiling 1	Ceiling 2	Panama	max	Ceiling 1	Ceiling 2	Panama
Applied Ratio (%)	5.00%	4.00%	3.00%	2.33%	5.00%	4.00%	3.00%	2.33%
1. Food	479.0	479.0	479.0	479.0	-	-	-	-
2. Housing	204.0	204.0	204.0	204.0	-	-	-	-
***Water					31.1	24.9	18.7	14.5
***Sanitation					11.5	9.2	6.9	5.4
Water/Sanitation Subtotal	48.7	38.9	29.2	22.7	42.6	34.1	25.6	19.9
3. Transportation/ Correspondence	94.0	94.0	94.0	94.0	-	-	-	-
4. Education/ Amusement	52.0	52.0	52.0	52.0	-	-	-	-
5. Personal Goods	35.0	35.0	35.0	35.0	-	-	-	-
6. Clothing	30.0	30.0	30.0	30.0	-	-	-	-
7. Medical/Drug	37.0	37.0	37.0	37.0	-	-	-	-
8. Household Goods	17.0	17.0	17.0	17.0	-	-	-	-
9. Others	25.0	25.0	25.0	25.0	-	-	-	-
Monthly Expense Total	973.0	973.0	973.0	973.0	852.44	852.44	852.44	852.44

Notes: * INEI (2001). Encuesta Nacional de Hogares – Ivtrimetre del 2001
**The CVM was implemented in November 2003. It was 2 years after the implementation of the INEI survey in November 2001. Therefore the consumer price in the city of Iquitos during this period was adjusted with the following value: Consumer Price Index=99.15.
***Estimated from the present tariff structure of Water and Sanitation Public Corporation (Water/Sanitation=73.1/26.9)
Source: SADEP Study Team

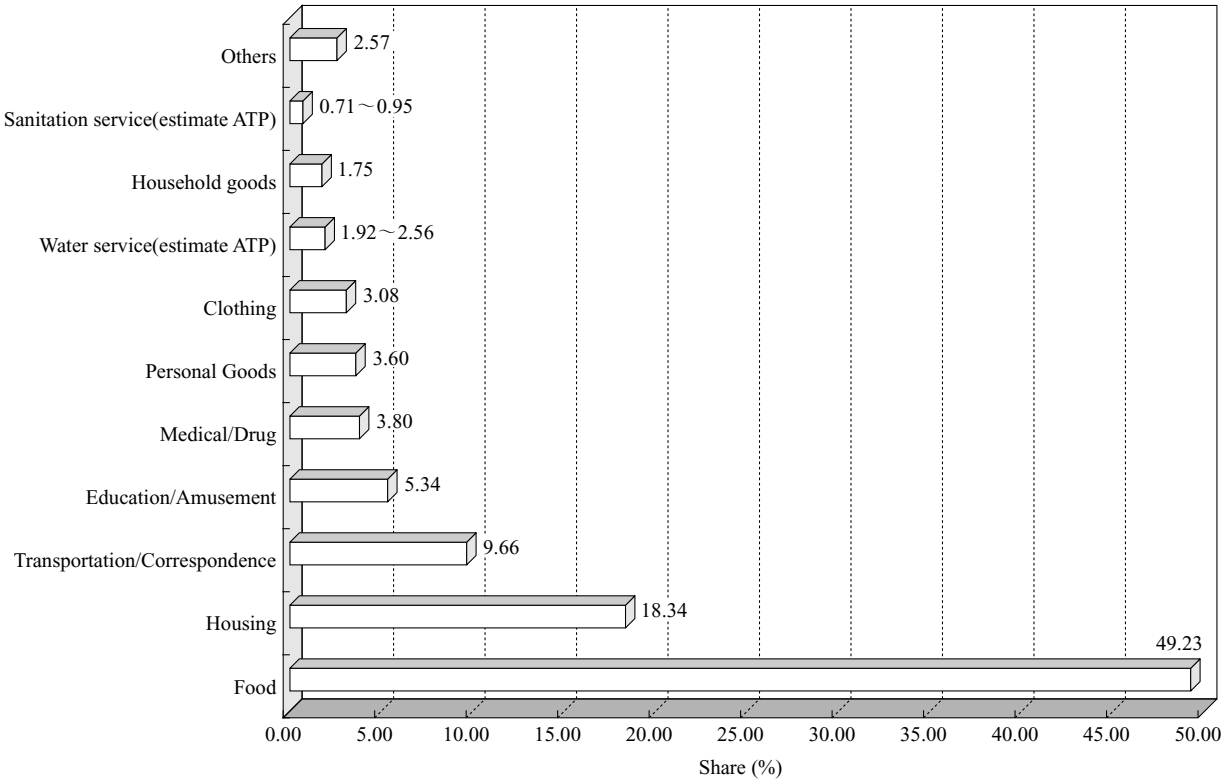
Table 27: Comparison of WTP and ATP

Section	No. of Samples	Total WTP (sols)			ATP (sols)			ATP/Total WTP (%)		
		Water	Sanitation	Total	Water	Sanitation	Total	Water	Sanitation	Total
Total	1,000									
Water	1,000	34.35	15.84	50.19	18.7-24.9	6.9-9.2	25.6-34.1	54.4%-72.5%	43.6%-58.1%	51.0%-67.9%
Group 1	295	24.18	-	-	-	-		-	-	-
Group 2	705	29.61	-	-	-	-		-	-	-
Sanitation	1,000	34.35	15.84	50.19	18.7-24.9	6.9-9.2	25.6-34.1	54.4%-72.5%	43.6%-58.1%	51.0%-67.9%
Group 1	383	-	13.82	-	-	-				
Group 2	274	-	14.97	-	-	-				
Group 3	343	-	11.04	-	-	-				
District	1,000	34.35	15.84	50.19	18.7-24.9	6.9-9.2	25.6-34.1	54.4%-72.5%	43.6%-58.1%	51.0%-67.9%
Belen	251	37.45	18.75	56.20	-	-				
Iquitos	498	32.07	14.48	46.55	-	-				
Punchana	151	34.27	14.57	48.84	-	-				
San Juan	100	38.84	20.70	59.54	-	-				

Note: "Total WTP" is the sum of the current payment and WTP derived from the questionnaire.
Source: SADEP Study Team

In order to verify appropriateness of the estimated ATP for current and potential users of water and sanitation services in Iquitos city, they were then compared with the shares of households expenditure items derived from the INEI survey. The comparison between the estimated ATPs and other household expenses is shown in Figure 5. According to the Figure, if the ATP for water and sanitation services is assumed to be 3.00%-4.00% of the household expenditure, the ATP for water is estimeted at 1.92%-2.56% of the total expenditure and the ATP for sanitation 0.71-0.95%, respectively. Thus, the estimated ATP of for the water falls between clothing expenses (3.08%) and household goods (1.75%), and that of sanitation is positioned below household goods (1.75%), which may be said to be an appropriate level in relation to the other expenditures.

Figure 5: Comparison of Estimated ATP against other Household Expenses



Source: SADEP Study Team (made from INEI 2001 and other materials)

(5) Possibility of changing tariff on the basis of WTP

Table 28 is a comparison between WTP, ATP and current payment for water and sanitation services, and may suggest the following:

① The estimated ATP (water: 18.70-24.90 sols/mouth, sanitation: 6.90-9.20 sols/month) in Iguitos city ranges from between minus 10% to plus 20% of from the current paymeut (water: 20.81 sols/mouth, sanitation: 6.48 sols/month), which may indicate that there is limited room for tariff increase.

② The estimated ATP is well below the total WTP (water: 34.35 sols/m, sanitation: 15.84 sols/m), which shows that the ATP is limted, while Iquitos residents show have relatively high WTP.

③ A tariff increase in the area would require a rise in income and subsequently a rise of the ATP. Moreover, an improvement in the tariff collection ratio could lead to an increase in the potential WTP of currently non-paying users. It should also be noted that in order to increase tariff levels, a reduction of operating costs by reviewing the business processes of the service provider is essential.

Table 28: Comparison between WTP, ATP and current payment for water and sanitation services

Item	*WTP total with price hikes by scenarios [sol/m]*	*ATP (sol/m)*	*Current average monthly payment (sol/m)*
Water charge	34.35	18.70-24.90	20.81
Sanitation charge	15.84	6.90-9.20	6.48
Total	50.19	25.60-34.10	27.29

Source: SADEP Study Team

Chart 4: Conclusion

CVM is a survey based on the consumer theory, using a questionnaire to assess, in moretary terms, “change of utilities from the present time when environment has not undergone improvement, to hypothetical future when environment will have improved”, and to estimate WTP for environment-improving services.

This means that the WTP is the amount expressed by respondents on the basis of a hypothetical scenario, so that the results cannot readily be applied to the actual tariff system of environmental improvement service; but still, the WTP estimated through CVM can provide important basic information for cost-benefit analysis and tariff setting. Governments can use this information for policy-making on water and sanitation services, thereby optimizing resource allocation among various public services.

In ensuring financial sustainability of water and sanitation sactors, it is necessary to have in place an appropriate tariff level, and to ensure a high collection ratio. In order to set appropriate tariff and user charges, sufficient justifications are needed for users and suppliers. The WTP estimated through CVM can be data of demand side (i.e., beneficiaries).

It seems that cost analysis in supply side was emphasized in public projects. But, in order to introduce private sector's management into the projects, it is necessary to set tariff and user changes in due consideration of demand side and market mechanism. CVM can be a tool to realize this approach.

Based on the above, it may be concluded that the CVM is an effective tool to ensure financial sustainability in the government/private/project levels. There is only limited number of large scale CVM surveys in developing countries, while there are many in Europe and the United States. In this study, a survey involving 1,000 samples in Iquitos City was conducted and produced useful outcome. This would be a good effort considering a concrete project, although there are several issues to be studies for actual application to set tariffs (drawing demand carve analysis of supply side and cost-benefit analysis).

References

<Japanese>

Kuriyama, Koichi (1998). Value of Environment and Evaluation Methodologies. Hokkaido University Press

Kuriyama, Koichi (2000). Illustrated Environmental Impact Assessment and Green Accounting. Nihonhyoronsha

Wakahara, Norio and Kaoru Yoshiaki (2001). "Evaluation of Benefit of Environmental Improvement through Contingent Valuation Method - A Case of Horikawa, Nagoya City," No.3, Vol 3, Nanzan Keiei Kenkyu

William H. Greene (Translated by Tsunemasa Shiba, Teruo Nakatsuma and Manabu Asai) (2003). Econometric Analysis (Fourth Ed.). Economist

Infrastructure Development Institute, Japan (2002). Guidelines for Sewerage Management in Developing Countries (Draft)

Japan International Cooperation Agency (2002). Study on Economic Evaluation Methodologies for Development Studies

Research Institute for Community Policy Co. Ltd.. Economic Evaluation Program for Environment and Administration - CVM 2002

<English>

INEI (2001). Encuesta Nacional de Hogares-Ivtrimetre del 2001

Instituto Cuanto (2000). Resultados preliinares: ENNIV_2000, p7

Ministry of Water and Power, Pakistan (2002). Pakistan Water Sector Strategy (http: //www.waterinfo.net.pk/pwss/vol 4 j.htm)

Baltic Marine Environmental Protection Commission (2002). Report on Water Pricing／Cost Recovery in the Baltic Sea Countries

<Appendix> Analysis of results of commercial user survey

In the main part of this paper, the surveyed samples were general household users of water supply and sanitation services in Iquitos City. However, since whole users of the services included commercial users, an additional survey of commercial users was conducted. Most of the commercial users in Iquitos City are self-employed stores, restaurants and other comparatively small-scale users. Large-scale commercial facilities cannot be seen except some hotels. In the tariff of the Water Supply and Sanitation Public Corporation, general household users and commercial users are treated separately. Commercial users must therefore be sampled as a different category.

The 750 samples randomly extracted on a trial basis during the first pre-test included 60 commercial users (8%). Simple random extraction of 1,000 samples may therefore include 80 commercial users (8%). Since 80 samples were insufficient for estimating WTP, it was decided to conduct another survey targeting a minimum of 200 samples and a pre-test for commercial users as well.

(1) Summary of profile of commercial users

Below is a summary of the profile from a sample of 200 commercial users.

-The majority are self-employed in sectors like restaurants and retail. The largest number of employees of a user was 25, with average staffing of 2.9. Most commercial users are very small-scale, owner-operated businesses.

-The largest monthly water consmption volume of a user was approximately 150,000 liters, the average approximately 12,000 liters. The maximum monthly water charge payment of a user was 300 sols, the average 33.9 sols.

-Average water availability time was 11.05 hours, putting commercial users under the same restrictions as general users. Because of this, some businesses used their own wells or other sources to ensure access to water.

-The maximum monthly sanitation charge payment was 100 sols, the average 11.1 sols.

-Among other utility charges, one business reportedly paid a maximum of 2,500 sols per month for electricity.

(2) Estimation of WTP

Rather than using a "choice of two options" format for commercial users, we used a "payment card" format to survey WTP. WTP was estimated as a representative value using ordinary statistical processing. To find the representative WTP value for the sample of 200 commercial users, we calculated an the average value, median value and standard deviation for the entire sample and for the sample after excluding the top 5% of WTP. From these basic statistical values, we selected the median value for the entire sample as the representative WTP value in light of the small number of samples in the commercial user survey and the large fluctuations in the WTP range depending upon the type of business.

The results indicate a representative WTP value for commercial user water services of 20.0 sols per month for businesses in Group 1 (not connected to the water system), and 4.0 sols per month for businesses in Group 2 (already connected). (Table 29)

The representative WTP value for sanitation services was 5.0 sols per month for businesses in Group 1 (not connected to the sanitation system), 1.5 sols per month for Group 2 (connected but receiving incomplete services because of overflows etc.) and 1.5 sols per month for Group 3 (receiving full sanitation services, but willing to pay for improvements of the surrounding environment because of no final treatment for sewage and placing a value on environmental enhancement of the surrounding rivers). (Table 30)

Table 29: Representative WTP estimate for commercial user (Water service)

Item	Statistic score	Entire beneficiaries	Water service group	
			Group 1	Group 2
No. of samples		200	13	187
Entire sample	Average value	5.54	19.62	4.54
	Standard deviation	0.04	0.88	0.03
	95% confidence interval	4.54-6.54	13.39-25.84	3.73-5.35
	Median value	5.00	20.00	4.00
Sample after excluding the top 5% of WTP	Average value	4.45	19.62	3.83
	Standard deviation	0.03	0.88	0.03
	95% confidence interval	3.69 - 5.22	13.39- 25.84	3.14 - 4.63
	Median value	4.50	20.00	0.00

Source: SADEP Study Team

Table 30: Representative WTP estimate for commercial user (Sanitation service)

Item	Statistic score	Entire beneficiaries	Sanitation service group		
			Group 1	Group 2	Group 3
No. of samples		200	18	66	116
Entire sample	Average value	2.26	5.56	2.42	1.66
	Standard deviation	0.01	0.12	0.04	0.01
	95% confidence interval	1.93-2.59	4.54-6.57	1.73-3.12	1.36-1.95
	Median value	2.00	5.00	1.50	1.50
Sample after excluding the top 5% of WTP	Average value	1.91	5.56	2.03	1.51
	Standard deviation	0.01	0.12	0.03	0.01
	95% confidence interval	1.65-2.17	4.54-6.57	1.50-2.56	1.24-1.79
	Median value	2.00	5.00	1.00	1.00

Source: SADEP Study Team

Urbanization and Development of Infrastructure in the East Asian Region

Atsushi Iimi*

Abstract

Urbanization is characterized by agglomeration of production and consumption, which stimulates overall economic growth. The East Asian region is now experiencing a rapid increase in urban populations. It is projected that in 2030 urban populations in the region will amount to thirty percent of the total global urban population. Although urbanization in East Asia can be characterized in various aspects, one of the most important features is the development of urban systems balanced between urban and regional areas. This can be partly explained by the fact that in East Asia public infrastructure investment has been actively implemented in rural regions with the aim of raising living standards in regional areas and to support the balanced development of urban and regional areas. In this context, in order to sustain balanced urban development an urgent issue that needs to be tackled as part of a mechanism to ensure equitable regional public investment distribution is decentralization, particularly fiscal decentralization. In addition, as a means of responding to rapid urbanization, it is also essential to realize a more service-oriented structure in the urban economy. Development of urban service industries is conducive to employment creation, poverty reduction and self-organized local business development in urban regions. In order to nurture a service economy in urban areas, the development of transportation infrastructure and reliable information and telecommunications systems are required, even at the feeder level, as a means of enabling efficient distribution in urban areas.

Chapter 1: Introduction

Urbanization in developing countries has various impacts on the national economy, society and environment. The current total urban population accounts for about 50% of the world population, three quarters of which is that of medium- and low-income countries (World Bank, 2003a). In developing countries, there is a general tendency for the population to concentrate quickly in urban areas as the economy grows. Following Latin American countries, Asian and African countries have been experiencing such rapid urbanization in recent years. An increase in urban population, particularly, in the Asian region will be the main factor of global urban population growth in the coming three decades (NRC, 2003). Accordingly, in order to address this rapid urbanization in developing countries, which appears to be one of the challenging issues for future economic development, an accurate grasp of the current status of urbanization is essential. The purpose of this paper is to review the current status of urbanization mainly in the East Asian region from various aspects and to examine the underlying issues.[1]

As urbanization is an engine for economic

* African Department, IMF (At writing : Development Policy Research Div., JBIC Institute)

1 The East Asian region, in this work, stands for the region covering China, (Japan), South Korea, Mongolia, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Thailand and Vietnam, unless individually specified.

JBICI Review No.10 March 2005 pp88~109

growth, there is apparently a positive correlation between urbanization and economic development. However, the causality is much complex (World Bank, 2000). The main reason why urbanization accelerates economic growth is the effect of agglomeration economies, which are: (1) internal scale economies generated by inseparability of production technology within a firm; (2) localization economies generated by firms' concentration in a particular industry, particularly through labor or intermediate input material markets; and (3) urbanization economies such as diversification of services enabled by geographical centralization of various industries. These agglomeration economies raise urban productivity and attract more companies in urban areas. As a result, urbanization contributes to economic growth in the aspects of job opportunity and income increase. In fact, numerous positive analyses of urban economics show that concentration of production activities in urban areas is determined by agglomeration economies, particularly by localization economies (Eberts and McMillen, 1999). This implies that wage increase associated with improvement of productivity in urban areas may expand an urban population with increasing speed.[2]

In the above argument for urbanization with a focus on agglomeration economies, one of the important factors is evidently firm location. Above all, while many developing countries suffer from cumulative foreign debt due to long-term worsened market conditions of primary products after the 1980s, industrial localization by multinational companies has played an important role in economic growth in the East Asian region where high growth has been solely maintained. During the course, major cities of the region have been developed and internationalized to a dramatic extent through direct investment from foreign countries (Yeung and Lo, 1998). Firm location is affected by the development level of economic infrastructure, the labor quality and wage level, agglomeration of related intermediate input materials, the scale of and the distance to markets, and the macroeconomic stability. For example, Belderbos and Carree (2002) show that the location of the Japanese electric industry in China is explained by the regional market size, the level of labor costs and locations of their affiliate and group companies. Particularly in direct investment as an export-oriented production base, the agglomeration of group companies and the existence of a harbor are more decisive factors, implying that industry agglomeration mainly by Japanese firms is self-organizing in export-oriented industries (Belderbos and Carree, 2002).

Agglomeration of production in urban areas means concentration of consumption. This is because the labor force as centralized in urban areas has an element of production, which generates large demand, forming a huge consumer market. Regardless of concentration of firms and people, however, usable space is physically limited in urban areas. Therefore, for urban areas to accommodate more firms and people, it is inevitable to develop non-land-intensive industries, resulting in an advancement of industrial structure. Many advanced countries have experienced service orientation of industrial structure as urbanization is furthered. For example, during the 60 years from the 1940s when the U.S. urban population rate increased from 60% to 80%, the employment share of the service sector went up from 55% to 76%, while that of the non-service sector dropped from 45% to 24% (O'Sullivan, 2000). It is also pointed out that in the case of Latin American countries, the rapid growth of urban population after the 1950s was allowed by an increase in employment in the service sector (Hataya, 1999).[3]

Needless to say, however, excess urbanization beyond the appropriate speed for economy and society to adjust causes various problems. These are internal urban issues, such as deficiency in public infrastructure services (i.e. shortage in supply of electricity, tap water and wastewater service), air pollution and water contamination, housing shortage, and heavy traffic. These negative effects of

2 In the case of redundant labor force in urban areas or sufficient new labor force supplied from rural areas, increase of labor cost may be mitigated. However, through price hike of housing rent due to population increase, labor cost generally increases in a nominal sense.

3 It may be true that the expansion of tertiary industries is interpreted to mean that the increased working population is likely to be absorbed by informal commercial and service industries.

urbanizations not only offset a part of urban productivity gains but also are incident to the poor in urban areas. Thus, living environment for the urban poor is further worsened, and the informal economy, which is characterized by expansion of economic activities not captured by formal statistics and not covered by social security and regulation). According to NRC (2003), in the case of about 50 developing countries, the electrification rate in urban areas is 64.5%, while the diffusion rates of tap water or well water and flush toilets are 55.1% and 61.7%, respectively. To satisfy the growing demand for public services in urban areas, a huge amount of funding is required for development of the infrastructure.

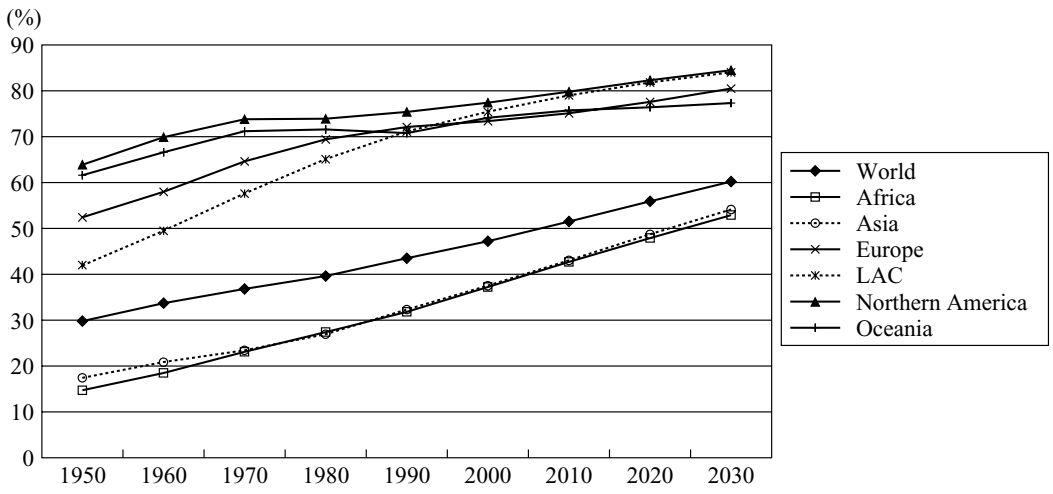
Outstanding development in urban areas has a large impact on the balance between urban areas and rural areas. If there is a significant differential in income or social services provided between urban and rural areas, a further migration from rural to urban areas will be provoked, which may aggravate the issue of overconcentration of population in the capital area. Therefore, even though it is important to enhance economic advantages of urban areas, a mechanism to reallocate the gains obtained in urban areas to rural areas may also be even more important. This viewpoint is closely related to the debate on decentralization of tax sources and public spending. In a decentralized system where each city supports itself in public services, tax sources and public spending tends to be concentrated in large cities with agglomeration of production and consumption. On the contrary, there is another argument that delegation of authorities and transfer of financial resources to the local government at the regional level are necessary for responding to urban issues directly. From the perspectives of urban autonomy and balanced development between urban and rural areas, certain rules seem to be required in the vertical alignment of responsibility and authority for central and local governments.

Based on the above background, this paper aims to review the current status of urbanization in the East Asian region in general terms and to examine the results and problems emerging as a consequence of the urbanization. Focusing on patterns and results of the urbanization, in addition, it discusses issues of urban development and possible effective measures.

Chapter 2: Urbanization in the East Asian Region

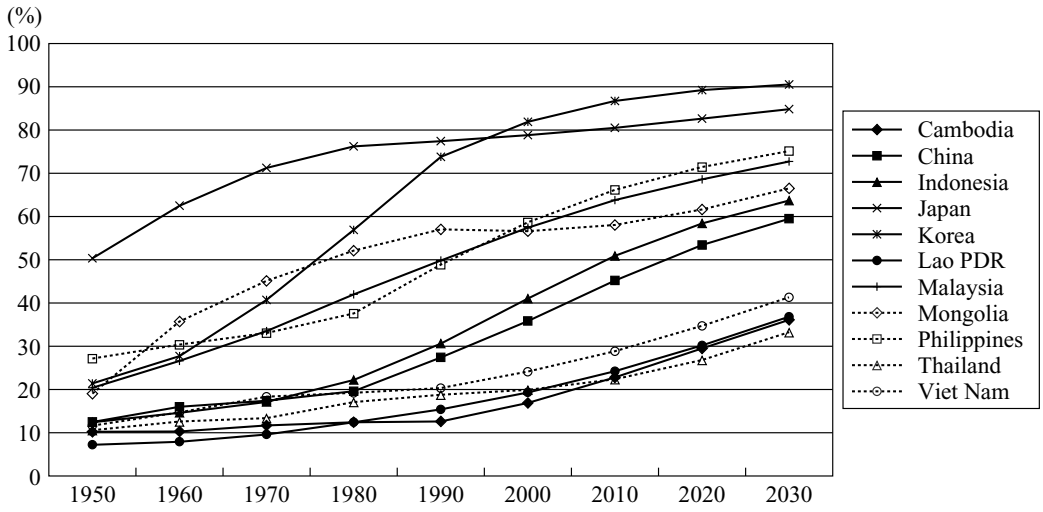
Although urbanization generally stands for concentration of population in urban areas, the concept of "urban areas" varies across countries and it is difficult to measure "urbanization" by only a single indicator.[4] If urbanization is defined by the proportion of urban residents to total population (urbanization rate), Figure 1 reflects the trend of urbanization in major regions of the world. The urbanization rate of high-income countries in the

Figure 1 Trends in Urbanization Rate (by Region)



Source: UN (2002).

Figure 2 Trends in Urbanization Rate of the East Asian Region



Source: UN (2002).

European, North American and Oceanic regions is around 75%, which suggests that these regions are highly urbanized. Among developing countries, urbanization has been accelerating in the Latin American region since the 1950s, reaching 70% in 1990. Meanwhile, the urbanization rates of the Asian and African regions have historically been low. Although they have increased gradually since the 1950s, the rates remain under 40% at the present moment. However, the rate of the Asian region is expected to jump from 37.5% to 54.1% by 2030. In terms of both speed and scale, urbanization of Asia will be a key element in the global urbanization (UN 2002).[5]

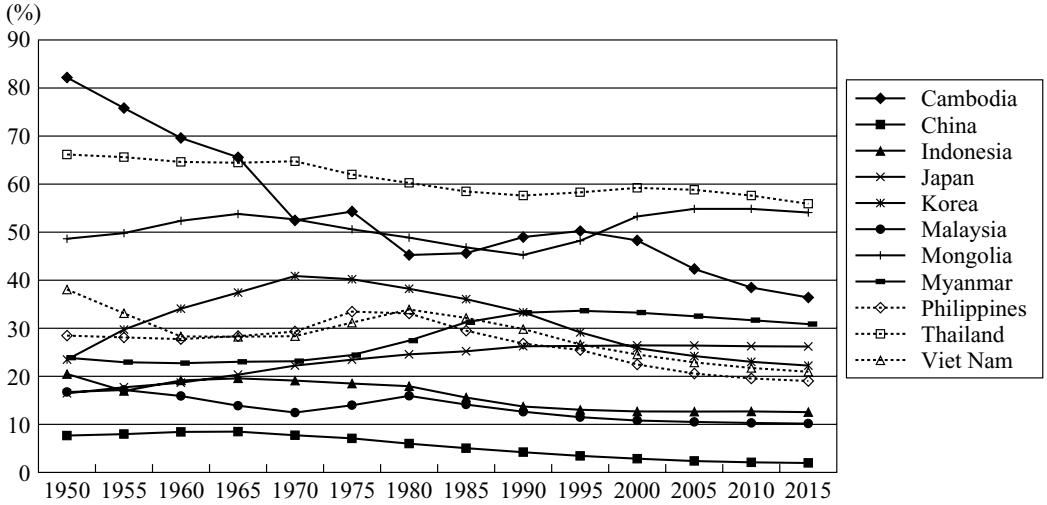
The trend in urbanization rate varies across countries even within the East Asian region. As Figure 2 shows, 80% or more of the population of high-income countries such as Japan and South Korea, except for city-states, lives in urban areas, which suggests that they are highly urbanized. On the other hand, the urbanization rates of Vietnam, Laos, Cambodia and Thailand are less than 30%. Malaysia, the Philippines and Mongolia, of which the current urbanization rate is about 60%, experienced rapid population growth in urban areas at a relatively early stage, from the 1960s through the 1980s. It is remarkable that China and Indonesia, rapidly urbanized after the 1990s, are expected to reach an urban population rate of 60% in 2030 after the coming accelerated increase, although the rates of both countries were about 30% in 1990.

The rate of urban residents to total population is widely used as an indicator of urbanization, but there may be four flaws preventing it from properly capturing multiple aspects of population concentration in urban areas in the East Asian region. First of all, the most significant problem is that an urbanization rate does not provide any information on the city size distribution, which may indicate overconcentration of population in the capital area or balanced growth of cities other than the largest. Secondly, there are some cases in urban issues in which an absolute scale holds greater significance than relative values such as urbanization rate. For example, when considering urban infrastructure supply, the absolute number of urban residents has significance. Thirdly, the trend of urbanization rates does not reveal anything about a dynamic path of each city development. Finally, based on argument using urbanization rates, no reason for urban population increase can be seen. From a political point of view, one of the important questions is why

4 This paper relies on the statistical classification of the United Nations Population Department (UNPD) for data analyses. As for each country's definition of "urban areas," see UN (2001). A city is defined as an administrative unit or as an economic unit. For example, "Tokyo" may include 87 neighboring cities in Kanagawa Prefecture, Saitama Prefecture and Chiba Prefecture, such as Kawasaki and Yokohama, in addition to the 23 Tokyo wards.

5 The urbanization rate of the African region is also expected to jump from 37.2% in 2002 to 52.9% by 2030.

Figure 3 Degree of Concentration in a Primate City: Major Countries in the East Asian Region



Source: Compilation of data from UN (2002).

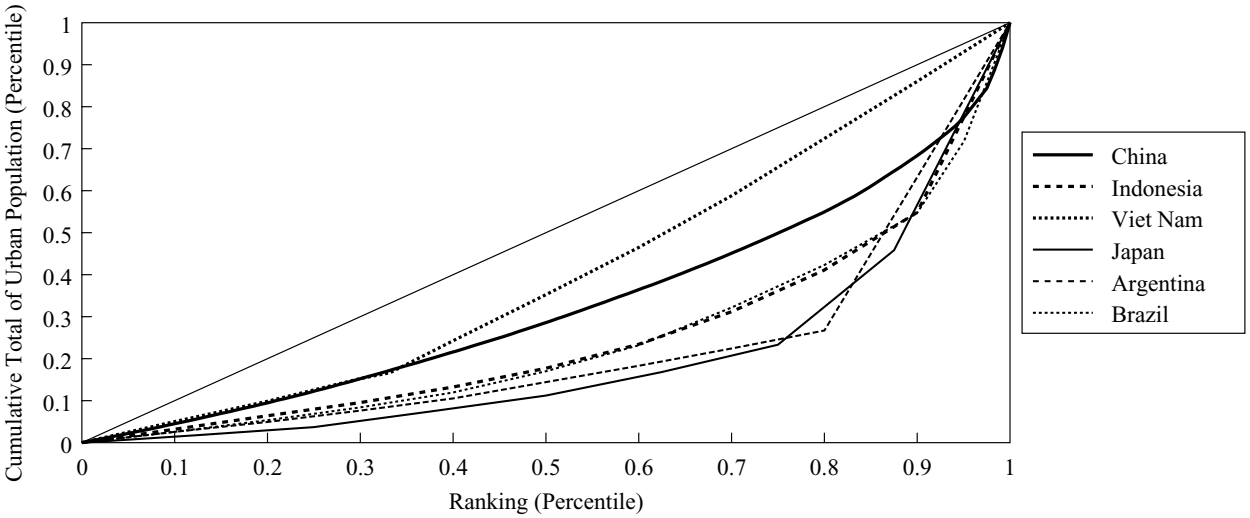
the urban population grows. From these various aspects, in the following sections, the current status and characteristics of the East Asian region will be discussed.

(1) Urban Primacy

The largest problem with an urbanization rate is that it does not provide any relative distribution map of urban scale that allows us to cast a light on overconcentration of population in the capital area or balanced growth of cities other than the largest. For example, the urbanization rate identifies two countries with the same total population, even though one of them has 10 local cities where one million people live and the other has a population-concentrated capital where 10 million people live. As ADB (1999) points out, it is of particular importance to deal with urbanization issues at the early stage and to decentralize and balance domestic industries by promoting local industries through creation of a free trade zone, before cities are being developed into mega cities. In that sense, an important argument is whether an increase of urban population results from overconcentration of population in a particular area or overall development of all the cities including regional satellites. Compared with the Latin American region, one of the characteristics of the East Asian region is balanced urban system development. In fact, while there are no less than 17 countries with its primate city accommodating more than 15% of the population in the Latin American region, there are only 15 countries including city states, such as Singapore, in the Asian region (NRC, 2003).

Figure 3 shows one of the urban primacy measurements, the proportion of population in a primate city to total urban population of major East Asian countries. Several patterns are observed in the region. Thailand, Mongolia and Cambodia have a high urban primacy rate and thus are experiencing excess concentration of population in a single area. Cambodia's degree of concentration in a primate city is expected to slow down rapidly in future. Although the primacy of Thailand has been slowing down over a long period, more than half the urban population is still concentrated in the capital area, similar to Mongolia. Therefore, Thailand will have to deal with the issue of overconcentration of population in the capital area. In fact, to mitigate overconcentration of industries in the capital area of Bangkok, Thailand has implemented the East Coastal Area Development Plan since the 1980s, forming the base of machinery and electric equipment industries in the area from 80 kilometers to 200 kilometers southeast of Bangkok. The east coastal area has played a certain role in absorbing population from other areas. The share of manufacturing value-added amount in the capital area exceeded 70% in 1981 but decreased to 63.2% by 1995. On the contrary, the share of the east coastal area increased from 11.2% to 15.8% for the same period (Ariga & Ejima, 2000). However, as stated above, it cannot be underestimated that the

Figure 4 Urban-Scale Distribution Chart



Note: Data of cities with a population of more than 750,000 is used here.
Source: Compilation of data from UN (2002).

overconcentration in Bangkok is still significantly high in international comparison.

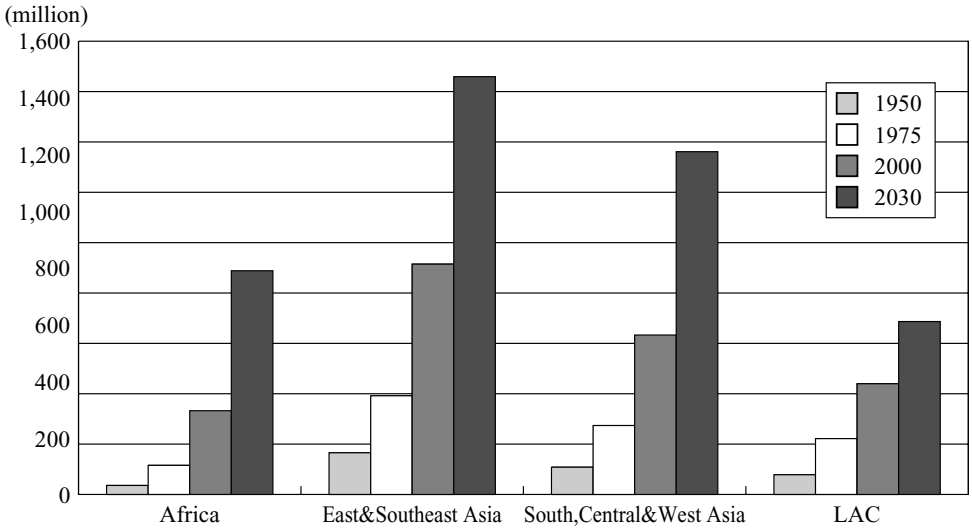
Indonesia, Malaysia and China have a consistently low urban primacy. The degrees as an indicator of concentration in a primate city are around 10% with a tendency to gradually decline. Interestingly, South Korea, Vietnam and the Philippines exhibited a tendency toward overconcentration of population in a primate city until the 1980s, but the primate cities are slowly losing their share due to the national policies of industrial dispersion. In future, it is expected that in these countries, the urban primacy declines to about 30%. Of particular note, since the 1970s, the Philippines has developed infrastructure of the core growth cities other than the metro-Manila, aiming at decentralizing population and industries. One of the projects is the development of the metro-Cebu through the Central Visayas Development Plan. Driven by development of infrastructure such as airports, roadways and electric power supplies, the number of new investments to the metro-Cebu rose dramatically. According to the Department of Trade and Industry, the new investment registration increased from 3,343 in 1990 to 7,759 in 1997-98 prior to the Asian crisis. As in foreign investments, the number of companies established in the Mactan Economic Zone No. 1, which is next to an international airport, increased to reach 103 in 1998 (JBIC, 2003b). It is considered that such national-level dispersal policies leveraging direct investments contribute to lowering the degree of concentration in a primate city in the Philippines.

Although the above urban primacy focuses on the largest cities only, more attention should be paid to a relative distribution of urban scale in each country. The reason is that the extremely low urban primacy of China, for instance, is affected by the fact that in China, there are a large number of cities other than Shanghai.[6] Hataya (1999), measuring urban-scale distributions of Latin American countries, points out that in Brazil all the cities are being developed in a balanced way without a large gap in population scale between the primate city and other cities. On the other hand, the development of the Buenos Aires capital area and Mexico City is salient in Argentina and Mexico, respectively, and the cities second to such largest cities are not fully developed. Based on the similar technique, Figure 4 shows the results of measuring urban-scale distributions of China, Indonesia and Vietnam, which have three cities or more with a population exceeding 750,000 in

6 In China, there are 18 cities with a population of more than 2.5 million.
7 Due to limitations of usable data, only the distributions of large- and medium-scale cities with a population of more than 750,000 are studied here.

the East Asian region.[7] The cities are ranked in order of population scale on a horizontal axis, and the vertical axis shows cumulative totals of urban population from the lowest rank to the highest. Accordingly, the 45-degree line represents a completely uniform urban-scale distribution, while the more uneven the distribution is, the lower the line deviates from 45 degrees. In the chart, the rankings and cumulative totals of urban population are shown in percentile. The data of 2000 shows that all the cities are being developed in a balanced manner in China, for which the urban primacy is relatively low. Although the number of observations is small, Vietnam also has a pattern of balanced city development. In Indonesia, contrarily, the population is concentrated in large cities and the regional core cities have not been developed yet. However, as Figure 4 shows, the distributions of the three East Asian countries presented here, including Indonesia, are much more balanced than those of Argentina and Japan where overconcentration of population in a particular area is remarkable.

Figure 5 Scale of Urban Population by Region



Source: UN (2002).

(2) Absolute Scale of Urban Population

In urbanization, an absolute scale of urban population itself is very important. In addition to balanced development of urban systems, as stated above, one of the characteristics of urbanization in the East Asian region is that the total urban population is overwhelmingly large (NRC, 2003). As Figure 1 shows, the trends in urbanization rate of the Asian region are quite similar to those of the African region. However, while the scale of urban population of the entire African region is no more than 0.3 billion, that of the East Asian region (including Southeast Asian countries) exceeds 0.8 billion. The number of urban populations in the Central and South American region is about 0.4 billion. As Figure 5 shows, the scale of urban population in the East Asian region will double to about 1.5 billion by 2030, which accounts for 30% of the global urban population.

The scale of urban population is varied indeed. There are large cities, such as Shanghai and Jakarta, with a population of more than 10 million, while there are capitals, such as Phnom Penh and Kuala Lumpur, with a population of no more than 1 million. While the urbanization rates of Cambodia, Laos, Thailand and Vietnam are quite similar at this point, the urban population scales of Thailand and Vietnam are 12 times and 9 times as large as those of Laos and Cambodia, respectively. The urban population of China is already over 0.45 billion. Such difference in absolute scale of urban population is particularly important in the area where the absolute number of urban population has a direct implication, such as demand projection and development of urban infrastructure.

Suppose that the urban population of the East Asian region expands as projected. A huge amount of investment in infrastructure will be required so that

an additional 0.66 billion urban residents at maximum are well off in the coming 30 years.[8] This means, for example, that additional electricity supply, which is more than 600,000 MkWh in urban areas, is required, assuming the current average consumption amount per person in developing countries. Significantly, this amount of additional electricity supply is equal to the total installed capacity of India in 2002 (the load factor is assumed to be 50%).

Similarly, in telecommunication, additional equipment for 85 million new phone lines may be required in urban areas. More precisely, in practice, more investments will be necessary, since the consumption amount of public services per person will increase as the economy develops.

In addition to urban infrastructure, an expansion of the absolute scale of urban population will require sufficient development of formal sectors in employment and housing. That is, in urban areas of the East Asian region, employment and housing will be required to accommodate an additional 0.66 billion people in future. Unless employment and housing are sufficient, informal sectors of these areas may be further aggravated.

(3) Dynamic Urbanization

The third problem with an urbanization rate is that the dynamism of each city is hardly captured. It is important to observe the dynamic development process of a city. This is because the urban spatial cycle hypothesis tells us that a city follows the self-directive cyclical development, which consist of urbanization, suburbanization, de-urbanization and re-urbanization, based on housing and rent prices as indicators, with physical population capacity as a limiting condition. In fact, some major cities of Japan, U.S. and European countries have developed, following the urban spatial cycle hypothesis (Klaassen et al., 1981, Ikekawa, 2001). Assuming that the hypothesis is true, the theoretical consequence of rapid urbanization in developing countries might be rather optimistic. While population growth of large urban areas would stagnate as urbanization is furthered, the population of neighboring medium-sized cities would grow and the urban population would end up with a balanced distribution with many small-sized cities.[9]

In urban economics, the explanation for such dynamics is that an incentive for living near central business districts is lowered by the improvement of connectivity from neighboring areas to city central areas through lower transportation and telecommunication costs, while the rent price goes up as the population density increases in central areas. Above all, in segmentalized urban administration systems, the externalities of local public services that people can enjoy urban benefits irrespective of their residential area encourage people and firms to move to suburban areas and emerging cities and avoid paying public service expenses. Consequently, the expense of public services per person in urban areas would be increased for the remaining residents and firms, and such large cities often suffer from financial difficulties due to massive costs of maintaining their old public infrastructure. As a result, suburbanization and development of emerging cities will be further spurred. Such suburbanization has been experienced in the world since the 19th century (O'Sullivan, 2000). In the Tiebout model where decentralization materializes as an equilibrium of local public service provision, it is indicated that local government tax and public service selection are optimized through people's movement (voting with feet) under certain conditions.[10]

---

8 As stated later, the additional demand of urban infrastructure is proportionately smaller than the increase of urban population, to be precise. This is because the additional demand of infrastructure does not arise from the increase of urban population due to transfer to urban areas by classification. 9 See Klaassen et al. (1981) for details of the urban cycle hypothesis. The hypothesis mainly focuses on the relative population distribution of central cities and the neighboring cities. A similar argument can be applied for a relationship between large city areas and regional cities.

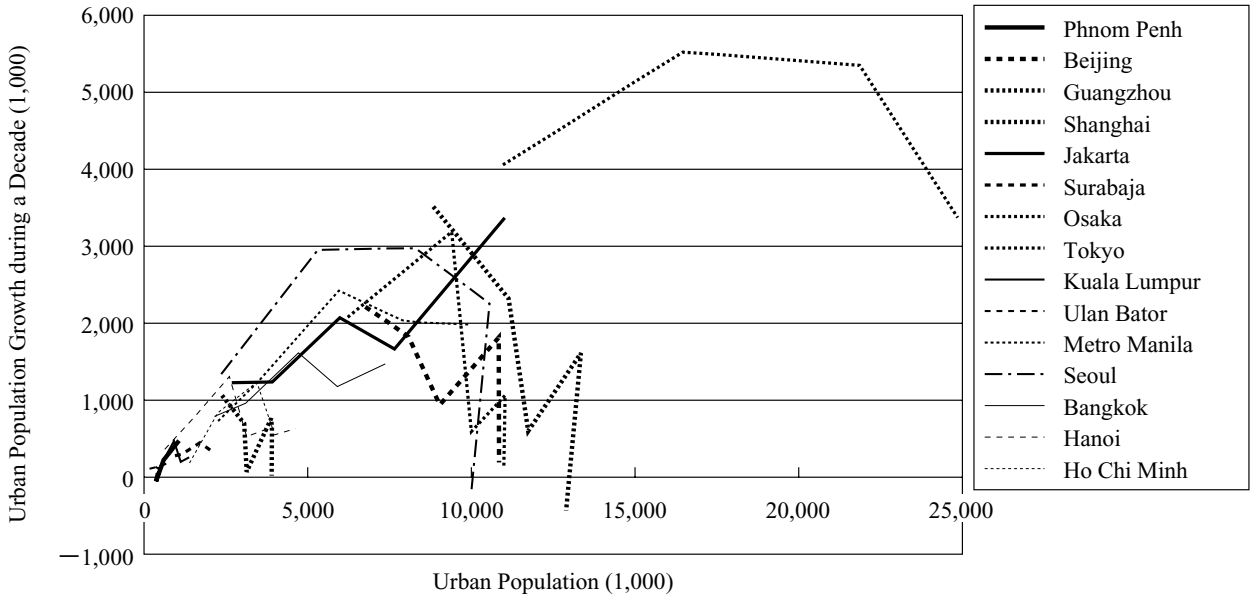
9 See Klaassen et al. (1981) for details of the urban cycle hypothesis. The hypothesis mainly focuses on the relative population distribution of central cities and the neighboring cities. A similar argument can be applied for a relationship between large city areas and regional cities.

10 The Tiebout model assumes that people have complete information about behavior patterns of local governments and enough mobility among geographic areas, that there are no scale economies and externalities in public services that exceed a local administrative unit, and that the expenses are paid out from poll tax. It has frequently been pointed out that these assumptions are not necessarily realistic.

In labor economics, the theory of equalizing differences, focusing on the relationship between wages and working or living environments, predicts that relatively high wages are paid as labor quality and a compensation for disamenity (bad working conditions, long commuting hours and poor living environment). Thus, it is expected that the real wages to which nominal wages are normalized by disamenity should converge at the same level across regions (Rosen, 1986). This is basically the same mechanism as Tiebout's model expecting a self-directive equilibrium of city systems. In fact, the existing empirical work shows that labor wages can be explained by various urban amenities. For example, Roback (1982) finds that a regional wage gap depends not only on land prices but also on the crime rates, unemployment rates and climates of the regions.[11] Therefore, more or less, a mechanism of the self-directive cycle seems to be effective on urbanization.

One of the most important implications here is the length of the urbanization cycle. The decennial movement of the urban population of major cities in the East Asian region for the period: 1960-2000 is shown in the phase diagram (see Figure 6). In this diagram, the process from urbanization to suburbanization in the urban spatial cycle hypothesis is illustrated by the inverted-U on the horizontal axis. In the process of urbanization, a city grows from around the origin on the chart to the upper right and then shifts to the lower right as the growth slows down. When an urban population starts to decrease, it goes into the negative side of the vertical axis, proceeding to de-urbanization and re-urbanization.

Figure 6 Urban Cycles of Major Cities in the East Asian Region (1960-2000)



Source: Compilation of data from UN (2002).

As Figure 6 shows, in the East Asian region excluding Tokyo, the population growth starts to be slowed down and adjusted over 5 million populations. When the number of a population is more than 10 million, many cities stop growing and start decreasing the population. For example, the number of population in Seoul decreased by 0.66 million during the decade before 2000. The population of Guangzhou also declined by 30,000. Tokyo is an exceptional case that the population continued augmenting until it reached 20 million in the 1980s.[12] In the major cities of developing countries in the East

11 Roback (1982) indicates that the crime rate and number of snowy or rainy days have positive effects on wages and that urban crimes and bad weather are disamenities for residents.

12 See Hatta & Tabuchi (1994) and Honjo (1998) for the issue of so-called "Tokyo problem" i.e. overconcentration of population in Tokyo.

Asian region shown in the chart, Jakarta is the only city with a population of more than 10 million and it is still expanding with a steady growth rate. Given the current trend until 2000, therefore, it threatens to follow a transition similar to that of Tokyo.

More importantly, Figure 6 shows that it takes at least 50 years for a city cycle to move from the expansion phase into the adjustment phase and for the population growth to start slowing down, even though there is a certain difference among regions in the adjustment speed of urban cycles. This means that population concentration in urban areas should not be left to simply depend on the self-directive counterturn of the cycle. If we leave excessive urbanization for more than half a century, the social welfare loss in economy would be significant. It is noteworthy that there are only a few East Asian cities that clearly shifted to the phase of de-urbanization or re-urbanization where an urban population decreases. In addition, it is important to recall that the urban cycle is irreversible rather than circulative in the medium term.

(4) Factors of Urbanization

Finally, an urbanization rate does not reveal the backgrounds of urbanization, although this is not necessarily the pitfall of only the urbanization rate. There are three factors of urbanization: natural increase in urban population, rural-urban migration and reclassification from rural to urban areas due to a population increase. It is extremely important in development policies to determine which factor causes urbanization. When the major parts are explained by natural increase or reclassification, the issues of urbanization are not so serious. It is because a change in classification has few significant impacts on the real economy, and a natural increase in population can occur everywhere, not only in urban areas. In that sense, what makes urbanization issues more complicated is rapid rural-urban migration, which generally accounts for about 40% of urban population growth (NRC, 2003). While there is a negative view on rural-urban migration that an excessive population inflow to urban areas expands the urban informal sector and leads to devastation of rural areas, there is also the positive view that it supports growth of urban areas providing inexpensive labor force. Another positive effect is that remittance by migrant workers increases purchasing power of rural areas.

One of the characteristics of urbanization in the Asian region is that rural-urban migration is the largest factor of population growth. On the other hand, the population growth in the Latin American and African regions is caused by natural increase (McGee, 1998). Interestingly, although it has been low in the Asian region compared with that of the Latin American region, the rate of rural-urban migration to rural population has sharply increased since the 1960s (Chen et al., 1998). If it is assumed for simplification that the rate of rural-urban migration to rural population of the Latin American region, the Asian region and the African region is 2%, 1% and 0.5%, the contribution of migration to population growth can be estimated at 25%, 49% and 20%, respectively. Thus, the impact of population flow from rural areas is strong in the Asian region.

Furthermore, Table 1 shows the estimates of the proportion of rural-urban migration rate to urban population growth in East Asian countries, which is based on a simple calculation using macro data, the "residual method."[13] Based on the population in 1985 (N_{1985}) and assuming that the annual death rate (μ) and the younger population rate under the age of 15 (d) are constant, the urban population only due to natural increase by 2000 is estimated (P_{2000}). Then, the proportion of rural-urban migration or reclassification can be computed by the difference between the estimated urban population by natural increase and the actual urban population (N_{2000}).[14] That is, the proportion of change in migration or reclassification to urban population growth (ρ) is calculated as follows:

13 See NRC (2003) for a more accurate calculation technique using the residual method.

14 The average mortality rate of males and females is used for the calculation of the annual death rate. The rate of the 0-15-aged population to total population is used for the calculation of the younger population rate. Each data is provided by the World Bank (2003a).

Table 1 Proportion of Migration or Reclassification to Urban Population Growth in East Asian Countries

	Urban Population (million)		Net Migration & Reclassification Percentage
	(1985)	(2000)	
Less developed regions	1,190,776	1,964,003	44.81
Eastern Asia			
China	246,089	456,340	68.27
China (Hong Kong)	5,070	6,860	51.61
DPR of Korea	10,683	13,415	-8.27
Japan	92,652	100,089	-77.20
Mongolia	1,051	1,434	-4.86
Republic of Korea	26,478	38,269	51.19
South Eastern Asia			
Cambodia	1,011	2,216	51.53
Indonesia	43,552	86,943	66.03
Lao PDR	500	1,018	46.25
Malaysia	7,197	12,758	44.20
Myanmar	8,927	13,220	27.81
Philippines	23,346	44,295	45.97
Singapore	2,709	4,018	50.90
Thailand	9,030	12,453	40.51
Viet Nam	11,558	18,816	36.73

Source: Compilation of data from UN (2002) and WB (2003).

$$\rho = (N_{2000} - P_{2000}) / (N_{2000} - N_{1985})$$
$$= \left(N_{2000} - \frac{N_{1985} \exp\left(-\int_0^{15} \mu dt \right)}{1 - \delta} \right) \Big/ (N_{2000} - N_{1985})$$

Looking at the proportion of migration or reclassification to urban population growth in the East Asian region, we find that those of Thailand and Vietnam are below 40%, lower than the average of developing countries. Meanwhile, the distinctly high numbers of China and Indonesia, which are over 65%, indicate that the major part of urban population growth comes from a population inflow to urban areas. In the existing studies, in China, the contribution degree of migration to the urban population growth is estimated at about 70% (McGee 1998, NRC 2003). This is because the frequent changes in urban classification have a large impact on the estimation, as for other East Asian countries, it is estimated that about half of the urban population growth results from natural increase in urban areas. We cannot classify changes in migration from reclassification in this estimation, which remains controversial. However, as far as urbanization in the East Asian region is concerned, it is clear that one of the challenges in the region is to control excessive rural-urban migration. Moreover, when the absolute scale of urban population, the extremely long urban cycle and the historical background of balanced development of urban systems are taken into consideration, it is concluded that a key task for East Asia is to manage rural-urban migration and maintain balanced growth among large city regions, regional cities and rural areas.

(5) Urbanization Patterns of East Asian Countries

Table 2 summarizes the current status of "urbanization" of major countries in the East Asian region based on the above discussion. China and Indonesia, with a very large urban population in absolute scale, have relatively low primacy rates and maintain balanced urban system development among all the cities including small and medium-sized cities. For both countries to keep this trend, rural-urban migration plays an extremely important role in urban population growth. It cannot be underestimated here that Jakarta is still growing. Thailand, the Philippines and Vietnam have a medium-sized population. While Thailand is showing a tendency

Table 2 Current Status of "Urbanization" of Major Countries in the East Asian Region

	Malaysia	Philippines	Mongolia	Indonesia	China	Thailand	Cambodia	Viet Nam
Urbanization Rate:	High (about 60%)			Rapidly Urbanized		Low (under 30%)		
Degree of Concentration in a Primate City:	Low	Medium (Decentralized)	Overconcentrated in a Particular Area	Low		Overconcentrated in a Particular Area		Medium (Decentralized)
Urban-Scale Distribution:	n.a.			Slightly Concentrated to Upper-Ranked Cities	Balanced	n.a.		Balanced
Absolute Scale of Urban Population (million):	(12.8)	(44.3)	(1.4)	(86.9)	(456.3)	(12.5)	(2.2)	(18.8)
Urban Cycle (major cities only):	Initial Stage of Growth	Stagnation in Population Growth	Initial Stage of Growth	Growing Trend (Jakarta)	Slowdown in Population Growth	Stagnation in Population Growth	Initial Stage of Growth	
Proportion of Migration or Reclassification to Urban Population Growth:	Medium			High		Low	Medium	Low

Source: Prepared by the writer.

toward overconcentration in a particular area, the trend in overconcentration is being mitigated in the Philippines and Vietnam due to growth of cities other than their primate cities during the past 20 years. The population growth in Bangkok has stagnated in recent years, and its challenge is how to deal with natural increase of the urban population in future. In other countries, such as Malaysia, Cambodia and Mongolia, the urbanization issue is considered to be relatively minor.

One key point in the argument on urbanization is that the presence of small and medium-sized cities with most of the urban residents is becoming large, while the international role of primate cities and large cities are becoming notable in the global economy. As Lo and Yeung (1998) point out, in the current global economy, it is the large cities that are expected to play an important role as world cities with network hubs for economic and social activities. On the other hand, large cities with a population of more than 10 million are exceptional in terms of number and urban population scale, and more than half of the urban population lives in small and medium-sized cities with a population of 1 million or less (World Bank 1999, NRC, 2003). Therefore, new issues would be raised, such as the responsibilities of small and medium-sized cities and coordination with and competition against large cities.

Chapter 3: Results of Urbanization: Macroeconomic Effects, Urban Infrastructure and Decentralization of Government Authorities

(1) Macroeconomic Effects

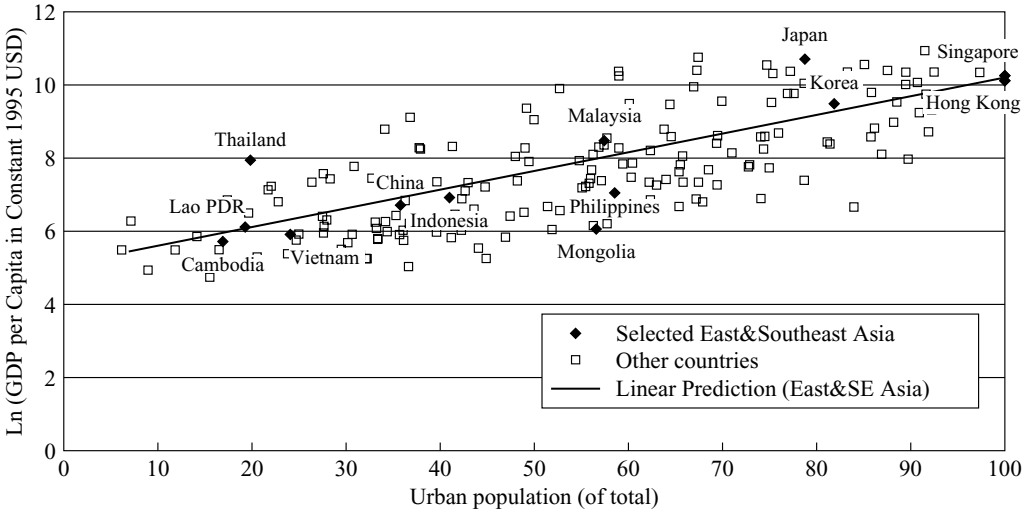
As stated above, urbanization of the East Asian region is defined from various aspects. No matter what definition is used, the importance is its effects and impacts. In this section, the macroeconomic effects of urban population growth are analyzed along with the impacts on quality of infrastructure for human life in urban areas and on the decentralization of government authorities. The urbanization effects on economic growth, poverty reduction and advancement of industrial structures are examined at the macroeconomic level.

① Economic Growth

The relationship between urbanization and economic growth is often pointed out. As Figure 7 shows, there is a significant positive correlation between them in East Asia and other countries (ADB 1999, World Bank 2000). The elasticity of economic growth to urbanization rate is estimated to be 2.71. It implies that a 1% increase in the urbanization rate raises the gross domestic product (GDP) per capita by 2.71%. This is the reason why urbanization is said to be an engine for growth. Although the causality is unsure, high productivity in urban areas by agglomeration economies leads to economic growth after all.

Importantly, however, urbanization is a necessary but

Figure 7 Urbanization and Economic Growth



Source: Compilation of data from UN (2002) and WB (2003).

not sufficient condition for economic growth. In fact, although the African region experienced urbanization at the same speed as that of the East Asian region during the past 40 years, urbanization did not necessarily boost the economy. According to Fay and Opal (2000), the living infrastructure of about two thirds of the urban population in the African region is in the informal sector, and a population inflow to urban areas is not effectively utilized for formal urban economic activities, because the rural-urban migration is induced by frequent conflicts in rural areas and the education standard of incoming people is low. As an inevitable consequence, although the urban population in the African region grew by 5.2% annually due to population inflows from rural areas after the 1970s, the wage gap between urban areas and rural areas was never resolved. Fay and Opal (2000) show that the differences in urbanization rate are explained mainly by the wage gap between urban and rural areas, and that there is a direct correlation between GDP and an urbanization rate, when the wage gap and the industrial structure are considered.[15]

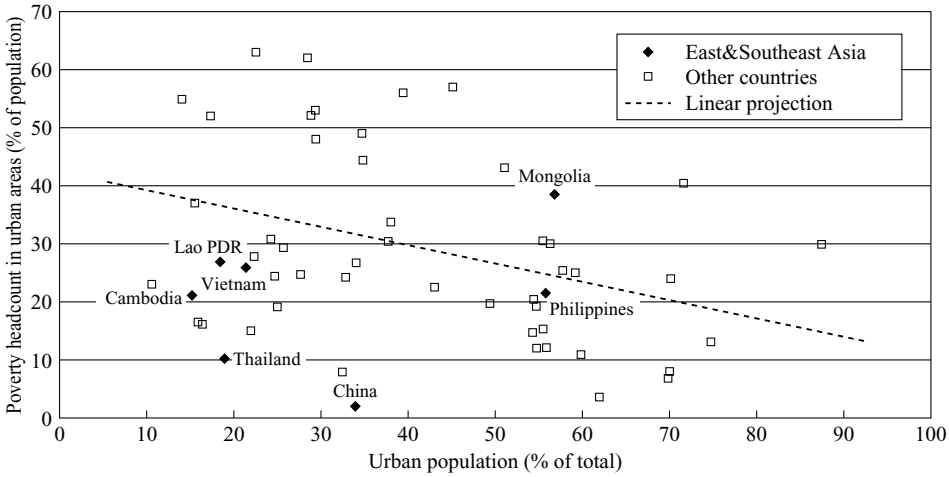
② Poverty Reduction

While urban areas are a strong driving force for economic growth, rapid urban population growth is criticized for deepening the poverty problems in urban areas. However, the aggregated macro data, regardless of one's prior expectation, show that there is no significant correlation between urbanization and urban poverty incidence (Figure 8). Rather, a 1% increase in urbanization rates results in a decline in the urban poverty rate by 0.23%. This means that the economic gains in terms of income and employment generated by the stimulated urban economy are more or less distributed to the urban poor, and thus contribute to poverty reduction in urban areas. However, this argument focuses only on income poverty on an aggregated data basis, paying little attention to social problems such as hygienic and health issues arisen from poverty. In fact, the World Bank (2003c), indicating that in the Philippines, the infant mortality rate of the poor is higher in urban areas than in rural areas, casts light on the fact that the living conditions for the urban poor are particularly weak in the social areas.

gative correlation between the national poverty rates over urban and rural areas and urbanization. Interestingly, this correlation coefficient is larger than that for only urban areas in absolute value. More specifically, when the urbanization rate increases by 1%, the national-level poverty rate goes down by 0.34%. Therefore, it means that the economic effects of urbanization would benefit not only the urban poor but also the rural poor through macroeconomic growth and stability along with remittance by migrant

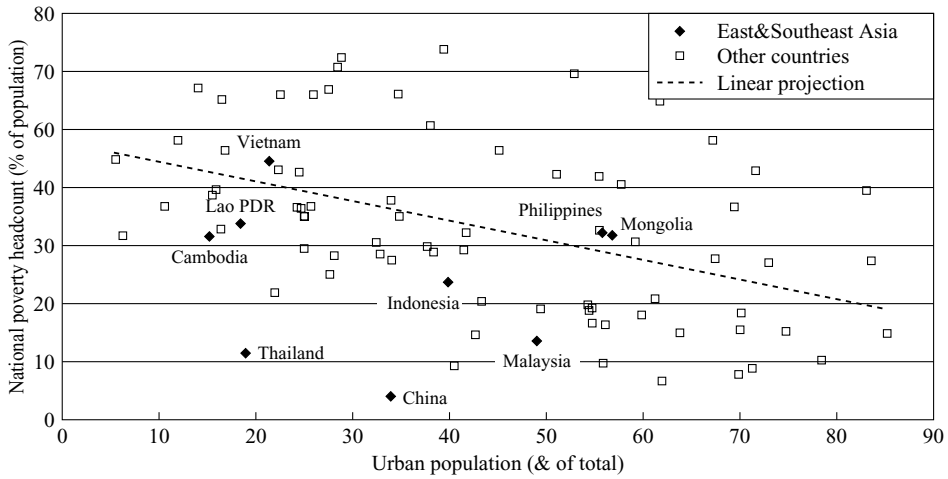
15 If other conditions are controlled, there is a correlation between an urbanization rate and the level of GDP per person. However, the correlation between a change in urbanization rate and GDP growth is still weak.

Figure 8 Relationship between Urbanization Rate and Urban Poverty Rate (Based on Recent Data: 1984-2000)



Source: Compilation of data from WB (2003).

Figure 9 Relationship between Urbanization Rate and Poverty (Based on Recent Data: 1984-2000)



Source: Compilation of data from WB (2003).

workers. In fact, JBIC (2003a) points out that the development of transportation infrastructure in Ha Noi and Haiphong, which experienced rapid urban population growth, not only promoted industrial agglomeration in their urban areas but also contributed to poverty reduction in the neighboring rural areas by accelerating changes in distribution systems and economic diversification in the region.

Another finding from Figures 8 and 9 is that most of the East Asian countries are located around the regression line or below. That is, the national-level urban poverty rates of East Asian countries are in general lower than the average poverty rate, with the urbanization rate controlled. In addition, in respect of a time-series trend in the urban poverty rate, urban poverty has diminished in the East Asian region, while it has expanded in South Asia since the 1990s. It can be concluded that the East Asian region has performed relatively well in poverty reduction. However, it never means that there is no urban poverty issue in the region. As explained in Chapter II, in terms of absolute scale, the number of the urban poor may have significant implications on various social aspects. The poor is also most vulnerable to external shocks so that it is necessary to take care of it from the aspect of social security. The World Bank

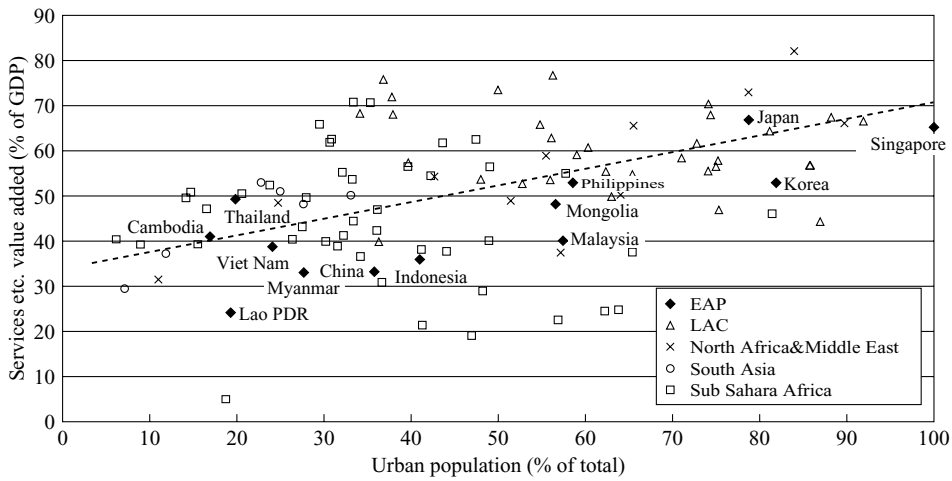
(2003b) stated that the poverty rate of Indonesia rapidly increased from 11.4% to 27.1% after the Asian crisis and that the urban poor was most likely to suffer from unemployment associated with the economic crisis.

③ Industrial Structures

A change in industrial structures should attract special attention in connection with a linkage between urbanization and economic growth. In urban areas, usable space is physically limited. Therefore, for urban areas to exploit more advanced agglomeration effects, development of non-land-intensive service industries is required. Recall that an urban area can be interpreted as agglomeration of consumption as well as concentration of production. Urban areas usually provide more diversified consumption opportunities than rural areas, since many shopping centers, opera houses, convention halls and recreational facilities are located at urban areas in response to their residents' demand. In turn this consumption diversification attracts further urban populations. As previously mentioned, the major employment in the urban areas is service industries in the Latin American region, where urbanization rose rapidly from the 1950s through the 1970s (Hataya, 1999). Figure 10 shows the relationship between the proportion of service industries to the GDP in 2001 and the urbanization rate. In general, there is a statistically significant and positive correlation. Of particular note, the share of service industries is lower in the East Asian region than the global average, except for Japan, Thailand and Cambodia. On the contrary, many of the Latin American countries are much more service-industry-oriented. The rates of service industries to GDP in major Latin American countries, such as Mexico, Argentina, Uruguay, Brazil and Jamaica are more than 60%. In Japan, the industrial structures of Tokyo experienced a quick shift to service industries in the 1970s when the overconcentration in the metropolitan area ("Tokyo problem") began to be concerned. In terms of employment, wholesale, retail sales, telecommunication and other services grew at a high speed (Honjo, 1998).

One of the physical conditions for a shift to service industries in urban areas is the development of thorough transportation infrastructure and information and telecommunication systems that enable efficient distribution. When service industries become the center of urban functions, people and goods generally flow in a small quantity at frequent intervals. Therefore, development and expansion of urban transportation infrastructure is necessary to survive an expansion of public transportation systems to ease heavy traffic. For example, the population of Ha Noi increased by 20% from 3.13 million to 3.75 million in the 1990s. An increase in traffic volume of people and goods including buses and trucks far exceeded the urban population growth in proportion.

Figure 10 Urbanization Rates and Service Orientation in Industrial Structures



Source: Compilation of data from WB (2003).

While the daily traffic volume on the National Highway No. 5 (NW5) around the center of Ha Noi was 281 buses, 1,078 regular trucks and 228 heavy trucks in 1993, it increased to 5,758 buses, 4,250 regular trucks and 4,368 heavy trucks in 2003 (JBIC, 2003a).[16] Such economies of frequency in distribution have an important external effect, possibly being one of the reasons for subsidizing public transport in urban areas. A marginal increase in public transportation users stimulates transport frequency, which in turn enhances the convenience of other users (Kanemoto, 1997). Additionally, the developed two-way information and telecommunication technologies are expected to partially substitute for physical movement of people and goods. For example, when Internet shopping with courier service becomes popular, it will be less meaningful for retail shops to be located on shopping streets in urban areas.

One of the reasons why advancement of industrial structures in the East Asian region is at a low level, in connection with urbanization, is that Asian countries have transferred more resources to the agricultural sector through investment in infrastructure, such as irrigation facilities and rural roads, than the Latin American region and the sub-Saharan African region (Teranishi, 1997). Consequently, the difference in utilization factors between rural and urban areas has been smaller than that of other areas. Furthermore, it is considered that urbanization of the East Asian region has been restrained because investment in rural infrastructure has created employment in rural areas and facilitated development of agriculture-related industries.[17] Fan et al. (2002) also point out that public investment in rural areas has partially contributed to poverty reduction and prevention of further widening of regional gaps in China, by estimating the effects of public investment in education and economic infrastructure in rural areas of the inland on agricultural productivity and regional economic gaps.

In summary, in the East Asian region, intensive public investment in rural areas has historically supported balanced development for urban and rural areas. In order to prevent excessive population concentration in urban areas, public investment in rural areas will continue to be important, and it is also expected that advancing industrial structure in urban areas will be essential if urbanization in the East Asian region is further accelerated in future.[18] Needless to say, all countries cannot shift to service industries, and industrial structures should be in accordance with the principle of global comparative advantages. It is important to remember that promotion of development of the agriculture sector not only mitigates urbanization but also plays an essential role in guaranteeing food security for a huge number of urban residents.

(2) Infrastructure in Urban Areas

It is reported that an excessive increase in urban population leads to aggravation of living infrastructure in urban areas. According to NRC (2003), public infrastructure, such as services of electricity, tap water and wastewater, is better provided, as the urban scale becomes larger, and the diffusion rates are lower in small and medium-sized cities and rural areas. This may differ from our intuitive understanding. However, from a viewpoint of statistics, it is also true that urbanization never lowers utilization factors of urban public infrastructure.[19] It is considered that this stems from the fact that a high ability to pay for public services in urban areas allows extensive investment in the

16 The observational data comes from the traffic volume at a spot closer to the National Highway No. 1 on the National Highway No. 5. For the purpose of data consistency, hourly fluctuations in traffic volume are ignored and the traffic volume (2003) observed in 14 hours is simply converted to the base of 24 hours a day. The traffic volume of regular cars increased from 1,424 in 1993 to 4,860 in 2003.

17 In fact, in Teranishi's analysis in which an urbanization rate is regressed by the agricultural GDP rate, the regression coefficient is not significant but negative.

18 If information and telecommunication technologies are further developed and cost less in the future, the significance of the geographic location of service industries may be meaningless (Kikuchi, 2004). Meanwhile, according to Park (2003), even if information and telecommunication infrastructure is fully developed, face-to-face communication is important in economic activities and decentralization of geographic agglomeration is difficult.

19 When data from the World Bank (2003) is used, the correlations between urbanization rate and urban access rates of tap water and wastewater are both positive.

better quality of infrastructure capital. Of course, the income level is relatively high in urban areas. Moreover, in construction of infrastructure networks, urban areas may be able to take advantage of scale economies because of their higher population density. In fact, McIntosh (2003) shows that the willingness-to-pay for tap water services of the urban poor is much higher than expected. Some households in the metro-Manila without access to public water supply services are purchasing water from private vendors at more than quadruple the public water tariffs. Therefore, as far as public services in urban areas are concerned, an institutional question is how to design mechanisms to encourage the private sector participation.

Figures 11, 12 and 13 show the diffusion rates by urban scale of tap water & well water, flush toilets and electricity, respectively, for home use.

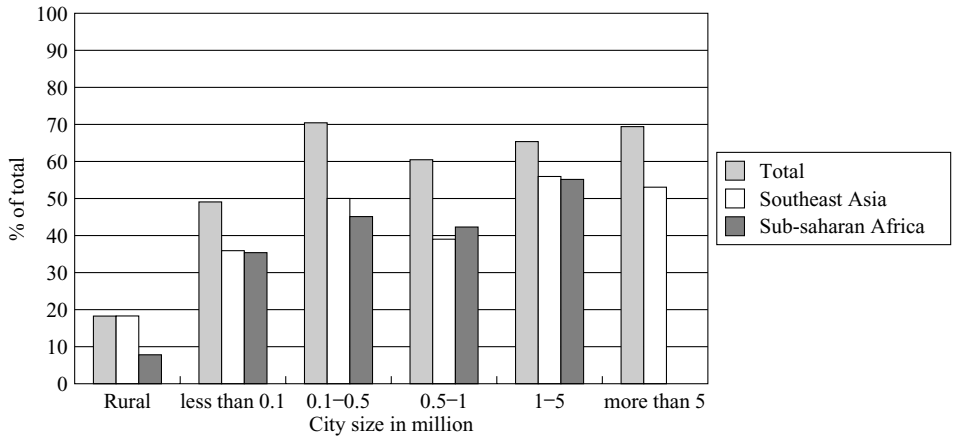
For comparison purpose, these figures reflect the diffusion rates of the sub-Saharan African region where the urbanization rate denotes the same tendency as that of the East Asian region. The first characteristic of the infrastructure diffusion in East Asia is that gaps among large cities, medium-sized cities and rural areas are small, which is consistent with the above finding by Teranishi (1997).Investment in infrastructure in the East Asian region has been evenly distributed geographically. The second characteristic is that the infrastructure development in small cities with a population of 100,000 or less and of rural areas is relatively limited in the East Asian region, and thus intensive investment in such areas may be necessary for balanced development for urban and rural areas. However, it is noteworthy that although public investment in urban areas in general mitigates congestion and partly solves the overconcentration problem, it sometimes fosters further overconcentration by inducing private firms and people to move to urban areas with a better quality of infrastructure. (Yoshino & Nakano, 1994). The third characteristic is that in East Asia, the access rate of water is lower than the global average and no more than around 50% in large urban areas with a population of more than 5 million, while the diffusion rates of electricity and flush toilets are higher than the global standard, reaching more than 80% in cities with a population of more than 100,000. In small cities with a population of 100,000 or less and rural areas, the access to water is no more than 20-30%. Because of the difference in data definitions, a time-series comparison with the above data is not straightforward, but the rate of access to high-quality water in East Asian urban areas decreased from 97% in 1990 to 93% in 2000. On the other hand, the rate of access to sanitation facilities improved from 61% to 72%. In the rural areas, the rate of access to water increased from 61% to 67%, and that to sanitation facilities increased from 24% to 34%, during the same period (World Bank 2003a). Therefore, in terms of sectors, access to water would be one of the most important areas to develop among public infrastructure services in urban areas of the region in future.

(3) Decentralization of Government Authorities

Along with the discussion of urbanization, there is much debate about decentralization of governmental responsibilities and authorities in the East Asian region. As World Bank (2000) points out, it is not possible to tell whether decentralization is right or wrong, since it is just a political and administrative tool. In basic theory, decentralization is rational since public services are more effectively and efficiently provided by the local government than by the central government. This is essentially because the local government is more familiar with the preferences of local residents through political channels, such as local elections. This argument is based on the informational advantages of the local government and is called the decentralization theorem. In urban economics, this decentralization theorem is implicitly assumed in the discussion of a mechanism for supplying local public services, including the Tiebout mechanism mentioned in Chapter II.. If a local government does not provide public services so that the demands of local residents are met, they would move out to other areas. Therefore, it creates an incentive for the local governments to respond to their local residents and maximize local tax revenues.

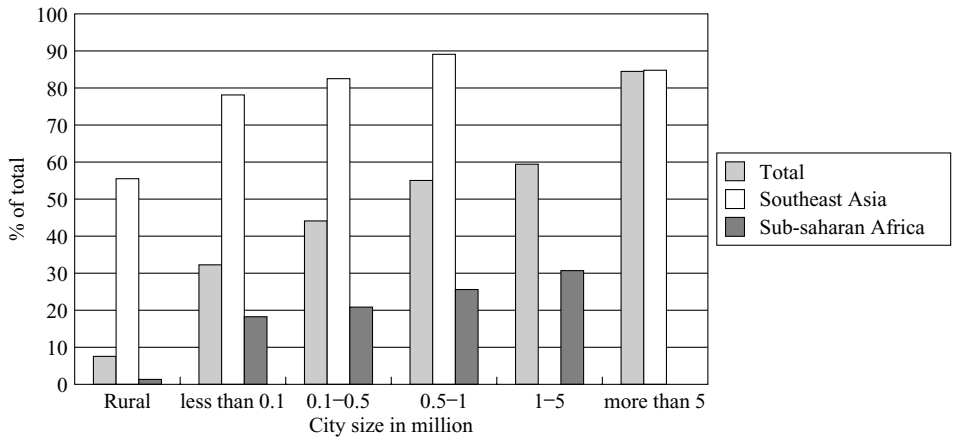
However, in reality, the relationship between decentralization and economic growth is not so self-evident. As explained by Sato (2004), the existing analyses indicate that in developing countries, there is

Figure 11 Diffusion Rates by Urban Scale of Tap Water & Well Water for Home Use



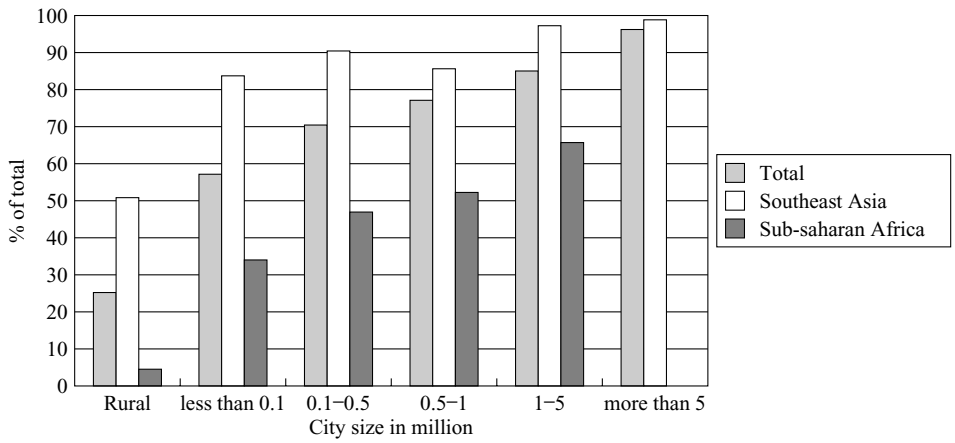
Source: NRC (2003).

Figure 12 Diffusion Rates by Urban Scale of Flush Toilets for Home Use



Source: NRC (2003).

Figure 13 Diffusion Rates by Urban Scale of Electricity for Home Use



Source: NRC (2003).

a negative correlation between devolution of public spending to the local level governments and regional economic growth. It seems to be really difficult to ensure that the benefits of decentralization in decision making would materialize. For example, Zhang and Zou (1998), examining the relationship between the share of the local government's financial spending and the growth of local economy, based on the provincial-level data from 1980 through 1992, show that there is a negative correlation between decentralization and growth. Note that in China, fiscal decentralization has been rapidly promoted since the 1970s. While development spending by the central government contributes to growth, spending on education and other human investments by local level governments is conducive to economic development. In a cross-country analysis, moreover, Davoodi and Zou (1998) points out that decentralization is negatively correlated with growth, based on the data of the 1970s to the 1980s.[20]

Such negative correlation between decentralization and growth is caused by various factors related to decentralization, including the relationship between the central and local governments under the decentralized circumstances, and the alignment of responsibilities and authorities over governments. That is, the question is what functions should be transferred to which level of governments. Generally, there are three types of decentralization: political, fiscal and administrative. Moreover, there is decentralization of financial resources and public spending in fiscal decentralization. The administrative decentralization takes place in various areas, such as planning, implementation and management of public services. Further discussion is needed about which government functions should or can be delegated to which government levels. It is also controversial when it is possible.. In that context, it is important to note that many local governments currently have their own limit in administrative capacity, and thus it would take certain time to build up their capacity. It is also noteworthy that participation of local residents in governmental decision-making might foster corruption. Therefore, the governance factors of the local governments are considered to crucially affect success of decentralization.

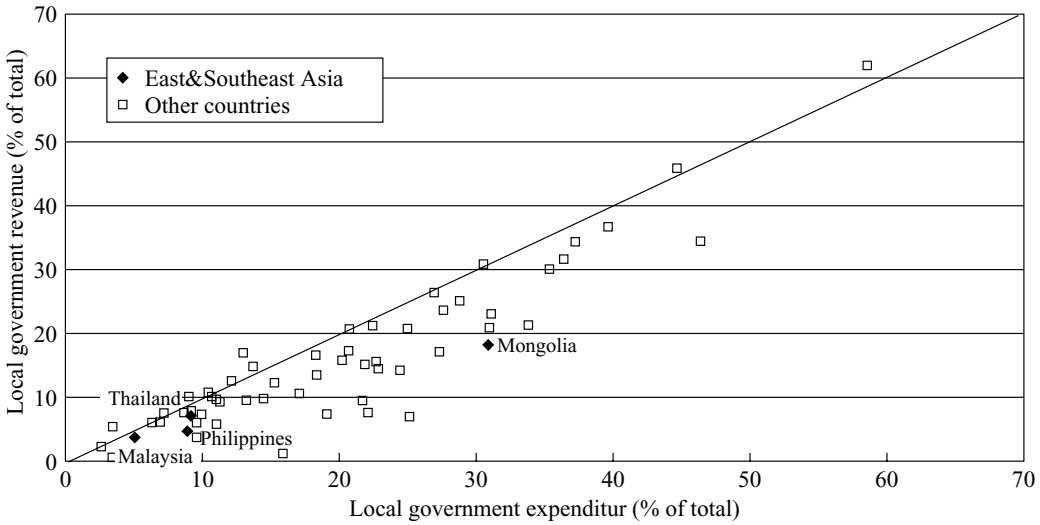
In the relationship with urbanization, there is an argument that local level governments, which directly manage rapidly growing urban areas (urban governments), can play a main role in providing public services more effectively in line with decentralization (World Bank, 2003b). Theoretically, whether the urban government is an optimal unit for supplying local public services depends on the relationship among economies of scale for the supply of public services, presence of critical mass, and externalities of public services, cross subsidization and universal services. Obviously, excessively segmented public service networks are inefficient in terms of cost performance. If network externalities across jurisdictions are not accommodated, it is a coordination failure. For example, the separate electricity systems operated by individual local governments lead to a huge loss of economic benefits, since intergovernmental coordination in supplying and purchasing electricity would improve efficiency of power generation and distribution.

The decentralization theorem tells us that the first requirement for urban government to efficiently supply local public services is a mechanism in which the demands of citizens are reflected in the plans of the local government through political decentralization. It is a key how to systematize citizen participation in budget preparation and planning of public investment, not only in direct election at a local level. The second requirement is fiscal decentralization. This is because the urban

20 Davoodi and Zou (1998) present a framework of the theoretical analysis about optimal financial decentralization. According to the framework, given the rate of total government spending to GDP, optimal allocation ratios of fiscal spending by central and local government are in proportion to the elasticity of their public investment to GDP.

21 In these respects, in the East Asian region, although financial decentralization in China is advanced, the mechanism of citizen participation in the decision making of public investment still seems to be weak. Meanwhile, in the Philippines, although political citizen participation seems to be advanced, financial decentralization is insufficient. In recent years, the proportion of government spending by local government has been decreasing in the Philippines. Indonesia is trying to promote decentralization in both areas simultaneously with a "Big Bang".

Figure 14 Decentralization of Tax Sources and Public Spending (Based on Recent Data: 1991-2001)



Source: Compilation of data from Government Finance Statistics Yearbook 2001.

governments that understand their citizen demands should actually provide public services.[21] In the discussion of decentralization, revenue shortage of the local government is always problematic. In the general discussion of local government finance, there are two approaches for local governments to supply public services: (1) tax sources are kept by the central government and government spending is decentralized through intergovernmental transfer to local government; and (2) taxation itself is delegated. If tax sources are distributed in proportion to spending, there is no difference between the two approaches. However, if tax sources are allocated disproportionately to urban areas, for example, reallocation by the central government is possible in the former approach, while it is impossible in the latter. Therefore, fiscal decentralization, discussed in relation to urbanization, is necessarily closely related to regional disparity and balanced urban system development.

Figure 14 plots the shares of tax revenue and public spending by local governments as the degree of fiscal decentralization. It is shown that decentralization in tax sources and spending does not progress globally in gross, although there is a sample problem. The share of the local government is about 10-30% and the role of the central government is still significant. Secondly, it is also found that focusing on the relationship between the two, decentralization on the revenue side tends to follow that on the expenditure side. This is because politicians might be concerned that too rapid decentralization of tax sources might impede balanced development of urban areas and rural areas. Otherwise, the central government may adhere to financial authorities simply due to political reasons. Therefore, thirdly, the transfer of financial resources by the central government has a certain role to play in many countries. The limited funding capacity of the local governments can be explained by the fact that the authority for taxation is not sufficiently delegated to local governments while their responsibility for providing services is more decentralized. Without sufficient fiscal autonomy, it is even difficult for local governments to fund through the market in a form of public bonds or foreign loans. Unless tax sources are delegated in proportion to public spending it is necessary for the central government to clarify the rules of intergovernmental transfer. In the decentralization of Indonesia, the allocation ratio of tax revenues collected by the central government is clearly defined.

In sum, the challenges for East Asia where urbanization would be accelerated in future are how to decentralize taxation to the urban governments, and how to design a reallocation mechanism among governments under the leadership of the central government. In fact, in Indonesia, which has been working on decentralization most rigorously in the East Asian region, most of the authorities and roles of

the central government, excluding diplomacy, finance and military affairs, have been delegated to 416 local governments (ko-tas, kabupatens) since January 2001. However, as a result of drastic decentralization, there emerges institutional flaws, such as a shortage of fundamental tax sources for local level governments, abuse of authorities to levy taxes, and insufficient regulation of national tax reallocation. Particularly, it is a problem in Indonesia that the fixed-asset tax, used as a fundamental local tax globally, is still federal tax (World Bank, 2003b). The taxes suitable for local tax are consumption tax and sales tax in addition to fixed-asset tax, in a sense of even distribution between urban and rural areas. From the viewpoints of geographical balance and stability in tax revenue, business tax and income tax are not suitable for local tax (Sato, 2004). Moreover, in the "Big Bang (decentralization)" of Indonesia, the tertiary level local governments, as a subordinate administration unit of 30 provinces under the central government, undertook full obligations of managing and providing public services, education, medical services, public investment and environmental conservation. Therefore, it is now essential for them to foster administrative abilities of local government staffs.[22]

Another decentralized nation in the East Asian region is China, which is in some sense regarded as a nation of one-party rule where the central government has a strong authority. Since the 1970s, it has actively promoted decentralization in economy and fiscal affairs. As a matter of fact, decision-making in corporate tax rate is delegated to each city, and induction of direct corporate investment is completely under the control of the local governments (332 local-level governments) (Won, 2003).[23] The difference inIndonesia is that the administrative process is obscure and the discretionary zone of the local government is very wide. Such obscurity might lead to corruption or create unstable factors in the macroeconomy (World Bank, 2000). However, China is also faced with the same challenge as Indonesia, that is how the central government should coordinate cities and regions. As Won (2003) points out, as independence of cities becomes strong in China, investments by many cities are duplicated. The intense competition among cities in the domestic market may lead to inefficiency in economic systems as a whole. Accordingly, their future assignment is to determine to what extent they accept regional disparity and how they would control for excessive regional gaps through fiscal decentralization and coordination under the central government, as urbanization proceeds.

Chapter 4: Conclusion

The urban population of the East Asian region is growing rapidly and will become the core of global urbanization in future. The absolute scale of the urban population is overwhelmingly large and expected to account for 30% of the global urban population by 2030. Urbanization is partly captured by the proportion of urban residents to total population. However, the urbanization in the region is more diverse and the characteristics vary throughout regions. One of the characteristics has been the balanced urban system development in urban and local areas. Although concentration of population in a primate city is observed in some countries, such as Thailand, local cities have been developed in a balanced manner in the East Asian region. This is partially because of the improvement of living standards in non-urban areas by public infrastructure investment in rural areas. Furthermore, policies aimed at disperse industries and employment to areas other than capital areas have been implemented in Thailand and the Philippines, contributing to the balanced urban development to some extent. In fact, there has been no significant difference in diffusion rates of public infrastructure, such as electricity, tap water and wastewater services between urban and local areas in East Asia.

With the economy presently being globalized, the major cities of the East Asian region are expected to function as global cities. As urbanization proceeds, further advancement of urban industrial structures,

22 There occurs an issue of disparity in laws for regulation of decentralization.
23 In China, there are 31 provinces, which include 332 local-level governments under which 2,873 prefectural governments exist.

along with development of non-land-intensive industries such as service industries, is required. The development of service industries creates employment in urban areas and would be useful for urban poverty reduction and self-directive development of local economy. Actually, as a global trend, there has been a significant relationship between service orientation in economy and urbanization. Urbanization has been a driving force for economic growth and poverty reduction. For promoting service orientation in urban economy, it is essential to develop street-level transportation infrastructure and information and telecommunication systems that enable efficient distribution in concentrated urban areas.

Accordingly, in response to rapid urbanization in the East Asian region, a key issue is how to maintain balanced development of large cities, regional cities and rural areas by taking proper steps toward urbanization promoted through service orientation in the urban economy. This cannot be underestimated, when (1) the absolute scale of urban population in the region, (2) the irreversible urban cycle with a long adjustment period, and (3) the significance of rural-urban migration to urban population growth are taken into account. Under the present situation, the public service infrastructure in small and medium-sized local cities and rural areas is relatively weak compared with that in large cities. To prevent excessive population concentration in urban areas, public investment in such areas continues to be necessary. Promoting rural areas will also be important in terms of food security for urban areas.

As urban areas are dominating economy, decentralization, particularly fiscal decentralization, becomes an important instrument for public investment allocation among regions. Since some cities have been developed enough, , it is necessary to further discuss which functions and authorities of the central government should be delegated to which local government, and how the central government should coordinate cities under the decentralized environment.

References

Ariga, K. & Ejima, S. (2000), Kingdom of Thailand: overall impact assessment of the East Coastal Area Development Plan. JBIC Institute Report, No. 2. JBIC.

Hataya, N. (1999), Urbanization and neighborhood community in the Latin American region. Kokin Shoin.

Hatta, T. & Tabuchi, T. (1994), Factors and measures for overconcentration in Tokyo. In *Economic Analysis of Overconcentration in Tokyo: Contemporary Economic Study Series 7,* Hatta. eds. Nihon Keizai Shimbun, Inc.

Ikekawa, S. (2001), Japan's urban cycle and direction of urban development: analysis of the postwar 50 years by the ROXY indicator. *Sogo Kenkyu, Volume* 20. Nippon Research Institute.

JBIC. (2003a), Vietnam: impact assessment of the North Transportation Infrastructure Project. *Ex-Post Evaluation Report 2003 of Yen-Loan-Financed Project.* JBIC.

JBIC. (2003b), Impact survey of contribution by yen-loan-financed project in the Cebu capital area.

Kanamoto, R. (1997), Urban economics: progressive economics series. Toyo Keizai Inc.

Kikuchi, T. (2004), Communication network and international trade. In *Path of Economics: Economic Analysis in the Age of Earth,* Kaji, Yanagawa, Shirai, and Tsumagari, eds. Keio University Press.

Teranishi, J. (1997), Interdepartmental transfer of resources, conflicts and macro stability in economic development. In *Economic Development and Roles of Government in the East Asian Region,* Aoki, Kim and Okuno-Fujiwara, eds. Nihon Keizai Shimbun, Inc.

Won, S. (2003), Future of Chinese economy. The Mainichi Newspapers Co.

Yoshino, N. & Nakano, H. (1994), Public investment allocation to the Tokyo metropolitan area. In *Economic Analysis of Overconcentration in Tokyo: Contemporary Economic Study Series 7,* Hatta. eds. Nihon Keizai Shimbun, Inc.

JAPAN BANK FOR INTERNATIONAL COOPERATION (JBIC)
http://www.jbic.go.jp/

4-1, Ohtemachi 1-Chome, Chiyoda-ku, Tokyo 100-8144, Japan
Telephone +81-3-5218-9720 (JBIC Institute),Facsimile +81-3-5218-9846

Osaka Branch
13th fl., Aqua Dojima East 4-4, Dojimahama 1-Chome Kita-ku, Osaka 530-0004, Japan
Telephone +81-6-6346-4770 Facsimile +81-6-6346-4779

Overseas Network

Representative Office in Beijing

3131, 31st Fl., China World Trade Center, No.1 Jian Guo Men Wai Ave., Beijing 100004, The People's Republic of China
Tel. 86-10-6505-8989, 3825～8,1196, 1197
Fax.86-10-6505-3829,1198

Hong Kong Office

Suite 3706, Level37, One Pacific Place, 88 Queensway, Hong Kong
Tel. 852-2869-8505～7
Fax.852-2869-8712

Representative Office in Bangkok

14th Fl., Nantawan Building, 161 Rajdamri Road, Bangkok 10330, Thailand
Tel. 66-2-252-5050
Fax.66-2-252-5514,5515

Representative Office in Hanoi

6th Fl., 63 Ly Thai To Street, Hanoi, Viet Nam
Tel. 84-4-8248934～6
Fax.84-4-8248937

Representative Office in Jakarta

Summitmas II 7th Fl., Jl. Jenderal Sudirman, Kav. 61-62, Jakarta Selatan, Jakarta, Indonesia
Tel. 62-21-522-0693
Fax.62-21-520-0975

Representative Office in Kuala Lumpur

22nd Fl., UBN Tower, Letter Box No. 59, Jalan P, Ramlee 50250, Kuala Lumpur, Malaysia
Tel. 60-3-2072-3255,2201,2202
Fax.60-3-2072-2115

Representative Office in Manila

31st / Floor, Citibank Tower, Valero St. corner Villar St., Makati, Metro Manila, Philippines
Tel. 63-2-848-1828, 752-5682
Fax.63-2-848-1833～35

Representative Office in Singapore

9 Raffles Place, #53-01 Republic Plaza, Singapore 048619
Tel. 65-6557-2806
Fax.65-6557-2807

Representative Office in Colombo

Level 13, Development Holdings 42, Navam Mawatha, Colombo 2, Sri Lanka
Tel. 94-11-300470
Fax.94-11-300473

Representative Office in Dhaka

IDB Bhaban（5th Floor）, E/8-A, Begum Rokeya Sharani, Sher-E-Bangla Nagar, Dhaka-1207, Bangladesh
Tel. 880-2-811-4081, 6700（Direct）
Fax.880-2-811-3336（Direct）

Representative Office in Islamabad

5th Floor, Evacuee Trust Complex, Aga Khan Road, F-5/1 Islamabad, Pakistan
Tel. 92-51-2820119
Fax.92-51-2822546

Representative Office in New Delhi

3rd Fl., DLF Centre, Sansad Marg, New Delhi 110001, India
Tel. 91-11-371-4362, 4363, 7090, 6200
Fax.91-11-371-5066, 373-8389

Representative Office in Sydney

Suite 2501, Level 25, Gateway 1 Macquarie Place, Sydney, N.S.W. 2000, Australia
Tel. 61-2-9241-1388
Fax.61-2-9231-1053

Representative Office in Moscow

123610 Moscow, Krasnopresnenskaya Nab.12, World Trade Center, Office No. 905, Russian Federation
Tel. 7-095-258-1832, 1835, 1836
Fax.7-095-258-1858

Representative Office in Frankfurt

Taunustor 2, 60311 Frankfurt am Main,Germany
Tel. 49-69-2385770
Fax.49-69-23857710

Representative Office in London

4th Fl., River Plate House, 7- 11 Finsbury Circus, London, EC2M 7EX, U.K.
Tel. 44-20-7638-0175
Fax.44-20-7638-2401

Representative Office in Paris

21, Boulevard de la Madeleine 75038 Paris Cedex 01, France
Tel. 33-1-4703-6190
Fax.33-1-4703-3236

Representative Office in Cairo

Abu El Feda Bldg., 16th Fl., 3 Abu El Feda Street, Zamalek, Cairo, Egypt
Tel. 20-2-738-3608～9
Fax.20-2-738-3607

Representative Office in Nairobi

6th Fl., International House, Mama Ngina Street, P.O. Box 49526, Nairobi, Kenya
Tel. 254-2-221420, 221637
Fax.254-2-221569

Representative Office in New York

520 Madison Avenue, 40th Floor, New York, NY 10152, U.S.A.
Tel. 1-212-888-9500, 9501, 9502
Fax.1-212-888-9503

Representative Office in Washington, D.C.

1909 K st., N.W., Suite 300, Washington, D.C. 20006, U.S.A.
Tel. 1-202-785-5242
Fax.1-202-785-8484

Representative Office in Bogota

Calle 114,No9-45 Torre B, Oficina 601
Teleport Business Park, Bogota, D.C., Colombia
Tel. 57-1-629 -2436, 2437, 2438
Fax.57-1-629-2707

Representative Office in Buenos Aires

Av. Del Libertador No.498, Piso19, 1001 Capital Federal Buenos Aires, Argentina
Tel. 54-11-4394-1379, 1803
Fax.54-11-4394-1763

Representative Office in Lima

Av.Canaval Moreyra No380, San Isidro, Lima 27, Peru
Tel. 51-1-442-3031
Fax.51-1-440-9657

Representative Office in Mexico City

Paseo de la Reforma 265 Piso-16, Col. Cuauhtemoc, Mexico, D.F. 06500, Mexico
Tel. 52-55-5525-67-90
Fax.52-55-5525-34-73

Representative Office in Rio de Janeiro

Praia de Botafogo, 228-801 B,Botafogo, CEP.22359-900, Rio de Janeiro, RJ,Brazil
Tel. 55-21-2553-0817
Fax.55-21-2554-8798

Toronto Liaison Office

P. O.Box493, 2 First Canadian Place, Suite3660, Toronto, Ontario, M5X 1E5, Canada
Tel. 1-416-865-1700
Fax.1-416-865-0124


JBIC
JAPAN
BANK FOR
INTERNATIONAL
COOPERATION