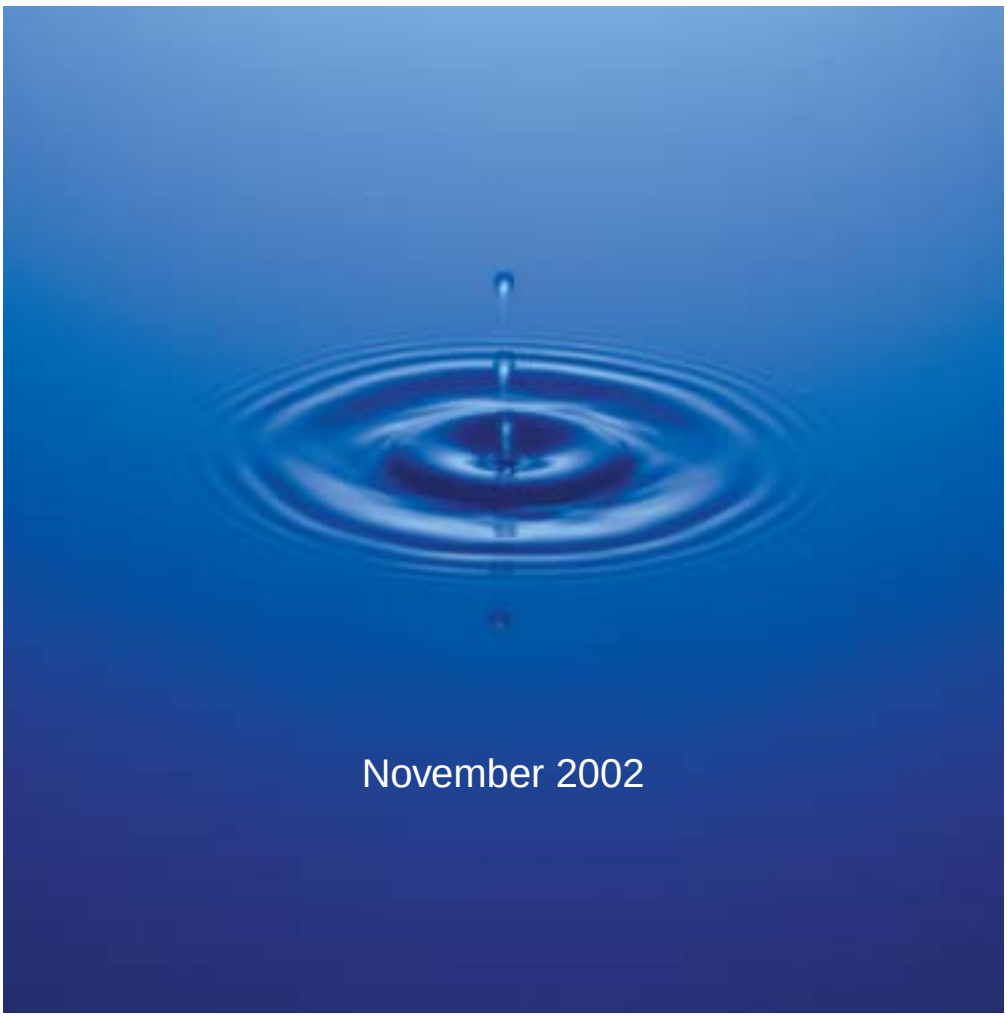
The Study on Development Assistance in Water Sectors

Response to Water Problems in Developing Countries

Summary - Issues and Proposals -



November 2002

Institute for International Cooperation
Japan International Cooperation Agency

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The analysis and recommendations of this Report do not necessarily reflect the views of JICA. It is the fruit of a collaborative effort by the study committee headed by Dr. Katsumi Mushiake, Professor of Institute of Industrial Science, the University of Tokyo.

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Published by Second Research and Development Division,
Institute for International Cooperation,
Japan International Cooperation Agency
10-5 Ichigaya Honmura-cho, Shinjuku-ku, Tokyo 162-8433 Japan
FAX: +81-3-3269-2185
E-mail: jicaiic2@jica.go.jp

FOREWORD

It is said that 1.1 billion people in the world do not have access to safe water, and 2.4 billion are without access to appropriate sanitation. Not only is there a safe water supply problem, but there are also many other water problems such as water shortage, water pollution, floods, droughts, groundwater drainage / contamination, and disputes over international rivers. By the mid-21st century, when the world population is expected to exceed 9 billion, the water problems will be more critical than those of the oil crisis in the 20th century as the most urgent issue among others.

Under these circumstances, the international community has begun to take various measures, focusing on water problems. The Agenda 21, agreed at the 1992 United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, pointed out that "water is essential not only to human beings but also to all ecosystems". Subsequently, the World Water Council (WWC) was founded in 1996 and, at its initiative, the "1st World Water Forum" was held in Marrakech, Morocco in 1997. The "World Water Vision" was announced at the "2nd World Water Forum", held in The Hague, the Netherlands in 2000 and the "3rd World Water Forum" will be held in Japan in 2003.

In response to the current water situation of the world, Japan International Cooperation Agency (JICA) organized from March to October 2001 internal review meetings involving senior water sector specialists and advisors. The objectives of these meetings were to classify comprehensively JICA's past performance of cooperation in water sectors and to propose a fundamental plan for future cooperation in water sectors. In February 2002, the "Study Group on Development Assistance in Water Sectors" was established and, based on Japan's experience and standpoint as a main donor, it has made various proposals on comprehensive water management and safe water supply in poverty areas.

The study group is composed of a chairperson, Professor Katsumi Mushiake, seven committee members, advisors, and a task force. Eight workshops have been held to date. This report has been compiled as a result of this study group's work. It is my sincere hope that this publication will not only be fully utilized in executing Japan's cooperation projects in the future, but that it will also be widely available to the relevant organizations.

I acknowledge deeply the efforts to arrange this report by Chairperson, Professor Katsumi Mushiake, all committee members, advisors, and the task force. I am also very grateful to the people who participated in the discussions of this study group.

November 2002

Takao Kawakami

President

Japan International Cooperation Agency

PREFACE BY THE CHAIRPERSON

As it is said that “the 21st century is a century of water”, there has been increasing global attention focused on resolving water problems that are especially serious in developing countries. Under these circumstances and taking advantage of the “3rd World Water Forum” that will be held in Kyoto in March 2003, the “Study Group on Development Assistance in Water Sectors” was established in February 2002 with the aim of reviewing results and problems of past assistance that Japan International Cooperation Agency (JICA) has extended in water sectors, and proposing future policies. This study group is composed of academic researchers with different specialties, committee members from JICA and the Japan Bank for International Cooperation (JBIC), experienced JICA senior advisors, and younger staff members. This report is compiled on the basis of substantial and interactive discussions between academic researchers and experienced practitioners.

For almost thirty years, JICA has been carrying out assistance activities, studies, projects, dispatch of experts, and training in Japan in water related areas such as water resources development and management, agricultural development, flood control, and environmental protection. However a study group to discuss the entire “water sector” extensively and comprehensively had never really existed. The reason for this seems to be that Japan’s ODA to date has been based on requests from recipient countries and mainly involved in individual projects. However, it is crucial to establish, from cross-sectional and comprehensive points of view, a fundamental stance, priority areas, and executing strategy for Japan to deliver effective and efficient assistance and cooperation to solve water problems that are most serious in developing countries. This was the consensus of the study group members.

Having recognized this, the study group emphasized a fundamental stance whereby Japan, as a primary donor after the United States, should not only help find solutions for globally important water problems but also provide assistance and cooperation utilizing Japan’s abundant experiences in tackling various water problems for its own modernization.

In this study group report, experienced practitioners of JICA have classified issues in each water sector and reviewed Japan’s performance of assistance. The committee members have classified issues related to their specialties and presented proposals. The five special priority areas of assistance and cooperation pointed out are “comprehensive water management in monsoon Asia”, “conservation of the regional environments by water pollution preventative measures”, “sustainable provision and impartial allocation of agriculture water”, “safe water supply in arid areas and for the poor”, and “strengthening of assistance to international river basin management”. The nine viewpoints to achieve them are “promotion of efficient water use”, “assistance in establishing legal-institutional system”, “importance of regional diversity”, “consideration for the socially vulnerable, the poor and gender issues”, “promotion of a multi-sector approach”, “strengthening mechanism for participation”, “collaborative assistance”, “strengthening domestic organization”, “utilization of Japan’s

experiences and technology development". Specific methods for assistance and cooperation are also explained.

Since discussions have been made over a short period and without sufficient data necessary to examine, there are limitations to the report in the sense that some issues are yet to be more scrutinized. However I think that we have presented, for the first time, a comprehensive framework of issues to be dealt with in considering Japan's future Official Development Assistance (ODA) in water sectors. This report should not end up as mere presentation materials at the World Water Forum. Rather, the opportunity of the World Water Forum should be used so that the report is a starting point to deepen discussions to make Japan's ODA in water sectors more effective and it should form a structure to realize this aim.

For example, it is easy to say assistance and cooperation might be provided "utilizing Japan's abundant experiences", however in reality experiences of Japan are not always well classified for utilization in developing countries from technical or legal points of view. Another important issue is capacity building of staff who are engaged in assistance and cooperation in software engineering areas such as "comprehensive water management", "assistance to international river basin management", and "assistance in establishing legal-institutional system". Furthermore this issue of capacity building will expand to include reorganization of water sector assistance related departments in JICA, and system building to reinforce coordination and cooperation with JBIC, other water related agencies, and Non-Profit Organizations (NPOs).

This report may be called Master Plan, which requires the next step discussion for an implementation plan. It is my hope that, in future discussions of specific action measures, this report will be utilized and the contents will be further evolved.

On the other hand, in order to make Japan's position clear in the international community, it will become more and more important to highlight Japan's presence in politics, economics, science and technology, and culture, to the world, as well as to make international contributions. In this sense, ODA assumes a highly important role and is regarded as a theme that should have the interest, understanding, and support of the Japanese people as a "national concern". From this standpoint, it is vital also in assistance and cooperation in water sectors to account for policies and real conditions more understandably. It would give me great pleasure if this report were to be of some help in deepening people's comprehension of Japan's assistance and cooperation in water sectors.

This report is compiled based on ardent and intensive discussions during eight workshops and various ad hoc meetings among committee members, JICA senior advisors, and the secretariat. Valuable knowledge provided by committee members from their standpoints as specialists, and from the problem consciousness of JICA staff, were brought together to form this report. Finally, I, as Chairperson, acknowledge wholeheartedly the eager involvement of committee members, and the contributions of the task force and the secretariat.

November 2002

Katsumi Mushiake

Chairperson

The Study Group on Development Assistance in Water Sectors

Study Group on Development Assistance in Water Sectors
List of Committee Members

Field	Name	Institution/Organization
Hydrology (Chairperson)	**Katsumi Mushiake**	Professor, Institute of Industrial Science, the University of Tokyo
Water Law	**Kenji Sanbongi**	Professor, Faculty of Real Estate Science, Meikai University
Water Resources	**Masahiro Murakami**	Professor, Department of Infrastructure Systems Engineering, Kochi University of Technology
International River Basin Management	**Mikiyasu Nakayama**	Professor, United Graduate School of Agricultural Science, Tokyo University of Agriculture and Technology
Urban Engineering	**Shinichiro Ogaki**	Dean, School of Engineering, the University of Tokyo
International Cooperation	**Kenjiro Izumi**	Vice-President, Japan International Cooperation Agency
Loan Projects	**Tomoki Sato**	Director, Engineer Division 3, Development Project Analysis Department Japan Bank for International Cooperation (until March 2002)
	Rentaro Tamaishi	Director, Engineer Division 3, Sector Strategy Development Department, Japan Bank for International Cooperation (from April 2002)

Resource Person	**Yasumoto Magara**	Professor, Graduate School of Engineering, Hokkaido University

Study Group on Development Assistance in Water Sectors
List of Task Force Members

Chief

Hidetomi Oi	Senior Advisor, Japan International Cooperation Agency

Sub-chief

Keiko Yamamoto	Senior Advisor, Japan International Cooperation Agency
Senichi Kimura	Director, Second Development Study Division, Social Development Study Department, Japan International Cooperation Agency

Advisor

Hideyuki Kanamori	Senior Advisor, Japan International Cooperation Agency
Hiromi Chihara	Senior Advisor, Japan International Cooperation Agency
Hisao Ushiki	Senior Advisor, Japan International Cooperation Agency
Masayuki Watanabe	Senior Advisor, Japan International Cooperation Agency
Senro Imai	Senior Advisor, Japan International Cooperation Agency
Shoshiro Horigome	Senior Advisor, Japan International Cooperation Agency

(in alphabetical order)

Task Force

Junko Mimaki	Second Overseas Assignment Division, Secretariat of Japan Overseas Cooperation Volunteers Japan International Cooperation Agency

Junko Uno	First Project Management Division, Grant Aid Management Department, Japan International Cooperation Agency
Masami Moko	Japan International Cooperation Agency in the People's Republic of China
Shigeyuki Matsumoto	First Budget Division, Finance and Accounting Department, Japan International Cooperation Agency
Shinichi Masuda	Indo-China Division, Regional Department I, Japan International Cooperation Agency
Taisuke Watanabe	Deputy Director, Administration Division, Institute for International Cooperation, Japan International Cooperation Agency
Yumiko Honda	Junior Expert, Japan International Cooperation Agency

(in alphabetical order)

Secretariat

Toshihiro Obata	Director, Second Research and Development Division, Institute for International Cooperation, Japan International Cooperation Agency (until September 2002)
Ryozo Hanya	Director, Second Research and Development Division, Institute for International Cooperation, Japan International Cooperation Agency (from October 2002)
Kazuaki Sato	Deputy Director, Second Research and Development Division, Institute for International Cooperation, Japan International Cooperation Agency

Ryosuke Isobe
Second Research and Development Division,
Institute for International Cooperation,
Japan International Cooperation Agency

Aiko Saito
Second Research and Development Division,
Institute for International Cooperation,
Japan International Cooperation Agency
Researcher, Japan International Cooperation Center
(until March 2002)

Junko Shinojima
Second Research and Development Division,
Institute for International Cooperation,
Japan International Cooperation Agency
Researcher, Japan International Cooperation Center
(from April 2002)

Consultant

Koichi Iwasaki
Executive Managing Director
Overseas Services Department
Nihon Suido Consultants Co., Ltd.

Takemasa Mamiya
Manager, Engineering Division,
Overseas Services Department
Nihon Suido Consultants Co., Ltd.

The Study on Development Assistance in Water Sectors
Response to Water Problems in Developing Countries

Summary

- Issues and Proposals -

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This booklet is a compilation from chapter 4 "Issues for Future Development Assistance in Water Sectors" and chapter 5 "Proposals for Future Approach of Japan's Cooperation in Water Sectors from the report "The Study on Development Assistance in Water Sectors–Response to Water Problems in Developing Countries".

1. Summary of Research Study

1-1 Background and Objectives of Study

Global water problems have been conspicuous such as water shortage, water contamination, groundwater problems (e.g. drainage, contamination), flood damage, large water consumption by irrigation, water problems caused by urbanization, multinational conflict over international rivers, floods, droughts, and subsequent sea level rises caused by global warming. Derivative problems such as food scarcity and outbreak of infectious diseases have also occurred.

Under these circumstances, the United Nations Water Conference held in Mar de Plata, Argentina, in 1977 designated the years from 1981 to 1990 the "International Drinking Water Supply and Sanitation Decade". As a result, groundwater resources have been developed and piped water supplies have been expanded. In 2000, drinking water at an affordable price was supplied to over 80 percent of the rapidly growing world population, and sanitation systems were supplied to over 50 percent of the population. However, it is said that still 1.1 billion people cannot access safe water and 2.4 billion people cannot access adequate sanitation facilities. In 1992, the "United Nations Conference on Environment and Development" (UNCED, or Earth Summit) was held in Rio de Janeiro. At the Earth Summit, "Agenda 21" was released as an action plan to realize sustainable development wherein "protection of quality and supply of freshwater resources" was highlighted. Since then, water problems have been dealt with, but efforts have generally been considered insufficient compared to those aimed at tackling global warming problems. As a result, the "World Water Council" (WWC) was founded in 1996.

The World Water Forum has been held every three years since 1997. The United Nations Millennium Summit held in September 2000 approved the Millennium Development Goals (MDGs), which state that the proportion of people that could not access potable water in 1990 should be halved by 2015. The World Summit on Sustainable Development (WSSD) held in Johannesburg in September 2002 recommended in its "Plan of Implementation" that the proportion of population that could not access appropriate sanitation systems in 1990 should be halved by 2015. Various water problems stated earlier are more serious in developing countries than in developed countries. It is necessary and vital that Japan plan and implement future assistance to developing countries with appropriate policies. To date Japan's cooperation with developing countries in Official Development Assistance (ODA) has focused on water sectors and Japan International Cooperation Agency (JICA) considers the "3rd World Water Forum" being held in 2003 to be an opportunity to review JICA's past achievements of cooperation in water sectors and to plan future policies of cooperation with developing countries in water sectors. Hence, this ODA Study Group for Water Sectors was created. Internal study sessions began in March 2001 with eight senior water sectors advisors , and this study group started in February 2002.

As explained earlier, global water problems are becoming more challenging. Under these circumstances, this study group aims to analyze the water problems from the viewpoint of comprehensive water management and find a basic direction in Japan's and JICA's future cooperation in water sectors. Therefore, the objective of this study is to grasp various water problems in a comprehensive manner and propose policies and methodologies to solve water problems in developing countries.

1-2 Structure of the Main Report

The structure of the report is explained in ''Figure 1-1 Structure of the Main Report''. Firstly, in order to understand various water problems that are frequently occurring in the world, the knowledge and experiences of the committee members and a cooperative professor are presented in Chapter 1 "Global Water Problems".

"1-1 Water Problems in Monsoon Asia" clarifies that these problems contain the characteristic of "Too much water" unlike problems in the western world that see "Too little water" as a problem. Then an inference is made that "Given land problems related to the monsoon climate and the tectonic zone of Asia, there exist in the monsoon Asia area, characteristic relationships between human beings and water such as land use, water use, flood measures, and water environmental problems". In "1-2 Problems of Supplying Safe Water and Securing Water Resources in Arid Areas (Water Poverty)", the importance of safe water supply mainly in the Middle and Near East and in Africa is highlighted as one of the global issues of water. "1-3 Safe Water Supply" explains ideas about water quality standards and the importance of human waste disposal from the point of view of human health and environmental sanitation. Also suggested are ideas about safe water supply in the future. "1-4 Problems and Issues of International River Basins" deals with the important concept of "Water security" in a global context where about 60 percent of the world population live in international river basins. Standards of conduct which river basin countries should observe, and activities in international river basins to which aid agencies can contribute, are also summarized here. "1-5 Significance of Legal-Institutional Development in Water Management Policy" points out, after an analysis of Japan's experiences, the importance of customary laws and judicial precedents. The recent legislative situations of many countries are classified and differences in the sense of values are pointed out, and new ideas of legal system development such as transnational laws, soft laws, and conflict evading mechanisms are explained.

In Chapter 2 "Review of Japan's Development Assistance in Water Sectors", the performance of cooperation in water sectors by JICA, JBIC, and the Ministry of Foreign Affairs are analyzed with the aim of establishing whether Japan's cooperation in water sectors has prioritized sectors and areas, and whether there are any characteristics in annual trends. Also the water sector assistance policy of each donor and their performances are reviewed and international trends in assistance for water sectors are examined. Furthermore as case studies, three projects in water sectors are examined to identify factors

for success and lessons learned that might provide suggestions for future cooperation in water sectors.

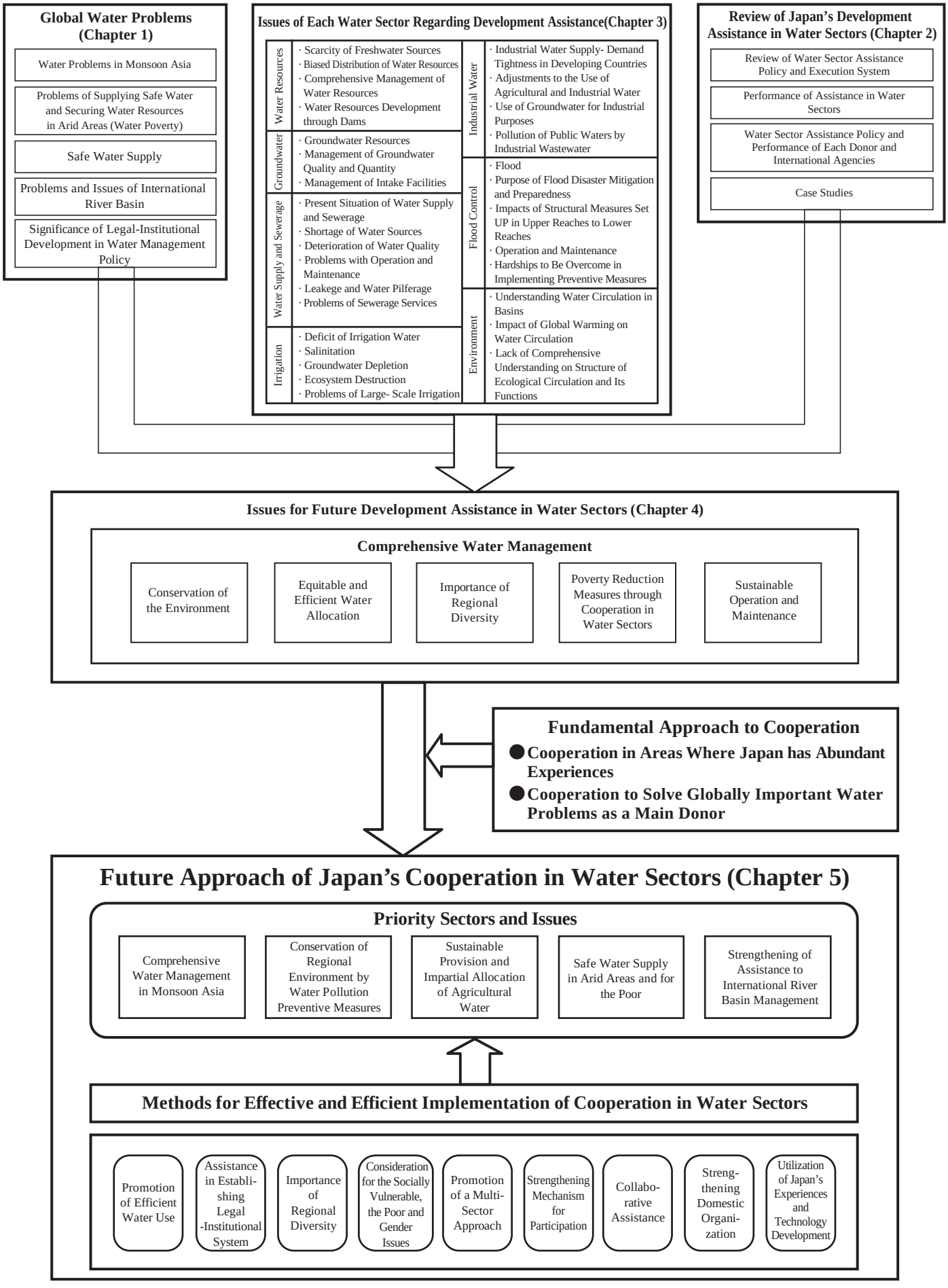
With regard to individual water sectors, Chapter 3 “Issues of Each Water Sector Regarding Development Assistance” deals with problems and future countermeasures for the following sectors: “water resources”, “groundwater”, “water supply and sewerage”, “irrigation”, “industrial water”, “flood control”, and “environment”. It is based on material produced by JICA senior advisors from their field experiences of cooperation in water sectors.

Of the problems and issues regarding water sectors clarified in Chapters 1 to 3, six common issues are abstracted and explained in Chapter 4, “Issues for Future Development Assistance in Water Sectors”. The issues are “comprehensive water management”, “conservation of the environment”, “equitable and efficient water allocation”, “importance of regional diversity”, “poverty reduction measures through cooperation in water sectors”, and “sustainable operation and maintenance”. Many of the issues here are important to deliver assistance more effectively and efficiently.

Based on problems and issues clarified in Chapters 1 to 4, “cooperation in areas where Japan has abundant experiences” and “cooperation to solve globally important water problems as a main donor” were identified as “fundamental approaches to cooperation”. In Chapter 5 “Proposals for Future Approach of Japan’s Cooperation in Water Sectors”, five priority areas are pointed out: “comprehensive water management in monsoon Asia”, “conservation of regional environments by water pollution preventive measures”, “sustainable provision and impartial allocation of agricultural water”, “safe water supply in arid areas and for the poor”, and “strengthening of assistance to international river basin management” To achieve execution of effective and efficient cooperation and assistance in these priority areas, nine specific actions are recommended: “promotion of efficient water use”, “assistance in establishing legal-institutional system”, “importance of regional diversity”, “consideration for the socially vulnerable, the poor and gender issues”, “promotion of a multi-sector approach”, “strengthening mechanism for participation”, “collaborative assistance”, “strengthening domestic organization”, and “utilization of Japan’s experiences and technology development”.

This digest version was prepared by summarizing the results of the study, and by abstracting from Chapter 4 of the Main Report that described common issues in water sectors and from Chapter 5 that described proposals to overcome the issues. References and quotations are detailed in the Main Report.

Figure 1-1 Structure of the Main Report



The table of contents of the main report “The Study on Development Assistance in Water Sectors” is shown below.

The Study on Develipment Assistance in Water Sectors
— Response to Water Problems in Developing Countries —

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2. Issues for Future Development Assistance in Water Sectors (Digest of Chapter 4 of the Main Report)

From Chapter 1 “Global Water Problems”, Chapter 2 “Review of Japan’s Development Assistance in Water Sectors”, and Chapter 3 “Issues of Each Water Sector Regarding Development Assistance” described in the Main Report, six common issues are abstracted: (1) comprehensive water management, (2) conservation of the environment, (3) equitable and efficient water allocation, (4) importance of regional diversity, (5) poverty reduction measures through cooperation in water sectors, and (6) sustainable operation and maintenance. These issues are important for effective and efficient implementation assistance. This chapter discusses the several points which are considered important in grasping and dealing with issues.

2-1 Comprehensive Water Management

Water problems are too diverse to be solved from a single perspective. Whether in Japan, Western countries, or developing countries, there have been tendencies from ancient times in each region to comprehensively deal with water problems arising in each era. However, as the socio-economy has changed rapidly due to population increase, urbanization, industrialization, and extensive agricultural development in the second half of the 20th century, water problems have become more complex and serious. To solve these problems, a comprehensive water policy, enlarged and more effective, is required.

Under these circumstances, terminologies such as “comprehensive water resources management”, “integrated water resources management”, and “river basin management” are frequently used globally. These terms are used without being well defined and sometimes cause misunderstanding and confusion. Thus, the concepts of each terminology are first defined in this subchapter, followed by an explanation of problems in water management. In order to understand the situation and consider the direction of future assistance and cooperation in water sectors, the significance of Japan’s water management policies is analyzed, since Japan, among other Asian countries, has experienced rapid population growth, urbanization, and industrialization, and so forth over the last half century.

2-1-1 Terminology in Water Management: Arrangement of Concepts

Concepts of terminology used in water management are defined in the table below.

Table 2-1 Terminology in Water Management : Arrangement of Concepts

Terminology	Concept Arrangement (Definition)
Management	Planning and designing facilities and their operation; handling, operation, and administration during and after construction of facilities.
Water Resources Management and Water Management	In Europe and North America, "Water Resources Management" is thought to indicate water utilization, flood control, and the water environment in a broad sense. However, in arid or semiarid areas such as Africa and the Middle East, "Water Resources Management" does not generally include flood control. Rather, it is used in a narrower sense denoting only water utilization and the water environment.Sometimes it is easier to understand if we distinguish "water management"—which covers all water issues, including water utilization—from "water resources management," which is used in the narrower sense.
Comprehensive	Indicates a broad base including diverse related factors.
Integrated	Includes a broad range of interrelated factors. As there are many interrelating factors within water sectors, the use of this word also varies depending on the water issue in question.
Basin	A geographical area surrounded by a hypothetical line called a 'water divide,' set when studying the hydrological circulation and water balance of terrain. With rivers and lakes where surface water is the main constituent, it is the area where rainwater divided along the water divides flows over the terrain to the respective river or lake. Terms used include river basin, lake basin, watershed (for branches or smaller areas), catchment, and drainage basin. In the case of groundwater, a basin is the area including the natural recharge limits and flow limits situated below the part divided by the watershed (determined by the structure of the aquifer). Sometimes the term "drainage basin" is used to describe the basin containing both surface water and groundwater.
Comprehensive Water Management and Integrated Water Management	Both concepts are defined to look at geographical areas aiming to generalize and integrate functional, hydrological, and ecological points of view. Both concepts devise countermeasures from administrative and academic points of view to accomplish this. These countermeasures include, integrated planning and management by combining the functions of water supply and sewerage, combined management of groundwater use and surface water use, and establishing coordination and cooperation systems for stakeholders to solve problems of water shortage and sanitation in some areas. The difference between these two concepts can be determined by whether relevant functions are fully incorporated in targeted water problems and whether clear allocation of duties ensures that effective administrative implementation systems are established.
River Basin Management	Comprehensive or integrated water management based on a river basin. A river basin is a basic unit in the analysis of the water balance and demand-supply balance in which both surface water and groundwater are traced through their circulation process. Hence, a river basin is the most important geographical unit in water management. In wet areas where surface water is the main component of water use, flood control, river basin management, or watershed management, the basic unit is the river catchment. In cases where the main component of water use in arid/semiarid areas is groundwater, the main management strategy will be for groundwater management, aiming for a balance between abstraction and recharge as well as water quality preservation.
Watershed Management	River basin management in the United States is a traditional concept dating back to the comprehensive development of the Tennessee River in the 1930s. In this case, comprehensive management sought to control water use and manage flood control measures, but the concept also included the management of multi-purpose dams, water source areas, and land use of flood plains. From the mid-1960s, river basin committees were established at many rivers with the aim of comprehensive management, but they were rarely considered successful. This was because administrative boundaries were drawn in straight lines without regard for river basin boundaries; the area of river basins was too wide to be managed by a single administration so the committees lacked authorization to make decisions and present a mutual approach that would provide incentives for the cooperation of the relevant parties and committee members. On the other hand, from the 1980s, the Environmental Protection Agency promoted river basin management stressing community participation with the aim of preserving and restoring water quality and the ecosystem of small river basins. This is called "watershed management".

2-1-2 Comprehensive Water Management/River Basin Management in Monsoon Asia and Measures in Japan's Water Administration

Japan and most of Asia are part of a rainy region with a monsoon climate. However, they still suffer from water shortages ("Too Little Water"), contamination of the water environment and poor sanitation, just as in arid and semiarid regions. This is due to poor water distribution in terms of timing and area, caused by a clear divide between rainy seasons and dry seasons, and a dense population density (one-third of the world population lives in Asia). The problems associated with "Too Much Water," such as flood damage and disasters in mountainous areas such as landslides, are also characteristic of this region.

Damage by heavy rain is aggravated by the fact that human beings live in and cultivate mountain ranges located on tectonic zones (orogenic zones) that are characterized by seismic and volcanic activities, and alluvial floodplains that are made of sediment accumulated from mountain ranges. In other words, these mountainous fracture zones, landslide zones, and volcanic eruption zones are prone to disaster, but at the same time they are arable and can produce food. Alluvial floodplains are also exposed to the danger of flooding, but are fertile and easy to get water. Thus, human beings have settled in these areas from ancient times and even big cities are located there. The factor that most aggravates problems of flood control and mountain disasters is not climatic conditions, such as the amount of precipitation, but rather the physiographic condition of being on a tectonic zone. Also, it should be noted that Asian water management including flood control is more complex and difficult than that of areas located in continental stable zones.

Asian river basins where surface water is the main issue of water use and flood control can be regarded as satisfactory for the requirement of water management by river basin. This requirement includes a comparatively small catchment area, that reflects physiographic conditions. Hence, the upstream tends to affect the downstream directly, and the combination of upper, middle, and down streams can be easily nurtured. In terms of catchment area, even river basins of large rivers like the Yangtze and the Hwang Ho in China are smaller than those in other continents. In fact flood control measures in the Yangtze River are executed on the basis of river basin viewpoints with the Three Gorges Dam at the upstream, a tributary confluence at the midstream, and storage adjustment at the downstream wetlands. The prevention of the drying up of the Hwang Ho river is also executed from the viewpoint of river basin management which is composed of reservoir adjustment in the upstream, midstream, and downstream, and intake allocation on the basis of the analysis of availability of water resources in the river basin. On the other hand, in the case of big rivers on stable zones such as the Mississippi and the Amazon, the necessity of considering the entire river basin as a unit is low. Because torrential rains in the upstream do not always affect the downstream, and the gully plains that are floodplains in the upper and mid stream are generally inappropriate for advanced land use, there is a low consciousness

for flood protection. Thus, Asian river basins have characteristics suitable for application of the river basin management concept. As specific water problems are to be considered on the basis of river basins, the following examples have been identified.

- Development and allocation of water resources based on analysis of available water resource volume in river basins (surface water and groundwater)
- Flood control measures based on integrated water systems (such as development of flood control facilities and their operation and management, alongside non-structural measures such as flood forecast warnings and flood defense systems)
- Optional measures for Flood damage mitigation, such as inducement/regulation of land use in river basins
- Integrated operation of dams in river basins and coordination among water users in the dry season
- Conservation and restoration measures for basin water quality including addressing the various pollution sources in a river basin.

As for the tasks of comprehensive water management, although not always on the basis of river basins, the following points are identifiable.

- Development and management of multi-purpose dams aimed at flood control, power generation, and development for various water uses
- Planning and management of unified systems of water supply and wastewater treatment
- Conservation and recovery plan for the water environment and their execution by means of cooperation among administrative agencies and citizen/community participation

As an exceptionally developed country in the wet area of monsoon Asia, Japan has developed various water control technologies and water policies for more than 100 years. Especially since the modernization of the Meiji era, Japan has transformed traditional technology into advanced hardware and software, and adopted technologies and water policies suitable to the social and economic development levels of the day. It may therefore be helpful to review this historical process to identify useful standards for better understanding of the contemporary situation for developing countries in the wet area of Asia, where natural conditions are similar to Japan. It may also be possible to forecast the future of water sectors and the adaptability of Japan's technologies and policies for these Asian developing countries.

For this reason it is necessary to systematically classify the relationship between Japan's social (transition aspects in political structure and system) and economic (transition aspects of evolution of population, population in workforce by industry, employment problems, income per capita, and financing method of projects) development level and the application of hardware and software measures in water sectors.

Although a detailed examination is a future task, it is apparent that, especially since the 1970s when importance was attached to local and environmental problems, various new measures have been

set forth in water administration and river administration from comprehensive and river basin viewpoints, have lead to the present situation. Those measures include specific cooperation and interchange between water source areas and downstream beneficiary areas; coordination among water users; sewerage development plans by river basin; comprehensive flood control measures; total amount control of water quality in enclosed waters; publication of flood hazard maps; obligation of discharging flow for river maintenance at renewal of water use appropriate for power generation; cooperation between embankment projects and urban redevelopment projects; building para-nature type rivers; cooperation between water related departments and river/ sewerage related departments to preserve sources of piped water; revision of the River Law in which the river environment and conservation are added as objectives and community participation is stipulated; and commencement of cooperation and coordination among water related departments in ministries aiming at soundness of circulatory systems of river basin water. These are regarded as appropriate measures in response to the needs of the day.

Thus, even in Japan, current methods of comprehensive water management and river basin management are recent developments in a long history and are results of experiences of each subsector. It seems that Asian developing countries are required to overcome all at once the water problems that Japan has faced and overcome in the more than half a century period. The key to the problem is how solutions suitable to the situation of each country can be found in a shorter period. It goes without saying that Japan's processes and current methods of water management cannot be applied as they are now to Asian developing countries. However examination of success and failure in Japan's process of development will be of use in international assistance and cooperation in the future.

Chapters on "social infrastructure" and "international cooperation" in the "Sectoral Promotion Strategy Based on the General Plan of Science and Technology" (September 2001) published by the Council for Science and Technology Policy, Cabinet Office seems precisely to express the Japan's standpoint on assistance and cooperation in water sectors. This is cited below.

"Japan has various technologies to develop social infrastructure both in terms of hardware and software, from traditional technology to advanced technology. Japan is capable of developing and transferring technologies adaptable to modernization and development of developing countries whose culture is different from Western culture, and especially located in monsoon Asia and areas experiencing frequent seismic activity.

By carrying out international cooperation utilizing such a capability, it is expected that Japan's technology may be regarded as a common standard in this area, which can become a moving force for industry. Furthermore there will surely come a new development with regard to the above two viewpoints ('building safety' in Japan and 'national regeneration and improvement of the quality of life')".

2-2 Conservation of the Environment

It is vital in international cooperation in water sectors to consider the environment in order to realize sustainable development. Objectives for the preservation of the water environment are to realize a safe and comfortable life by means of water quality conservation of public water areas and the improvement of the urban sewerage population served ratio, and to establish a water environment that contributes to the preservation of the natural environment.

At present, in executing almost all projects, consideration for the environment is regarded as necessity, and naturally it is vital to consider the environment in cooperation in water sectors too.

2-2-1 Water Environmental Administration in Japan

Japan experienced severe water pollution during its period of high-growth that seriously affected local socio-economies. This was mainly because there was inappropriate water use relative to the characteristics of water circulation of entire river basins. There were several factors behind this, which include economic factors, littoral industrial development policy, scientific and technical factors, vested rights in water, and delayed development of wastewater treatment infrastructure such as sewerage that could not catch up with the growth of cities.

As a result of the socio-economic loss and human loss caused by the severe water pollution, various measures for environmental improvement and conservation have been introduced. These include strict regulations for industrial wastewater (Extraordinary Diet session on pollution held in 1970); introduction of the ‘‘Pollution Control Officer System’’ at companies; promotion of sewerage development; total mass control of COD (Chemical Oxygen Demand) in the closed sea areas including Tokyo Bay (1980); and regulations for N (nitrogen) and P (phosphorus) to restrain eutrophication of lakes. Water conservation (large increase in the recycle rate) by industry also greatly contributed to the reduction of pollution levels.

Other than these regulations to prevent pollution, the attempts at regionally based river basin management were also effective. These attempts included the creation of a committee by relevant groups in a river basin to coordinate their interests and to control pollution. As a result of these various measures, the river and sea environment improved. The implication of this improvement was not only beautification of water bodies, but also benefit for other related areas. For example, there was a revival in local fishing industries that had once been destroyed, and tourism, and new investment such as the seaside sub-center of Tokyo , and Minato Mirai 21 in Yokohama, flowed in. However groundwater pollution by chemical substances from advanced industries, which are different from pollution by conventional pollutants, are still problematic although certain measures (reporting and establishment of a registration

system for chemical substances) have been taken.

Thus Japan's environmental problems that occurred in the development stage or high economic growth period have been gradually curtailed by the development of the legal systems. Comprehensive and preventive measures, and various types of residents based activities at local level have also contributed to environmental improvement.

Developing countries have a similar situation where industrial development is prioritized over environmental policy. Japan, based on its past environmental administration, will be able to assist them in environmental protection by means of systems, institutions, and community participation.

2-2-2 Development of Sewerage and Sanitation

The fundamental roles of sewerage systems are (1) improvement of human environment (draining of wastewater), (2) draining of rainwater, and (3) water quality conservation of public waters.

These actions aim for satisfactory maintenance of urban and periurban environments by reducing various pollutant loads generated by social production activities and the living activities of human beings, and by properly controlling the flow of rainwater in cities and draining it into public waters. Sewerage is also entrusted with the function of artificially supplementing and promoting the outflow and purification mechanisms of water circulation systems that occur in the natural world.

Although it is difficult to develop sewerage systems all at once because of the amount of investment required, phased development can temporarily reduce the investment amount. The idea of phased development is that at first small individual treatment districts are gradually developed, which are then integrated into a centralized treatment district while sewers are installed. To realize phased improvement, it is necessary to consider how to minimize the extent of double investment, bearing in mind the ultimate plan for an integrated system.

Furthermore in addition to the traditional role, sewerage is expected to assume a larger role in the water cycle from the point of view of treated water reuse. However, to promote the reuse system, a consensus has to be reached by the majority of the population on the reuse of treated wastewater. Technical and financial issues also have to be resolved.

Sanitation facility development and sewerage development are extremely important. There are as many as 2.4 billion people who do not have access to sanitation facilities, which presents a significant environmental risk. Cooperation in the development of sanitation is already underway. However, this involves not only constructing toilets, but also periodic disposal of sludge from septic tanks. Therefore,

such cooperation needs to secure financial sources for proper maintenance including the organization of maintenance groups.

2-2-3 Conservation and Restoration of Natural Ecosystems

Efforts should be made to ensure the water circulation in the natural ecosystems. If a structure such as barrages, dams, etc. exists in a river, the circulation of water and thereby the organic substances, nutrients etc. in the natural ecosystem is interrupted. As a result, water pollution becomes serious. When planning the building of a structure, a decision to proceed should only be made after considering both positive and negative influences so that sound water circulation is not impaired.

Some of the new environmental protection measures utilize inherent nature's ecological function. For example, as a measure against adverse environmental impact of dams a marsh biotope is created in the peripheral area. By this measure, a tributary that flows into a reservoir is dammed by a low weir and a marsh is created as a second reservoir. The biotope forms a stable marsh that is not affected by water level fluctuation. This marsh, which serves as a habitat for aquatic plants and animals, and birds, can maintain the diversity of the ecosystem that the region originally had.

Approaches and activities to review the management of entire river basin ecosystems are also noteworthy. An ecological water treatment system known as the "Simanto-gawa System" is a new water treatment system where the purification function belonging originally to nature is utilized with a water purification function of paddy fields as a model. This system is also known as the "natural circulation type water treatment system". Also, the "direct treatment of domestic wastewater" is practiced in a tributary of the Ainoya River in Toride City of Ibaraki Prefecture.

The way communities relate to water in cities and in areas consisting of hills and paddy fields (sometimes called "Satoyama"), as well as the function of the water environment is recently receiving attention once again. Ideal routes of storm sewers in cities, and the resurrection and regeneration of new waterfront areas that enrich the human environment are examined as an attempt to revive urban water circulation both qualitatively and quantitatively. This examination reveals a new aspect (including the ecological technologies to be adapted) of water related public works that have traditionally tended to divide human beings from nature (and the ecosystem). Rediscovery of small water circulation at "Satoyamas" (paddy field, irrigation canal, irrigation pond, hill etc.), and activities to maintain or revive water circulation are valuable as they function as an educational place for the next generation to learn that small water circulation spaces linking cities to natural areas should be managed in a new way. They also function as protectors of habitats of animals and plants.

Thus ecological technologies that use ecological functions inherently existed in the nature will be

seemingly more and more applicable to various areas. Also it seems possible for them to be widely applied to water environmental problems in developing countries.

2-2-4 Preservation of Groundwater

Although groundwater is highly appreciated as a convenient water source, it can easily dry up if the exploitation exceeds the recharge due to the slower velocity than that of surface water. Groundwater has another characteristic that it is vulnerable to the contamination of chemical substances and the water pollution caused by the pollutant load exceeding the natural purification capacity. Therefore, prior to the groundwater development, a full investigation is required, both quantitatively and qualitatively. Regarding quantity, the groundwater recharge should be examined and the development volume should be confirmed of not exceeding the recharge. Also after the completion of wells, technology should be transferred for measuring groundwater level periodically and monitoring the movement for a long term. The execution system for the monitoring should also be established.

As for the water quality of groundwater, the problem of arsenic contamination in Bangladesh and the problem of high-concentration of fluoride in African countries are still not solved. When developing groundwater in those countries, it is the primary task to check the water quality. However, many developing countries are not furnished with proper capability of arsenic analysis in the water quality testing systems, equipment and technology. It is not realistic to construct a water analysis center in every district where groundwater is used, but it is desirable to build centers on the national or provincial basis so that any needs of measuring anomaly change in groundwater quality can be met.

2-2-5 Preservation of Surface Water Sources

In water supply systems using surface water as a water source, appropriate treatment processes and water quality of treated water vary highly depending on the water quality at the water source. When an intake is at an upstream location of a river, forests surrounding the water source should be protected as riverhead forestry, and source water quality should be preserved by proper measures. There are cases in developing countries where slash and burn agriculture is carried out at riverhead forests because regulations to protect riverhead areas are not well developed and not properly implemented. If forests are burnt, the recharge capacity at the source water point is lowered and the surface soil can easily flow out following rainfall, causing an increase in turbidity of the source water. This leads to the deterioration of the water quality at the water source and to the additional economic burden to the operation of water supply systems including water treatment facilities.

If an intake point is located at mid or down stream, the situation will become even worse. This means that urban wastewater from upstream and midstream, and industrial wastewater from watersheds

flow into the water source. Not only are there these point source loads, but also non-point source loads of pollutants such as pollution inflow from agricultural lands in the watershed. To cope with this problem, environment regulations should be developed and urban and industrial wastewater should be controlled, which makes sewerage development indispensable. Even if sewerage development is difficult, sanitation development such as the introduction of septic tanks should be constructed to prevent the discharge of human waste into rivers.

2-3 Equitable and Efficient Water Allocation

2-3-1 Introduction

Water resources are used for various purposes. It is said that globally, agricultural use, industrial use (including power generation), and domestic use accounts for 69 percent, 23 percent, and 8 percent, respectively. However, in the 21st century, water resources are feared to lapse into a critical situation because of the increase in water demand and aggravation of water pollution caused by recent population growth and economic development, and extremely poor distribution of rainfall caused by climatic variation. Thus the importance of comprehensive water resource management has been stressed since the 1990s. One issue is the realization of equitable and efficient water allocation.

At present, inequitable water allocation can be seen globally. While the lives of more than a billion people are in jeopardy because of the water shortage, water is wasted in many places. However quantity and the difficulty or ease of the use of water resources differ regionally. The concepts of equity and efficiency also vary depending on history, culture, and the livelihood in each area. Hence quantity alone cannot simply help in the judgment.

How can equity and efficiency be secured while fully considering the relationship between human beings and water that has been cultivated in each area over many years? Japan's ODA has to tackle this difficult problem from the standpoint of providing assistance to developing countries.

2-3-2 Equitable Water Allocation

(1) Inequitable Conditions at Present

Many areas have experienced water conflicts caused by water shortage and inequitable water allocation. Inequitable water allocation exists in the context of sectors, upstream and downstream, the rich and the poor, the strong and the weak, established water users and new comers, those who live near water sources and those who live far, etc. For example, at the Chao Phraya River in Thailand, since a massive amount of water is used for irrigation upstream, the metropolitan area

downstream suffers from an urban water shortage. Inequitable water allocation also exists in the Mae Taeng River in Thailand, and the Euphrates River. Other examples of inequity can be seen in many well projects in which drilling points are decided by politicians and powerful people, and when the poor who live in flood danger zones are not included in emergency evacuation plans, and as a result suffer flood damage.

(2) Consideration for Equity

As stated above, under the current situation where many inequities exist, how can equity be assured? If the water resource is insufficient, first, the amount of available water should be increased. Secondly, in cases where the water resources cannot meet demand, a method to manage (allocate) water should be established from the point of view of equity. In this case, water uses should be prioritized. Water users have to reach an agreement on the meaning of “equity”, and each user should be restricted in volume.

1) Amount of Available Water and Appropriate Demand

Deficiency of water volume can be filled by water resource development (surface water, groundwater), facility development, reuse of wastewater, desalination of sea water, elimination of waste by efficient water use and water conservation, and expansion of usability of existing water sources by reduction and protection of water pollution. An increase in the usable water volume will solve deficiency problems, and equity can be maintained.

Many people living in arid areas cannot even secure basic human living conditions. The main reason is the near impossibility of developing water resources and facilities due to water shortage and poverty. Through assistance for water resource development and facility development in Africa and the Middle East, many people will move one step closer to equitable water allocation.

However the water volume available to people is restricted by the water resource volume available in the area. Types of agriculture, industry, and livelihood also vary. It is also important to consider the appropriate water demand under different conditions, and to seek security of well-being for human life.

2) Equitable Distribution by means of Water Management

To allocate limited water resources equitably, customary water use and traditional organizations of water users cannot be neglected. In addition, to respond to new water demands, legal

systems and institutional development are required. With these in mind, it should be regarded that water use rights exist for water users. Therefore, there should be organizations that manage water resources in compliance with a legal system acceptable to all water users.

When assisting the establishment/development of legal systems, it is necessary to fully respect the recognition of equitability that is rooted in the areas. Requirements of users also vary depending on the stage of economic development. The usage of water for industrial purposes tends to be relatively decreasing in developed countries and increasing in developing countries. Domestic water use increases with population growth and living standard improvement. In these processes, traditional water use rights and vested interests should be reviewed and reallocated. Similar to profit allocation, losses also should be shared equitably.

To maintain equitability, it is important for water users and water use organizations to participate in the development of legal systems and management organizations. Also important is information disclosure and sharing of information to all relevant parties. Special considerations for the vulnerable (the poor, women, minorities, etc) are needed. Traditionally, the needs of the vulnerable did not reach the water rulers (occupation by the strong), which limited satisfactory water use by the vulnerable.

Participation of the vulnerable should be promoted by systems where their opinions and activities can be especially guaranteed. In many developing countries, even though a legal system has been developed, the executing agency is powerless and the law is not enforceable in reality. It is necessary to reinforce this framework as well as to develop human resources including the water user's association to ensure a properly functioning legal system.

2-3-3 Efficiency of Water Use

Loss of water resources caused by inefficient water use is enormous. It is said that as much as 60 percent of water used for agriculture, which accounts for about 70 percent of all water use, is lost by infiltration and evaporation prior to reaching crops. The rate of water unaccounted for (mostly caused by leakage) in developing countries is about 40 percent. Also problematic is the water wasteful lifestyle of people in developed countries.

Efficient use of water requires technological development and improvements in terms of hardware-orienred cooperation (facilities), such as the rehabilitation of facilities and the development of water-saving facilities and equipment, plus the reprocessing of sewage. Development and improvement of software of engineering aspects (organization, management) including improvement of irrigation schedules, establishment of water volume management systems, collection of water use charges, introduction of efficient private

management, and community education can also promote efficient water use.

(1) Rehabilitation of Facility and Technical Development by Different Sectors

1) Agricultural Sector

Since irrigation water is the biggest use of water resources, the effect of efficiency improvement is significant. Water use efficiency of large-scale irrigation facilities is low and salinity and wet damage occurs due to poor drainage. Small-scale irrigation can develop new water resources at lower economic, social, and environmental costs. Poor farmers can also benefit from small-scale irrigation. Also economizing water can be practiced by improving water productivity.

Efficiency improvement in water use includes crop cultivation matched with seasonal variation of rainfall by developing dry tolerant varieties. Technologies that do not require many pesticides and chemical fertilizers can reduce water pollution by chemical substances, and adverse effects on the ecosystem, which is also an important way to improve efficiency of water use.

On the other hand, paddy farming uses massive amounts of water, but also has effects on aquifer charging, flood mitigation, and soil conservation. In India, paddy fields of 180 thousand hectares were developed as a measure for an area with severe groundwater level lowering, and it was effective. In the case of agricultural water, it is difficult to measure efficiency improvement by water consumption only. Judgment from various aspects is necessary.

2) Industrial Sector

Developed countries that continue to grow economically through industrial development have many problems related to industrial water consumption and wastewater discharge into public waters. Having experienced this problem, the Japan’s industrial sector developed and introduced wastewater treatment facilities, that is end-of-pipe technology, under effluent water regulations and groundwater regulations. Technology of circulation and utilization of treated water was also introduced with the aim of efficient water use. As a result, industrial water use has fallen by 80 percent and water pollution has also improved.

It is important for Japan to transfer such technology and experience to assist developing countries. Also important is to accelerate their development by establishing conditions (legal controls, tariff collection of sewerage and water supply, government subsidies, etc.) that can provide incentives for development and use of water conservation type facilities and water

conservation processes.

3) Water Supply Sector

The rate of water leakage in developing countries is nearly 40 percent. If this can be reduced to between 10 and 20 percent, which is the rate in developed countries, it will mean that another 20 to 30 percent of distributed water can be utilized. This brings economic effects of cost saving in new water resource development and increase of revenue collection. But many developing countries currently cannot cope with an increase in investment costs for facility improvement, operation, and maintenance. The Phnom Penh Water Supply Authority in Cambodia has realized a remarkable reduction in the leakage rate by grant aid projects (Japan and others) for installation of pipes and meters, and assistance for improvement of water tariff collection systems (World Bank, France, and others). Water conservation is also realizable by promoting development and use of water conservation type equipment and domestic utensils (water conservation taps, washing machines, showers, flush toilets, etc.).

4) Sewerage Sector (Sewage Reuse and Use of Rainwater)

There is an expression that “a wastewater treatment plant is an urban dam”. If treated wastewater can be used effectively, it can match new water sources. In large cities in Japan, intermediate water supply systems are installed in some buildings to use rainwater effectively. Likewise is rainwater use by utilizing roofs of large-scale buildings, such as the Tokyo Dome and the Kokugikan Sumo Arena as receptacles. In the intermediate water supply system, wastewater generated in buildings is treated, but rainwater collected from roofs is not (or undergoes simple treatment). These water sources are for miscellaneous use such as toilets, ponds and rivers in parks, plants and lawns, and emergency use such as fire fighting. Also, the heat from wastewater is utilized for air conditioning local areas by means of heat pumps.

Domestic reuse of wastewater in Japan requires tertiary treatment and advanced systems, which are technically and financially difficult for developing countries to apply immediately. Regarding heavy metals, coliform bacillus, and bacterium that are contained in wastewater, careful investigation and treatment should be considered. However in areas where the water source is limited, treated wastewater is another precious water source. To effectively use this, it is necessary to develop the technology for low cost treatment and to study methods of application. Whereas rainwater, after simple treatment, can be used for drinking purposes if the reservoirs are kept structurally hygienic.

(2) Improvement of Efficiency through Collecting of Water Charges

The Organization for Economic Cooperation and Development (OECD) declared in its "recommendation on policy of water resource management" that "in tariff setting for water resources, at least opportunity costs of water supply services such as capital costs, operation costs, and environmental costs have to be covered (User Pays Principle: UPP)". Also in 1997, the United Nations General Assembly Special Session on Environment and Development (UNGASS), proposed "to consider applying progressive tariff policies to realize cost recovery including promotion of water preservation, and equitable and efficient water allocation". The collection of tariff and improvements in efficiency by sector will be discussed below.

1) Agricultural Sector

Traditionally irrigation water has been free of charge or priced at inexpensive levels. The collection method of irrigation water charge is generally based on irrigation areas or average amount because water consumption cannot be measured by meters. In this case, economizing water cannot be expected.

Many irrigation facilities are developed as national development projects, and serve multiple functions such as environmental preservation of water. Hence it is difficult to charge irrigation water users to recover all the project costs. However a global tendency is that at least operation and maintenance costs of facilities should be paid by water users in order to promote efficient water use.

2) Industrial Sector

Water users have been reducing consumption and costs by introducing water conservation type facilities and circulation systems. For industries where potable water quality is not needed, many directly use river water and groundwater by paying water intake charges because industrial use of potable water is costly.

3) Water Supply Sector

It is generally considered that water tariffs, politically set at low levels, and national subsidy systems lead to water waste and discourage sustainable operation and maintenance of water supply systems. However, water supply is indispensable for the maintenance of life and strongly related to public welfare factors. Therefore tariffs corresponding to minimum requirements are set at a low level and volumetric tariffs with increasing block rates are adopted by many

countries.

In developed countries, water consumption per capita tends to level out or decrease due to volumetric and increasing block tariff systems and consciousness of water conservation. In any case, an important prerequisite is that meters have to be installed and usage has to be correctly measured for bill collection.

4) Sewerage Sector

There are various sewerage tariff structures such as volumetric rates based on the level of water consumption, certain fixed ratios of the water bill, and fixed rates. While it is difficult to recover construction, operation, and maintenance costs from sewerage rate collection, sewerage bill collection in connection with the use of water supply systems leads to efficient water use.

(3) Efficiency Improvement through the Participation and Education of Local Residents

In irrigation water and rural water supply projects, systems suited to the economic/living level of the area can be introduced by establishing water use associations and water committees, and carrying out operation and maintenance of facilities through community participation. If ownership is fostered by community participation, water volume management will become intensive through the installation of meters. Leakage and illegal water use will also decrease.

(4) Participation of the Private Sector and Efficiency Improvement

Private sector participation in water sectors has intensified in recent years. The main objectives of this are to introduce private funds for development of water sectors that is quite costly, and effectively use water resources by utilizing the efficient management capability of the private sector. International agencies regard private sector participation as important to solve global water problems. It is said that currently private companies provide 6 percent of the world population with water supply services. Private investment in water supply and sewerage in developing countries from 1990 to 1999 amounted to 31.4 billion dollars.

There are various modalities of private sector participation such as full privatization (UK) in which all assets were sold to the private sector; concession contracts (utilized in many developing countries) where the ownership of assets remains with public organizations but the private sector assumes responsibility for operation and maintenance of services and investment for development under long-term contracts of 25 to 30 years; management and lease contracts where the private sector

assumes operation and maintenance; service contracts where only specific activities in operations are entrusted to the private sector; and BOT (Build, Operate, and Transfer) where construction and long-term operation and maintenance after completion are assumed by the private sector, and the facility is transferred to the public organization following the contract period. In many developing countries there are BOT of dams and water purification facilities, and concession contracts for water supply and sewerage operations.

In developed countries legal and institutional systems have been developed, hence it is possible to raise the service level of water supply while maintaining the level of public service by supervising, regulating, and advising private activities. However, governments of developing countries tend to be powerless and incapable of controlling the private sector. Therefore even though private sector participation is promoted, it is necessary first to improve legal systems, organizations, and staff capability.

In any event, water use is greatly characterized by public factors. Public welfare should not be neglected by pursuing economic efficiency. Japan's ODA should assist in institution strengthening and capacity building of governments of developing countries. Even though a developing country positively promotes privatization, Japan should assist the government for them to be able to exert the power to guide and regulate public welfare and environmental protection.

2-4 Importance of Regional Diversity

2-4-1 International Cooperation and Regional Diversity in Water Sectors

Starting from the "International Drinking Water Supply and Sanitation Decade" set in the 1980s, many water sector development projects have been implemented. However some of these projects have already become ineffective. Likely reasons may include easy application of technologies and ideas from the donor side without fully considering the characteristics of the target areas, and uniform cooperation regardless of regionality. For development assistance in water sectors, consideration of regional characteristics is especially important because water has extremely indigenous factors both in natural and social conditions.

2-4-2 Regional Diversity of Natural Conditions

The water balance situation is heavily dependent on natural conditions such as local climate and geographical/geological features. The problem of "too much water" is an indispensable aspect in considering water problems in monsoon Asia. On the other hand, in arid areas in the Middle and Near East, cooperation corresponding to the extreme limitation of water resources is important. Thus, conditions

of arid areas are completely different from those of relatively water-abundant areas. Therefore, it is necessary to alter the approach of cooperation according to the area's natural conditions.

As water systems like rivers and marshes are habitats for various forms of life, considerations of environmental impacts are important when artificial alterations for water use are made. Even within a country, natural conditions vary depending on regions. Therefore careful attention is needed on the basis of an understanding of the characteristics of hydrological cycle and ecosystems.

Even though natural conditions are supposedly considered, due to development's influence on nature, preconditions themselves may change and unexpected effects may emerge. There are some cases where a large-scale water resource development changes evaporation quantity, underground infiltration capacity, and finally the local microclimate itself.

2-4-3 Regional Diversity of Social Conditions

With regard to between human beings and water is largely formed by cultures and customs. Water consumption varies greatly depending on whether a custom of frequent bathing exists, whether toilets are flushed, and whether water use for domestic animals exists, etc. In many areas, water fetching is regarded as the work of women and children. Household chores needing water are mostly taken care of by women too.

With regard to systems related to water such as water use rights, in many cases, traditional systems suited to natural conditions and society in local areas have been historically formed. Customary water laws are respected and handed down even in countries where Western statues and water administration have been introduced. For rules of water distribution and farming methods, a lot of traditional wisdom has also been handed down. Cooperation will be effective if these rules are respected and utilized.

The level of technology will greatly differ according to the community. Generally, most water treatment technology used in developed countries is highly technical, and in many cases it is difficult to apply such technology directly to developing countries. While in some areas, solar pumps have been introduced and maintained by aid projects, in other areas not even pulleys are used to scoop up water from wells. For example in sewage treatment, the lagoon method, that applies biological treatment to wastewater that flows into a holding pond, is widely used in developing countries, but the standard treatment method in Japan is the activated sludge process that is accompanied with facility construction. Seemingly only a limited number of developing countries and cities can operate the activated sludge process, hence careful examination is required prior to technology transfer.

Past projects have faced difficulties in achieving original objectives due to local incapability to

operate and maintain facilities with advanced technology. It is important to learn this lesson and to try to introduce appropriate technologies suited to local technical levels.

2-4-4 Consideration for Regional Diversity in the Evaluation of Paddy Field Irrigation

In quite a few cases, an apparently inefficient water use to outsiders actually has characteristics suitable to the natural and social conditions of that area. For example, there are some criticisms mostly in Europe and North America that paddy farming, popular in monsoon Asia, is characterized by the use of massive amounts of irrigation water, and water loss by evaporation and seepage. However, paddy farming is an agricultural form suited to natural conditions such as a plentiful supply of water in the rainy season; an outflow of sediments and formation of a vast alluvial low land on diastrophic belts; flooding and impounding in plains; and a high groundwater level. Paddy farming also has the merit of sustainability in terms of soil conservation and injury by continuous cropping.

Paddy farming has evolved in close connection with natural and social conditions in monsoon Asia, adapting to these conditions through a long history, and therefore the criticism of it being wasteful of water may not be pertinent. In cooperation in water sectors, it is necessary to have an in depth understanding of regional characteristics from both natural and social aspects.

2-4-5 Diversity of Water Sources

As water is a necessity to maintain lives of human beings, villages and cities have been located in places where water is obtainable. Various water sources are used corresponding to the natural conditions in each area. Representative water resources include rivers, lakes, reservoirs, fountains, and shallow wells by hand drilling. A tubular well that requires a boring machine has been rapidly popularized in relatively recent years. The method of introducing rainwater runoff from a roof to a water jar through a gutter can be widely seen especially in rainy Asia. In foggy areas, the method of collecting fog by stretching a net is adopted.

Water sources used are not limited to a single source but selected according to the type of water use. An ordinary case is to use stored rainwater for drinking and cooking purposes, and river water for bathing and washing.

In water supply and water resources development, selection of water source is one of the most important factors. It is important then not only to acquire knowledge on the use of water sources that have been developed locally, but also to devise methods to use various sources for different purposes and to use limited water sources efficiently.

2-4-6 Technical Cooperation Attaching Importance to Regional Diversity

It is necessary in cooperation in water sectors to develop planning after fully analyzing local nature and society and understanding the unique conditions. For example, water quality standards of potable water should be determined taking into consideration technology level, measuring capability, pollution level, and intake from sources other than water. For instance, the potable water quality standard for fluoride in Japan is 0.8 mg / L, which is about half of the WHO guideline value. This is because fluoride intake from water needs to be limited because Japanese gain a large amount of fluoride from sources other than water, such as marine products. Thus, it is necessary for even water quality standards that tend to be regarded as uniquely determinable by scientific knowledge to be defined in accordance with local characteristics of target areas.

When Japan carries out cooperation even on the basis of its own experience, intrusiveness should be avoided. Necessary improvement in accordance with the actual situation should be made after fully understanding the technologies and systems of target areas.

2-5 Poverty Reduction Measures through Cooperation in Water Sectors

2-5-1 Water and Poverty

About one in five of the world population is said to belong to the absolute poverty that live on less than a dollar per day. About one in two live on less than two dollars per day. These people live in circumstances where the most fundamental social services such as medical treatment and education are not available and water supply is similar. Many of the poor live in periurban, hillsides, or swampy areas where living conditions are bad and development of water supply infrastructure tends to be left behind. Water supply operators are unwilling to expand services to poverty areas where tariff collection is uncertain. As a result, the poor often cannot receive public services, and therefore are forced to walk long distances for drawing water or they have to buy water from water sellers paying prices higher than the water charges.

In many countries the population growth rate decreases if the maternal mortality rate and infant mortality rate decrease by improving safe water supply, health and sanitation. Therefore, the provision of safe water to the poor is a development agenda that directly affects their survival.

Getting water, a necessity of life, tends to have a higher priority compared to wastewater treatment and storm water drainage. Poverty areas tend to spread out along riverbeds or swamps susceptible to flooding. Also in agricultural water use, areas of poorer farmers receive less benefit from irrigation and less water during droughts. As a result, the poor have a fragile livelihood and cannot easily get out of

poverty.

One of the reasons why Development Assistance in the past could not fully incorporate projects which directly target the poor, is the difficulty in implementing projects aimed at poverty areas. For example, remote places which are not accessible for well-drilling machines and villages without access roads are, in many cases, omitted from cooperation projects. Such places tend to be poorer and suffer water problems. Most of urban poverty areas are illegally inhabited compounds which are called squatter areas. Therefore, project implementation is difficult because landownership and consistency with city planning pose a problem before launching development of water supply infrastructure.

2-5-2 Privatization and Its Impact on the Poor

Privatization of public services is underway even in developing countries, mainly for water supply services in large cities, and the bottled water business is also becoming prosperous. While privatization is expected to promote efficiency, it is highly likely that periurban and rural areas will be left behind, where investment efficiency may be lower and tariff collection may be difficult. JICA's cooperation, by taking advantage of grant aid, can cover those areas likely to be left behind under the private sector involvement and assist directly the poor. Even in cases where privatization has been carried out, it will also be effective to carry out cooperation to improve the regulatory capacity of public agencies so that appropriate consideration for the poor can be made.

2-5-3 Poverty Reduction Measures tin Water Sector Cooperation

It is possible to directly benefit the poor through cooperation in water sectors and it will be necessary to prioritize such cooperation in the future. Specifically identifiable at first will be the provision of safe water to the poor as stated in the Millennium Development Goals. Also, in projects like sanitation improvement (installation of toilets, construction of drainage and sewerage systems), irrigation, and flood control, priority should be given to projects mainly targeting the poor.

Extracting knowledge from Japan's experience that projects for agricultural infrastructure and flood control contributed to better living for the poor, projects can be designed to improve livelihood and create jobs for the poor. Through the provision of safe water, various benefits can be expected such as a decrease in water-borne diseases, reduction of water purchase costs, and a reduction in labor hours used for collecting water. They lead to improvement in living conditions through direct reduction of expenses and an increase in time available for productive activities. It is also possible to generate income from vegetable farming and freshwater aquaculture by utilizing water. If facility construction, operation, and maintenance are carried out by labor-intensive methods, new jobs will be created. Facilities constructed for flood control can also be used for productive activities.

Recently participatory planning and project implementation has become more frequent mainly in rural water supply projects and irrigation projects. The opinion and position of the inarticulate poor should be appropriately reflected in projects.

2-6 Sustainable Operation and Maintenance

2-6-1 Sustainability of Project Impacts

It is extremely important to secure sustainability of systems, facilities, and institutions built through execution of projects or in other words, sustainability of the benefits of the projects in order to carry out a great deal more high-quality projects by utilizing limited aid resources. In this section, operation and maintenance of facilities is especially highlighted when considering sustainability of project benefits.

2-6-2 Participation in Projects of Water Users/ Groups and Stakeholders

(1) Promotion of the “Participatory” Approach

The participatory approach has attracted attention as a method to improve efficiency in project management and to enhance the outcome. On the other hand the concept of the participatory approach has evolved from the idea that community participation was regarded as merely an input factor (“participation in development”) to the idea that community participation is a process of empowerment (“participatory development”). Promotion of participation should consider this evolution.

(2) Cooperation in Water Sectors

The Dublin Conference on Water and Environment in 1992 announced the principle that “Water development and management should be based on participatory methods that involve users, planners, and policy makers at all levels”. Promoting participation by all relevant parties can foster the ownership of projects and incentives for operation and maintenance.

With regard to technology transfer for operation and maintenance after completion of a project, in many cases, technical advice is given to water committees of rural water supply facilities and water user associations. It is a further requirement to assist in establishing and managing an operation and maintenance system (that includes monitoring), with each administration level.

(3) Integrating the Viewpoint of the Socially Vulnerable, the Poor and Gender Issues

In promoting the participation of water users in the project, above all, the participation of the socially vulnerable, the poor, and women should be ensured and consideration should be given to the cultural background of each local community. Even within a single society, poorer classes have less access to safe water and tend to suffer more from hazards like floods. Also in many cultures and societies women are charged with the responsibility of securing domestic water supply.

2-6-3 Capacity Building

Operation and maintenance of facilities usually involves more than one level of organization. For example, if a problem cannot be handled by an operation and maintenance center on site, the operation and maintenance head office (central level) assists it. Devising its action plan and supervision is handled by supervisory agencies of water supply authorities. It is necessary for the various levels of organizations to play their roles in full cooperation with others in order to carry out appropriate operation and maintenance.

However, in the present situation, the ability to manage and maintain human resources is not sufficient. Therefore, it is necessary to develop human resources according to the role of each level through reinforcement of the guidance and supervising functions with the central administrative institutions, strengthening the ability of institutions to monitor and make repairs in order to prevent accidents (breakdowns, water pollution, etc.), and supporting water users associations with training to enable them to carry out low level maintenance.

2-6-4 Establishment of Operation and Maintenance Systems and Securing Costs

There is a cycle where a facility is constructed, a system to operate and maintain the facility is established, benefit is generated by offering services, and water users pay charges for them. If such a cycle is established, operation, maintenance and expansion costs can be secured and sustainable operation of facilities becomes possible. Thus, provision of high-quality services is crucial for facilities to be operated and maintained.

When it comes to operation and maintenance systems, it is not only private companies that can replace the public sector. Also promoted are operation and maintenance by cooperative organizations such as Water Management Committees in rural water supply and Water User Associations in agricultural irrigation.

With regard to tariff structure, if the economic situation and cultural background of the society to

which water users belong are not fully taken into consideration, the collection efficiency will stay at a low level and the service will not be provided to low-income earners. For example, with agricultural water, we will have to consider a tariff structure that takes into account low income earners, a collection method that takes into consideration the cash income during the crop season, and the price setting that takes into account the profitability of farm products.

2-6-5 Selection and Application of Appropriate Technology

If technologies suitable to the situation of recipient countries are not properly selected, appropriate operation and maintenance of facilities is difficult. As developing countries usually differ from Japan in many aspects such as meteorological conditions, geographical features, funds, and educational systems, it is difficult to apply Japan's experiences and technology to projects as they are. Therefore appropriate technologies must be selected after examining them from various viewpoints including whether they are technically feasible, economically justifiable, suited to particular cultures, and whether they do not cause environmental destruction. Other effective alternatives are phased introduction starting from small and medium sized and regionally distributed facilities, selection of energy saving or resource saving facilities, and utilization of traditional technologies used in a target area.

3. Proposals for Future Approach of Japan's Cooperation in Water Sectors (Digest of Chapter 5 of the Main Report)

3-1 Fundamental Approach to Cooperation in Water Sectors

3-1-1 Global Water Problems in the 21st Century

While water shortage and water pollution is aggravated internationally by the increase in demand for water caused by rapid population growth and economic development, many places are also afflicted with frequent and severe flood damage. Furthermore, many developing countries suffer from food scarcity caused by water shortages, unequal distribution of water and outbreaks of infectious diseases from contaminated drinking water. Water shortages and poor water quality contribute directly to the high infant mortality and low life expectancy rates common in the developing world. In some areas the situation has already become disastrous. World water problems are expected to move into a critical phase in the near future, affected by climatic variation unless drastic measures are taken internationally.

3-1-2 International Movement on Water Problems

The UN held a conference on water in Mar del Plata for the first time in 1977. The conference resolved that the ten years from 1981 to 1990 be designated the "International Drinking Water Supply and Sanitation Decade". Subsequently facilities for safe water and sanitation were globally developed. In 1992 the "International Conference on Water and Environment" was held in Dublin wherein a statement was made that "immediate actions are required to solve problems of excessive use of water, water pollution, droughts, and floods". In response to this, "Protection of the quality and supply of freshwater resources" in the action plan "Agenda 21" that was released at "UN Conference on Environment and Development" dealt with water problems as an international task. Subsequently in 1997, the "1st World Water Forum" was held with discussions on how to resolve international water problems. Three years later in March 2000, the "2nd World Water Forum" was held and the "World Water Vision" toward the 21st century was advocated. In September 2000, the United Nations General Assembly adopted the Millennium Development Goals, in which water problems were positioned as an important development subject. In December 2000, the United Nations General Assembly declared the year 2003 as the "International Year of Freshwater". The "3rd World Water Forum" to be held in Japan in March 2003 is aiming to be a "conference where specific actions materialize after discussions".

3-1-3 Principles of Japan's ODA for Global Water Problems

As a main donor nation, Japan has been greatly assisting developing countries with water sectors, the main recipient of assistance. As water problems are more serious in developing countries, Japan

would like to continue contributing to resolve world water problems through assistance to developing countries. Consequently the following five issues should be prioritized taking into consideration Japan's experience and international responsibility. Also efficient and effective execution of cooperation will be targeted by the following nine methods.

(1) Priority Issues

Japan has valuable experience of evolution composed of modernization since the Meiji Era, and subsequent progress from developing country to developed country after World War II. Japan also has developed its water sectors after repeated trial and error, and with absorption of knowledge from foreign countries. Therefore, Japan can be effective in utilizing this experience and know-how for solving various water problems that developing countries are facing in the process of modernization. This can be also regarded as a responsibility of Japan as it became a developed country earlier than others. As a main donor nation, Japan should positively tackle important problems that developing countries are facing. Developing countries have great expectations for Japan to do this. Therefore, the following five issues should be prioritized for assistance in water sectors.

(1) Comprehensive water management in monsoon Asia

(2) Conservation of regional environments by water pollution preventive measures

(3) Sustainable provision and impartial allocation of agricultural water

(4) Safe water supply in arid areas and for the poor

(5) Strengthening of assistance to international river basin management

Concrete contents and methods of cooperation corresponding to each task are explained in the second part in this chapter.

(2) Efficient and Effective Assistance

The needs for assistance in water sectors are high and urgent, and an enormous sum of money and human resources is required to find a solution. However Japan's ODA budget and human resources are limited, hence it is necessary for Japan to deliver cooperation more efficiently and effectively in the future, considering past experiences of assistance. The table below explains the nine specific actions regarded as important.

Table 3-1 Methods Ensuring Efficient and Effective Cooperation

Regarding efficiency

	Contents of input	Efficiency	Specific Actions	Sub-section concerned
Input efficiency	Funds	Investment without waste (overlap) in water sectors	Promotion of a multi-sector approach	3-3-5
		Effective utilization of Japan's ODA budget	Collaborative assistance	3-3-7
	Knowledge and know-how	Utilization of Japan's knowledge and experience	Strengthening domestic organization	3-3-8
			Utilization of Japan's experiences and technology development	3-3-9
		Utilization of other donors' know-how	Collaborative assistance	3-3-7

Regarding effectiveness

	Effectiveness	Specific Actions	Sub-section concerned
Effective project	Benefit to the socially vulnerable	Consideration for the socially vulnerable, the poor, and gender issues	3-3-4
	Adaptation to local characteristics	Importance of regional diversity	3-3-3
		Assistance in establishing legal-institutional system	3-3-2
	Sustainability	(Technical aspect)	
		Promotion of efficient water use	3-3-1
		Promotion of a multi-sector approach	3-3-5
		(Operational aspect)	
		Strengthening mechanism for participation	3-3-6

In Chapter 3, project efficiency from the viewpoint of input and approaches towards effective projects are studied for improved efficiency and effectiveness in project implementation.

3-2 Priority Sectors and Issues

3-2-1 Comprehensive Water Management in Monsoon Asia - To Cooperate with Developing Countries in Monsoon Asia to Incorporate Comprehensive River Basin Management

As the world population has grown and the economy developed, problems such as water shortage, environmental degradation, and flood disasters have rapidly become evident. The countries of monsoon Asia are tackling these problems with comprehensive river basin management, by making river basin plans, and developing their institutional and legal systems. However in the face of many difficulties such as the complexity of water problems, conflict of interests, and shortage of human resources, these countries have a strong need for external cooperation. Over the years, Japan's water management systems have been reflecting its social, geographic and economic situation of each period. There systems are appropriate for use in the developing countries of monsoon Asia; compared to Western European systems, which address water problems in very different conditions. Therefore Japan should positively assist them in dealing with their water problems by utilizing Japan's experience and considering the actual individual situations of each country.

In order to incorporate river basin based comprehensive water management, cooperation in various areas is possible, but the following areas of (1) comprehensive river basin planning, (2) institutional and legal systems, and (3) information system development are especially effective. The contents and methods of cooperation are explained below.

(1) Specifics of Cooperation

1) Comprehensive River Basin Planning

JICA can assist in comprehensive river basin planning such as water use, flood control, and the environment. Many countries in monsoon Asia are rushing to draft comprehensive river basin plans. Some countries including Indonesia have been making comprehensive river basin plans for major rivers and reviewing them repeatedly. In many other countries such as Vietnam, Thailand, and Malaysia, the plans are underway. Countries like Laos have just embarked on the planning. As can be seen in JICA's past performance, there have been many cooperation programs focused on single subjects either in water use, flood control, or the environment, however comprehensive river basin planning has just begun in many countries.

These countries are facing various difficulties in developing comprehensive river basin planning. Experience, human resources, and funds are in short supply. There are many cases where local agencies such as river basin organizations are regarded as responsible for the planning, which is a reflection of the decentralization policy. However in reality local agencies are more likely to have such shortages.

Accordingly, for many developing countries, comprehensive river basin planning cannot be completed without external assistance. If Japan provides assistance to expedite the development of comprehensive river basin plans, this will contribute to solving water problems in developing countries. Also various projects in river basins can be prioritized through Japan's assistance, which is significant in the sense that Japan can effectively assist those countries in the future.

2) Institutional and Legal System Development

JICA can assist in building institutional systems (both at national and local levels) and legal systems. With regard to institutions, a considerable number of countries are establishing a central management (or regulatory) organization at the national level. However these organizations are not fully functional in many of the countries. Thus some countries such as the Philippines, Vietnam, Laos, and Thailand are making efforts to strengthen their functions. Also at the river basin level, river basin management organizations are being initiated on a

river basin basis, however in reality only a few organizations have been established. Therefore, it is necessary to aim at water management wherein many stakeholders can participate with focused objectives in the same river basin.

Legislation is necessary for appropriate and proper execution of river basin planning, institution building, and information system structuring. JICA's cooperation to date has mainly covered technical aspects like river basin planning. In terms of institutional and legal systems, cooperation involvement has been low partly due to other donors' active involvement in this area. However since it is fundamental to improve institutional and legal systems for resolution of water problems, future cooperation in this area should be more positive.

3) Information System Development

JICA can assist in building systems to collect and supply information on river basins. In order to carry out not only integrated water resources management in river basin, but also cooperative and desirable river basin management by relevant organizations and residents, it is fundamental to provide and utilize a range of information on rivers and river basins.

(2) Cooperation Methods

1) Cooperation Methods for "Comprehensive River Basin Planning"

JICA can cooperate in comprehensive river basin planning through development study projects. JICA has carried out considerable number of cooperation projects in single sector river basin planning such as water use, flood control, and the environment. However, more importance should be attached to "comprehensive" projects in the future. Therefore, it is desirable to remain up to date on the progress of river basin planning for the main rivers in monsoon Asia (including cooperation with other donors).

Even if a cooperation request is related to a specific problem in a specific area, the solution should naturally be examined from the viewpoint of the river basin. However if a comprehensive river basin plan is not in existence, the cooperation should consider covering comprehensive river basin planning. This consideration should be made at the stage of preliminary study or during task discussions.

2) Cooperation Methods for "Institutional and Legal System Development"

JICA can cooperate in building and strengthening national level regulatory (coordination)

agencies and river basin level management organizations by dispatching experts and assigning development study projects. Although in development studies, advice is usually given on institutional building and strengthening as part of the study, it is difficult due to the limited study period to achieve cooperation that fully reflects local situations. In order to realize practical cooperation in this area, it is necessary not only to build human resources through training, but also to carry out supportive activities in Japan such as preparation, production and distribution of materials.

Legal-institutional system development is detailed in sub-chapter 3-3-2. It is especially necessary to propose a legal-institutional system development program in harmony with the social norms of the particular place. To this end, specialized knowledge and experience are required. Hence it is important to carry out activities such as human resource development in Japan. Not only should individual expert dispatch be considered, but also large-scale technical cooperation if necessary. The domestic support framework and human resource development should be reinforced so that Japan's level and quality of cooperation in this area ranks with that of other donors.

To promote legal-institutional system building, it is also necessary to obtain the understanding and continuous commitment of relevant governmental agencies. Activities (including various meetings) with international organizations (United Nations Economic and Social Commission for Asia and the Pacific: ESCAP, Asian Development Bank: ADB, World Bank, etc.) play an important role in this. Deployment of staff in international organizations should also be considered.

3) Cooperation Methods for "Information System Development"

Information system building can be a single development study. Alternatively a development study on river basins can include information system building. Only one example is found in Malaysia (Study on River Basin Information System 1996-1998) where information system building was carried out as a single development study.

In planning an information system it is necessary to carefully consider the contents and maintenance of information. Specifically, this could involve a system (hardware and software) whereby river basin information is collected and provided to residents and others by national water management institutions and a river basin management organization should be established. JICA may consider whether cooperation can be implemented by a combination of technical cooperation (development study) and financial cooperation.

3-2-2 Conservation of Regional Environments by Water Pollution Preventive Measures - To Cooperate with Developing Countries in Conservation of Regional Environments by Improvement of Water Circulation and Reduction of Water Pollution, and Establishment of a Sound Base for Regional Development.

Water pollution problems are aggravated in developing countries. Japan experienced severe water pollution problems during the high growth period that seriously affected local socio-economies.

Based on what was carried out during the high growth period and also on experiences and lessons gained, Japan can assist developing countries that are in a similar development process (or toward a similar development process) in regional development through the conservation of the environment, especially water based ecosystems. Such cooperation can be Japan's responsibility as a country that has achieved a very high level of economic development.

(1) Specifics of Cooperation

1) Cooperation in Preparation and Review of Environmental Laws and Regulations

In developing countries, management foundations of enterprises are fragile and financial resources to invest in pollution prevention are insufficient. Hence a long-term perspective is important so that an environmental management system can be gradually strengthened. Assistance by dispatching experts and financial cooperation is needed to establish and enforce more realistic and effective legal systems for the environment including a review of existing laws and regulations related to the environment.

2) Strengthening of Monitoring and Regulatory Organizations and Water Quality Monitoring

In many developing countries, environmental monitoring, water quality monitoring, and ecosystem monitoring to scientifically define water pollution problems are not fully established, hence policies and strategies to tackle problems appropriately are insufficient. Organizations and systems in charge of the environment should be strengthened.

3) Cooperation in Introducing Cleaner Production

Cleaner Production is a concept to rationalize the production process as a whole with a view to increasing the company profit and reducing the pollutants load simultaneously. Incentives for companies in developing countries can be attractive because the investment cost of introducing cleaner production is recoverable.

4) Developing Sewerage Systems

In many cases it is difficult for wastewater treatment methods generally used in developed countries to be adopted in developing countries because these methods require advanced operation and maintenance techniques, and a stable supply of electricity. Therefore, it is important to assist in developing and installing methods such as the lagoon method that are applicable to developing countries in the tropics and subtropics.

Furthermore sewerage treatment should be understood as a system in the context of the water cycle, instead of a system that merely treats domestic and industrial wastewater and protects the environment.

5) Natural Water Treatment Systems

Wastewater treatment systems should be suited to local conditions. Examples of this are an ecological wastewater treatment system called "Shimanto-gawa System", and "direct treatment of domestic wastewater" practiced at a tributary of the Ainoya River in Toride city of Ibaraki Prefecture. These water purification methods principally use microbial power, combining well-mixed fabricated fillers made from natural material such as charcoal, deadwood and stones instead of chemicals. Such visually appealing methods also serve as valuable community education tools to highlight the potential for effective water treatment using natural cleaning principles.

(2) Cooperation Methods

1) Comprehensive Measures for Conservation of Water Quality in River Basins

Two types of measures should be considered. One is a development of several systems in Japan through which lessons and experiences could properly be transferred. The other is an establishment of cooperation methods. With respect to the development of systems in Japan, the focus should be on the mobilization and utilization of lessons and experiences of local governments, particularly in the field of pollution control including water pollution control for both industrial and municipal waste water. Lessons include both technical(hard) and instituional(soft) dimensions of control measures.

Water pollution is generally caused by industrial wastewater and domestic wastewater but in developing countries, waste dumping is another major cause. Much of the solid waste is dumped into watercourses, rivers, and valleys, while most of the liquid waste such as solvents

and oils are discharged into sewers. Therefore, in developing countries, solid waste disposal measures are also important in the context of pollution control.

2) Foundation of Management Cooperation (Committee) for Conserving Water Quality in River Basins

With respect to the foundation of river management cooperation, several initiatives, worth paying attention and sharing lessons, have been taken in Japan. Various types of community groups including fishermen, farmers participate in these initiatives.

In Aichi Prefecture of Japan, there is a river basin management method to prevent water pollution called the “Yahagi River Method” where farmers and fishermen in the private sector took the initiative in founding a committee. In Kesennuma in Miyagi Prefecture, there is a movement called the “Forest is a sea’s love”, where fishermen are afforesting upstream areas. These type of initiatives which led to the foundation of cooperations and committees benefit entire river basins, from the upstream to downstream and finally coastal water area, and promotes sound water circulation. When cooperating with developing countries in water sectors, it is important to promote such community movements that involve the establishment of committees and cover entire river basins.

3) Technology Transfer of Decentralized Small-Scale Wastewater Treatment Systems Such as Small-Scale Sewerage and Domestic On-site Wastewater Treatment Units

As the construction of sewerage systems tends to be very costly, consideration should be given for decentralized small-scale wastewater treatment systems that do not require large-scale sewer construction. In order to employ technologies suitable to local situations and to enhance the sustainability, it is important to consider the technology of decentralized small-scale wastewater treatment systems from the viewpoints of local conditions of water cycle, costs, and simplicity of operation and maintenance.

4) Analysis of Japan’s Experience of Overcoming Water Pollution and its Application to Developing Countries

In Japan, through enforcing regulations, water quality was improved. This improvement brought about enormous economic benefits to the regions and areas concerned. Japan’s environmental policies and environmental engineering programs have evolved step by step through repeated trial and error, and they may not be directly applicable to developing countries. It is necessary to find a feasible method suited to those countries, learning from Japan’s experiences.

5) Study on River basin Ecological Management

It is necessary to promote preservation of ecosystems in marshes, rivers, lakes, and coastal sea areas by promoting nature protection and carrying out water management in entire river basin. To this end, however, the precise knowledge and in-depth analysis of the feature of ecosystems in the river basins concerned are in need. Studies on river basin ecosystems are therefore indispensable to come up with management program. When planing the study, due attention should be paid to the fact the upkeep and recovery of sound ecosystems contribute much to the development of the regions concerned.

3-2-3 Sustainable Provision and Impartial Allocation of Agricultural Water

Irrigation is an important factor in increasing food production at the rate required to keep up with population growth. Irrigation water for agricultural use accounts for nearly 70 percent of all water developed and used. Population increase is especially high in developing countries, having more than doubled in the last 40 years. Even under these circumstances, food production has been able to be increased, keeping pace with the population growth, with water use supporting the production increase. However, World Water Vision reports that forecasts for the year 2025 include drastic restrictions in the use of irrigation water and that the possible incremental volume available for irrigation water will remain at 9 percent, irrespective of the necessity for a 40 percent increase in food production.

In responding to this global challenge, experiences of Japan may be utilized in considering Four types of cooperation: (1) water productivity improvement through conversion of paddy fields into multi-purpose fields, (2) farmer participatory irrigation management by utilizing Japan's experiences of land improvement districts, (3) small-scale irrigation through rural development, and (4) development and dissemination of low-cost technologies.

Against this background, Japan, as a major donor, should cooperate on major global issues, utilizing its experiences. Agricultural water has become a major priority area, because it is an important issue in water sectors and Japan has useful experience to contribute.

(1) Specifics of Cooperation

1) Cooperation for Water Productivity Improvement through Conversion of paddy Fields into Multi-Purpose Fields

The conversion into multi-purpose fields means developing the land conditions necessary to use farmland originally used as paddy fields for both paddy rice and non-rice crops. This

technology could contribute efficiency to the improvement of water use and land use in monsoon Asia where there are rainy seasons and dry seasons. This is because in rainy seasons paddy fields can store excessive water and flooding can be controlled, while in dry seasons non-rice crops can be cultivated. Having this conversion technology of paddy fields, that can timely control irrigation and drainage, would be an advantage of Japan's cooperation.

2) Cooperation for Farmer Participatory Irrigation Management by Utilizing Japan's Experiences of Land Improvement Districts

A land improvement district is an executing body for land improvement projects whose purpose is to develop, improve, and maintain water use conditions and land conditions for agricultural infrastructures. It is also a farmer group that operates the facilities constructed. Utilization of this experience in building water management organizations in developing countries would greatly contribute to the promotion of participatory water management.

3) Cooperation for Small-Scale Irrigation through Rural Development

As a measure to give the benefit of irrigation to poor farmers in developing countries, cooperation for development of small-scale irrigation at the rural level is carried out. This cooperation is comprehensive including not only providing irrigation, but also forming water management organizations and improving cultivation. Although many donors carry out this type of cooperation, the Japan's method is regarded as more practical, according to an example in Ghana.

4) Cooperation for Development and Dissemination of Low-cost Technologies

According to successful promotion of "Irrigation by hand pumps in Bangladesh" by Japan Overseas Cooperation Volunteers (JOCV), utilization of JOCV as a measure to disseminate low-cost technologies applicable at the grassroots level in rural areas will be effective cooperation in this area. The development of these low-cost technologies can be executed through technical cooperation projects such as vertification studies in development studies.

(2) Cooperation Methods

1) Cooperation for Transfer of Conversion Technology of Paddy Fields into Multi-Purpose Fields through Study

To transfer the conversion technology of paddy fields, the field verification study during both rainy and dry seasons is necessary, and economical and other studies are also needed prior to

its utilization. Therefore it is necessary that experts stay for a long period to study and transfer the technology under the Technical Cooperation Projects.

2) Cooperation for Participatory Irrigation Management by Systematization of Experiences of Land Improvement Districts and Lessons Learned from Overseas Projects

Cases of cooperation for participatory irrigation management in overseas projects and experiences of land improvement districts can be classified and systematized. As a result, guidelines for cooperation methods with more preferable manuals can be effectively prepared, and efficiency improvement of cooperation for building water management organizations can be realized.

3) Improving Cooperation Efficiency by Classifying Experiences of Small-Scale Irrigation in Rural Development

Japan already has a great deal of experience gained through execution of many projects. Hence it would be useful for these experiences to be classified, compiled, and utilized so that cooperation for rural development can be more efficient and strengthened.

4) Diffusion of Low-cost Technologies Developed in Technical Cooperation Projects by Utilization of Japan Overseas Cooperation Volunteers (JOCV)

This includes two steps which are the preparation of technology and its transfer. First, a vertification study of low cost technologies in development studies or the Technical Cooperation Projects are carried out to examine the practicability of the method, and the technology is established. Secondly, the technology is diffused by JOCV to grass root level in villages. This is regarded as especially effective in Africa where there are many poor countries.

3-2-4 Safe Water Supply in Arid Areas and for the Poor – To Cooperate with Water Supply While Prioritizing Arid Areas and the Poor Who Have Difficulty to Get Safe Water, and Considering Sustainable Operation and Maintenance and Water Source Pollution

The United Nations Millennium Development Goals state that the ratio of population without access to drinking water should be halved by 2015. Provision of safe drinking water and environmental improvement through water supply need to be dealt with as an important problem in future international cooperation as well. Under these circumstances, the future cooperation of JICA should attach importance to the following cooperation contents and methods.

(1) Specifics of Cooperation

1) Expanding Access to Safe Water

Japan has been cooperating for water resources studies, water supply, and sewerage and groundwater development in order to help increase access to safe water. Increasing the service rate of safe water will continue to be a significant priority issue in the future and consideration should be given to prioritize benefits for the poor.

Currently there are limitations in constructing new facilities, developing new water sources, and the usable quantity of water resources, yet the population keeps growing. Under these circumstances, it is important to transfer technology and provide financial cooperation to rehabilitate existing facilities, while protecting existing water sources from pollution and taking into account the efficiency of existing facilities. Examples are utilization of low-cost, easily repairable facilities, equipment and materials; grant of repair tools and technology transfer; and measures for flow rate management, leakage, and illegal water use through the installation of meters.

2) Strengthening Capacity for Operation and Maintenance of Facilities

After water supply facilities are developed, appropriate operation and maintenance is needed to keep supplying safe water. Japan has been carrying out technology transfers mainly in engineering aspects through Project-type Technical Cooperation and dispatch of experts. But in the future, the emphasis of assistance should be placed on areas other than engineering.

In many projects for rural water supply or for urban impoverished areas (slums), it is the residents who operate and maintain the facilities. Hence not only should facilities be developed, but also residents should be organized and educated in operation and management.

3) Assisting in Ensuring Safe Water Quality and Establishing Water Quality Standards/Targets Suited to Actual Conditions of Each Country

With regard to water quality, it is effective to assist in establishing realistic water standards/ target values that are suited to the actual conditions of each country.

As groundwater pollution (arsenic, fluoride, nitrate, etc.) is a serious problem in certain areas, it is crucial that development planning incorporates fact-finding surveys and analysis, develop practical treatment facilities and therapies and alternative water source surveys, and improve

awareness as to the correct use of different water sources. In areas where the pollution is widespread and serious such as arsenic pollution in China and Bangladesh and fluoride pollution in Tanzania, Japan's bilateral aid efforts alone would not be highly effective. Hence collaboration with other donors is required.

(2) Cooperation Methods

1) Combining Drinking Water Supply, Sewage Treatment/Sanitation Facilities, and Health Education

Provision of safe drinking water should be considered as a part of a program with the ultimate aim of improving environmental health. Accordingly it is necessary to carry out integrated cooperation of water supply, treatment of wastewater that is generated by water supply, appropriate treatment of excreta, assistance on operation and maintenance of facilities (technical aspects, operational and administrative aspects), and health education.

2) Water Quality Survey of Groundwater Development and Continuous Monitoring of Water Quality and Quantity

As seen in the cases of contamination by arsenic and fluoride, although the water source is groundwater, water pollution (stemming from nature) that affects health may occur. Cooperation should take this possibility into account.

Needless to say, water quality should be surveyed for groundwater development. Furthermore water quality and quantity should be monitored continuously to determine whether they are acceptable for a water supply facility. Monitoring should be done by the recipient countries, hence Japan's cooperation should incorporate, if need be, assistance for monitoring planning, technical advice on monitoring, advice on how to utilize monitoring results, and assistance on countermeasures for when contamination occurs.

3) Technology Transfer in Management of Water Supply Projects

In addition to conventional technology transfer on the engineering side of water supply projects, assistance in managing a water supply operation to ensure its sustainability is essential.

4) Development and Application of Appropriate Technology for Safe Water Supply

In developing facilities, the most appropriate technology must be selected, taking into account

technical feasibility such as troubleshooting, economic justification such as the reduction of operation and maintenance costs, adaptability to particular cultures, and the viewpoint of avoiding environmental degradation.

In order to utilize Japan's experience effectively, it is also important to carry out research and development to adapt Japan's technology toward appropriate technology. JICA should play a pivotal role of synthesizing domestic technology with appropriate technology for safe water supply by collecting information on research and development of appropriate technology, conducting demonstrative tests of developed technology, and transferring the technology if effectiveness is recognized.

5) Cooperation with Research Institutes and International Agencies in Establishing Water Quality Standards/Target Values

It is necessary to consider assistance in establishing water quality standards/targets suitable to each country by taking into account each country's water resource situation, water use situation, and lifestyle habits. Accordingly, cooperation should not be limited to bilateral relationships. Information on water quality surveys and analysis can be provided by a research institute that is already dealing with the same issue, or through new cooperation between JICA and the Institute. JICA can develop and disseminate systems together with relevant international organizations. The resultant knowledge and findings can be fed back to research institutes. By this type of cooperation, JICA can carry out assistance effectively.

3-2-5 Strengthening of Assistance to International River Basin Management - To Assist in Building Cooperation Between Relevant Countries in International River Basins

According to the United Nations, the number of international rivers and lakes is over 200, and they have a combined catchment area accounting for about half of the world's land area and about 60 percent of the world population . In other words, these rivers cross over borders and water resources are shared by many countries. There is some anxiety that conflicts between river basin countries over these water resources may jeopardize many lives and security, and there is even a possibility of a Water War breaking out as an ultimate result of these conflicts.

In recent years both the number of conflicts and cooperation between river basin countries of international rivers has been increasing. However, the amount of cooperation is found out to outnumber that of conflicts. Therefore, it can be supposed that water resources sharing encourages river basin countries to cooperate rather than to promote conflict.

International river basin standards of conduct that should be observed by river basin countries have been developed in recent years. The World Water Vision released in 2000 adopted as one of its seven messages, "increasing cooperation in international basins". When Japan assists in this area in the future, this international trend has to be respected, and in Japan's cooperation, greater importance should be attached to the following points to build trust among river basin countries.

(1) Specifics of Cooperation

1) Support for Low Politics

When it comes to high politics, there are some foreign organizations that have been positively involved in conflict resolutions in international river basins. For example, aid agencies of the Netherlands and Sweden have achieved some success in the river basin of the Ganges River by involvement in high politics. However it would be difficult for Japanese aid agencies to lead the way in high politics in international river basins at this point in time, considering their accumulated experience and human resources.

However in terms of low politics, Japan has been contributing to international agencies in technical aspects of water resources development and management. Under these circumstances, more importance should be attached to assistance with low politics in future Japan's cooperation.

When assisting with low politics, high politics should be fully analyzed to ensure that low politics do not hinder high politics.

2) Promotion of Opportunity for Dialogue

JICA should adopt a neutral position as a bilateral aid agency and create opportunities for dialog among relevant people of the river basin countries. JICA should also encourage these countries to understand international river basins, deepen mutual trust, and proceed with cooperation. Not only dialogue among representatives of relevant countries, but also dialogue among communities in river basins and dialogue between communities and governments should be promoted . JICA should advocate for realization of such dialogue.

In setting a dialogue for relevant people, viewpoints should be carefully considered such as "when managing multiple small and medium watersheds as 'one river basin', how existing organizations (especially community organizations in watersheds) are positioned in the framework of international river basin management and administration", and "how vested interests, existing

organizations, and traditional customs that water users have processed are positioned".

3) Examination of Projects Considering Other River Basin Countries

"Treaty on Non-Navigation Use of International Rivers (1997)" stipulates that "a river basin country should not cause other river basin countries a significant loss when it uses water resources in an international river basin". When proceeding with bilateral cooperation, those involved in projects related with international river basins should observe this spirit. Therefore if a significant adverse effect is expected, cooperation should be withheld.

(2) Cooperation Methods

1) Cooperation in View of Entire River Basin

International river basins cross over multiple countries and the catchment area tends to be extensive. Therefore in proceeding with management and development of entire river basins, there are many problems to be solved which tend to be complexly interrelated.

When formulating projects, then, such projects should not only be examined, but also the problems of the entire river basin must be considered to clarify the extent of Japan's cooperation and the role of Japan's cooperation in the river basin. In some cases, where a project may have adverse effects for parts of the river basin, it may be necessary to propose new cooperation.

If Japan encounters difficulties in delivering bilateral cooperation aimed at alleviating a specific problem within a river basin context that is both technical and financial in nature, an alternative method would be to proceed with the cooperation in coordination and agreement with other aid agencies. Especially in bilateral cooperation, as aid resources inputs are limited, such cooperation with other aid agencies should be discussed to ensure effective use of limited resources.

2) Cooperation in Collecting Meteorological and Hydrologic Data

In developing countries, although each country in the river basin collects hydrologic data, the measurement method and points tend to be problematic, and reliability of data is also erratic due to deficiency of data, which in many cases cannot be combined as they are not collected under identical conditions. Therefore cooperation in data collection is regarded as an effective means of cooperation.

3) Disclosure of Information and Data Collected

The disclosure of information on river basins should be promoted in the future. To this end, there should be a requirement that any hydrologic data collected in cooperation will be open to the public, including river basin neighboring countries. Disclosure of information and data collected is significant from the three viewpoints outlined below.

a) Viewpoint of "Promotion of Community Participation"

In making the dialog mechanism among river basin countries function effectively, community participation in the discussions is indispensable. Regarding this, some researchers point out that community participation is encouraged through information disclosure.

b) Viewpoint of "Expansion of Foreign Cooperation to River Basins"

Information disclosure cannot only expand support to countries and organizations that assist in economic development of river basins, but also act as a trigger for many researchers to be engaged in research activities in river basins.

c) Viewpoint of "Building Trust among River Basin Countries"

In areas where traditionally there has been no close cooperation among river basin countries, initially, representatives of each relevant country can bring and exchange the collected data. Such an attempt for cooperation can provide a foothold for building trust among river basin countries.

4) Capacity Building

In promoting cooperation among river basin countries, it is important to train staff who can play a pivotal role in dialog between river basin countries. To this end it is necessary not only to accept trainees in Japan, but also to promote and hold workshops locally so that members from river basin countries can attend such workshops. Specialists for river basin management can be trained, and a network of relevant people can be established.

With regard to the contents of training for members who are engaged in policy making, more consideration should be given to river basin management rather than to technical aspects.

5) Holding International Seminars

As one of the measures to promote dialog among the relevant parties of each country, it is appropriate to hold international seminars. In holding seminars, invitations for attendance of communities of river basins should be extended to relevant countries if necessary.

6) Training of Japanese Experts

It is expected that the need to dispatch experts to international organizations will increase in order that Japan's assistance in low politics can be strengthened in the future. However experts who have been dispatched so far have not been given enough opportunity to attend international conferences in order to improve their specialized skills and absorb new knowledge. Attendance at international conferences or academic societies should be encouraged in the future, so that the capability of experts is heightened and the network with water sector personnel in the world is built up. In this way, not only the experts will benefit, but also new information can be effectively brought to organizations (countries) to which the experts are dispatched.

3-3 Methods for Effective and Efficient Implementation of Cooperation in Water Sectors

3-3-1 Promotion of Efficient Water Use (water conservation and technological development in agricultural, industrial and domestic sector)

It is important that not only the agriculture sector, but also domestic and industry sectors promote water conservation and that water shortages are alleviated with by more efficient water use. Each sector should try to use water efficiently. For example, technical innovation should be promoted; more efficient use of existing water sources should be promoted; and the ratio of water reuse should be increased as much as possible.

(1) Combined Use of Surface Water and Groundwater

Groundwater, especially fossil groundwater may dry up. Therefore in agricultural use, surface water should be used when it is available such as in the rainy season. It is then considered effective to combine different water sources by for example, complementary use of groundwater when surface water is not available such as in the dry season.

(2) Community Participation

Residents should participate in a project from its planning stage. When they contribute financially

to the project, they would choose facilities affordable to them. They can set up a water management association and the operation and maintenance of the facilities can be done by community participation. By this method, wastage of water is reduced and sustainability of the facilities is ensured. If a sense of ownership is cultivated through community participation, the water consumption volume will be thoroughly controlled and water leakage and illegal water connection is expected to decrease.

(3) Optimizing Water Use from Different Sources of Water Based on Quality

If the water quality of a water source is problematic and not suitable for drinking purposes, depending on the regional water resources situation, it may be used for miscellaneous use by clearly indicating the level of safety of the water source.

(4) Promotion of Water Leakage Preventive Measures in Urban Water Supply Systems

The rate of unaccounted-for water in water supply systems in developing countries is generally high and wastage of water is prevalent. In order to lower the rate of water that is unaccounted for, it is effective to promote leakage reduction measures such as the repair and reinstallation of distribution and service lines, and routine leak detection and repair.

(5) Meter Installation and Introduction of Increasing Block Rates in Urban and Industrial Water Supply Systems

In the former USSR, where water supply systems were not metered, water consumption was extremely high and wastage of water was customary. In order to sensitize water users for efficient water usage, the installation of meters and introduction of volume-based tariffs are essential. Furthermore the incentive for water conservation becomes stronger when the tariff is not only volume-based, but also has an increasing-block structure.

(6) Widespread Use of Equipment and Utensils Designed to Conserve Water

Promoting the development and widespread use of water conservation type equipment and domestic utensils such as water conservation taps and washing machines is expected to contribute to efficient use of water. The widespread use of water conservation type equipment and utensils not only lowers the water bills of companies and consumers, but also can reduce infrastructure expansion by administrative agencies such as water supply, sewerage, and water resources. Hence, this measure leads to a win-win situation and can be easily employed by all parties.

(7) Promoting the Reuse of Industrial Water

Industrial water use in Japan has been decreasing due to the promotion of water reuse, and as a result, the reuse rate of industrial water is about 80 percent. In the face of a future water shortage in developing countries, Japan's technologies of industrial water conservation and reuse should be transferred to those countries after proper consideration of their particular situations.

(8) Promotion of Technology Development for Efficient Water Use

For efficient water use, it is important to promote technology development and improvement in hardware-type engineering such as rehabilitation of aging facilities for reducing leakage, developing water conservation equipment and utensils, and developing treated wastewater reuse technology. However it is also necessary to develop and improve software-type engineering such as coordination of water use timing, collection of water use fees, introduction of efficient management methods in the private sector, community awareness, establishment of water flow rate control systems, etc. With regard to technology development in hardware-type engineering, technology developed for the domestic market in Japan should be tailored to ODA recipient countries. In terms of future cooperation in water sectors, software-type engineering also should be strengthened by utilizing Japan's human resource assistance and training schemes.

3-3-2 Assistance in Establishing Legal-Institutional System

Japan has a century of experience in river basin management under the River Law, whose results are the most prominent in the world. However the Japanese model is not always directly applicable to developing countries. Therefore legal systems acceptable to local societies need to be proposed through discussions with legal professionals and policy makers. It is also important to entrust the local side with the final decision as to which system should be adopted from the various institutional options.

(1) Respect for Customary Laws

In the area of legal assistance, there have been Western donors who simply introduced their legal ideas. However, in cases where Japan assists in developing water laws, including water resources management, the existing characteristics of the legal-institutional system of the recipient country should be considered and local customary laws should be carefully respected. In particular when assistance goes to establishing the legal infrastructure for water, an adequate preliminary study must be performed. Also, bearing in mind the public nature of water, attention should be paid to water users as a basis of a legal-institutional system.

(2) Human Resource Development

The shortage of legal experts in water laws is of great concern for developing countries, especially as fostering legal specialists is a lengthy process that needs continuous assistance. Such assistance includes the preparation of training programs to foster legal specialists and administrators who draft and enforce laws, and the dispatch of specialists that provide advice from time to time on the development and enforcement of laws in accordance with local conditions.

(3) Community Based Water Use Rights

Community-oriented characteristics of water use rights are intrinsic in Asian societies, and this feature is contrasted to the individualistic Western system such as riparian rights connected with landownership. The concept of community-oriented water use rights should be shared globally in the face of future water shortage.

(4) Groundwater as Common Resources

Some developing countries are experiencing land subsidence and increased salinity caused by excessive abstraction of water. Experiences of Japan that has overcome the problems of excessive groundwater use and subsequent land subsidence may be transferred to administrators and stakeholders of water resources in developing countries. Simultaneously Japan should recommend that they too appreciate preservation and appropriate use of groundwater.

(5) Measures to Treat Effluents

In Japan's experience, there are two ways to treat effluents. One is to first regulate by statute and then allocate fees for the improvement of public facilities at a feasible time. The other is to encourage the private sector to invest in the reduction or treatment of its own effluents in order to appropriately apply the Polluters Pay Principle (PPP). It should be noted that simple application of economic measures is not wise.

(6) Setting Up Database

International water law is not a unified code that contains provisions to cover the entire world, but should constitute a system of shared values of respecting legal diversity of coexistent countries and societies. For international water law to ensure the preservation and appropriate use of water resources, it is important to set up a database of water laws and institutions. JICA is willing to dispatch specialists to assist in such a database or invite trainees from developing countries.

(7) Paradigm-Shift in Water Law

Because of the rigidity of the international legal system as seen in existing treaties and agreements, a paradigm-shift should be considered. From the experiences of water law and water management, the conversion axis could include items such as (1) transnational laws, (2) soft laws, and (3) conflict evasion mechanisms. Assistance for the establishment of the new paradigm basis concerning water law may include organizing seminars, accumulation and disclosure of scientific and neutral information, etc. to build trust among the parties concerned. It is expected that the provision and the sharing of information, based on the so-called “society of harmony” way highly prioritized in Asia that cooperation is preferable to conflict, will eventually help in evading conflicts.

3-3-3 Importance of Regional Diversity

Cooperation in water sectors should fully respect endemism of natural and social conditions specific to each local areas. The following points are proposed as future cooperation methods:

(1) Adequate Study of Natural and Social Conditions in Target Area Prior to Project Design

Cooperation in water sectors is strongly subject to the natural and social conditions of each local area. Hence, sufficient basic study should be made prior to cooperation. Then after understanding the regional peculiarities and diversity, appropriate projects should be designed.

(2) Respect for, and Utilization of, Traditional Water Allocation Systems, Customary Laws, Agricultural Methods, Lifestyles

Attempts to introduce completely new legal systems or other systems tend to be unsustainable. Water use systems have historical backgrounds and are closely related to natural conditions and local societies. Therefore an effective approach is to make use of existing systems and improve them.

(3) Application of Technologies and Scale Appropriate for the Local Technical Level, the Economic Level, and the Culture

Instead of directly applying Japanese experiences and technologies developing countries, these should be tailored to local situations. Advanced water treatment technologies in developed countries are based on the stable supply of electricity and chemicals, and careful management by highly qualified engineers. Therefore they cannot be easily applied to developing countries as they are, and it is necessary to introduce or develop low-cost water treatment technologies for easy operation and

maintenance.

(4) Not Applying Successful Experiences in One Area Uniformly to Other Areas

Recently popular approaches are known by keywords such as "Full cost pricing" and "Participatory water management", whereby beneficiaries are charged water bills and a community forms a water management committee. However although it seems to be a generally accepted approach, if it is applied uniformly to different areas, the risk of failure will be high.

3-3-4 Consideration for the Socially Vulnerable, the Poor, and Gender Issues

Consideration of the Socially Vulnerable, the poor, and Women is especially important when cooperating in water sectors. As for specific cooperation methods, the following points are proposed.

(1) Prioritization of Projects Which Aim at the Poor as Main Beneficiary in Project Screening Process

Impoverished areas have higher needs for cooperation. The poverty ratio tends to be high in arid areas where the quantity of water is insufficient and areas where water supply infrastructure is not developed.

At the country level, in sub-Saharan areas there is a concentration of countries with low levels of access to water. This is because the countries themselves are too poor to afford even small-scale development investment for safe water supplies. These countries should be prioritized

(2) Understanding the Situation of the Socially Vulnerable, the Poor, and Gender Issues (Social Analysis) Prior to Project Delivery

In order to carry out cooperation considering the Socially Vulnerable, the poor, and Women, it is necessary to first fully investigate their situation. The main items to be investigated are their distribution, economic conditions, actual water use, water use habits, accessibility to social services such as water supply, role sharing between males and females, and the social and traditional background. These investigations tend to touch on the subtleties of the object society, hence, use of local consultants is desirable rather than direct involvement of Japanese as outsiders.

(3) Promoting the Participation of the Socially Vulnerable, the Poor and Women in Decision Making and Contributing to Improvements in Their Social Status

In participatory planning methods and participatory operation and maintenance by water management

committees, ways of proceeding with workshops and decision making methods have to be devised in order for the wishes of the socially vulnerable, the poor, and women to be reflected. Various ideas need to be devised to promote women's participation, and careful consideration is needed, especially in areas where social activities by women are largely limited by cultural constraints, for example in Islamic areas.

(4) Contributing to Improving the Lives of the Socially Vulnerable, the Poor, and Women

Since improvement of water supply can raise people's standard of living, execution of continuous cooperation in water supply is desirable. Furthermore when designing projects, it is necessary to devise labor-intensive methods in facility construction and operation and maintenance in order to create new employment.

When setting water charges, an appropriate tariff should be established so as not to hinder access to water, particularly for the poor. There are also methods such as cross-subsidization by the introduction of a volumetric charge and acceptance of payment by installments or payment in kind.

(5) Employing Technologies Taking into Account the Socially vulnerable, the Poor, and Women

In many areas of developing countries, water collection is considered the work of women and children. Therefore in designing communal taps and containers for transporting water, the technologies employed should take into account their physical dimensions and strengths. Technology that can be operated and maintained for low costs should be used to reduce the financial burden of facilities in poor areas.

3-3-5 Promotion of a Multi-Sector Approach

There are many sub-sectors where water is a main factor. Conventionally, technical cooperation has been based on a single-sector oriented approach. However in the future, a multi-sector approach should be emphasized to develop relevant sub-sectors comprehensively.

(1) Strengthening Coordinating Function

A high-level of commitment is needed in order to strengthen the coordination among implementing agencies which are divided according to sub-sectors.

(2) Formulaing Cooperation Programs

A multi-sector approach is realized through formulating cooperation program.

(3) Covering Multi Sub-Sectors

Even though some components do not belong to an object sub-sector, if they are needed, they should be included in the cooperation. For example, increase of potable water supply leads to an increase in wastewater and a deterioration of the sanitary environment, hence, potable water supply should be integrated with sewage system. Another example is that a rural potable water supply project needs to incorporate a health education program.

(4) Linking Projects Activities

In regional development projects or community development projects, linking of each project activity should be strengthened. For example, water users associations can form the bases for projects aimed at improving livelihood.

3-3-6 Strengthening Mechanism for Participation

Participation should be encouraged at all levels. Formation of partnerships among governments, private sectors, NGOs, and communities, and empowerment of communities should also be supported. These are important to strengthen ownership. Participation of users results in (1) making services and service providers sensitive to and accountable to beneficiaries, (2) coordinating service provision with user needs and affordability, and improving cost recovery and sustainability, and (3) adjusting institutional agreements for service maintenance with the requirements of local customs.

(1) Strengthening Stakeholder Analysis

JICA should strengthen survey and analysis of stakeholders in social assessment.

(2) Participation at the Planning Stage

Environment and social impact assessment should be introduced at the planning stages of JICA cooperation, i.e. at the beginning of the Master Plan stage and the Feasibility Study stage.

(3) Involvement and Empowerment of Communities

It is important to implement social analysis surveys to understand social capabilities of communities, as communities have complicated relations such as race, landownership, employment and genders. By implementing this survey with community participation, it is expected that the ability to solve problems of a community will be enhanced, and this will lead to empowerment of the community.

(4) Participation of private sector including NGOs and Communities

Japan's cooperation should support private sector participation and decentralization not only to private enterprise but also to NGOs and communities. Cooperation should be given so that private sector participation can produce positive impacts not only in management, but also in service provision such as consideration for the poor.

(5) Partnership

Joint ownership of a process, service or project among communities, enterprises, NGOs, governments and donors is important. While there are variety of steps to form partnerships, it is important to deepen the understanding of responsibility in the participation process described above.

3-3-7 Collaborative Assistance

Water sectors cover various areas such as water use, flood control, and the environment. The issue of a safe and stable water supply is important for issues of poverty reduction, health, food security, etc., therefore this issue should be considered by those planning and delivering cooperation in other sectors.

In a framework that is shared globally such as the Millennium Development Goals, Japan is expected to send out positive visions as a leading donor.

In the assistance arena, Western visions are apt to be a mainstream. However in water sectors, it is important that by stimulating sound discussions Japan demonstrates the ideal method of carrying out comprehensive water management in the monsoon Asia area whose climate differs from that of Western Countries.

(1) Cooperation Strategy for Water Sectors

Most Japan's technical cooperation in water sectors has been implemented by JICA. In terms of

funding cooperation, the Ministry of Foreign Affairs (grant assistance) and JBIC (ODA loans) have provided the majority. On the other hand, many ministries such as the Ministry of Land, Infrastructure and Transport; the Ministry of Agriculture, Forestry and Fisheries; the Ministry of Health, Labor and Welfare; and the Ministry of the Environment are independently engaged in project formulations and carry out networking with governments in developing countries.

However, there has not been a unified opinion on Japan's assistance policy in water sectors. As can be seen in the Millennium Development Goals and the World Water Forums, international efforts to solve water problems are now in earnest, hence it is extremely important to clearly express Japan's medium and long-term visions, and assistance policy. It is necessary that the relevant knowledgeable people and agencies get together and discuss these comprehensively.

(2) Program Approach

Instead of conventional assistance to individual technology issues, a program approach is effective whereby political and institutional-level issues are identified and solved after getting a bird's-eye view of each country's water sectors. Highly specialized knowledge is required to examine assistance related to development of policies and institutions. It is therefore regarded as effective for JICA, which has accumulated most of the experience in Japan's technical cooperation, to coordinate cross-sectoral cooperation of the relevant agencies and knowledgeable academics.

(3) Preparation of Local Aid Delivery Systems

When assistance policies and objectives are examined, it is necessary to have in depth discussions with recipient countries on solutions to their problems. When cooperation with other donors is necessary, the arrangement has to be done under the ownership of recipient countries. In that case, swift and flexible responses are required so the authority should be delegated to the local office of the technical cooperation agency.

(4) Promotion of Regional Based Cooperation

Whilst regional economic integration is now a global phenomenon, rectification of the development gap among neighboring countries is an important issue. Discussions on interregional development issues have also become lively in regional cooperation agencies like ASEAN.

It is necessary to carry out a comprehensive study on development issues in water sectors and comprehensive water management issues in areas where natural and social conditions are relatively alike, the ideal method of cooperation in those issues, and the possibility of utilizing Japan's

experience.

Also as many projects such as water supply, sewerage and irrigation are being executed in water sectors, it would improve effectiveness if results and lessons of each country were discussed, and a network formed that could share best practices and appropriate technologies.

3-3-8 Strengthening Domestic Organization

As Japan's economy remains in the doldrums, funding for cooperation has tended to shrink. Hence efficient and effective execution of cooperation is all the more necessary.

The "Medium-term Policy on Official Development Assistance" states that execution of technical cooperation is centered on JICA by fully utilizing knowledge, know-how, and human resources owned by the relevant agencies. If JICA promotes cooperation and coordination with not only central governmental agencies, but also academics, local governments, NGOs, etc., effective use of the limited ODA resources can be encouraged. Furthermore it is expected that participation by all strata of the nation can deepen peoples' understanding of assistance.

(1) Information Sharing with Domestic Cooperating Agencies

Various agencies/organizations are involved in water sectors such as governmental agencies (e.g. Ministry of Land, Infrastructure and Transport; Ministry of Agriculture, Forestry and Fisheries, and Ministry of Health, Labor and Welfare), academics, local governments, and NGOs.

JICA is sending experts to executing agencies in recipient countries and providing technical training to trainees from developing countries. Also JICA maintains foreign offices in 56 countries, therefore it can always stay in contact with those countries.

Governmental agencies and universities dispatch many experts and study teams every year and collect relevant government publications, statistics, various project documents, etc. In particular, the study teams sent by JICA outnumber others, therefore if JICA sets up a database of collected information on the basis of regions and areas, and discloses it on the internet for those interested, the data obtained can be effectively utilized. Then JICA can go on to collect and classify information on activities of other governmental agencies, universities, and NGOs on the same basis and if this information can be exhibited on the website, JICA can function as a resource center.

JICA is now using knowledge management to systematically archive valuable experiences obtained through on-site technical cooperation in developing countries.

(2) Partnership

NGOs have become active in rural development such as water supply facility construction and health education. NGOs play an important role in direct assistance to residents for improvement of their welfare.

Careful development assistance by NGOs and Japan's local governments is directly fulfilling the needs of residents in developing countries. In areas such as environmental pollution and regional disaster prevention, Japan's local governments tend to be more experienced than central governmental agencies. Therefore Japan's assistance should be positively coordinated among those agencies.

JICA has expanded technical cooperation for grassroots projects in order to implement joint projects with NGOs, universities, and public service corporations. When research institutes or universities specializing in water sectors engage in activities in developing countries they can utilize the JICA network for efficient preparation.

(3) Training of Cooperation Specialists

A key to success in technical cooperation to developing countries is the ability to communicate in not only technology, but also language itself. But Japanese human resources who are good at both are limited. In order to solve water problems in developing countries, it is important to train not only technical experts, but also coordinators who can bridge the communication gap between local and Japanese personnel.

3-3-9 Utilization of Japan's Experiences and Technology Development

Japan has prioritized support for self-help projects in developing countries because these types of project provide opportunities for collaborative working, developing mutual understanding and ensuring recipient countries continue to assume responsibility and retain a sense of ownership.

In contrast, in Western cooperation at the project execution stage, a special unit is formed which is not along the decision-making lines. It is said that the characteristic of Japan's technical cooperation lies in knowledge sharing aimed at technology transfer, human resource building, and nation building, which is different from the Western type gap-filling assistance. Japan's technical cooperation is implemented with the organized assistance of relevant Japan's agencies. Thus, planning and execution of cooperation projects with long-term prospects are possible. This significance has recently once again been recognized

(1) Systematization of Japan's Experiences

In the period since World War II, Japan experienced rapid economic development, destruction of nature and pollution problems. As a result, Japan has learned and accumulated lessons from the processes of dealing with both good and bad aspects of development.

In developing countries water problems are multifarious depending on the socio-economic environment and natural conditions of the countries. Thus Japan's experience in its plain form may rarely be applicable to them. If Japan's experience is to be studied and properly utilized in the development of national policies and legal systems in developing countries, Japan colud give much more practical advice on the basis of its experiences in development.

Present Japan's technologies, knowledge and know-how that are understood and transferred by the experts and consultants that work in technical cooperation are all based on valuable past experiences. In technical cooperation, it is important to understand not only the theoretical dimension of the technology development but also experiences of Japan which played a role behind the technology development.

In order to achieve this, Japan's experiences should be systematically archived and converted into a database, which should be utilized by those engaged in assistance. Furthermore it would be effective to hold workshops for better understanding and sharing of those experiences by people concerned in developing countries.

(2) Cooperation for Comprehensive Water Management

In Japan's water administration, development works to date have progressed through participation of local governments and residents in river basins. And in recent years, relevant authorities have been tackling positively the issue of comprehensive water management.

Assistance to comprehensive water management requires various issues to be dealt with such as the legal system of water administration, coordination among administrative organs, relationship between government and residents, technical issues, etc. In order to carry out effective assistance, a possible way for example, is that a particular country or river basin is set as a model assistance area. Japan can extend intellectual assistance based on its experience, while a comparative study is done between Japan's experience in water administration and local conditions.

Examples of success and failure should be analyzed not only from the viewpoint of technical evaluation in specific areas, but also from other extensive viewpoints. It is desirable for requisites

for success to be objectively analyzed.

(3) Re-evaluation of Traditional Technologies

As the importance of consideration for the environment and harmony with nature is reconsidered in development areas, traditional technologies have been evaluated in Japan. For example, the characteristics of traditional riparian technology, including natural forces and harmony, inexpensive operation and maintenance costs, and independent participation of residents are being given more credit. These characteristics address well the needs of developing countries, hence, they are expected to be utilized in technical cooperation. In the Mekong River technical cooperation is being implemented by applying Japan's traditional technology such as groyne and fascine mattress.

However, even traditional technology cannot be directly transferred to developing countries as they have to be modified in accordance with local conditions. Exchange activities between areas where knowledge of traditional technology has been accumulated, and developing countries, can be supported by, for example, technical cooperation through grassroots projects. This is expected to contribute to re-appreciation of traditional technology and revitalization projects using these technology.

Figures and Tables

Figures and Tables attached here are selected from Chapter 1 of the Main Report. These will help to understand the contents of the Digest Version.

Table 1 shows the classification of world natural disasters by region and cause based on data from the "International Decade for Natural Disaster Reduction, 1990-2000". As shown in this Table, flood damage occurred in Europe, but the proportion of floods is much smaller than in the Asian region. In Asia, disasters caused by the "Too much water" problem such as floods, tropical low pressure, rainstorms, and landslides have been very serious. This is not only because of heavy rainfall from Asian monsoons, but also the land condition, or land use in alluvial plains that are easily affected by vulnerable mountains and flooding.

Table 1 Record of World Disasters that Caused 100 or More Deaths or Missing People Classified by Region and Cause

(Statistics for the 30 years from 1963 to 1992)

Region / Cause	Asia			America			Europe	Africa			Caribbean Sea	Pacific Ocean Islands
	East	South-East, Australia	South	North	Central	South		North, Mid-East	Central	South		
Flood	42	130 10	78	5	35 3	27	10	9	19 1	9	2	6
Drought	2	6 4	0	0	0 0	0	0	0	15 11	4	0	0
Food Shortage /Famine	0	1 1	0	0	0 0	0	0	0	3 1	2	0	0
Tropical Storm	41	84 1	42	8	13 4	1	0	1	5 0	4	11	40
Storm, Others	8	27 0	19	9	10 0	1	1	3	4 1	0	0	4
Earthquake	11	34 10	13	4	20 5	11	22	19	22 2	1	0	4
Landslide	9	26 5	12	1	20 1	18	3	0	3 0	3	1	1
Epidemic	4	41 3	34	0	16 2	14	1	3	74 49	22	0	0
Others	6	31 5	20	14	21 2	5	7	2	5 2	1	1	7

Source: Prepared using data from "Disasters around the World – A Global and Regional View, 1994"

East Asia: Japan, Democratic People's Republic of Korea, Republic of Korea, People's Republic of China, Republic of China, Mongolia, Hong Kong, Macao, Vietnam, Laos, Cambodia, Thailand, Myanmar

Southeast Asia and Australia: New Zealand, Australia, Papua New Guinea, Indonesia, and Malaysia

South Asia: Bangladesh, Nepal, India, Sri Lanka, Maldives, Pakistan, and Afghanistan

North America: Canada, United States of America, and Mexico

Central America: Belize, Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, and Panama

South America:Venezuela, Guyana, Surinam, Colombia, Ecuador, Brazil, Peru, Bolivia, Paraguay, Uruguay,

and Argentina

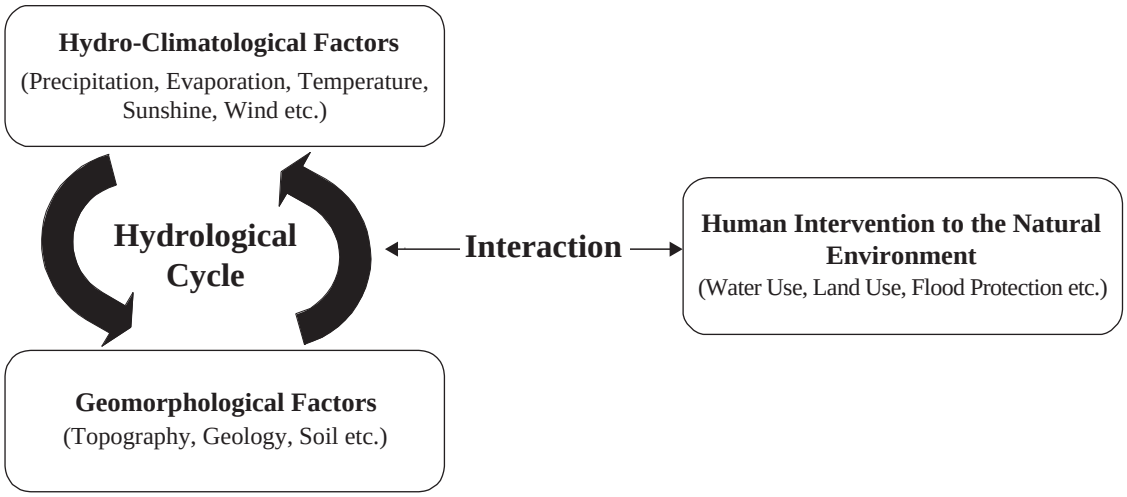
Middle East, North Africa:Iran, Iraq, Syria, Lebanon, Israel, Jordan, Bahrain, Saudi Arabia, United Arab Emirates, Oman, Yemen, Egypt, Libya, Tunisia, Algeria, and Morocco

Central Africa: Somali, Djibouti, Ethiopia, Sudan, Chad, Central African Republic, Cameroon, Niger, Nigeria, Benin, Togo, Burkina Faso, Ghana, Mali, Cote d'Ivoire, Liberia, Sierra Leone, Guinea, Guinea-Bissau, Senegal, Gambia, Mali, Mauritania, and Cape Verde

Southern Africa: Mauritius, Madagascar, Comoros, Kenya, Uganda, Rwanda, Burundi, Tanzania, Mozambique, Malawi, Zimbabwe, Swaziland, Lesotho, Congo Democratic Republic, Zambia, Botswana, South Africa, Namibia, Angola, Congo, Gabon, Equator Guinea, and Sao Tome and Principe

Interrelation between Hydro-Climatological Factors, Geomorphology Factors, and Human Intervention is as shown in Figure 1 and this relation is called as Hydrology-Water Resource System. This is a dynamic system in which natural factors and man-made factors affect each other and these factors themselves will change.

Figure 1 Three Major Factors Governing Hydrology-Water Resources System

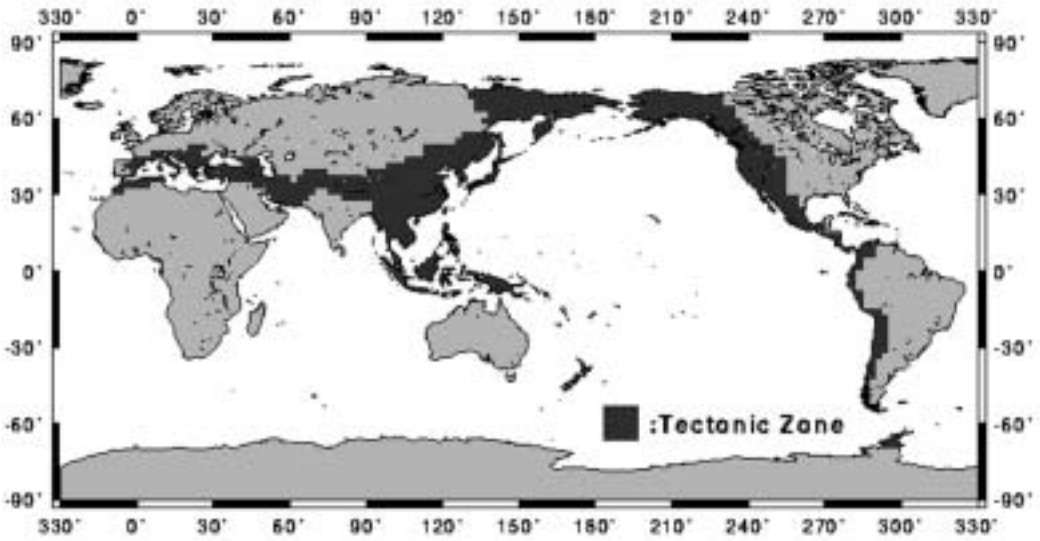


· System including water, land, and humans.
· Dynamic system which natural factors and man-made factors affect each other and these factors themselves will change.

Source: Musiake,K. (2002) ''Monsuun Ajia no Suimon to Mizu Shigen'' Hydrology and Water Resources in Monsoon Asia *Dai 6 kai Mizu Shigen ni kansuru Shinpojiumu Ronbunshuu* [Collection of Papers from the 6th Symposium on Water Resources] Shinpojiumu Jikko Iinkai

Most river basins in Asia are in the Tectonic Zone as shown in Figure 2. Natural land conditions in the Tectonic Zone and those in the Stable Zone differ significantly.

Figure 2 World Distribution of Tectonic Zones

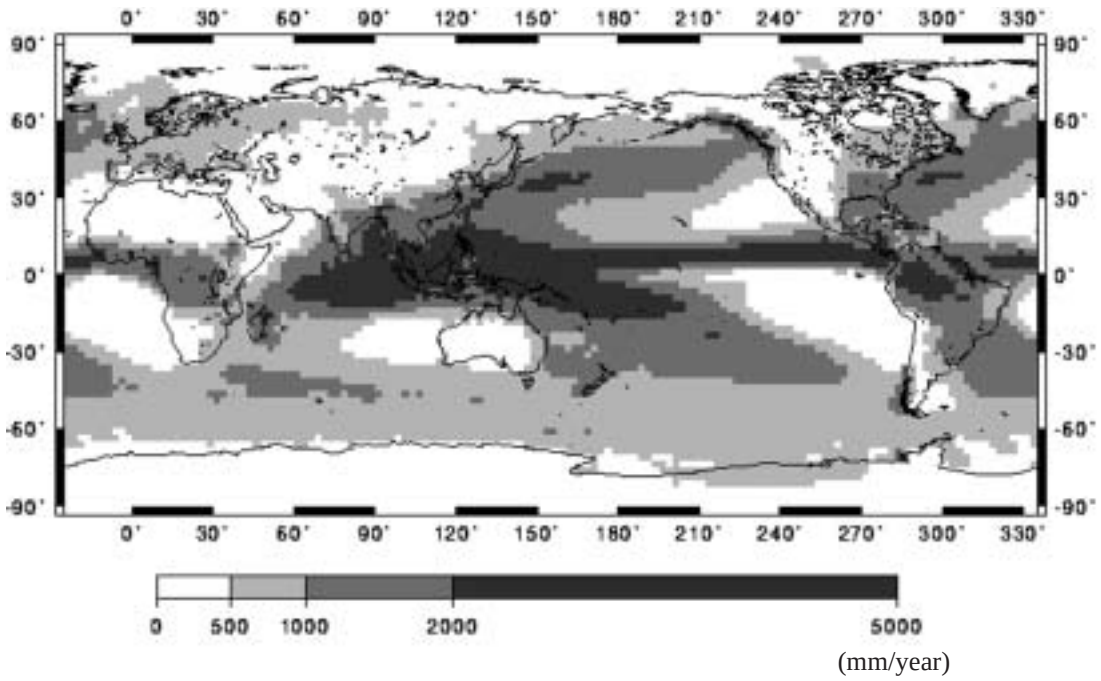


Source: Strahler, A. H. and Strahler, A. N. (1992) *Modern Physical Geography,* John Wiley & Sons, Inc.

Warm-rainy climate areas in the monsoon Asia, to which Japan belongs, are defined by a combination of integrated precipitation patterns and latitudinal divisions. As shown in Figure 3, this "warm-rainy climate" area covers wide areas of East Asia, South East Asia, and South Asia.

Figure 3 World Distribution of Annual Precipitation

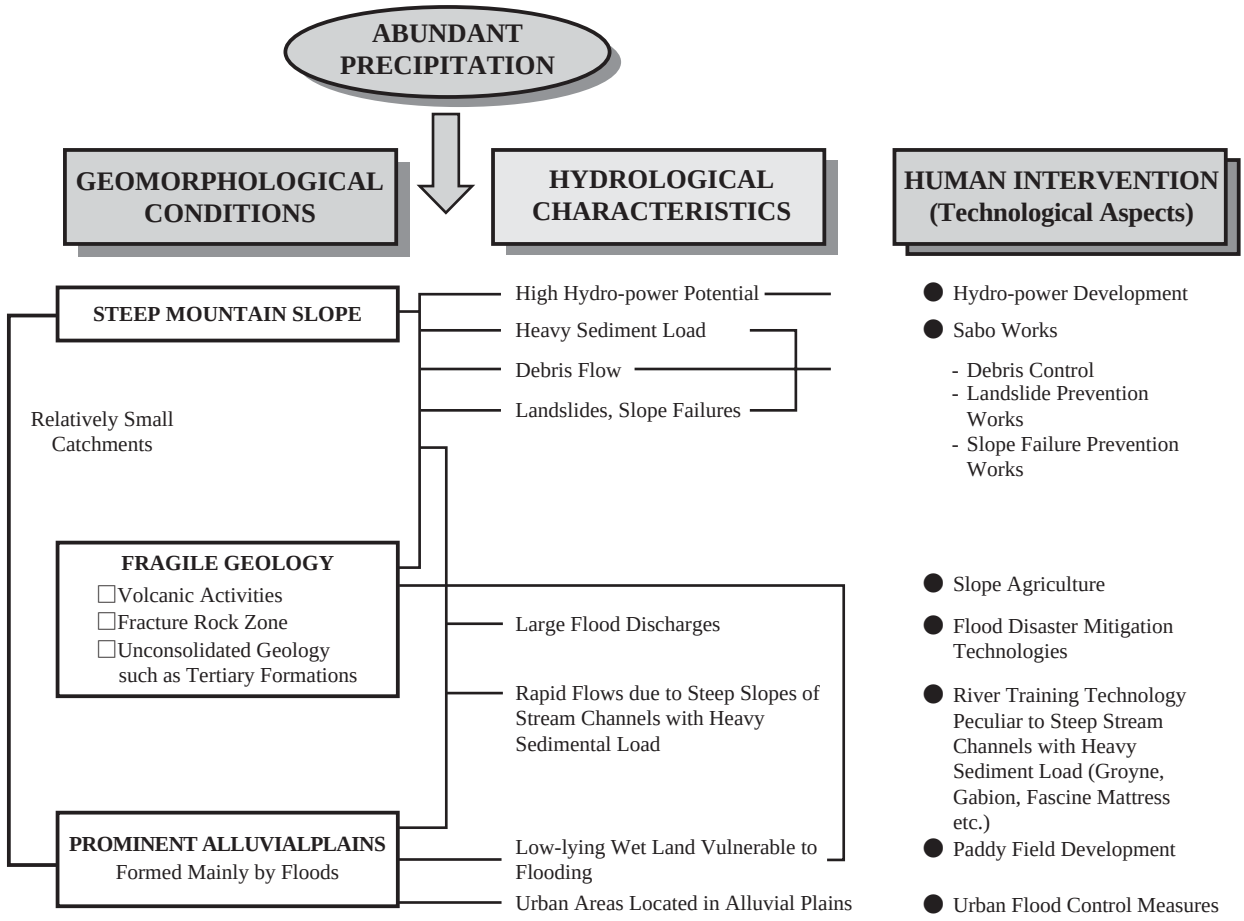
Mean Annual Precipitation (Average of 1979-1999)



Source: Musiake,K. (2002) ''Monsuun Ajia no Suimon to Mizu Shigen'' Hydrology and Water Resources in Monsoon Asia *Dai 6 kai Mizu Shigen ni kansuru Shinpojiumu Ronbunshuu* [Collection of Papers from the 6th Symposium on Water Resources] Shinpojiumu Jikko Iinkai

The relationship between the characteristics of river hydrology, which is affected by land condition of the Tectonic Zone, warm-rainy climate, and major human intervention, to the water resources is shown in Figure 4.

Figure 4 Hydrological and Water Resources Characteristies Common in Warm-Hunid Tectonic Zones



Source: Musiake,K. (2002) ‘‘Monsuun Ajia no Suimon to Mizu Shigen’’ Hydrology and Water Resources in Monsoon Asia *Dai 6 kai Mizu Shigen ni kansuru Shinpojiumu Ronbunshuu* [Collection of Papers from the 6th Symposium on Water Resources] Shinpojiumu Jikko Iinkai

Although fresh water resource distribution is uneven in the world as shown in Table 2, the quantity of water resources is stable in respective regions. Restrictions on water resources will be severe because of population increase and limited water resources especially in Asian and African regions.

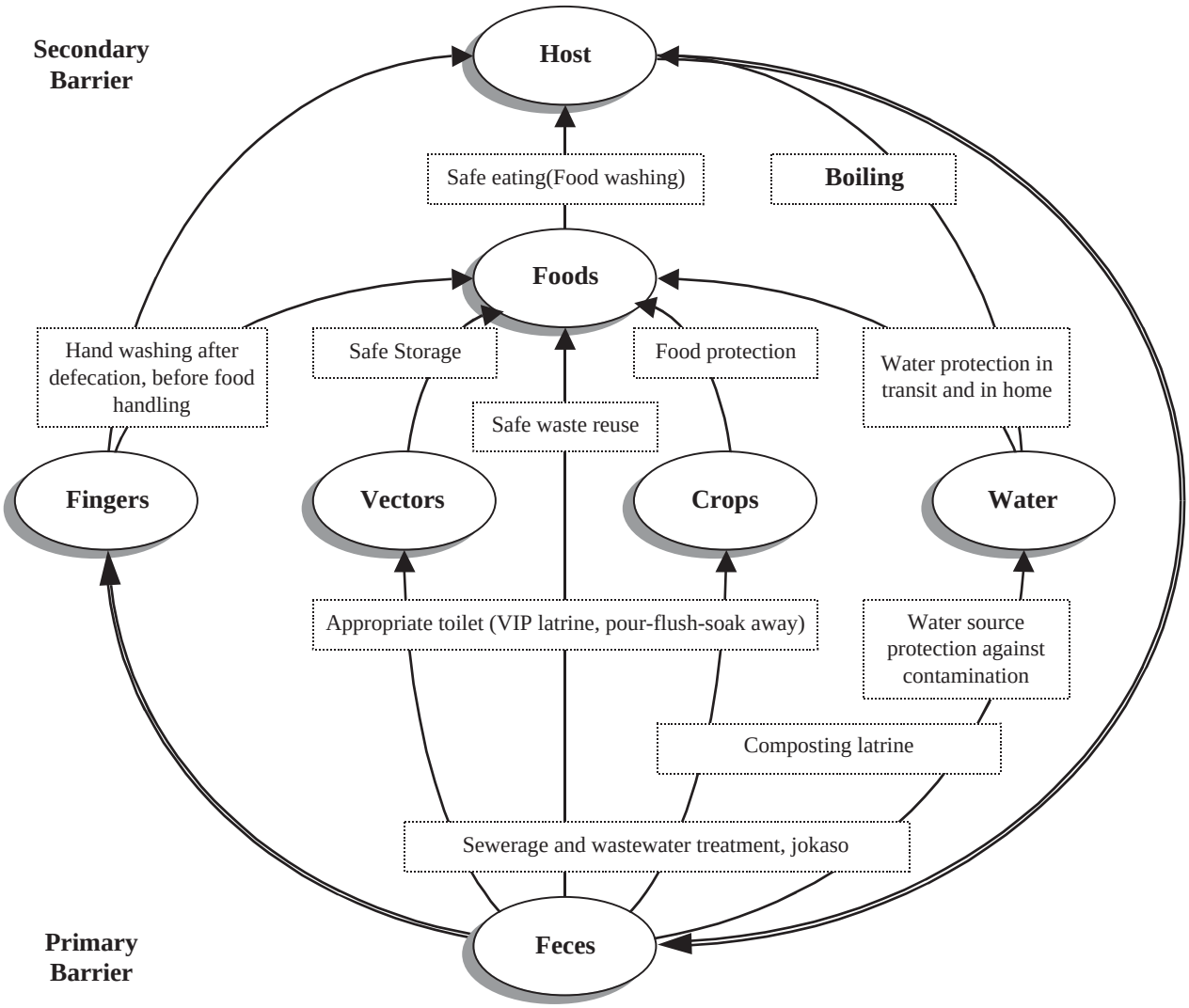
Table 2 River Water Volume Worldwide

Region	Water Volume in Rivers km^3/year	Water Volume in Rivers km^3/year/person
Europe	2,900	4.2
North America	7,700	17
Africa	4,040	5.7
Asia	10,508	4.0
South America	12,030	38
Australia, Oceania	2,400	84
World total	42,650	7.6

Source: Ministry of Land, Infrastructure and Transport *Nippon no Mizu Shigen* [Water Resource in Japan]

A crisis of infectious diseases will occur directly or indirectly to human beings if they are in contact with pathogenic organisms present in human feces. The most effective countermeasure for infectious diseases is to intercept these contagious routes.

Figure 5 Route of Infectious Disease Caused by Excrement



Source: Professor Y. Magara, Hokkaido University, Japan

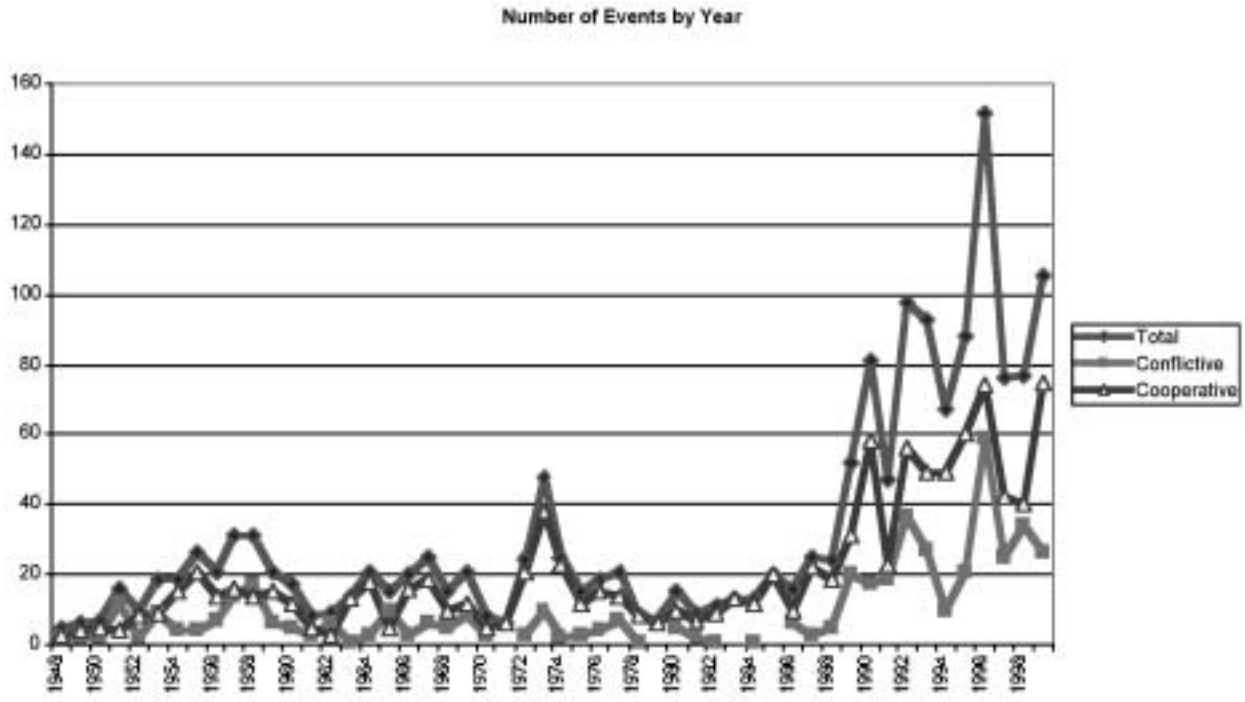
The number of international rivers (including lakes) in the world is 214 according to the United Nations. These river basins occupy approximately 47 percent of the world, and contain approximately 60 percent of the world population. As shown in Figure 6, many international river basins exist in Southeast Area and South Asia.

Figure 6 International River Basins in Asia

Source: Transboundary Freshwater Dispute Database, 2000

Figure 7 shows the number of cases of conflicts and cooperation among river basin countries since World War II. In recent years, the number of conflicts or cooperation between river basin countries of international rivers has been increasing, but the amount of cooperation is found to outnumber that of conflicts. Therefore it can be assumed that water resource sharing direct encourages the river basin countries to cooperate rather than to promote conflict.

Figure 7 Number of Conflicts and Cooperation among River basin Countries



Source: Professor A. Wolf, Oregon State University, USA